

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY

RE-ACCREDITED WITH 'A' GRADE(THIRD CYCLE) BY NAAC WITH CGPA 3.11)



**Programme Scheme, Scheme of Examination and Syllabi**

**(From 2023 – 2023 Batch onwards)**

# **Department of Biotechnology**

**UG Programme**

Approved in the Academic Council –

**Curriculum Design and Development Cell**

**Annexure K**

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**(From 2023 – 2024 Batch onwards)**

# **Department of Biotechnology**

**UG Programme**

**Approved in the Academic Council – XIV held on 31/07/2023**

## **Curriculum Design and Development Cell**

*M. Sujatha*  
**HOD**

*J. Pradeep*  
**Dean of  
Pure science**

*S. Jeyaraj*  
**Dean of  
Academic Affairs**

*[Signature]*  
**Principal**

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**MEMBERS OF BOARD OF STUDIES**

S.No	Board Members	Name & Designation
1.	Chairman of the Board	Dr. M. Sujatha Head & Assistant Professor of Biotechnology Sri Kaliswari College (Autonomous), Sivakasi.
2.	University Nominee	Dr. B. Ashok kumar Associate Professor Department of Genetic Engineering School of Biotechnology Madurai Kamaraj University Madurai - 625021
3.	Academic Expert 1.	Dr. S. Venkatesh Associate Professor Department of Biotechnology Manonmaniam Sundaranar University, Tirunelveli.
4.	Academic Expert 2.	Dr.G. Sridevi Assistant Professor Department of Plant Biotechnology School of Biotechnology Madurai Kamaraj University Madurai - 625021
5.	Industrialist	Mr. K. Aruldoss Happyman Natural Manure, Organic fruits and Vegetables Pavali, Virudhunagar.
6.	Alumna	Ms. S. Ranjini Assistant Professor, Department of Biotechnology, Arulmigu Kalasalingam College of Arts and Science, Krishnankoil
<b>Members</b>		
7.	Dr. R. Narayana Prakash	Guest Faculty in Biotechnology
8.	Mrs. P. Devi	Assistant Professor of Biotechnology
9.	Mrs.G.Mareeswari	Assistant Professor of Biotechnology
10.	Dr. V. Pradeepa	Assistant Professor of Biotechnology
11.	Dr. A.Rajalakshmi	Assistant Professor of Biotechnology
12.	Dr. P. Suganya	Assistant Professor of Biotechnology
13.	Dr. T.Victor Athisayam	Assistant Professor of Biotechnology
14.	Dr. P. Selvaraj	Assistant Professor of Biotechnology

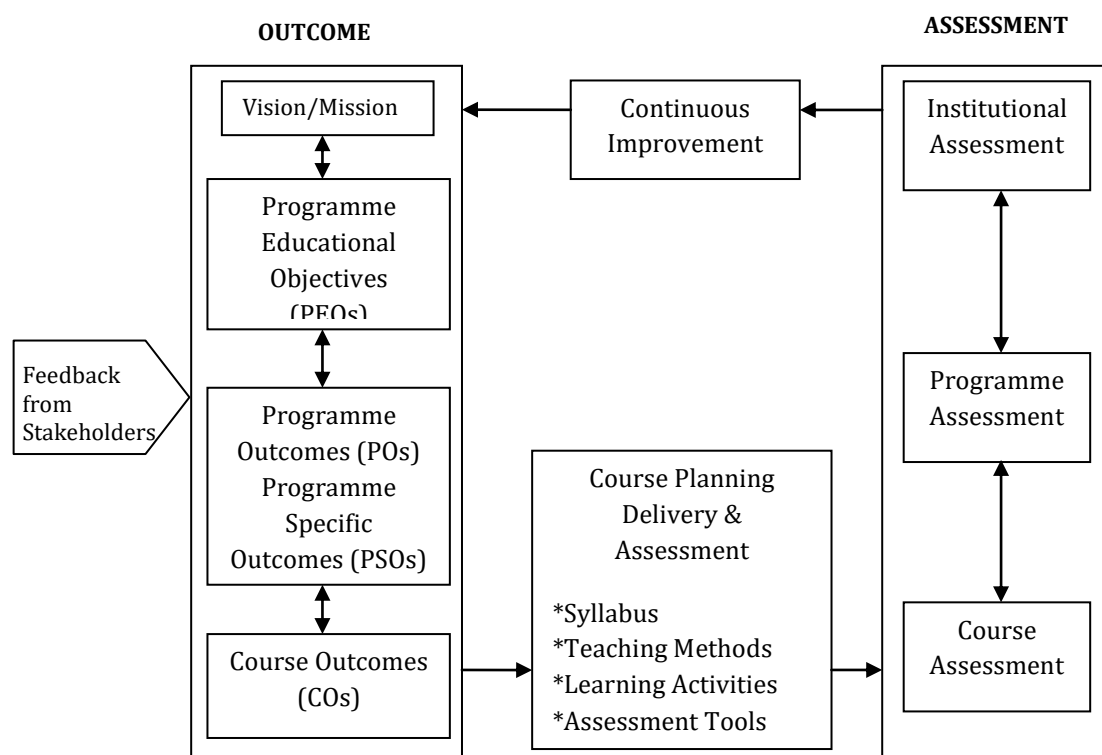
**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**(Affiliated to Madurai Kamaraj University,**  
**Re-accredited with A Grade (CGPA 3.11) by NAAC)**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**GUIDELINES FOR OUTCOME-BASED EDUCATION WITH CHOICE BASED**  
**CREDIT SYSTEM**  
**(From 2023-2024 Batch onwards)**

**INTRODUCTION**

Sri Kaliswari College in its pursuit of imparting quality education has marked a remarkable growth in terms of academic excellence, infrastructure, student strength, ICT facilities, library and placement records since its establishment in 2000-2001. This institution constitutes an academic community that is committed to encourage the student community to experience and share knowledge, identify their potential, enhance the employability skills and enable them to pursue their goals. After the conferment of autonomous status in the year 2012, the college has so far gone for revision of the syllabi three times and is continually updating the syllabi to meet the needs and demands of the student community.

The institution in its success journey of imparting quality education has been Re-Accredited with A grade (CGPA 3.11) in its third cycle of accreditation by NAAC. As an added feather to its cap, the institution has taken a giant leap to embrace the Outcome-Based Education system to enable the student community to develop their knowledge, skill and attitude simultaneously through a focussed learning and help the graduates to compete with their global counterparts and prepare them for life.

**I. OUTCOME-BASED EDUCATION (OBE) FRAMEWORK**



## **II. VISION OF THE INSTITUTION**

- To impart quality higher education to produce highly talented youth capable of developing the nation

## **III. MISSION OF THE INSTITUTION**

- Ensuring quality in all aspects of the activities
- Developing the latent skills of the rural youth
- Providing value - based education to instil courage and confidence
- Nurturing the entrepreneurial skills of the rural youth
- Creating competency to meet global challenges
- Imbibing social awareness and social responsibilities

## **IV. VISION OF THE DEPARTMENT**

- To impart quality higher education in the field of Biotechnology that intensely impact the existing paradigm of agriculture, industry, health care, and sustainable environment

## **V. MISSION OF THE DEPARTMENT**

- To become a pioneer department of higher learning, imparting state of the art education, training, and research in the field of Biotechnology.
- To generate skilled manpower in different areas of Biotechnology to work in the Biotechnology related industries.
- To contribute to the advancement of science through applied research leading to the development of innovative products.

## **VI. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

The Graduates will

**PEO1:** demonstrate advance knowledge in the field of biotechnology and its cutting edge developments in a specific and emerging area.

**PEO 2:** acquire ability to use theoretical knowledge, practical skills, and recent technological tools in solving any technological challenges and problems in the social context and construct logical arguments using correct technical language

**PEO 3:** imbibe entrepreneurial traits to develop new products, processes, services and induce a desire to set-up a small-medium scale biotech based industrial system.

**PEO 4:** pursue higher education and enhance career opportunities in the industries and Pharma companies with global competency.

**PEO 5:** develop innovative technology by continuously updating their knowledge and demonstrate professional and ethical attitude with awareness of current issues for achieving personal and institutional growth.

## **VII. PROGRAMME OUTCOMES (POs)**

Programme Outcomes are narrower statements that describe what students are expected to know and be able to do upon the graduation. These relate to the skills, knowledge and behavior that students acquire in their study through the programmes.

### **PO1: Disciplinary knowledge**

Acquire comprehensive and scientific knowledge in the field of Science.

### **PO2: Critical thinking, Problem solving and Analytical reasoning**

Develop students' ability of critical observation and capacity to apply the principles/facts of science to identify, analyse, evaluate and solve problems in order to draw realistic conclusions.

### **PO3: Scientific reasoning and Research related skills**

Capability to involve in planning and conducting experiments, analyze the scientific research field, interpret and draw conclusions from experiments and investigate practically.

### **PO4: Communication skills and Digital literacy**

Communicate effectively and articulate clearly the scientific ideas in written and oral form and make use of appropriate software for scientific computations and gain ICT skills to disseminate knowledge.

### **PO5: Ethics, Values and Multicultural competence**

Embrace moral and ethical values and apply it with a sense of responsibility in the workplace and community and adopt objective, unbiased and truthful actions in all aspects of work.

### **PO6: Team Work, Leadership and Employability skills**

Work effectively and respectfully in groups with enhanced inter-personal skills and exhibit qualities associated with leadership to build a team and achieve the vision and show proficiency in professional, employability and soft skills required for placements and higher educations

### **PO7: Self-directed and Life-long learning**

Recognize the need and have the ability to engage in independent learning and be self-motivated and acquire knowledge through lifelong learning in the broadest context of technological change.

## VIII. PROGRAMME SPECIFIC OUTCOMES (PSOs) – B.Sc. BIOTECHNOLOGY

On successful completion of B.Sc. Biotechnology, the students will

**PSO 1:** acquire knowledge to understand various facets of molecular procedures and basics of Cell Biology, Microbiology, Biochemistry, Genomics, proteomics, plant and animal Biotechnology, Genetic Engineering, and Computational Biology.

**PSO 2:** Identify, analyze, and understand the problems related to life sciences and find suitable solutions with basic knowledge acquired in Biotechnology.

**PSO 3:** perform experiments as per established laboratory standards in the areas of Biotechnology and provide suitable scientific conclusions.

**PSO 4:** equip reading, presenting, communicating and writing scientific ideas and learn to use computer software to tabulate and interpret the Biological data.

**PSO 5:** learn ethical principles and show commitment to professional ethics and responsibilities with an understanding of the social, ethical, legal, and cultural aspects of society.

**PSO 6:** evolve managerial and leadership skill to start-up Biotech farms and skills for career and starting up own firms and function effectively as an individual, and as a member or leader in diverse teams, and multidisciplinary settings.

**PSO 7:** acquire the ability to engage in an independent and life-long learning in the broadest context of socio-technological changes.



**IX. PO-PSO Mapping Matrix - B.Sc. Biotechnology**

PO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
P01	✓						
P02		✓					
P03			✓				
P04				✓			
P05					✓		
P06						✓	
P07							✓

**X. PO-PEO Mapping Matrix - B.Sc. Biotechnology**

PO \ PEO	PEO1	PEO2	PEO3	PEO4	PEO5
P01	✓	✓			✓
P02		✓	✓		
P03		✓	✓		✓
P04	✓	✓		✓	
P05		✓	✓	✓	✓
P06		✓	✓	✓	
P07				✓	✓

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**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**

**REGULATIONS**

**Duration of the Programme** : Three years (equivalent to six semesters)

**Eligibility**

Candidate should have passed the Higher Secondary Examinations conducted by the Board of Higher Secondary Education, Government of Tamil Nadu or any other examination accepted by the Syndicate of the Madurai Kamaraj University, Madurai as its equivalent.

a) Biology/ Physics/ Chemistry as Subjects in the higher secondary education

b) Candidates should have secured at least 60% in the above subjects and above in aggregates

c) A relaxation of 10% marks in the aggregate will be given to SC/ST candidates

**Medium of Instruction** : English

**Age Limit**

Maximum age limit : 21 Years

**Age Relaxation**

SC/ SCA/ST/BC/BCM/MBC/DNC & Women : 3 years age relaxation

Differently-Abled Students : 5 years age relaxation

**Transitory Permission**

Students joined from 2023 - 2024 may be permitted to write their examinations in this pattern up to April 2031.

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SCHEME OF EXAMINATION**

For all the UG Programmes, the internal and external marks are distributed as follows:

For all Theory Courses (Part I, II, III): Internal Marks: 25; External Marks: 75

For Courses with both Theory and Practical, it will be considered as practical course and assessment will be for both Theory and Practical.

For Part-IV Courses : Internal Marks:25; External Marks: 50  
(Converted to 75)

For all Practical Courses, Project and Internship : Internal Marks: 25; External Marks: 75

**Internal Mark Distribution for Theory Courses**

<b>Assessment Type</b>	<b>Marks</b>	<b>Scheme of Assessment</b>
<b>Internal Test</b>	10 marks	Two Internal Tests and 1 Model Exam will be conducted and average of the best two will be considered
<b>Written Assignment E-Assignment/ Case Studies/ Reviews/ Field Assignments/ Poster Presentations/ Portfolios</b>	5 marks	Any two of the Assignments will be given and the average of the two will be considered
<b>Quiz</b>	5 marks	One Quiz Test will be conducted
<b>Viva/ Oral Exam/ Group Discussion/ Role Play</b>	5 marks	Test will be conducted in any one of the Oral Mode

**Internal Mark Distribution for Practical Courses**

<b>Assessment Type</b>	<b>Marks</b>	<b>Scheme of Assessment</b>
<b>Lab work /Program Execution</b>	15 marks	Two Internal Tests will be conducted and the average of the two will be considered
<b>Observation/Record Notebook</b>	5 marks	Assessment will be done during every practical class
<b>Viva -Voce / Lab Quiz</b>	5 marks	Two Lab Quiz Tests/viva-voce will be conducted and the average of the two will be considered

### External Mark Distribution for Practical Courses

Assessment Type	Marks	Scheme of Assessment
Lab work/Program Execution	65 marks	End result of the Practical
Viva -Voce	10 marks	Oral Mode Test

### Internal Mark Distribution for Courses with both Theory and Practical

Assessment Type	Marks	Scheme of Assessment
Internal Test	10 marks	Two Internal Tests and 1 Model Exam will be conducted and average of the best two will be considered
Written Assignment E-Assignment/ Case Studies/ Reviews/ Field Assignments/ Poster Presentations/ Portfolios	5 marks	Any two of the Assignments will be given and the average of the two will be considered
Lab work /Program Execution	10 marks	Two Internal Tests will be conducted and the average of the two will be considered

### External Mark Distribution for Courses with both Theory and Practical

Assessment Type	Marks	Scheme of Assessment
External Written Test	50 marks	Two hours External Exam will be conducted for 50 marks
Lab work /Program Execution	20 marks	End result of the Practical
Viva -Voce	05 marks	Oral Mode Test

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**QUESTION PAPER PATTERN FOR PART- I, PART- II & PART-III COURSES**

**Internal Test – 30 Marks – 1 hr Duration**

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 3 questions Answer in a Word/Sentence – 3 questions	03 03
2.	Short Answer-2 questions – either or type	2x7=14
3.	Long Answer-1 question – either or type	1x10=10

**Summative Examinations – For Part- I, Part- II & Part-III Courses**  
**75 Marks -3 hrs Duration**

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 5 questions Answer in a Word/Sentence – 5 questions	05 05
2.	Short Answer - 5 questions – either or type	5x7=35
3.	Long Answer - 3 questions – either or type	3x10=30

**QUESTION PAPER PATTERN FOR PART -IV COURSES**  
**Internal Test- 30 Marks – 1 hr Duration**

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 5 questions	05
2.	Short Answer - 3 questions – either or type	3x5=15
3.	Long Answer - 1 question – either or type	01x10=10

**Summative Examinations – For Part-IV Courses 50 Marks (converted to 75)**  
**-2 hrs Duration**

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 10 questions	10
2.	Short Answer - 4 questions – either or type	4x5=20
3.	Long Answer - 2 questions – either or type	02x10=20

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**

**Attainment of Course outcomes**

Attainment of Course outcomes is computed using Direct and Indirect assessment methods. Direct Method of Assessment is based on performance of the students in the Continuous Internal Assessment Tests, Summative Examinations and supporting activities such as Seminar, Assignment, Case study, Group Discussion, Quiz, etc., and Indirect Method of Assessment is based on periodical feedback from the students at the end of each course.

Weightage of Direct and Indirect Assessment in computation of attainment of each course is 70% for Direct Assessment and 30% for Indirect Assessment.

**Direct Assessment of Course outcome attainment**

**i) Rubrics:**

Internal Assessment contributes 60% and Summative Examinations Assessment contributes 40% to the Direct Assessment of a course outcome for Theory Courses. For the Practical Courses, Internal Assessment contributes 70% and Summative Examinations Assessment contributes 30% to the Direct Assessment of a course outcome.

**ii) Setting of Target:**

50% of the maximum mark is set as target of Internal Assessment tools and the average mark of the class is set as target of Summative Examinations Assessment.

**Formula for calculating percentage attainment of each course outcome**

Based on the result of Summative Examinations and Internal Assessment tools, the number of students scoring more than the target is found out.

**For each Internal Assessment Tools,**

$$\text{Percentage attainment of each course outcome} = \frac{\text{No. of Students who scored more than the target in the concerned course outcome}}{\text{Total Number of Students}} \times 100$$

$$\text{Percentage attainment of each Course outcome for Internal Assessment tools} = \text{Average of percentage attainment of all Internal Assessment tools}$$

### For Summative Examinations,

$$\text{Percentage of attainment of each Course outcome} = \frac{\text{No. of. Students who scored more than the target in the concerned co}}{\text{Total Number of Students}} \times 100$$

### Formula for calculating Attainment Percentage of Course outcome of a course

$$\text{Percentage Attainment of Course outcome for Internal Assessment tools} = \text{Average of percentage attainment of all COs}$$

$$\text{Percentage Attainment of Course outcome for Summative Examinations} = \text{Average of percentage attainment of all COs}$$

### Final Direct Assessment of Course Outcome Attainment

#### For Theory Courses

$$\text{Percentage Attainment of Course outcome through Direct Assessment} = (0.6 \times \text{percentage attainment of CO for internal assessment tool}) + (0.4 \times \text{percentage attainment of CO for summative examinations})$$

#### For Practical Courses

$$\text{Percentage Attainment of Course outcome through Direct Assessment} = 0.7 \times \text{percentage attainment of CO for Internal Assessment tools} + 0.3 \times \text{percentage attainment of CO for Summative Examinations}$$

### Indirect Assessment of CO Attainment

The course outcome feedback is conducted at the end of every semester by distributing structured feedback questionnaire to the students. The analysis of this feedback questionnaire is done on the following score. The feedback forms will be sorted with various scores and feedbacks with a score more than 5.5 are considered as satisfactory level for calculations for indirect attainment.

**A : 10-8.5      B : 8.4-7.0      C : 6.9-5.5      D : 5.4-4.0      E : 3.9-0**

$$\text{Percentage attainment for each CO} = \frac{\text{Satisfaction Number}}{\text{Response Received}} \times 100$$

Percentage Attainment of CO of a course = Average of percentage attainment of all COs

### Final Assessment of CO attainment

$$\text{Average course attainment} = 0.7 \times \text{Direct assessment of CO attainment} + 0.3 \times \text{Indirect assessment of CO attainment}$$

### Expected Level of Attainment for each of the Course Outcomes

Percentage of CO Attainment	Level of Attainment
= 70% and above	Excellent
= 60% - <70 %	Very good
= 50% - < 60 %	Good
= 40% - < 50 %	Satisfactory
Below 40%	Not Satisfactory

### Assessment of PO attainment

At the end of the each programme, the Direct PO Assessment is done from the CO Attainment of all courses. The Direct PO Attainment for a particular course is determined from the attainment values obtained for each course outcome related to that PO and the CO-PO mapping values.

Weighted contribution of the course in attainment of each PO	$= \frac{\text{Weighted Percentage of contribution of the course in attainment of each PO}}{\text{average course attainment}} \times 100$
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$$\text{Percentage attainment for each PO} = \frac{\text{Total Weightage of all Courses contributed to each PO}}{\text{Total Weightage of all Courses contributed to all POs}} \times 100 \times \text{weighted contribution of the course in the attainment of each Po}$$

Percentage Attainment of PO = Average of Percentage attainment of all POs

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

Percentage of PO Attainment	Level of Attainment
= 70% and above	Excellent
= 60% - <70 %	Very good
= 50% - < 60 %	Good
= 40% - < 50 %	Satisfactory
Below 40%	Not Satisfactory

### Attainment of Programme Educational Objectives (PEO)

PEOs are assessed after 3 to 4 years of graduation. Attainment is measured based on the Feedback from Stakeholders

1. Alumni
2. Parents
3. Employer

The analysis of this feedback questionnaire is done on the following score. The feedback forms will be sorted with various scores and feedbacks with a score more than 5.5 are considered as satisfactory level for calculations for Indirect Attainment.

A : 10-8.5      B : 8.4-7.0      C : 6.9-5.5      D : 5.4-4.0      E : 3.9-0

$$\text{Percentage attainment of PEOs} = \frac{\text{Satisfaction number}}{\text{Response Received}} \times 100$$

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

Percentage of PEO Attainment	Level of Attainment
= 70% and above	Excellent
= 60% - <70 %	Very good
= 50% - < 60 %	Good
= 40% - < 50 %	Satisfactory
Below 40%	Not Satisfactory

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**DEPARTMENT OF BIOTECHNOLOGY  
UG Programme - B.Sc. Biotechnology  
CURRICULUM STRUCTURE**

**OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM  
(From 2023-2024 Batch onwards)**

Part	Courses	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Credits
I	Tamil / Hindi	6 (3)	6 (3)	6 (3)	6 (3)	-	-	12
II	English	6 (3)	6 (3)	6 (3)	6 (3)	-	-	12
III	Core Courses	4 (4) 4P (4)	4 (4) 4P (4)	4 (4) 4P(4)	4 (4) 3P (3)	4 (4) 4 (3) 4 (3) 4P (4) 4P (4)	6 (4) 6 (4) 8 (5)	62
	Elective Courses Generic/ Discipline Specific	4 (3) 2P (2)	4 (3) 2P (2)	4(3) 2P(2)	4 (3) 2P(2)	4 (2) 4 (2)	4 (3) 4 (3)	30
IV	Skill Enhancement Courses	2 (2)F 2(2)NME	2 (2) 2(2)NME	1(1)(E) 2P(2)	2 (2) 2 (2)	-	2 (2)	17
	Environmental Studies	-	-	1	1 (2)	-	-	02
	Value Education	-	-	-	-	2 (2)	-	02
	Internship/ Industrial Training	-	-	-	-	(2)	-	02
V	Extension Activity	-	-	-	-	-	(1)	01
Total Hours (Per week)/Credits		30(23)	30(23)	30(22)	30(24)	30(26)	30(22)	140 180

Self-paced Learning (Swayam Course)	-	-	-	-	-	-	1 Credit	1 Credit
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**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**CURRICULUM PATTERN**  
**OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM**  
**(From 2023-2024 Batch onwards)**  
**PROGRAMME CODE - UBT**

Semester	Part	Course Code	Course Name	Hours	Credits	Internal Marks	External Marks	
I	I	23UTAG11	Podhu Tamil / Hindi – I	6	3	25	75	
	II	23UENL11	General English – I	6	3	25	75	
			23UBTC11	<b>Core Course - I:</b> Cell and Molecular Developmental Biology	4	4	25	75
			23UBTC1P	<b>Core Course - II: Practical:</b> Cell and Molecular Developmental Biology	4	4	25	75
	III		23UBTA11	<b>Elective Course Generic/Discipline specific - I:</b> Biological Chemistry	4	3	25	75
			23UBTA1P	<b>Elective Course Generic/Discipline specific - I: Practical:</b> Biological Chemistry	2	2	25	75
	IV		23UBTS11	<b>Skill Enhancement Course - I: Foundation Course -</b> Basic Concepts of Biotechnology	2	2	25	75
			23UBTN11	<b>Skill Enhancement Course II: Non Major Elective Course:</b> Food and Nutrition	2	2	25	75
	<b>Total</b>				<b>30</b>	<b>23</b>		
II	I	23UTAG21	Podhu Tamil / Hindi – II	6	3	25	75	
	II	23UENL21	General English – II	6	3	25	75	
			23UBTC21	<b>Core Course - III:</b> Genetics	4	4	25	75
			23UBTC2P	<b>Core Course - IV: Practical:</b> Genetics	4	4	25	75
	III		23UBTA21	<b>Elective Course Generic/Discipline specific - II:</b> Fundamentals of Microbiology	4	3	25	75
			23UBTA2P	<b>Elective Course Generic/Discipline specific - II: Practical:</b> Fundamentals of Microbiology	2	2	25	75
	IV		23UBTS21	<b>Skill Enhancement Course – III:</b> Plant and Animal Physiology	2	2	25	75
			23UBTN21	<b>Skill Enhancement Course IV: Non Major Elective Course:</b> Biotechnology for society	2	2	25	75
	<b>Total</b>				<b>30</b>	<b>23</b>		

III	I	23UTAG31	Podhu Tamil / Hindi – III	6	3	25	75
	II	23UENL31	General English – III	6	3	25	75
	III	23UBTC31	<b>Core Course - V: Immunology and Immunotechnology</b>	4	4	25	75
		23UBTC3P	<b>Core Course - VI: Practical: Immunology and Immunotechnology</b>	4	4	25	75
		23UBTA31	<b>Elective Course Generic/Discipline specific - III: Bioinstrumentation</b>	4	3	25	75
	23UBTA3P	<b>Elective Course Generic/Discipline specific - III: Practical: Bioinstrumentation</b>	2	2	25	75	
	IV	23UBTS31	<b>Skill Enhancement Course - V: (Entrepreneurial Skill) - Biofertilizer</b>	1	1	25	75
		23UBTS3P	<b>Skill Enhancement Course - VI: Practical: Biofertilizer Production</b>	2	2	25	75
		-	Environmental Studies	1	-		
	<b>Total</b>				<b>30</b>	<b>22</b>	
IV	I	23UTAG41	Podhu Tamil / Hindi – IV	6	3	25	75
	II	23UENL41	General English – IV	6	3	25	75
	III	23UBTC41	<b>Core Course - VII: Genetic Engineering and rDNA technology</b>	4	4	25	75
		23UBTC4P	<b>Core Course - VIII: Practical: Genetic Engineering and rDNA technology</b>	3	3	25	75
		23UBTA41	<b>Elective Course Generic/Discipline specific - IV: Bioinformatics and Biostatistics</b>	4	3	25	75
		23UBTA4P	<b>Elective Course Generic/Discipline specific -IV: Practical: Bioinformatics and Biostatistics</b>	2	2	25	75
	IV	23UBTS41	<b>Skill Enhancement Course -VII: Clinical Nutrition and Dietary Management</b>	2	2	25	75
		23UBTS42	<b>Skill Enhancement Course -VIII: Clinical Microbiology</b>	2	2	25	75
		23UESR41	Environmental Studies	1	2	25	75
	<b>Total</b>				<b>30</b>	<b>24</b>	
V	III	23UBTC51	<b>Core Course - IX: Plant Biotechnology</b>	4	4	25	75
		23UBTC52	<b>Core Course - X: Animal Biotechnology</b>	4	3	25	75
		23UBTC53	<b>Core Course - XI: Environmental and Industrial Biotechnology</b>	4	3	25	75
		23UBTC5P	<b>Core Course - XII: Practical: Plant Biotechnology and Animal Biotechnology</b>	4	4	25	75
		23UBTC5Q	<b>Core Course - XIII: Practical: Environmental and Industrial Biotechnology</b>	4	4	25	75

		23UBTO51 23UBTO52	<b>Elective Courses Generic/Discipline specific - V:</b> 1. Nanobiotechnology 2. Enzymology	4	2	25	75
		23UBTO53 23UBTO54	<b>Elective Courses Generic/Discipline specific - VI:</b> 1. Bioethics and Biosafety 2. Cancer Biology	4	2	25	75
	IV	23UVED51	Value Education	2	2	25	75
		23UBTJ51	Internship/Industrial Training	-	2	25	75
			<b>Total</b>	<b>30</b>	<b>26</b>		
<b>VI</b>	III	23UBTC61	<b>Core Course - XIV:</b> Bioentrepreneurship	6	4	25	75
		23UBTC62	<b>Core Course - XV:</b> Pharmaceutical Biotechnology	6	4	25	75
		23UBTJ61	<b>Core Course - XVI:</b> Project with Viva Voce	8	5	25	75
		23UBTO63 23UBTO64	<b>Elective Courses Generic/Discipline specific - VII:</b> 1. Marine Biotechnology 2. Food Technology	4	3	25	75
		23UBTO65 23UBTO66 23UBTO67	<b>Elective Courses Generic/Discipline specific - VIII:</b> 1. Medical Biotechnology 2. Forensic Biotechnology 3. Good Laboratory Practices	4	3	25	75
	IV	23UBTS61	<b>Skill Enhancement Course - IX:</b> Quality Control and Testing	2	2	25	75
	V	-	Extension Activity	-	1	100	-
			<b>Total</b>	<b>30</b>	<b>22</b>		

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**PROGRAMME ARTICULATION MATRIX (PAM)**

Semester	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>I</b>	23UTAG11	Podhu Tamil / Hindi – I	10	07	02	08	02	02	03
	23UENL11	General English – I	10	07	02	08	02	02	03
	23UBTC11	<b>Core Course - I:</b> Cell and Molecular Developmental Biology	15	13	13	07	07	05	05
	23UBTC1P	<b>Core Course - II: Practical:</b> Cell and Molecular Developmental Biology	15	13	13	07	07	05	05
	23UBTA11	<b>Elective Course Generic/Discipline specific - I:</b> Biological Chemistry	15	10	05	04	02	03	02
	23UBTA1P	<b>Elective Course Generic/Discipline specific - I: Practical:</b> Biological Chemistry	15	10	05	02	02	04	03
	23UBTS11	<b>Skill Enhancement Course - I: Foundation Course - Basic Concepts of Biotechnology</b>	09	09	07	07	03	02	03
	23UBTN11	<b>Skill Enhancement Course II: Non Major Elective Course:</b> Food and Nutrition	13	10	05	05	02	10	05
<b>II</b>	23UTAG21	Podhu Tamil / Hindi – II	10	08	02	08	02	02	03
	23UENL21	General English – II	10	08	02	08	02	02	03
	23UBTC21	<b>Core Course - III:</b> Genetics	15	13	14	06	07	06	06
	23UBTC2P	<b>Core Course - IV: Practical:</b> Genetics	15	12	13	07	08	05	07
	23UBTA21	<b>Elective Course Generic/Discipline specific - II:</b> Fundamentals of Microbiology	12	10	07	05	05	05	05
	23UBTA2P	<b>Elective Course Generic/Discipline specific - II: Practical</b> Fundamentals of Microbiology	10	10	07	05	10	05	05

	23UBTS21	<b>Skill Enhancement Course – III:</b> Plant and Animal Physiology	11	08	07	05	02	0	05
	23UBTN21	<b>Skill Enhancement Course IV: Non Major Elective Course:</b> Biotechnology for society	09	09	07	07	03	02	03
III	23UTAG31	Podhu Tamil / Hindi – III	10	8	2	8	2	2	2
	23UENL31	General English – III	10	08	03	09	03	03	02
	23UBTC31	<b>Core Course - V:</b> Immunology and Immunotechnology	15	13	12	06	07	06	05
	23UBTC3P	<b>Core Course - VI: Practical:</b> Immunology and Immunotechnology	15	13	12	06	07	06	05
	23UBTA31	<b>Elective Course Generic/Discipline specific - III:</b> Bioinstrumentation	10	13	10	05	05	05	05
	23UBTA3P	<b>Elective Course Generic/Discipline specific - III: Practical:</b> Bioinstrumentation	10	13	10	05	05	05	05
	23UBTS31	<b>Skill Enhancement Course – V: (Entrepreneurial Skill) –</b> Biofertilizer	10	12	10	05	05	05	05
	23UBTS3P	<b>Skill Enhancement Course - VI: Practical:</b> Biofertilizer Production	11	11	10	09	05	05	05
	-	Environmental Studies	0	0	0	0	0	0	0
IV	23UTAG41	Podhu Tamil / Hindi – IV	10	8	2	9	2	2	2
	23UENL41	General English – IV	10	09	03	08	02	03	03
	23UBTC41	<b>Core Course – VII:</b> Genetic Engineering and rDNA technology	15	11	12	05	07	03	04
	23UBTC4P	<b>Core Course - VIII: Practical:</b> Genetic Engineering and rDNA technology	15	12	12	05	07	03	04
	23UBTA41	<b>Elective Course Generic/Discipline specific - IV:</b> Bioinformatics and Biostatistics	08	09	11	05	05	05	05
	23UBTA4P	<b>Elective Course Generic/Discipline specific -IV: Practical:</b> Bioinformatics and Biostatistics	12	11	12	09	05	05	05
	23UBTS41	<b>Skill Enhancement Course -VII:</b>	10	07	10	05	05	05	05

		Clinical Nutrition and Dietary Management							
	23UBTS42	<b>Skill Enhancement Course -VIII:</b> Clinical Microbiology	10	09	10	05	05	05	05
	23UESR41	Environmental Studies	08	5	1	7	08	05	05
V	23UBTC51	<b>Core Course - IX:</b> Plant Biotechnology	15	13	13	09	08	13	09
	23UBTC52	<b>Core Course - X:</b> Animal Biotechnology	15	15	14	10	13	15	15
	23UBTC53	<b>Core Course - XI:</b> Environmental and Industrial Biotechnology	15	15	15	10	12	09	05
	23UBTC5P	<b>Core Course - XII: Practical:</b> Plant Biotechnology and Animal Biotechnology	15	12	10	09	10	10	05
	23UBTC5Q	<b>Core Course - XIII: Practical:</b> Environmental and Industrial Biotechnology	12	12	13	10	05	10	13
	23UBT051	<b>Elective Courses Generic/Discipline specific - V:</b> Nanobiotechnology	11	09	08	05	09	10	11
	23UBT052	<b>Elective Courses Generic/Discipline specific - V :</b> Enzymology	11	09	08	05	09	10	11
	23UBT053	<b>Elective Courses Generic/Discipline specific - VI:</b> Bioethics and Biosafety	11	10	08	05	09	10	11
	23UBT054	<b>Elective Courses Generic/Discipline specific - VI:</b> Cancer Biology	11	10	08	05	09	10	11
		23UVED51	Value Education	08	05	01	05	09	04
	23UBTJ51	Internship/Industrial Training	08	12	04	07	01	05	08
VI	23UBTC61	<b>Core Course - XIV:</b> Bioentrepreneurship	15	13	15	10	07	12	06
	23UBTC62	<b>Core Course - XV:</b> Pharmaceutical Biotechnology	15	12	12	10	05	09	07
	23UBTJ61	<b>Core Course - XVI:</b> Project with Viva Voce	15	13	12	10	05	06	05



23UBTO63	<b>Elective Courses Generic/Discipline specific - VII: Marine Biotechnology</b>	10	08	09	05	09	10	07
23UBTO64	<b>Elective Courses Generic/Discipline specific - VII: Food Technology</b>	10	08	09	05	09	10	07
23UBTO65	<b>Elective Courses Generic/Discipline specific - VIII: Medical Biotechnology</b>	12	10	09	05	09	10	07
23UBTO66	<b>Elective Courses Generic/Discipline specific - VIII: Forensic Biotechnology</b>	12	10	09	05	09	10	07
23UBTO67	<b>Elective Courses Generic/Discipline specific - VIII: Good Laboratory Practices</b>	12	10	09	05	09	10	07
23UBTS61	<b>Skill Enhancement Course - IX: Quality Control and Testing</b>	11	08	08	05	09	10	09
-	Extension Activity	08	02	01	07	09	08	05
<b>Total Weightage of all courses contributing to PO</b>		<b>579</b>	<b>498</b>	<b>404</b>	<b>332</b>	<b>280</b>	<b>286</b>	<b>271</b>

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**PROGRAMME ARTICULATION MATRIX - WEIGHTED PERCENTAGE**

Semester	Course Code	Course Name	P01	P02	P03	P04	P05	P06	P07
<b>I</b>	23UTAG11	Podhu Tamil / Hindi - I	1.73	1.41	0.5	2.41	0.71	0.7	1.11
	23UENL11	General English - I	1.73	1.41	0.5	2.41	0.71	0.7	1.11
	23UBTC11	<b>Core Course - I:</b> Cell and Molecular Developmental Biology	2.59	2.61	3.22	2.11	2.5	1.75	1.85
	23UBTC1P	<b>Core Course - II: Practical:</b> Cell and Molecular Developmental Biology	2.59	2.61	3.22	2.11	2.5	2.45	2.95
	23UBTA11	<b>Elective Course Generic/Discipline specific - I:</b> Biological Chemistry	2.59	2.01	1.24	1.2	0.71	1.05	0.74
	23UBTA1P	<b>Elective Course Generic/Discipline specific - I: Practical:</b> Biological Chemistry	2.59	2.01	1.24	0.6	0.71	1.4	1.11
	23UBTS11	<b>Skill Enhancement Course - I: Foundation Course - Basic Concepts of Biotechnology</b>	1.55	1.81	1.73	2.11	1.07	0.7	1.11
	23UBTN11	<b>Skill Enhancement Course II: Non Major Elective Course:</b> Food and Nutrition	2.25	2.01	1.24	1.51	0.71	3.5	1.85
<b>II</b>	23UTAG21	Podhu Tamil / Hindi - II	1.73	1.61	0.5	2.41	0.71	0.7	1.11
	23UENL21	General English - II	1.73	1.61	0.5	2.41	0.71	0.7	1.11
	23UBTC21	<b>Core Course - III:</b> Genetics	2.59	2.61	3.47	1.81	2.5	2.1	2.21
	23UBTC2P	<b>Core Course - IV: Practical:</b> Genetics	2.59	2.41	3.22	2.11	2.86	1.75	2.58
	23UBTA21	<b>Elective Course Generic/Discipline specific - II:</b> Fundamentals of Microbiology	2.07	2.01	1.73	1.51	1.79	1.75	1.85
	23UBTA2P	<b>Elective Course Generic/Discipline specific - II: Practical:</b> Fundamentals of Microbiology	1.73	2.01	1.73	1.51	3.57	1.75	1.85

	23UBTS21	<b>Skill Enhancement Course - III:</b> Plant and Animal Physiology	1.9	1.61	1.73	1.51	0.71	0	1.85
	23UBTN21	<b>Skill Enhancement Course IV: Non Major Elective Course:</b> Biotechnology for society	1.55	1.81	1.73	2.11	1.07	0.7	1.11
III	23UTAG31	Podhu Tamil / Hindi – III	1.73	1.61	0.5	2.41	0.71	0.7	0.74
	23UENL31	General English – III	1.73	1.61	0.74	2.71	1.07	1.05	0.74
	23UBTC31	<b>Core Course - V:</b> Immunology and Immunotechnology	2.59	2.61	2.97	1.81	2.5	2.1	1.85
	23UBTC3P	<b>Core Course - VI: Practical:</b> Immunology and Immunotechnology	2.59	2.61	2.97	1.81	2.5	2.1	1.85
	23UBTA31	<b>Elective Course Generic/Discipline specific - III:</b> Bioinstrumentation	1.73	2.61	2.48	1.51	1.79	1.75	1.85
	23UBTA3P	<b>Elective Course Generic/Discipline specific - III: Practical:</b> Bioinstrumentation	1.73	2.61	2.48	1.51	1.79	1.75	1.85
	23UBTS31	<b>Skill Enhancement Course - V: (Entrepreneurial Skill) -</b> Biofertilizer	1.73	2.41	2.48	1.51	1.79	1.75	1.85
	23UBTS3P	<b>Skill Enhancement Course - VI: Practical:</b> Biofertilizer Production	1.9	2.21	2.48	2.71	1.79	1.75	1.85
	-	Environmental Studies	0	0	0	0	0	0	0
IV	23UTAG41	Podhu Tamil / Hindi – IV	1.73	1.61	0.5	2.71	0.71	0.7	0.74
	23UENL41	General English – IV	1.73	1.81	0.74	2.41	.71	1.05	1.11
	23UBTC41	<b>Core Course – VII:</b> Genetic Engineering and rDNA technology	2.59	2.21	2.97	1.51	2.5	1.05	1.48
	23UBTC4P	<b>Core Course - VIII: Practical:</b> Genetic Engineering and rDNA technology	2.59	2.41	2.97	1.51	2.5	1.05	1.48
	23UBTA41	<b>Elective Course Generic/Discipline specific - IV:</b> Bioinformatics and Biostatistics	1.38	1.81	2.72	1.51	1.79	1.75	1.85
	23UBTA4P	<b>Elective Course Generic/Discipline specific - IV: Practical:</b> Bioinformatics and Biostatistics	2.07	2.21	2.97	2.71	1.79	1.75	1.85
	23UBTS41	<b>Skill Enhancement Course - VII:</b> Clinical Nutrition and Dietary	1.73	1.41	2.48	1.51	1.79	1.75	1.85

		Management								
	23UBTS42	<b>Skill Enhancement Course - VIII:</b> Clinical Microbiology	1.73	1.81	2.48	1.51	1.79	1.75	1.85	
	23UESR41	Environmental Studies	1.38	1	0.25	2.11	2.86	1.75	1.85	
V	23UBTC51	<b>Core Course - IX:</b> Plant Biotechnology	2.59	2.61	3.22	2.71	2.86	4.55	3.32	
	23UBTC52	<b>Core Course - X:</b> Animal Biotechnology	2.59	3.01	3.47	3.01	4.64	5.24	5.54	
	23UBTC53	<b>Core Course - XI:</b> Environmental and Industrial Biotechnology	2.59	3.01	3.47	3.01	4.29	3.15	1.85	
	23UBTC5P	<b>Core Course - XII: Practical:</b> Plant Biotechnology and Animal Biotechnology	2.59	2.41	2.48	2.71	3.57	3.5	1.85	
	23UBTC5Q	<b>Core Course - XIII: Practical:</b> Environmental and Industrial Biotechnology	2.07	2.41	3.22	3.01	1.79	3.5	4.8	
	23UBTO51	<b>Elective Courses Generic/Discipline specific - V:</b> Nanobiotechnology	1.9	1.81	1.98	1.51	3.21	3.5	4.06	
	23UBTO52	<b>Elective Courses Generic/Discipline specific - V :</b> Enzymology	1.9	1.81	1.98	1.51	3.21	3.5	4.06	
	23UBTO53	<b>Elective Courses Generic/Discipline specific - VI:</b> Bioethics and Biosafety	1.9	2.01	1.98	1.51	3.21	3.5	4.06	
	23UBTO54	<b>Elective Courses Generic/Discipline specific - VI:</b> Cancer Biology	1.9	2.01	1.98	1.51	3.21	3.5	4.06	
		23UVED51	Value Education	1.38	1	0.25	1.51	3.21	1.4	2.58
		23UBTJ51	Internship/Industrial Training	1.38	2.41	0.99	2.11	0.36	1.75	2.95
VI	23UBTC61	<b>Core Course - XIV:</b> Bioentrepreneurship	2.59	2.61	3.71	3.01	2.5	4.2	2.21	
	23UBTC62	<b>Core Course - XV:</b> Pharmaceutical Biotechnology	2.59	2.41	2.97	3.01	1.79	3.15	2.58	
	23UBTJ61	<b>Core Course - XVI:</b> Project with Viva voce	2.59	2.61	2.97	3.01	1.79	2.1	1.85	
	23UBTO63	<b>Elective Courses Generic/Discipline specific - VII:</b> Marine Biotechnology	1.73	1.61	2.23	1.51	3.21	3.5	2.58	
	23UBTO64	<b>Elective Courses Generic/Discipline specific - VII:</b> Food Technology	1.73	1.61	2.23	1.51	3.21	3.5	2.58	

	23UBTO65	<b>Elective Courses Generic/Discipline specific - VIII: Medical Biotechnology</b>	2.07	2.01	2.23	1.51	3.21	3.5	2.58
	23UBTO66	<b>Elective Courses Generic/Discipline specific - VIII: Forensic Biotechnology</b>	2.07	2.01	2.23	1.51	3.21	3.5	2.58
	23UBTO67	<b>Elective Courses Generic/Discipline specific - VIII: Good Laboratory Practices</b>	2.07	2.01	2.23	1.51	3.21	3.5	2.58
	23UBTS61	<b>Skill Enhancement Course - IX: Quality Control and Testing</b>	1.9	1.61	1.98	1.51	3.21	3.5	3.32
	-	Extension Activity	1.38	0.4	0.25	2.11	3.21	2.8	1.85
<b>Total Weightage of all courses contributing to PO</b>			<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF TAMIL**  
**UG PROGRAMME - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER - I**  
**(2023-2026)**  
**பொதுத்தமிழ் - I (23UTAG11)**  
**(From 2023-2024 Batch onwards)**

**HOURS / WEEK : 6**  
**CREDITS : 3**  
**DURATION : 90 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**நோக்கங்கள்**

- முதலாமாண்டு பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ் மொழி இலக்கியங்களை அறிமுகம் செய்தல்.
- தற்கால இலக்கியப் போக்குகளையும் இலக்கணங்களையும் மாணவர் அறியுமாறு செய்து அவர்களின் படைப்பாற்றலைத் தூண்டுதல்.
- தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.

**கற்றலின் விளைவுகள்**

- CO1[K1]:** பாரதியார் காலந்தொட்டு தற்காலக் கவிதைகள் வரை கவிதை இலக்கியம் அறிமுகப்படுத்தப்படுவதால் அவற்றை அடையாளம் காண்பர்.
- CO2[K2]:** கவிதை வரலாற்றினை புரிந்து கொண்டு பிழை இல்லாமல் எழுதும் திறன் பெறுவர்.
- CO3[K3]:** இக்கால இலக்கிய வகைகள் மற்றும் இலக்கணம் கற்பதன் மூலம் அவற்றை தம் வாழ்நிலையோடு பொருத்திப் பார்ப்பர்.
- CO4[K4]:** மொழியறிவோடு சிந்தனைத்திறன் பெற்று இலக்கியம் மற்றும் இலக்கணங்களைப் பகுப்பாய்வர்.
- CO5[K5]:** உலகளாவிய இலக்கியங்களைக் கற்று மதிப்பீடு செய்வர்.

**CO/PO Mapping Table (Course Articulation Matrix)**

CO \ PO	PO						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	2	2	-	2	-	-	-
CO2[K2]	2	2	-	2	-	-	-
CO3[K3]	2	1	-	2	1	-	1
CO4[K4]	2	1	1	1	1	1	1
CO5[K5]	2	1	1	1	-	1	1
Weightage of the Course	10	07	02	08	02	02	03
Weighted percentage of Course Contribution to Pos	1.73	1.41	0.5	2.41	0.71	0.7	1.11

Based on the Level of Contribution ('3' -High, '2' -Medium, '1' -Low, '-' No Correlation)

### கூறு I

(18 hrs)

**மரபுக்கவிதை:** பெ.சுந்தரனார் - தமிழ்த் தெய்வ வணக்கம், பாரதிதாசன் - சிறுத்தையை வெளியில் வா, கவிமணி - புத்தரும் சிறுவனும், முடியரசன் - மொழி உணர்ச்சி, கண்ணதாசன் - ஆட்டனத்தி ஆதிமந்தி - ஆதிமந்திபுலம்பல், சுரதா - துறைமுகம் தொகுப்பிலிருந்து ஏதேனும் ஒருகவிதை, தமிழ் ஒளி - கடல்

### கூறு II

(18 hrs)

**புதுக்கவிதை:** அப்துல் ரகுமான் - வீட்டுக்கொருமரம் வளர்ப்போம், ஈரோடு தமிழன்பன் - சென்றியூ கவிதைகள் (ஏதேனும் ஐந்து கவிதைகள்), வைரமுத்து - பிற்சேர்க்கை, மு.மேத்தா - வாழைமரம், அறிவுமதி - வள்ளுவம் பத்து, நா முத்துக்குமார் - ஆனந்தயாழை மீட்டுகிறாய், சுகிர்தராணி - சபிக்கப்பட்ட முத்தம், இளம் பிறை - நீ எழுத மறுக்கும் எனது அழகு.

### கூறு III

(18 hrs)

**சிறுகதைகள் :** வாய்ச்சொற்கள் - ஜெயகாந்தன் (மாலைமயக்கம் தொகுப்பு), கடிதம் - புதுமைப்பித்தன், கரு - உமாமகேஸ்வரி, முள்முடி - தி.ஜானகிராமன், சிதறல்கள் - விழி.பா.இதயவேந்தன், காகிதஉறவு - சு.சமுத்திரம், வீட்டின் மூலையில் சமையல் அறை - அம்பை, (மொழிபெயர்ப்புக் கதை) ஆண்டன் செக்காவ் - நாயக்காரச் சீமாட்டி, சந்தியா பதிப்பகம்;

### கூறு IV

(18hrs)

மரபுக்கவிதை கவிதை தோற்றம் வளர்ச்சி - புதுக்கவிதை கவிதை தோற்றம் வளர்ச்சி - சிறுகதை தோற்றம் வளர்ச்சி

### கூறு V

(18 hrs)

**மொழித்திறன் போட்டிதேர்வு:** பொருள் பொதிந்த சொற்றொடர் அமைத்தல், ஓர் எழுத்து ஒருமொழி, வேற்றுமை உருபுகள், திணை, பால், எண், இடம், கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு. (குறிப்பு: அலகு 4, 5 ஆகியன போட்டித் தேர்வு நோக்கில் நடத்தப்பட வேண்டும்).

### பாடநூல்கள்

1. தமிழியல் துறையினர், *தொகுப்பு நூல்*, ஸ்ரீ காளீஸ்வரி கல்லூரி (தன்னாட்சி), சிவகாசி.
2. வாசுதேவன், கா. *பன்முக நோக்கில் தமிழ் இலக்கிய வரலாறு*, தேவன் பதிப்பகம், திருச்சிராப்பள்ளி, 2017.

### பார்வை நூல்கள்

1. சிற்பி. பாலசுப்பிரமணியன், *தமிழ் இலக்கிய வரலாறு*, கவிதா வெளியீடு, சென்னை.
2. தமிழண்ணல், *புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு*, சோலை பதிப்பகம், மதுரை
3. பாக்கியமேரி, *வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு*, பாரி நிலையம், சென்னை.

### வலைப்பதிவுகள் (Web Sources)

1. Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org)  
<<http://www.tamilheritage.org>>
2. Tamil virtual University Library- [www.tamilvu.org/library](http://www.tamilvu.org/library)  
<http://www.virtualvu.org/library>
3. Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).

4. Chennai Library- [www.chennailibrary.com](http://www.chennailibrary.com)  
<<http://www.chennailibrary.com>>.
5. Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <<http://www.ulib.prg>>.
6. Tamil E-Books Downloads- [tamilebooksdownloads.blogspot.com](http://tamilebooksdownloads.blogspot.com)
7. Tamil Books on line- [books.tamilcube.com](http://books.tamilcube.com)
8. Catalogue of the Tamil books in the Library of British Congress  
[archive.org](http://archive.org)
9. Tamil novels on line - [books.tamilcube.com](http://books.tamilcube.com)



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF ENGLISH**  
**UG PROGRAMME - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER- I**  
**GENERAL ENGLISH-I (23UENL11)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK: 6 (L-5, T-1)**

**CREDITS : 3**

**DURATION : 90 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To enable learners to acquire the linguistic competence necessarily required in various life situations.
- To help them understand the written text and able to use skimming, scanning skills .
- To assist them in creative thinking abilities.
- To enable them become better readers and writers.
- To assist them in developing correct reading habits, silently, extensively and intensively.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** identify the use of the language skills i.e. reading, listening, speaking and writing

**CO2[K2]:** demonstrate communicative skills by articulating simple dialogues and instructions

**CO3[K3]:** apply knowledge of word and grammar in framing sentences

**CO4[K4]:** analyze prose, poetry and short stories to develop language skills through literature

**CO5[K5]:** assess the linguistic competence that enables them, in the future, to present their views in social, academic and employment situations

**CO-PO Mapping table (Course Articulation Matrix)**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	-	2	-	-	-
<b>CO2[K2]</b>	2	2	-	2	-	-	-
<b>CO3[K3]</b>	2	1	-	2	1	-	1
<b>CO4[K4]</b>	2	1	1	1	1	1	1
<b>CO5[K5]</b>	2	1	1	1	-	1	1
<b>Weightage of the course</b>	10	07	02	08	02	02	03
<b>Weighted percentage of Course contribution to POs</b>	<b>1.73</b>	<b>1.41</b>	<b>0.5</b>	<b>2.41</b>	<b>0.71</b>	<b>0.7</b>	<b>1.11</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

<b>UNIT I - PROSE</b>		<b>(18 hrs)</b>
Jerome K Jerome	-	Uncle Podger Hangs a Picture
David Sedaris	-	Us and Them -From Dress Your Family in Corduroy and Denim
Harish Bhat	-	JRD

<b>UNIT II - POETRY</b>		<b>(18 hrs)</b>
William Ralph Emerson	-	A Nation's Strength
Paul Laurence Dunbar	-	The Sparrow
Subramania Bharati	-	A Patch of Land
Chinua Achebe	-	Love Cycle

<b>UNIT III - SHORT STORIES</b>		<b>(18 hrs)</b>
Bhabani Bhattacharya	-	The Faltering Pendulum
R.K. Laxman	-	The Gold Frame
Sudha Murthy	-	How I Taught My Grandmother to Read

<b>UNIT IV - LANGUAGE COMPETENCY</b>		<b>(18 hrs)</b>
Vocabulary: Synonyms, Antonyms, Word Formation		
Appropriate use of Articles and Parts of speech		
Error Correction		

<b>UNIT V - ENGLISH FOR WORKPLACE</b>		<b>(18 hrs)</b>
Self-Introduction, Greetings		
Introducing others		
Listening for General and Specific Information		
Listening to and Giving Instructions/Directions		

### TEXTBOOKS

1. Bhattacharya, Bhabani. *Steel Hawk and other stories*. New Delhi: Sahitya Akademi, 1967.
2. Sudha, Murthy. *How I Taught My Grandmother to Read and other Stories*, India: Penguin Books, 2004.

### REFERENCES

#### Books

1. Kumar, Vijay T & K Durga Bhavani. *English in use -A Textbook for College Students*. YL Srinivas
2. Swan, Michael. *Practical English Usage - 4th Edition*. New York: Oxford University Press, 2016.
3. Shepherd Margaret & Sharon Hogan. Penny Carter (Illustrator). *The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace*. Now York: Broadway Books, 2005.

#### Web Sources

1. [https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks\\_redir=0](https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks_redir=0)

[&source=gb\\_mobile\\_search&sa=X&redir\\_esc=y#v=onepage&q=subramania%20bharati%20poems&f=false](#)

2. <https://poets.org/poem/sparrow-0>
3. <https://poets.org/poem/nations-strength>
4. <https://www.best-poems.net/chinua-achebe/love-cycle.html>
5. <https://www.tata.com/newsroom/heritage/coffee-tea-jrd-tata-stories>
6. <https://legacy.npr.org/programs/morning/features/2004/jun/sedaris/unsandthem.html>
7. <http://rosyhunt.blogspot.com/2013/01/uncle-podger-hangs-picture.html>
8. <https://fybaenglish.blogspot.com/2018/12/the-gold-frame-r-k-laxman.html>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER I**

**CORE COURSE - I: CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY (23UBTC11)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L-3, T-1)**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To understand structural design of prokaryotic and eukaryotic cells.
- To understand cyclic events of cell division and types of cell division.
- To gain knowledge about the synthesis, structure, importance and the inter-relationships between DNA, RNA and Proteins.
- To understand the major molecular processes and development that governs all cellular activities.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** explain discovery, diversity of cells and cell theory

**CO2[K2]:** describe structure and function of cell organelles

**CO3[K3]:** determine the events of cell cycle and its regulation

**CO4[K4]:** analyze the molecular mechanisms involved in cellular

differentiation, morphogenesis, growth and potency of the cell

**CO5[K5]:** assess the response of cells to the intra and extracellular environment by intracellular signaling pathways

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	2	3	1	1	1	1
<b>CO2[K2]</b>	3	3	3	2	1	1	1
<b>CO3[K3]</b>	3	3	3	1	2	1	1
<b>CO4[K4]</b>	3	3	2	2	1	1	1
<b>CO5[K5]</b>	3	2	2	1	2	1	1
<b>Weightage of the course</b>	15	13	13	07	07	05	05
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.61	3.22	2.11	2.5	1.75	1.85

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' - no correlation)

**UNIT I (12 hrs)**

Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells).

**UNIT II (12 hrs)**

Biomacromolecules and Biomicromolecules (Primary functions in the cell). Structure and functions of cell organelles: cell wall - cell membrane - cytoplasm - nucleus - chromosomes -endoplasmic reticulum - ribosomes - golgi bodies - plastids - vacuoles - lysosomes - mitochondria - microbodies - flagella - cilia - centrosome and centrioles - cytoskeleton.

**UNIT III (12 hrs)**

Structure and functions of DNA and RNA -Central dogma of the cell. DNA - replication in prokaryotes - Transcription in prokaryotes and eukaryotes - RNA processing - Genetic code- Translation - similarities and differences in prokaryotic and eukaryotic translation - Post translational modifications - Protein sorting - Protein degradation.

**UNIT IV (12 hrs)**

Cell cycle - Cell cycle check points - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell adhesion - Extra cellular matrix - Cell to cell communications - Signal transduction - G - Protein coupled receptors Signal transduction pathways.

**UNIT V (12 hrs)**

Gametogenesis - Spermatogenesis and Oogenesis in mammals. Fertilization - Types of cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals - Organogenesis.

**TEXTBOOKS**

1. Devasena T. *Cell Biology*. Oxford University Press, 2012.
2. Gupta Renu & Makhija, Seema & Toteja, Ravi. *Cell Biology Practical Manual*, 2018.
3. Gilbert, S.F., *Developmental Biology, 11<sup>th</sup> edition*. Sinauer Associates Inc. Publishers USA, 2016.
4. Bruce Alberts, *Molecular Biology of the cell* W. W. Norton & Company 6<sup>th</sup> Edition, 2014.
5. James D. Watson, *the Double Helix: A personal account of the Discovery of the Structure of DNA*, Touchstone Publishers, 2001.

**REFERENCES****Books**

1. Karp's. *Cell and Molecular Biology: Concepts and Experiments*. 8<sup>th</sup> Edition Wiley Publications, 2015.
2. James D. Watson. *Molecular Biology of the Gene*, 7<sup>th</sup> Edition Pearson Publications, 2014.
3. Geoffrey M. Cooper. *The Cell: A Molecular Approach*, 7<sup>th</sup> Edition Sinauer Associates, Qxford University Press, 2015.

4. LodishHarvey, *Molecular Cell Biology*, 6<sup>th</sup> Edition W. H. Freeman Publications, 2016.
5. Wolpert L and Tickle C. *Principles of Development*, 5<sup>th</sup> edition, Oxford University Press, 2015.

### **Web Sources**

1. <http://www.cellbiol.com/education.php>
2. <https://global.oup.com/uk/orc/biosciences/cellbiology/wang/student/weblinks/ch16/>
3. <https://dnlc.cshl.edu/websites/>
4. <https://www.cellsignal.com/contents/science/cst-pathways/science-pathways>
5. <https://nptel.ac.in/courses/102/106/102106025/11>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER I**  
**CORE COURSE - II: PRACTICAL:**  
**CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY (23UBTC1P)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4**  
**CREDITS : 4**  
**DURATION : 60 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To understand the fundamental concepts of cellular and subcellular organization.
- To study the molecular basis of genetic information.
- To familiarize with molecular biology pathways and cellular processes.
- To understand cell cycle events and its check points.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** demonstrate the components of microscope

**CO2[K3]:** identify blood cells and its types

**CO3[K4]:** illustrate the structure of plant and animal cells.

**CO4[K5]:** explain the techniques involved in mounting chick embryo

**CO5[K6]:** elaborate the basic principles of cell fractionation and Identification of cell organelles

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1[K2]</b>	3	2	3	1	1	2	2
<b>CO2[K3]</b>	3	3	2	1	2	1	1
<b>CO3[K4]</b>	3	3	2	2	1	2	1
<b>CO4[K5]</b>	3	2	3	2	1	1	2
<b>CO5[K6]</b>	3	3	3	1	2	1	2
<b>Weightage of the course</b>	15	13	13	07	07	07	08
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.61	3.22	2.11	2.5	2.45	2.95

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low ' - ' no correlation)

## Experiments

1. Components of a Compound / Light Microscope.
2. Blood smear preparation and identification of Blood cells
3. Buccal smear preparation and identification of squamous epithelial cells.
4. Isolation and identification of plant cells.
5. Observation of sperm & egg
6. Mounting of chick embryo - 24 hrs, 48 hrs, 72 hrs, 96 hrs.
7. Types of placenta in mammals.
8. Cell fractionation and identification of cell organelles (Demo)

## TEXTBOOK

1. Chaitanya K.V. *Cell and molecular biology*: Lab manual, PHI publishers, 2013.

## REFERENCES

### Books

1. Palanivelu, P. *Analytical biochemistry and separation techniques*, MKU, Madurai, 2012.
2. Gunasekaran, P. *Laboratory Manual in Microbiology*. New Age International, 2007.
3. Khan N.A and Singh K.N. *Laboratory manual of Biochemistry*. Daya publishing house, 2020.
4. Felix Valentin. *Principles and Techniques of Practical Biochemistry*. Arcler, Press, 2015.
5. Douglas, A Skoog, F.James Holler and Stanley R. Crouch *Principles of Instrumental Analysis*. Cengagelearning publishers, seventh Edition, 2020.

### Web Sources

1. <https://www.microscopeworld.com/t-parts.aspx>
2. <https://www.youtube.com/watch?v=Z1N-Ma2lGIU>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2818712/>
4. <https://www.youtube.com/watch?v=MRIQZPCX45I>



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF CHEMISTRY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER- I**  
**ELECTIVE COURSE GENERIC / DECIPLINE SPECIFIC – I:**  
**BIOLOGICAL CHEMISTRY (23UBTA11)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS/WEEK</b>	<b>: 4(L-3, T-1)</b>	<b>INT. MARKS</b>	<b>: 25</b>
<b>CREDITS</b>	<b>: 3</b>	<b>EXT. MARKS</b>	<b>: 75</b>
<b>DURATION</b>	<b>: 60 hrs</b>	<b>MAX. MARKS</b>	<b>: 100</b>

**Course Objectives.**

- To know the basics of atomic orbitals, chemical bonds and hybridization
- To inculcate the concepts of thermodynamics and its applications
- To get an idea about the concepts of nuclear chemistry
- To ensure the importance of chemical industries
- To improve qualitative and analytical methods

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** describe the chemical bonding in organic compounds, acids, bases, amino acids, carbohydrates and lipids.

**CO2[K2]:** explain the concepts hybridization, acids and bases, carbohydrates, lipids and proteins.

**CO3[K3]:** find out the various reactions in organic compounds, buffer action, metabolism of biomolecules.

**CO4[K4]:** classify the organic compounds, organic reaction, acids, bases and biomolecules

**CO5[K5]:** determine the shapes of orbitals, concentration of solutions and importance of biomolecule

CO-PO Mapping table (Course Articulation Matrix)

CO \ PO	P01	P02	P03	P04	P05	P06	P07
CO1[K1]	3	2	1	-	-	1	-
CO2[K2]	3	2	1	1	-	-	-
CO3[K3]	3	2	1	1	1	1	1
CO4[K4]	3	2	1	1	-	-	1
CO5[K5]	3	2	1	1	1	1	-
Weightage of the course	15	10	05	04	02	03	02
Weighted percentage of Course contribution to Pos	2.59	2.01	1.24	1.2	0.71	1.05	0.74

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' no correlation)

### UNIT I – CHEMICAL BONDING AND ORGANIC REACTIONS (12 hrs)

Atomic Theory, Formation of molecules, Electronic configuration of atoms- S & P Shapes of Atomic orbitals. Periodic table, Periodic classification, Valency. Types of chemical bonds. Classification of organic compounds. Hybridization in methane, ethane, acetylene, and benzene. Definition with Examples- Electrophiles, Nucleophiles and Free radicals. Types of reactions with an Example: Addition, Substitution, Elimination, Condensation and Polymerization. Electrophilic substitution reaction in Benzene, Nitration and Sulphonation.

### UNIT II – ACIDS AND BASES (12 hrs)

Acids & Bases properties and differences, concepts of acids and bases- Arrhenius, Lowry - bronsted and Lewis. Concentration of solution, Ways of expressing Concentrations of solutions – Percent by weight, normality, Molarity, Molality, Mole Fraction. pH of Solution, pH Scale, Measurement of pH. Buffer Solutions, Properties of buffers, Henderson – Hasselbalch Equation, Mechanism of Buffer action of acidic buffer and basic buffer.

### UNIT III – BIOCHEMISTRY (12 hrs)

Importance to Biochemistry-The Chemical foundation of life. Water: Its unique properties, Ionization of water, Buffering action in biological system, Properties and characteristics of water. Classification of carbohydrates. Properties of carbohydrates. Ring structure of sugars and conformations of sugars. Metabolism of carbohydrates – Glycogenesis, Glycogenolysis, Cori's Cycle, Glycolysis, TCA Cycle, Bioenergetics of Carbohydrate Metabolism

#### **UNIT IV – LIPIDS**

**(12 hrs)**

Classification of Lipids. Characteristics, Properties and Biological Importance of Lipids. Metabolism of Fatty Acids, Triglycerides, Phospholipids, Cholesterol. B-Oxidation of Fatty Acids. Classification of Nucleic Acids. Purine and Pyrimidine Bases. Classification of DNA & RNA. Metabolism of Nucleic Acids, Salvage Pathway.

#### **UNIT V – AMINOACIDS AND PROTEINS**

**(12hrs)**

Classification and Structure of Amino Acids. Structural Conformation of Proteins. Classification of Proteins. Properties and Biological Importance of Amino Acids and Proteins. Degradation of Amino Acids and Urea Cycle. Vitamins and Hormones. Role of Hormones in Metabolism. ATP Production. Oxidative Phosphorylation, Electron transport chain and Photophosphorylation

#### **TEXTBOOKS**

1. Soni P. L, *A Textbook of Inorganic Chemistry*, 11<sup>th</sup> Edition, S. Chand and Sons Publications.
2. Abhilasha Shourie, Shilpa S, Chapadgoankar & Anamika Singh, *Textbook of Biochemistry*, 1<sup>st</sup> Edition, 2020.
3. Jain J. L, *Fundamentals of Biochemistry*, 7<sup>th</sup> Edition, S. Chand Publication.
4. Deb A. C, *Fundamentals of Biochemistry*, 7<sup>th</sup> Edition, New Central Book Agencies,

#### **REFERENCES**

##### **Books**

1. Lehninger, *Principles of Biochemistry*, 4<sup>th</sup> Edition, WH Freeman and Company NY, 2013.
2. Murray, *Harper's Biochemistry*, 26<sup>th</sup> Edition, Appleton and Lange Publishers: Florida USA.
3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, *Principles of Biochemistry*, 3<sup>rd</sup> Edition, W. C. Brown Publishers, 1995.
4. Bahl B. S, Arul Bhal, *Advanced Organic Chemistry*, 23<sup>th</sup> Edition, S. Chand and company: New Delhi, 2012.

##### **Web Sources**

1. <https://archive.nptel.ac.in/courses/104/105/102105034/>
2. <https://www.digimat.in/nptel/courses/video/104101084/L33.html>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF CHEMISTRY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER- I**  
**ELECTIVE COURSE GENERIC / DECIPLINE SPECIFIC – I: PRACTICAL:**  
**BIOLOGICAL CHEMISTRY (23UBTA1P)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS/WEEK</b> : 2	<b>INT. MARKS</b> : 25
<b>CREDITS</b> : 2	<b>EXT. MARKS</b> : 75
<b>DURATION</b> : 30 hrs	<b>MAX. MARKS</b> : 100

**Course Objectives.**

- To know the safety in chemistry lab
- To get an idea to handle the glassware
- To gain knowledge in the identification of organic functional groups
- To acquire knowledge for elemental determination
- To understand and differentiate organic compounds with functional groups

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1 [K2]:** recognize the analytical procedure to identify the given organic compounds

**CO2 [K3]:** determine the saturation/unsaturation nature of given organic compounds

**CO3 [K4]:** inspect the aliphatic/aromatic and nature of given organic compounds

**CO4 [K5]:** predict elements (other than C, H and O) present in the given compound

**CO5 [K6]:** perform systematic analysis and report the functional groups present in the given organic compound.

**CO-PO Mapping table (Course Articulation Matrix)**

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K2]</b>	3	2	1	-	-	-	1
<b>CO2[K2]</b>	3	2	1	1	-	1	-
<b>CO3[K4]</b>	3	2	1	-	-	1	-
<b>CO4[K5]</b>	3	2	1	1	1	1	1
<b>CO5[K6]</b>	3	2	1	-	1	1	1
<b>Weightage of the course</b>	15	10	05	02	02	04	03

<b>Weighted percentage of Course contribution to Pos</b>	<b>2.59</b>	<b>2.01</b>	<b>1.24</b>	<b>0.6</b>	<b>0.71</b>	<b>1.4</b>	<b>1.11</b>
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Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

### **ANALYSIS OF ORGANIC COMPOUNDS**

1. Aromatic Mono and Bi carboxylic acids
2. Aromatic Phenol
3. Aromatic Ester
4. Aromatic Amines
5. Aromatic Aldehydes
6. Aromatic Ketones
7. Aliphatic Diamide, Diamide Containing Sulphur
8. Aliphatic Carbohydrate

### **REFERENCE**

#### **Book**

1. Furniss B. S., Hannford A. J., Smith P. W. G., Tatchell A. R., *Vogel's Textbook of Practical Organic Chemistry*, Longman Scientific and Technical, England.

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER – I**  
**SKILL ENHANCEMENT COURSE - I: FOUNDATION COURSE –**  
**BASIC CONCEPTS OF BIOTECHNOLOGY (23UBTS11)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS/WEEK : 2</b>	<b>INT. MARKS : 25</b>
<b>CREDITS : 2</b>	<b>EXT. MARKS : 75</b>
<b>DURATION : 30 hrs</b>	<b>MAX. MARKS : 100</b>

**Course Objectives**

- To understand the role of biotechnology in sericulture, apiculture and mushroom cultivation.
- To gain knowledge about the production of Biofertilizer and Biopesticide.
- To understand the significance of microorganism in biodegradation.
- To propose comprehend about Transgenic plants.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** outline the biotechnological tools and their products for commercial purposes

**CO2[K2]:** explain the basic techniques of biotechnology

**CO3[K3]:** determine the steps involved in gene cloning

**CO4[K4]:** analyse the role of biotechnology in pollution control

**CO5[K5]:** differentiate the primary and secondary metabolites

**CO - PO Mapping table (Course Articulation Matrix)**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	1	2	1	1	1
<b>CO2[K2]</b>	2	1	1	1	-	-	-
<b>CO3[K3]</b>	2	2	2	1	1	1	1
<b>CO4[K4]</b>	1	2	1	1	-	-	-
<b>CO5[K5]</b>	2	2	2	2	1	-	1
<b>Weightage of the course</b>	09	09	07	07	03	02	03
<b>Weighted percentage of Course contribution to POs</b>	<b>1.55</b>	<b>1.81</b>	<b>1.73</b>	<b>2.11</b>	<b>1.07</b>	<b>0.7</b>	<b>1.11</b>

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' - No Correlation)

**UNIT I (6 hrs)**

Introduction to Biotechnology- Role of Biotechnology in sericulture- Rearing of silkworms- Importance and applications- Role of Biotechnology in apiculture- Bee hive hierarchy- Bee keeping process- Products obtained- Mushroom farming stages- Cultivation of paddy straw mushroom- Importance of mushroom cultivation.

**UNIT II (6 hrs)**

Biofertilizer- Definition- Mass production of *Rhizobium*-Advantages and disadvantages- Biopesticides- Definition- Microbial biopesticides- *Bacillus thuringiensis*- Single cell protein- Introduction – history - production of *Spirulina* SCP- Applications- Advantages & disadvantages.

**UNIT III (6 hrs)**

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics - advantages - Bio weapons- introduction- history-potential agents- delivery methods- harmful effects.

**UNIT IV (6 hrs)**

Antibiotics- Definition - Introduction and history of antibiotics - sources – classification – spectrum - production of penicillin - definition of antibiotic resistance.

**UNIT V (6 hrs)**

Transgenic plants – Definition of transgene and transgenesis - BT Cotton, Flavr-Savr tomato and Golden rice- history – importance, applications, advantages and disadvantages.

**TEXTBOOKS**

1. Dubey, R.C. *Advanced Biotechnology*. New Delhi : S. Chand and Co. Pvt. Ltd, 2014.
2. Indu Shekhar Thakur. *Environmental biotechnology: basic concepts and applications*. Dreamtech Press 2019.
3. Chatterji and Adhar Kumar. *Introduction to environmental biotechnology*. PHI Learning Pvt. Ltd., 2011.
4. Patel, H. *Industrial Microbiology*, 2<sup>nd</sup> edition, MacMillan Publishers, 2011.
5. Thakur, I.S. *Environmental Biotechnology- Basic principles and applications*. 2<sup>nd</sup> edition, Dreamtech Press, 2019.

**REFERENCES**

**Books**

1. Satyanarayana U and Chakrapani U. *Essentials of biochemistry*. Kolkata : Book and Allied, India, 2019.
2. Veer balarastogi. *Principles of molecular biology*. Medtech Publishers, 2016.

3. Primrose, S.B., Twyman, R.M. and Old, R. K. *Principles of Gene Manipulation*. John Wiley Blackwell , Seventh Edition, 2014.
4. Rapley, Ralph, and David Whitehouse. *Molecular biology and biotechnology*. Royal Society of Chemistry, 2015.

**Web Sources**

1. <https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC - 02 - PPT.pdf>
2. <https://nptel.ac.in/courses/102/105/10210505>



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER I**  
**SKILL ENHANCEMENT COURSE – II: NON MAJOR ELECTIVE COURSE:**  
**FOOD AND NUTRITION (23UBTN11)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 2**

**CREDITS : 2**

**DURATION : 30 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To determine the relationship between food and health.
- To assess nutritional status of individuals in various life cycle stages.
- To determine nutrition related conditions and diseases.
- To identify nutrition related public health issues.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** define food, nutrients and their energy value

**CO2[K2]:** explain the classification of foods and their deficiency diseases

**CO3[K3]:** describe factors affecting BMR

**CO4[K4]:** examine basic food groups and their adulteration

**CO5[K5]:** illustrate the principles and objectives of meal planning

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	3	2	1	1	1	2	1
<b>CO2[K2]</b>	3	2	1	1	1	2	1
<b>CO3[K3]</b>	3	2	1	1	1	2	1
<b>CO4[K4]</b>	2	2	1	1	1	2	1
<b>CO5[K5]</b>	2	2	1	1	1	2	1
<b>Weightage of the course</b>	13	10	05	05	02	10	05
<b>Weighted percentage of Course contribution to POs</b>	2.25	2.01	1.24	1.51	0.71	3.5	1.85

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' - no correlation)

**UNIT I (6 hrs)**

Definition of food, Nutrition, Nutrient, Nutritional status, Dietetics, Balance diet, Malnutrition, Energy (Unit of energy - Joule, Kilocalorie). Health, Immunity by food and function of food.

**UNIT II (6 hrs)**

Carbohydrate, Protein, Fat, Vitamin and Minerals(Calcium, Phosphorous, Sodium, Potassium, Iron, Iodine, Fluorine) - Sources, Classification, Function, Deficiencies of these nutrients. Function of water and dietary fiber.

**UNIT III (6 hrs)**

BMR: Definition, factors affecting BMR and total energy requirements (Calculation of energy of individuals)

**UNIT IV (6 hrs)**

Basic five food groups, nutritional significance of cereals, pulses, milk, meat, fish, vegetables, egg, nuts, oils and sugars. Food toxins, Food additives, Food quality, Safe food handling, Food adulteration, Preservatives and Packaging.

**UNIT V (6 hrs)**

Principles and Objectives of meal planning. Diet for an infant, preschool child, School child, normal male and female of different occupations.

**TEXTBOOKS**

1. Vidya and Rao. *A textbook of nutrition*, Discovery Publishing house, 2010.
2. Carolyn D. Berdanier. *Handbook of Nutrition & Food*, CRC Press (Taylor and Francis group) third edition, 2010.
3. Sunetra Roday. *Food science and Nutrition*, Oxford publication
4. Janet D Ward & Larry T Ward ,*Principles of food science* Good heart-Wilcox Publishing, 2008.

**REFERENCES****Books**

1. Gustavo F. Gutierrez–Lopez. *Food Science and Food Biotechnology*. CRC Press, 2003.
2. Vinod K. Joshi and R. S. Singh.*Food Biotechnology*. I K International Publishing House, FirstEdition, 2012.
3. Watson, K. *Industrial Biotechnology*. Volume 1, CBS Publisher & Distributors P Ltd, 2016.

**Web Sources**

1. <https://nptel.ac.in/courses/102/106/102106053/>
2. <https://nptel.ac.in/courses/102/106/102106022/>
3. <https://nptel.ac.in/courses/102/105/102105058/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF TAMIL**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER - II**  
**பொதுத்தமிழ் - II (23UTAG21)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS / WEEK</b>	: 6	<b>INT. MARKS</b>	: 25
<b>CREDITS</b>	: 3	<b>EXT. MARKS</b>	: 75
<b>DURATION</b>	: 90 hrs	<b>MAX. MARKS</b>	: 100

**நோக்கங்கள்**

- சமய இலக்கியங்களையும் சிற்றிலக்கியங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- மொழித்திறனையும் சிறுகதை இலக்கிய வடிவத்தையும் மாணவர்களுக்கு உணர்த்துதல்.

**கற்றலின் விளைவுகள்**

- CO1[K1]:** பக்தி இலக்கியங்களைக் கற்பதன் மூலம் பக்தி நெறியினையும், சமய நல்லிணக்கத்தையும் அறிவர்.
- CO2[K2]:** சமயப்பாடல்கள் மற்றும் சிற்றிலக்கியங்களின் அமைப்பினையும், நோக்கத்தினையும் தெளிவாகக் கூறுவர்.
- CO3[K3]:** தமிழில் உள்ள பக்தி இலக்கியம் மற்றும் சிற்றிலக்கியங்களின் பொருண்மைகளுடன் இலக்கணத் தெளிவையும் அடைவர்.
- CO4[K4]:** தமிழ்ச் சமூகப் பண்பாட்டு வரலாற்றினை இலக்கியங்கள் வாயிலாக அறிந்து கொண்டு பாகுபடுத்துவர்.
- CO5[K5]:** போட்டித் தேர்வுகளில் வெற்றி பெறுவதற்குத் தமிழ்ப் பாடத்தினைப் பயன்கொள்ளும் வகையில் ஏற்ற பயிற்சி பெற்று மதிப்பீடு செய்வர்.

**CO/PO Mapping Table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	1	-	1	-	-	-
<b>CO2[K2]</b>	2	2	-	1	1	-	1
<b>CO3[K3]</b>	2	2	-	2	-	1	-
<b>CO4[K4]</b>	2	2	1	2	1	-	1
<b>CO5[K5]</b>	2	1	1	2	-	1	1
<b>Weightage of the Course</b>	10	08	02	08	02	02	03
<b>Weighted percentage of Course Contribution to Pos</b>	1.73	1.61	0.5	2.41	0.71	0.7	1.11

Based on the Level of Contribution ('3' -High, '2' -Medium, '1' -Low, '-' No Correlation)

**கூறு I (18 hrs)**

**பக்தி இலக்கியம்:** திருநாவுக்கரசர் தேவாரம் - நாமார்க்கும் குடியெல்லாம் எனத் தொடங்கும் பதிகம் (10 பாடல்கள்), ஆண்டாள் - திருப்பாவை (முதல் 10 பாசரம்)

**கூறு II (18 hrs)**

வள்ளலார் - அருள் விளக்கமாலை (முதல் 10 பாடல்), எச்.ஏ.கிருட்டிணப் பிள்ளை - இரட்சணியமனோகரம் - பாலயபிரார்த்தனை, குணங்குடி மஸ்தான் சாகிபு - பராபரக்கண்ணி (முதல் 10 கண்ணி)

**கூறு III (18 hrs)**

**சிறுநிலக்கியங்கள்:** தமிழ்விடு தூது (முதல் 20 கண்ணி), திருக்குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறுதல், முக்கூடல் பள்ளு - நாட்டு வளம்;

**கூறு IV (18 hrs)**

பாடம் தழுவிய இலக்கிய வரலாறு (பல்லவர் காலம், நாயக்கர் காலம்)

**கூறு V (18 hrs)**

**மொழித்திறன் போட்டித்தேர்வுதிறன்:** தொடர் வகைகள், மரபுத்தொடர், பழமொழிகள், பிறமொழிச் சொற்களைக் களைதல், வழ்ச்சொற்கள் நீக்குதல், இலக்கணக் குறிப்பு அறிதல். (குறிப்பு: அலகு 4, 5 ஆகியன போட்டித் தேர்வு நோக்கில் நடத்தப் பட வேண்டும்).

**பாடநூல்கள்**

1. தமிழியல் துறையினர், *தொகுப்பு நூல்*, ஸ்ரீ காளீஸ்வரி கல்லூரி (தன்னாட்சி), சிவகாசி.
2. வாசுதேவன், கா. *பன்முக நோக்கில் தமிழ் இலக்கிய வரலாறு*, தேவன் பதிப்பகம், திருச்சிராப்பள்ளி, 2017.

**பார்வை நூல்கள்**

1. சிற்பி. பாலசுப்பிரமணியன், *தமிழ் இலக்கிய வரலாறு*, கவிதா வெளியீடு, சென்னை.
2. தமிழண்ணல், *புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு*, சோலை பதிப்பகம், மதுரை
3. பாக்கியமேரி, *வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு*, பாரி நிலையம், சென்னை.

**Web Sources**

1. Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org)  
<<http://www.tamilheritage.org>>
2. Tamil virtual University Library- [www.tamilvu.org/library](http://www.tamilvu.org/library)  
<http://www.virtualvu.org/library>
3. Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).
4. Chennai Library- [www.chennai.library.com](http://www.chennai.library.com)  
<<http://www.chennai.library.com>>.
5. Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <<http://www.ulib.prg>>.
6. Tamil E-Books Downloads- [tamilebooksdownloads.blogspot.com](http://tamilebooksdownloads.blogspot.com)
7. Tamil Books on line- [books.tamilcube.com](http://books.tamilcube.com)
8. Catalogue of the Tamil books in the Library of British Congress  
[archive.org](http://archive.org)

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF ENGLISH**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER- II**  
**GENERAL ENGLISH-II (23UENL21)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 6(L-5, T-1)**

**CREDITS : 3**

**DURATION : 90 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To introduce learners to the essential skills of communication in English.
- To enable them use these skills effectively in academic and non-academic contexts.
- To help them identify and eliminate common mistakes in writing and speaking.
- To enable them use various business communication strategies and to use advanced vocabulary.
- To familiarize them in writing descriptive essays and respond to arguments orally and in writing.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1 [K1]:** identify appropriate literary terms such as diction, tone, imagery, figures of speech, motif etc.,

**CO2 [K2]:** define verbs, tenses and concord and its role in speaking and writing effectively.

**CO3 [K3]:** apply the knowledge of language competency at workplace and day-to-day life

**CO4 [K4]:** analyze prose, poetry and short stories to develop language skills through literature.

**CO5 [K6]:** construct grammatically correct and meaningful sentences by choosing apt words.

**CO-PO Mapping table (Course Articulation Matrix)**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	1	-	1	-	-	-
<b>CO2[K2]</b>	2	2	-	1	1	-	1
<b>CO3[K3]</b>	2	2	-	2	-	1	-
<b>CO4[K4]</b>	2	2	1	2	1	-	1
<b>CO5[K6]</b>	2	1	1	2	-	1	1
<b>Weightage of the course</b>	10	08	02	08	02	02	03
<b>Weighted percentage of Course contribution to POs</b>	<b>1.73</b>	<b>1.61</b>	<b>0.5</b>	<b>2.41</b>	<b>0.71</b>	<b>0.7</b>	<b>1.11</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

<b>UNIT I- PROSE</b>		<b>(18 hrs)</b>
W.R. Inge	-	The Spoon-Fed Age
Dale Carnegie	-	If You Are Wrong. Admit it
Shashi Tharoor	-	Kindly Adjust to our English

<b>UNIT II- POETRY</b>		<b>(18 hrs)</b>
Alfred Lord Tennyson	-	The Flower
Nissim Ezekiel	-	Very Indian Poem in Indian English
Maya Angelou	-	Still I Rise
Dr. Gieve Patel	-	On Killing a Tree

<b>UNIT III- FICTION</b>		<b>(18 hrs)</b>
Paulo Coelho	-	The Alchemist

<b>UNIT IV- LANGUAGE COMPETENCY</b>		<b>(18 hrs)</b>
Homonyms, Homophones, Homographs, Portmanteau words		
Verbs and Tenses, Subject Verb Agreement, Error correction		

<b>UNIT V- ENGLISH IN THE WORKPLACE</b>		<b>(18 hrs)</b>
Reading for General and Specific information		
[charts, tables, schedules, graphs etc]		
Reading news and weather reports		
Writing paragraphs		
Taking and making notes		

### TEXTBOOKS

1. Coelho, Paulo. *The Alchemist*. New York: Harper, 2005.
2. Pillai, Radhakrishna. *Emerald English Grammar and Composition*. Chennai: Emerald Publishers, 2016.

### REFERENCES

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1. Hewings, Martin. *Advanced English Grammar*. Cambridge University Press, 2000.
2. SP Bakshi, Richa Sharma. *Descriptive English*. India: Arihant Publications Ltd, 2019.
3. Sheena Cameron, Louise Dempsey. *The Reading Book: A Complete Guide to Teaching Reading*. London: S & L. Publishing, 2019.
4. Sherman, Barbara. *Skimming and Scanning Techniques*. Virginia: Liberty University Press, 2014.
5. Chambers, Phil. *Brilliant Speed Reading: Whatever you need to read, However You want to Read it-Twice as Quickly*, India: Pearson, 2013.
6. Coelho, Paulo. *The Archer*. New York: Penguin Viking, 2020.

#### Web Sources

1. [http://econtent.in/pacc.in/admin/contents/40 %20 202010300110271 4.pdf](http://econtent.in/pacc.in/admin/contents/40%202020103001102714.pdf)

2. <https://www.poetryfoundation.org/poems/46446/still-i-rise>
3. <https://www.poemhunter.com/poem/the-flower-2/>
4. <https://www.poemhunter.com/poem/on-killing-a-tree/>
5. <https://www.tbr.fun/if-youre-wrong-admit-it/>
6. <https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/>
7. <https://docplayer.net/217945876-The-spoon-fed-age-1-by-the-very-reverend-w-r-inge.html>
8. <https://www.youtube.com/watch?v=lxBYpmxjeDU>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**CORE COURSE - III: GENETICS (23UBTC21)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L-3, T-1)**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To gain knowledge about the concepts of heredity and mendelian genetics.
- To explain the properties of genetic materials and genetic information.
- To understand knowledge about the Mutagens and Mutations.
- To obtain a strong foundation for the advanced genetics.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** describe the transmission of genetic characters from one generation to another

**CO2[K2]:** explain the classical genetics and modern genetics

**CO3[K3]:** determine the factors responsible for inherited disorders

**CO4[K4]:** differentiate linkage and crossing over

**CO5[K5]:** categorize the role of eugenics, euphenics and euthenics on population genetics

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1[K1]</b>	3	3	3	2	2	2	2
<b>CO2[K2]</b>	3	2	3	1	2	1	1
<b>CO3[K3]</b>	3	2	3	1	1	1	1
<b>CO4[K4]</b>	3	3	3	1	1	1	1
<b>CO5[K5]</b>	3	2	2	1	1	1	1
<b>Weightage of the course</b>	15	13	14	06	07	06	06
<b>Weighted percentage of Course contribution to POs</b>	<b>2.59</b>	<b>2.61</b>	<b>3.47</b>	<b>1.81</b>	<b>2.5</b>	<b>2.1</b>	<b>2.21</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)



## **UNIT I**

**(12 hrs)**

Mendel's experiments, Monohybrid cross, Dihybrid cross, Backcross or Testcross, Mendel's laws. Incomplete dominance. Interaction of Genes- Epistasis -lethal genes. Multiple alleles – In Drosophila, Rabbit and Blood group inheritance in man.

## **UNIT II**

**(12 hrs)**

Linkage - linkage in Drosophila- Morgan's experiments, factors affecting linkage. Crossing over- types, mechanism, significance of crossing over. Mapping of Chromosomes, interference and coincidence. Cytoplasmic inheritance -Carbon dioxide sensitivity in Drosophila and milk factor in mice. Sex –Linked Inheritance and Sex- Determination in Man.

## **UNIT III**

**(12 hrs)**

Fine structure of the gene and gene concept, Operon Concept. Identification of the DNA as the genetic material - Griffith experiments, Avery, McLeod, McCarty and Hershey Chase experiment. Microbial Genetics- bacterial recombination, Conjugation, Transformation, Transduction and sexduction

## **UNIT IV**

**(12 hrs)**

Mutation – types of mutation, mutagens, DNA damage and Repair Mechanism. Chromosomal aberrations - Numerical and Structural, Pedigree Analysis - Mendelian inheritance in human. (Cystic Fibrosis, Muscular Dystrophy)

## **UNIT V**

**(12 hrs)**

Population Genetics– Hardy Weinberg principle, gene frequency, genotype frequency and factors affecting gene frequency. Eugenics, Euphenics and Euthenics.

## **TEXTBOOKS**

1. Veer Bala Rastogi. *Elements of Genetics*, 11<sup>th</sup> Revised & Enlarged Edition, KedarNath RamNath Publications, Meerut, 2-9, 2020
2. Verma, P.S. and Agarwal, V.K. *Genetics*, 8<sup>th</sup> edition, S.Chand & Co, 1995.
3. Verma, P.S., and Agarwal, V.K. *Cell and Molecular Biology*, 8<sup>th</sup> edition, S.Chand and Co., New Delhi, 1995.

## **REFERENCES**

### **Books**

1. Gardener E.J. Simmons M.J. Slustad D. P. *Principles of Genetics*, 2006.
2. Lewis, R. *Human Genetics- Concepts and application*. 4<sup>th</sup> edition. McGraw Hill, 2001.
3. Griffiths, Miller, J.H. *An Introduction to Genetic Analysis* W.H. Freeman. New York.

4. Winter, P.C. Hickey, G.J. and Fletcher, H.L. *Instant notes in Genetics*. Viva books, Ltd, 2000.
5. Good enough U. *Genetics*. Hold Saunders international, 1985.

### **Web Sources**

1. <https://nptel.ac.in/courses/102/106/102106025/>
2. <http://www.ocw.mit.edu>
3. <http://enjoy.m.wikipedia.org>
4. <https://www.acpsd.net>
5. <http://sciencenetlinks.com/lessons/cell-dna/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**CORE COURSE - IV: PRACTICAL: GENETICS (23UBTC2P)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To develop skill and hands on training in genetics.
- To apply basic knowledge of cells and genes.
- To evaluate the stages of cell divisions in plants
- To identify the mutants in Drosophila

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** demonstrate the basic principles of important techniques in Molecular biology and genetics.

**CO2[K3]:** identify Barr bodies from buccal smear

**CO3[K4]:** analyze the Polytene chromosome of the organisms

**CO4[K5]:** evaluate the preparations and maintenance of culture medium.

**CO5[K6]:** predict the steps in Human karyotyping

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO \ CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1[K2]</b>	3	2	2	1	1	1	1
<b>CO2[K3]</b>	3	2	3	2	2	1	2
<b>CO3[K4]</b>	3	3	2	2	2	2	2
<b>CO4[K5]</b>	3	3	3	1	2	1	1
<b>CO5[K6]</b>	3	2	3	1	1	-	1
<b>Weightage of the course</b>	15	12	13	07	08	05	07
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.41	3.22	2.11	2.86	1.75	2.58

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' - No Correlation)

## Experiments

1. Mitotic stages of onion (*Allium cepa*) root tip
2. Meiotic stages of cockroach testes/ Flower bud
3. Giant chromosomes from Chironomus larvae/ Drosophila salivary glands
4. Identification of Barr bodies from Buccal smear
5. Preparations of culture medium and culture of Drosophila – methods of maintenance
6. Identifications of mutants of Drosophila
7. Human karyotyping (Demo)

## TEXTBOOK

1. Kaushik Kumar Panigrahi. Practical Manual on "Fundamentals of Genetics" (PBG-121). Edition: First Publisher: Odisha University of Agriculture & Technology. 2019.

## REFERENCES

### Books

1. Palanivelu, P. *Analytical biochemistry and separation techniques*, MKU, Madurai, 2012.
2. Gunasekaran, P. *Laboratory Manual in Microbiology*. New Age International, 2007.

### Web Sources

1. [https://r.search.yahoo.com/\\_ylt=AwrjaUf0gnNjsI0L8pVXNyoA; ylu=Y29sbwNncTEEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1668543348/RO=10/RU=https%3a%2f%2fwww.researchgate.net%2fpublication%2f334330459-Practical-Manual-on-Fundamentals-of-Genetics-PBG121/RK=2/RIS=5od7iXwxRYJ6dx8wR0Wz7ZLdV0o-](https://r.search.yahoo.com/_ylt=AwrjaUf0gnNjsI0L8pVXNyoA; ylu=Y29sbwNncTEEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1668543348/RO=10/RU=https%3a%2f%2fwww.researchgate.net%2fpublication%2f334330459-Practical-Manual-on-Fundamentals-of-Genetics-PBG121/RK=2/RIS=5od7iXwxRYJ6dx8wR0Wz7ZLdV0o-)

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**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - II:**  
**FUNDAMENTALS OF MICROBIOLOGY (23UBTA21)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L-3, T-1)**

**CREDITS : 3**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To understand ubiquitous nature of microbes.
- To explain the role of microbes in various biotechnological field.
- To develop core competencies in microbiology; structure and function.
- To understand role of microbes in causing diseases.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** describe the structure and classifications of bacteria

**CO2[K2]:** demonstrate various microbiological techniques  
in culturing microorganisms

**CO3[K3]:** select the methods of sterilization and identify significance of  
culture media in the growth of different microbes

**CO4[K4]:** analyze the importance of bioinsecticides and biofertilizers

**CO5[K5]:** assess the role of microbes in food intoxications.

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO \ CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1[K1]</b>	3	2	1	1	1	1	1
<b>CO2[K2]</b>	3	2	1	1	1	1	1
<b>CO3[K3]</b>	2	2	1	1	1	1	1
<b>CO4[K4]</b>	2	2	2	1	1	1	1
<b>CO5[K5]</b>	2	2	2	1	1	1	1
<b>Weightage of the course</b>	12	10	07	05	05	05	05
<b>Weighted percentage of Course contribution to POs</b>	<b>2.07</b>	<b>2.01</b>	<b>1.73</b>	<b>1.51</b>	<b>1.79</b>	<b>1.75</b>	<b>1.85</b>

Based on the level of contribution ('3' - High, '2' - Medium, '1' - Low '-' - No Correlation)

**UNIT I (12 hrs)**

History of Microbiology, Classification of bacteria, fungi, virus, protozoa and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology.

**UNIT II (12 hrs)**

Structure of bacteria - Bacterial growth and measurement of growth, Media – types and preparation- plating methods - staining methods (Gram's, capsule, spore, LCB mount)- methods of preservation and storage of microbes. Culture of fungi, virus and algae.

**UNIT III (12 hrs)**

Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL.

**UNIT IV (12 hrs)**

Bioinsecticides - *Bacillus thuringiensis*, Baculoviruses- Biofertilizers - *Azospirillum* and blue green algae - single cell protein – prebiotics and probiotics - Dairy products (Cheese and Yoghurt).

**UNIT V (12 hrs)**

Microbial Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria).

**TEXTBOOKS**

1. Pelczar.M. J. Chan E.C.S. and Noel. R.K. *Microbiology*, McGraw –Hill, New York, 7<sup>th</sup> Edition, 2007.
2. Ananthanarayanan, Paniker, Kapil. *Textbook book of Microbiology*, Orient BlackSwan, 9<sup>th</sup> edition, 2013.
3. Dubey R.C. and Maheswari, S. *A textbook of Microbiology*, New Delhi: S. Chand & Co, 2003.
4. Prescott, Harley, Klein, *Microbiology*, 10<sup>th</sup> Edition, McGraw – Hill, 2016.
5. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Editions). *Methods for General and Molecular Bacteriology*. ASM Press, Washington, DC, 1994.

**REFERENCES**

**Books**

1. Madigan, Martinko, Bender, Buckley, StahlBrock. *Biology of Microorganisms*, 14<sup>th</sup> edition, 2017.
2. Gillespie, Bamford. *Medical Microbiology and Infection at a Glance*. 4<sup>th</sup> edition, 2012.
3. Boyd, R.F. *General Microbiology*. 2<sup>nd</sup> Edition, Times Mirror, Mosby College Publishing, St Louis, 1998.

4. Tortora, G.J. Funke, B.R., Case, C.L. *Microbiology. An Introduction* 11<sup>th</sup> Edition, A La Carte Pearson, 2013.
5. Salle. A.J. *Fundamental Principles of Bacteriology*. 7<sup>th</sup> Edition, McGraw Hill Inc. New York, 1992.

### **Web Sources**

1. [www. Biotech.kth.se](http://www.Biotech.kth.se) Electronic Journal of biotechnology
2. <http://www.ejb.org/content>.
3. <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>
4. <https://bio.libretexts.org/@go/page/9188>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - II: PRACTICAL:**  
**FUNDAMENTALS OF MICROBIOLOGY (23UBTA2P)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 2**  
**CREDITS : 2**  
**DURATION : 30 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To understand the safe practices in a microbiology laboratory.
- To demonstrate practical skills in microscopy and their handling.
- To use appropriate methods to identify microbes.
- To isolate microbes from the samples.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** describe the sterilization techniques

**CO2[K3]:** develop skills in media preparation, isolation of microorganisms

**CO3[K4]:** analyze the morphological features of bacteria by staining techniques

**CO4[K5]:** evaluate the motility of organisms

**CO5[K6]:** develop biochemical test for characterization and identification of bacteria

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K2]</b>	2	2	1	1	2	1	1
<b>CO2[K3]</b>	2	2	1	1	2	1	1
<b>CO3[K4]</b>	2	2	1	1	2	1	1
<b>CO4[K5]</b>	2	2	2	1	2	1	1
<b>CO5[K6]</b>	2	2	2	1	2	1	1
<b>Weightage of the course</b>	10	10	07	05	10	05	05
<b>Weighted percentage of Course contribution to POs</b>	1.73	2.01	1.73	1.51	3.57	1.75	1.85

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**



## Experiments

1. Sterilization techniques – Preparation of Media
2. Inoculation techniques- Pour plate, spread plate
3. Isolation of bacteria from various sources and dilution techniques.
4. Staining techniques: Simple, Gram's, Capsule (Negative), Spores,
5. Preparation of temporary mounts- Lacto phenol cotton blue staining.
6. Motility tests: Hanging drop technique.
7. Biochemical characterization - catalase, oxidase, IMVIC test and TSI.
8. Antibiotic sensitivity test (demonstration).

## TEXTBOOKS

1. James G Cappucino and N. Sherman MB. *A lab manual Benjamin Cummins*, New York 1996.
2. Kannan. N. *Laboratory manual in General Microbiology*. Palani Publications, 1996.
3. Sundararaj T. *Microbiology Lab Manual* (1<sup>st</sup> edition) publications, 2005.
4. Gunasekaran, P. *Laboratory manual in Microbiology*. New Age International Ltd., Publishers, New Delhi, 1996.
5. DubeyR C and MaheswariD K. *Practical Microbiology*. S. Chand Publishing, 2002.

## REFERENCES

### Books

1. Atlas R. *Principles of Microbiology*, 2<sup>nd</sup> Edition, Wm.C.Brown publishers, 1997.
2. Amita J, Jyotsna A and Vimala V. *Microbiology Practical Manual*. (1<sup>st</sup> Edition). Elsevier India, 2018.
3. Talib VH. *Handbook Medical Laboratory Technology*. (2<sup>nd</sup> Edition). CBS, 2019.
4. Wheelis M. *Principles of Modern Microbiology*, 1st Edition. Jones and Bartlett Publication, 2010.
5. Lim D. *Microbiology*, 2<sup>nd</sup> Edition, WCB McGraw Hill Publications, 1998.

### Web Sources

1. <http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403>.
2. <https://www.ebooks.cambridge.org/ebook.jsf?bid=CB09781139170635>
3. [https://www.grsmu.by/files/file/university/cafedry//files/essential\\_microbiology.pdf](https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf)
4. <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**SKILL ENHANCEMENT COURSE – III:**  
**PLANT AND ANIMAL PHYSIOLOGY (23UBTS21)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 2**

**CREDITS : 2**

**DURATION : 30 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To understand physiological process in plants.
- To gain knowledge about mechanism of anabolic and catabolic reactions.
- To assess the absorption and assimilation of digested food materials.
- To understand the structure and metabolism of plant and animal cells.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** describe the mechanism of digestion of food materials in animals

**CO2[K2]:** illustrate various physiological processes in plants

**CO3[K3]:** determine the mechanism of circulation in animals

**CO4[K4]:** discriminate the metabolic pathways in plants

**CO5[K5]:** elaborate the process of photosynthesis in plants

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO \ CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>	<b>P06</b>	<b>P07</b>
<b>CO1[K1]</b>	3	2	1	1	1	-	1
<b>CO2[K2]</b>	3	1	1	1	-	-	1
<b>CO3[K3]</b>	3	1	1	1	1	-	1
<b>CO4[K4]</b>	1	2	2	1	-	-	1
<b>CO5[K5]</b>	1	2	2	1	-	-	1
<b>Weightage of the course</b>	11	08	07	05	02	0	05
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>1.61</b>	<b>1.73</b>	<b>1.51</b>	<b>0.71</b>	<b>0</b>	<b>1.85</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I (6 hrs)**

Cell as a physiological unit. Osmosis, Imbibition. Diffusion, D.P.D. Water potential, Absorption of water, (active & passive). Plasmolysis, cohesion, tension and transpiration pull theory, Mechanism of stomatal march, Guttation and antitranspirants.

**UNIT II (6 hrs)**

Photosynthesis - Electron transport chain. Photophosphorylation, carbon fixation. Photorespiration - Crassulacean Acid Metabolism. Physiological effects and mode of action of Plant hormones. Nutrition - Macronutrients and micronutrients and their uptake by plants.

**UNIT III (6 hrs)**

Physiology of digestion -Absorption and assimilation of digested food materials - Hormonal control of digestion - Basal Metabolic Rate (BMR). Excretion - structure of kidney - mechanism of urine formation.

**UNIT IV (6 hrs)**

Ultra structure of Skeletal muscle - mechanism of muscle contraction. Structure of Neuron. Endocrine and exocrine glands - Pituitary, Thyroid, Adrenal, Ovary, Testis.

**UNIT V (6 hrs)**

Structure of Respiratory system, mechanism of breathing. Circulatory System: Structure and function of Heart - origin and conduction of Heart beat - Composition of blood and its function.

**TEXTBOOKS**

1. Taiz, Lincoln. *Plant physiology and development*. No. Ed. 6. Sinauer Associates Incorporated, 2015.
2. Moyes, C.D. & Schulte, P.M. *Principles of Animal Physiology*. Pearson Education, India, 2016.
3. Verma, S. K & Verma, M. *Plant Physiology, Biochemistry and Biotechnology*. S.Chand & Company, Ltd., New Delhi, 2012.
4. Arumugam, N & Kuttikan, A.M. *Animal Physiology*. Saras Publication, 2014.

**REFERENCES****Books**

1. Salisbury and Ross. *Plant Physiology*. CBS Publisher 3<sup>rd</sup>, 2006.
2. Noggle, Glen Ray, and George John Fritz. *Introductory plant physiology*. No. Ed. 2. Prentice-Hall Inc., 1983.
3. Mohammad Pessaraki. *Handbook of plant and crop physiology*. CRC press, third edition, 2014.
4. Rastogi, S. C. *Essentials of animal physiology*. New Age International, 2019.

5. Verma, P. S., B. S. Tyagi, and V. K. Agarwal. *Animal physiology*. S. Chand Publishing, 2000.

**Web Sources**

1. <https://youtu.be/UBm2wUCxE0o>
2. <https://youtu.be/fyCY5DN-lkA>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme – B.Sc. Biotechnology**  
**SEMESTER II**  
**SKILL ENHANCEMENT COURSE – IV: NON MAJOR ELECTIVE COURSE:**  
**BIOTECHNOLOGY FOR SOCIETY (23UBTN21)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 2 (L-1, T-1)**  
**CREDITS : 2**  
**DURATION : 30 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To understand the role of Biotechnology in sericulture, apiculture and Mushroom cultivation.
- To gain Knowledge about the production of Biofertilizer and advantages of Biopesticides.
- To understand the significance of microorganisms in biodegradation.
- To know about history of antibiotics.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** outline the Biotechnological tools and their products for commercial purposes

**CO2[K2]:** explain the basic techniques in Biotechnology

**CO3[K3]:** determine the steps involved in gene cloning

**CO4[K4]:** analyse the role of biotechnology in pollution control

**CO5[K5]:** categorize the primary and secondary metabolites

**CO - PO Mapping table (Course Articulation Matrix)**

<b>CO \ PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1[K1]</b>	2	2	1	2	1	1	1
<b>CO2[K2]</b>	2	1	1	1	-	-	-
<b>CO3[K3]</b>	2	2	2	1	1	1	1
<b>CO4[K4]</b>	1	2	1	1	-	-	-
<b>CO5[K5]</b>	2	2	2	2	1	-	1
<b>Weightage of the course</b>	09	09	07	07	03	02	03
<b>Weighted percentage of Course contribution to POs</b>	<b>1.55</b>	<b>1.81</b>	<b>1.73</b>	<b>2.11</b>	<b>1.07</b>	<b>0.7</b>	<b>1.11</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (6 hrs)**

Introduction to Biotechnology - Role of Biotechnology in sericulture- Rearing of silkworms- Importance and applications- Role of Biotechnology in apiculture - Bee hive hierarchy - Bee keeping process - Products obtained- Mushroom farming stages- Cultivation of paddy straw mushroom- Importance of mushroom cultivation.

**UNIT II (6 hrs)**

Biofertilizer- Definition- Mass production of *Rhizobium*-Advantages and disadvantages- Biopesticides- Definition- Microbial biopesticides - *Bacillus thuringiensis*- Single cell protein- Introduction- history- production of *Spirulina* SCP- Applications- Advantages & disadvantages.

**UNIT III (6 hrs)**

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics-advantages- Bio weapons- introduction- history- potential agents- delivery methods- harmful effects.

**UNIT IV (6 hrs)**

Antibiotics- Definition- Introduction and history of antibiotics- sources- classification- spectrum- production of penicillin- definition of antibiotic resistance.

**UNIT V (6 hrs)**

Transgenic plants – Definition of transgene and transgenesis - BT Cotton, Flavr-Savr tomato and Golden rice- history – importance, applications, advantages and disadvantages.

**TEXTBOOKS**

1. Sathyanarayana, U., Chakrapani, U. *Biotechnology*, First edition, Books and allied (P) Ltd, Kolkata, 2008.
2. Chatterji A.K. *Introduction to Environmental Biotechnology*, Third edition, PHI Learning Pvt Ltd. New Delhi, 2011.
3. Dubey, R.C. *A text book of Biotechnology*, S.Chand & Company, New Delhi, 2014.
4. Patel H. *Industrial Microbiology*, (2<sup>nd</sup> edition), MacMillan Publishers, 2011.
5. Thakur, I.S. *Environmental Biotechnology- Basic principles and applications*- (2<sup>nd</sup> edition)- Dreamtech Press, 2019.

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1. Nair Basics A.J. *Biotechnology*. Laxmi Publications, 2004.
2. Ratledge Colin. *Basic Biotechnology*. Cambridge University Press, 2008.\

### Web Sources

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2. <https://nptel.ac.in/courses/102/105/102105058>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF TAMIL**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER - III**  
**பொதுத்தமிழ் - III (23UTAG31)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS / WEEK</b>	: 6	<b>INT. MARKS</b>	: 25
<b>CREDITS</b>	: 3	<b>EXT. MARKS</b>	: 75
<b>DURATION</b>	: 90 hrs	<b>MAX. MARKS</b>	: 100

**நோக்கங்கள்**

- இலக்கியங்களின் சிறப்பினை உணர்த்துதல்.
- காலந்தோறும் எழுந்த காப்பியங்களின் போக்கையும், புதினத்தின் இலக்கிய வடிவத்தையும் யாப்பு, அணி போன்ற இலக்கிய வகைகளையும் மொழிபெயர்ப்புத் திறனையும் மாணவர்கள் உணருமாறு செய்தல்.
- தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.

**fw;wypd; tpisTfs;**

**CO1[K1]:** இலக்கியங்களின் வழி வாழ்வியல் சிந்தனைகள் பற்றி அறிவர்.

**CO2[K2]:** காப்பிய சமயக் கருத்துக்களையும் நோக்கங்களையும் அடையாளம் காண்பர்.

**CO3[K3]:** தமிழ் புதினங்களின் வழி சமகாலப் படைப்புகளின் வாழ்க்கை முறையின் ஆற்றலைப் பெறுவர்.

**CO4[K4]:** காப்பியங்கள் மற்றும் புதினங்களின் வரலாற்றினைப் பாகுபடுத்துவர்.

**CO5[K5]:** இலக்கிய இலக்கணங்களை கற்று அவற்றை மதிப்பீடு செய்வர்.

**CO/PO Mapping Table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	2	1	-	1	-	-	-
<b>CO2[K2]</b>	2	1	-	1	-	-	-
<b>CO3[K3]</b>	2	2	-	2	1	-	-
<b>CO4[K4]</b>	2	2	1	2	-	1	1
<b>CO5[K5]</b>	2	2	1	2	1	1	1
<b>Weightage of the Course</b>	10	8	2	8	2	2	2
<b>Weighted percentage of Course Contribution to Pos</b>	1.73	1.61	0.5	2.41	0.71	0.7	0.74

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No correlation)



**கூறு I (18hrs)**  
**பெருங்காப்பியங்கள்:** சிலப்பதிகாரம் - வழக்குரை காதை - இளங்கோவடிகள், மணிமேகலை ஆதிரை பிச்சையிட்ட காதை - சீத்தலைச்சாத்தனார், சீவகசிந்தாமணி - பூமகள் இலம்பகம் - திருத்தக்கதேவர், வளையாபதி - நாதகுந்தனார்.

**கூறு II (18hrs)**  
**சமயக் காப்பியங்கள்:** பெரியபுராணம் - பூசலார் நாயனார் புராணம் - சேக்கிழார், கம்பராமாயணம் - மந்தரை சூழ்ச்சிப் படலம் - கம்பர், வில்லிபாரதம் - மற்போர் சருக்கம் - வில்லிப்புத்தூராழ்வார், சீராப்புராணம் - புலி வசனித்த படலம் - உமறுப்புலவர்.

**கூறு III (18 hrs)**  
**புதினம்:** வஞ்சிமாநகரம் (வரலாற்றுப் புதினம்) - நா.பார்த்தசாரதி.

**கூறு IV (18 hrs)**  
**காப்பியத்தின் தோற்றமும் வளர்ச்சியும் - புதினத்தின் தோற்றமும் வளர்ச்சியும்**

**கூறு V (18 hrs)**  
**மொழித்திறன்:** நூல் மதிப்புரை, திறனாய்வு செய்தல், கடிதம் வரைதல், விண்ணப்பம் எழுதுதல்.

#### பாடநூல்கள்

1. தமிழியல் துறையினர், *தொகுப்பு நூல்*, ஸ்ரீ காளீஸ்வரி கல்லூரி (தன்னாட்சி), சிவகாசி.
2. வாசுதேவன், கா. *பன்முக நோக்கில் தமிழ் இலக்கிய வரலாறு*, தேவன் பதிப்பகம், திருச்சிராப்பள்ளி, 2017.

#### பார்வை நூல்கள்

1. சிற்.பி. பாலசுப்பிரமணியன், *தமிழ் இலக்கிய வரலாறு*, கவிதா வெளியீடு, சென்னை.
2. தமிழண்ணல், *புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு*, சோலை பதிப்பகம், மதுரை
3. பாக்கியமேரி, *வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு*, பாரி நிலையம், சென்னை.

#### வலைப்பதிவுகள் (Web Sources)

1. Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org)  
<http://www.tamilheritage.org>
2. Tamil virtual University Library- [www.tamilvu.org/library](http://www.tamilvu.org/library)  
<http://www.virtualvu.org/library>
3. Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).
4. Chennai Library- [www.chennailibrary.com](http://www.chennailibrary.com)  
<http://www.chennailibrary.com>
5. Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <http://www.ulib.prg>
6. Tamil E-Books Downloads- [tamilebooksdownloads.blogspot.com](http://tamilebooksdownloads.blogspot.com)
7. Tamil Books on line- [books.tamilcube.com](http://books.tamilcube.com)
8. Catalogue of the Tamil books in the Library of British Congress  
[archive.org](http://archive.org)
9. Tamil novels on line - [books.tamilcube.com](http://books.tamilcube.com)

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF ENGLISH**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER- III**  
**GENERAL ENGLISH - III (23UENL31)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 6 (L- 5, T-1)**  
**CREDITS : 3**  
**DURATION : 90 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To enhance the level of literary and aesthetic experience of students and to help them respond creatively.
- To sensitize them to the major issues in the society and the world.
- To provide them with an ability to build and enrich their communication skills.
- To equip them to utilize the digital knowledge resources effectively for their chosen fields of study.
- To help them think and write imaginatively and critically.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1 [K1]:** relate and state ideas by reading simple poems and scenes from Shakespearean plays.

**CO2 [K2]:** demonstrate effective speaking skills by listening to speeches of famous personalities and express it in day-to-day life.

**CO3 [K3]:** apply the knowledge of language competency in writing letters, emails and display social etiquettes in everyday life.

**CO4 [K4]:** analyse data interpretation, meeting etiquettes, organizing and participating in a meeting.

**CO5 [K5]:** develop language skills through literature and assess the knowledge of English in the workplace.

**CO-PO Mapping table (Course Articulation Matrix)**

PO CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	2	1	-	2	-	-	-
<b>CO2[K2]</b>	2	2	-	2	1	1	-
<b>CO3[K3]</b>	2	2	1	2	1	1	-
<b>CO4[K4]</b>	2	2	1	2	-	-	1
<b>CO5[K5]</b>	2	1	1	1	1	1	1
<b>Weightage of the course</b>	10	08	03	09	03	03	02
<b>Weighted percentage of Course contribution to POs</b>	<b>1.73</b>	<b>1.61</b>	<b>0.74</b>	<b>2.71</b>	<b>1.07</b>	<b>1.05</b>	<b>0.74</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I - SPEECHES OF FAMOUS PERSONALITIES (18 hrs)**

Jawaharlal Nehru	-	Tryst with Destiny
Steve Jobs	-	You've got to Find What You Love
Barack Obama	-	Yes, We Can

**UNIT II- POETRY (18 hrs)**

Christina Rossetti	-	In an Artist's Studio
Toru Dutt	-	Sita
Oodgeroo Noonuccal	-	A Song of Hope
Mamang Dai	-	The Voice of the Mountains

**UNIT III - SCENES FROM SHAKESPEARE (18 hrs)**

Romeo & Juliet	-	The Balcony Scene
Macbeth	-	Banquet Scene
Julius Caesar	-	Murder Scene

**UNIT IV - LANGUAGE COMPETENCY (18 hrs)**

Writing letters and emails  
Writing and messaging in social media platforms [blogs, twitter, Instagram, facebook]  
Learning netiquette, email etiquette

**UNIT V - ENGLISH FOR WORK PLACE (18 hrs)**

Data Interpretation and Reporting  
Data Presentation and analysis  
Meeting Etiquettes - language, dress code, voice modulation  
Online Meetings - Terms and expressions used  
Conducting and participating in a meeting

**TEXTBOOK**

1. Arden Shakespeare: *Complete works of William Shakespeare*. Bloomsbury, 2011.

**REFERENCES**

**Books**

1. Wells, Stanley. *The Shakespeare Book: Big Ideas Simply Explained*, et al. DK Publishing, 2015.
2. Gandhi, Mahatma. *Famous Speeches by Mahatma Gandhi*, Create space Independent Publishing Platform, 2016.
3. Bernish, Jeanne Kelly. *How to Build a Professional Digital Profile* Kindle Edition, Bernish Communications Associates, LLC; 1st edition (May 29, 2012).
4. Folse, Keith.S. *Keys to Teaching Grammar to English Language Learners*, Second Ed.: A Practical Handbook, Michigan Teacher Training, 2016.
5. Yardley, Krysia.M. *Role Play- Theory and Practice*. Matwiejczuk, SAGE publications ltd, 1997.

## Web Sources

1. <https://www.scribd.com/document/558838656/>
2. <http://www.wordslikethis.com.au/>
3. <https://www.poetryfoundation.org/poems/146804/in-an-artist39s-studio>
4. <https://www.poetrynook.com/poem/s%E2%94%9C%C2%ABta>
5. <https://www.cam.ac.uk/files/a-tryst-with-destiny/index.html#:~:text=Jawaharlal%20Nehru%2C%20delivering%20his%20Tryst%20with%20Destiny%20speech.&text=%22Long%20years%20ago%20we%20made,awake%20to%20life%20and%20freedom>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**

**DEPARTMENT OF BIOTECHNOLOGY**

**UG Programme- B.Sc. Biotechnology**

**SEMESTER - III**

**CORE COURSE – V: IMMUNOLOGY AND IMMUNOTECHNOLOGY (23UBTC31)**

**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 4 (L-3, T-1)**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS: 100**

**Course objectives**

- To gain knowledge about the structure, functions and integration of immune system.
- To explore the students in natural mechanism of body defense and scope of immunology.
- To impart the knowledge on immune response, cells and organs of the immune system.
- To learn the immunodiagnostic techniques of infectious diseases.
- To know the applications of antibody production in disease diagnostics.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** state the organization of the immune system and their functions

**CO2[K2]:** illustrate the types of antigen and immunoglobulin

**CO3[K3]:** choose the appropriate immunotechniques for disease diagnosis

**CO4[K4]:** analyze the factors responsible for immunodeficiency and auto immune disease

**CO5[K5]:** categorize cell mediated and humoral immune response

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO</b>							
<b>CO1 [K1]</b>	3	2	2	2	1	1	1
<b>CO2 [K2]</b>	3	3	3	1	1	1	1
<b>CO3 [K3]</b>	3	3	3	1	2	1	1
<b>CO4 [K4]</b>	3	3	2	1	2	1	1
<b>CO5 [K5]</b>	3	2	2	1	1	2	1
<b>Weightage of the course</b>	15	13	12	06	07	06	05
<b>Weighted percentage of course contribution to Pos</b>	2.59	2.61	2.97	1.81	2.5	2.1	1.85

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I: (12 hrs)**

Introduction to Immunology. Cells involved in immune response. Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen. Hematopoiesis – development of B and T lymphocytes. Types of immunity – Innate and acquired.

**UNIT II: (12 hrs)**

Antigen: Characteristics and types. Antibody – Structure, Types, Properties and their Biological Function. Production of antibodies- Hybridoma technology: Applications of Monoclonal antibodies in biomedical research.

**UNIT III: (12 hrs)**

Antigen – Antibody interactions, Immunodiffusion and immuno electrophoresis. Principle and application of ELISA and RIA and Fluorescent antibody technique and Western blotting. Purification of antibodies.

**UNIT IV: (12 hrs)**

The complement system and activation and regulation. Types – Classical, alternative and Lectin pathway. Biological function of C' proteins. Cytokines- Structure and function. Vaccines – Types, production and application.

**UNIT V: (12 hrs)**

Hypersensitivity Reactions and Types. Major Histocompatibility Complex – MHC genes, MHC in immune responsiveness, Structure and function of Class I and Class II MHC molecules. HLA tissue typing.

**TEXTBOOKS**

1. Thomas J. Kindt, Barbara A. Osborne and Richard A Goldsby., Kuby *Immunology*, 6th edition, W. H. Freeman and Company, 2006.
2. Kannan, I., *Immunology*. MJP Publishers, Chennai, 2010.
3. Abbas, A.K., A.H.L., Lichtman and S. Pillai., *Cellular and Molecular Immunology*, 6th Edition. Saunders Elsevier Publications, Philadelphia, 2010.
4. NandiniShetty, *Immunology : introductory textbook* – I. New Age International, New Delhi. 1996.
5. Fahim Halim K., *The Elements of Immunology*. Pearson Education. 2009.

**REFERENCES**

**Books**

- 1) Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt., *Essential Immunology*, Wiley- Blackwell. USA, 2011
- 2) Janeway Travers. *Immunobiology- the immune system in health and disease*. Current Biology Ltd. London, New York. 3<sup>rd</sup> Edition, 1997.
- 3) William R Clark. *The Experimental Foundations of Modern Immunology*. 3<sup>rd</sup> Edition. John Wiley and Sons Inc. New York, 1991.
- 4) Frank C. Hay, Olwyn M. R. Westwood. *Practical Immunology*, 4<sup>th</sup> Edition., Wiley-Blackwell, 2002.

- 5) Noel R. Rose, Herman Friedman, John L. Fahey. *Manual of Clinical Laboratory Immunology*. ASM.3<sup>rd</sup> Edition, 1986

**Web sources**

1. <https://www.ncbi.nlm.nih.gov/books/NBK279395/>
2. <https://med.stanford.edu/immunol/phd-program/ebook.html>
3. <https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/>
4. [Immunology Overview - Medical Microbiology - NCBI Bookshelf \(nih.gov\)](#)
5. [Immunology - an overview | ScienceDirect Topics](#)

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - III**  
**CORE COURSE - VI: PRACTICAL: IMMUNOLOGY AND IMMUNOTECHNOLOGY**  
**(23UBTC3P)**  
**(From 2023 – 2024 Batch onwards)**

<b>HOURS/WEEK : 4</b>	<b>INT. MARKS : 40</b>
<b>CREDITS : 4</b>	<b>EXT. MARKS : 60</b>
<b>DURATION : 60 hrs</b>	<b>MAX. MARKS: 100</b>

**Course Objectives**

- To provide students with a foundation in immunological processes.
- To describe principles involved in immunological techniques.
- To evaluate and correlate test results with associated diseases or conditions.
- To describe different types of blood groups, blood cells and their function and also prepare antigens and antibody from the blood

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** demonstrate blood grouping and determine blood type

**CO2[K3]:** estimate WBC and RBC Cells

**CO3[K4]:** examine serological diagnostic tests such as ASO, CRP, RA and widal test.

**CO4[K5]:** determine a technical skill required for immunodiffusion and knows the principle behind the techniques.

**CO5[K6]:** predict ELISA technique

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K2]</b>	3	2	2	2	1	1	1
<b>CO2 [K3]</b>	3	3	3	1	1	1	1
<b>CO3 [K4]</b>	3	3	3	1	2	1	1
<b>CO4 [K5]</b>	3	3	2	1	2	1	1
<b>CO5 [K6]</b>	3	2	2	1	1	2	1
<b>Weightage of the course</b>	15	13	12	06	07	06	05
<b>Weighted percentage of course contribution to Pos</b>	2.59	2.61	2.97	1.81	2.5	2.1	1.85

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**



## **EXPERIMENTS**

1. Separation of Serum and Plasma.
2. Blood grouping and Rh typing.
3. WBC counting
4. RBC counting
5. Differential blood count
6. WIDAL Slide test
7. ASO test
8. Double Immunodiffusion
9. Single Radial Immunodifusion
10. ELISA – Demonstration
11. Handling of Laboratory animals - Demonstration
12. Skin test – Demonstration

## **TEXTBOOKS**

1. Goldsby, R.A., Kindt, T.J., Osborne, B.A. and Kuby, J. *Immunology*. W.H. Freeman and Company, New York, Eighth Edition, 2019.
2. Tizard, I.R. *Immunology - An introduction*. Cengage learning Pvt Ltd, India, 2.Tenth Edition, 2017.
3. AbulK.Abbas, Andrew H.Litchman and Shiv Pillai. *Basic Immunology*. Elsevier India, 6th edition, 2019.

## **REFERENCES**

### **Books**

1. Delves, P.J., Martin, S. J. Burton, D. R. and Roitt, I. M. *Essential Immunology*. Blackwell publishing, Thirteenth Edition, 2017.
2. Parija, S. C. *Textbook of Microbiology and Immunology*. Elsevier India, SecondEdition, 2013.
3. Zabriskie, J.B. *Essential Clinical Immunology*. Cambridge University Press, UK, Sixth edition, 2017.

### **Web sources**

1. <https://www.wiley.com/encz/Manual+of+Molecular+and+Clinical+Laboratory+Immunology%2C+8th+Edition> - p - 9781555818715
2. <https://www.asmscience.org/content/book/10.1128/9781555815905>
3. <https://www.springer.com/gp/book/9783030646851>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - III**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - III:**  
**BIOINSTRUMENTATION (23UBTA31)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 4 (L-3, T-1)**  
**CREDITS : 3**  
**DURATION : 60 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS: 100**

**Course Objectives**

- To gain indepth knowledge about analytical techniques and principles.
- To emphasize the importance of instrumentation for biological research.
- To gain expertise in handling instruments and understand their applications.
- To understand principles, concepts and operations of electrophoresis, spectroscopy and chromatography

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** state the principles and working mechanism of microscopes

**CO2[K2]:** explain the principles and applications of chromatography and spectrometry

**CO3[K3]:** apply the electrophoresis technique in separation of biomolecules

**CO4[K4]:** analyse the role of radioactive isotopes in bioanalytical techniques

**CO5[K5]:** explain the principle of sedimentation of centrifugation

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K1]</b>	2	2	2	1	1	1	1
<b>CO2 [K2]</b>	2	2	2	1	1	1	1
<b>CO3 [K3]</b>	2	3	2	1	1	1	1
<b>CO4 [K4]</b>	2	3	2	1	1	1	1
<b>CO5 [K5]</b>	2	3	2	1	1	1	1
<b>Weightage of the course</b>	10	13	10	05	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	<b>1.73</b>	<b>2.61</b>	<b>2.48</b>	<b>1.51</b>	<b>1.79</b>	<b>1.75</b>	<b>1.85</b>

Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)

**UNIT I (12 hrs)**

pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope.

**UNIT II (12 hrs)**

Spectra – Absorption and Emission Spectra – Beer Lambert's law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR).

**UNIT III (12 hrs)**

Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Principle, Paper Electrophoresis – Cellulose Acetate Electrophoresis - Agarose Gel Electrophoresis – SDS- PAGE and Iso-electric focusing.

**UNIT IV (12 hrs)**

Radioactivity – Isotopes – Clinically important isotopes – Measurement of Radioactivity – GM Counters, Scintillation Counters – Autoradiography – Applications. SOPs for Radioactive materials.

**UNIT V (12 hrs)**

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

**TEXTBOOKS**

1. Keith Wilson, John Walker. *Principles and techniques of Biochemistry and Molecular Biology*. Cambridge University Press. 7<sup>th</sup> edition, 2010.
2. David L. Nelson, Michael M Cox. Lehninger. *Principles of Biochemistry*, Fifth edition W.H. Freeman, New York, 2008.
3. Khandpur R S. *Handbook of Biomedical Instrumentation*, 3rd edition, McGraw Hill Education, 2014.
4. L.A Geddes and L.E. Baker. *Principles of Applied Biomedical Instrumentation*. Wiley India Third Edition, 2008.
5. Sharma B K. *Instrumental Methods of Chemical Analysis* 24th Edition, GOEL Publishing House, 2005.

**REFERENCES****Books**

1. Keith Wilson, John Walker. *Principles and techniques of Biochemistry and Molecular Biology*. Cambridge University Press. 7<sup>th</sup> edition, 2010.
2. David L. Nelson, Michael M Cox. Lehninger. *Principles of Biochemistry*, Fifth edition W.H. Freeman, New York, 2008.
3. Khandpur R S. *Handbook of Biomedical Instrumentation*, 3rd edition, McGraw Hill Education, 2014.

4. L.A Geddes and L.E.Baker. *Principles of Applied Biomedical Instrumentation*. WileyIndia Third Edition, 2008.
5. Sharma B K. *Instrumental Methods of Chemical Analysis* 24th Edition, GOEL Publishing House, 2005.

**Web sources**

1. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod.pdf>
2. <https://nptel.ac.in/courses/102/107/102107028>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - III**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – III: PRACTICAL:**  
**BIOINSTRUMENTATION (23UBTA3P)**  
**(From 2023 – 2024 Batch onwards)**

<b>HOURS/WEEK : 2</b>	<b>INT. MARKS : 25</b>
<b>CREDITS : 2</b>	<b>EXT. MARKS : 75</b>
<b>DURATION : 30 hrs</b>	<b>MAX. MARKS: 100</b>

**Course Objectives**

- To provides the technical skills employed in quantitative and qualitative analysis of biomolecules.
- To give a strong foundation and information on the application of bioinstrumentation.
- To understand the principles and techniques of analytical centrifugation.
- To know the theory and application of spectroscopy and Chromatography

**Course Outcomes (Co)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** estimate the lipids and antioxidants in biological samples

**CO2[K3]:** apply the knowledge of chromatographic techniques in identification of amino acids

**CO3[K4]:** examine the nucleic acid and proteins using UV Spectrophotometer

**CO4[K5]:** choose the appropriate technique for the separation of biological material

**CO5[K6]:** prepare buffer using biological samples in pH meter

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K2]</b>	2	2	2	1	1	1	1
<b>CO2 [K3]</b>	2	2	2	1	1	1	1
<b>CO3 [K4]</b>	2	3	2	1	1	1	1
<b>CO4 [K5]</b>	2	3	2	1	1	1	1
<b>CO5 [K6]</b>	2	3	2	1	1	1	1
<b>Weightage of the course</b>	10	13	10	05	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	1.73	2.61	2.48	1.51	1.79	1.75	1.85

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

## EXPERIMENTS

1. Preparation of Buffer (Phosphate Buffer)
2. Determination of pH of biological samples using pH meter
3. UV spectra of Nucleic acids and proteins.
4. Chromatography analysis of sugar, amino acids, lipids by paper chromatography.
2. Chromatography analysis of sugar, amino acids, lipids by thin layer chromatography.
3. Fractionation of biological material into its various components by Centrifuge.

## TEXTBOOK

1. Himanshu Sharma, Pramod K. Singh. *Laboratory Manual for Bioinstrumentation, Biochemistry, Microbiology, Cell Biology and Enzyme Technology For PG and UG students*. New Delhi: Excellent Publishing House, 2018

## REFERENCES

### Books

1. Palanivelu P. *Analytical biochemistry and separation techniques*. MKU, Madurai, 2012.
2. Douglas A Skoog, F. James Holler, Timothy A. Nieman. *Principles of Instrumental Analysis*. Brooks Cole publishers, Seventh Edition, 2017.

### Web sources

1. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf>
2. <https://nptel.ac.in/courses/104/104/104104066/>
3. <https://nptel.ac.in/courses/103/108/103108100/#>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - III**  
**SKILL ENHANCEMENT COURSE - V: (ENTREPRENEURIAL SKILL)**  
**BIOFERTILIZER (23UBTS31)**  
**(From 2023 – 2024 Batch onwards)**

<b>HOUR/WEEK : 1</b>	<b>INT. MARKS : 25</b>
<b>CREDIT : 1</b>	<b>EXT. MARKS : 75</b>
<b>DURATION : 15 hrs</b>	<b>MAX. MARKS : 100</b>

**Course Objectives**

- To study the impact of soil management practices on microbial functions and soil health.
- To exploit the microbial diversity in various agro ecologies for biofertilizer application in diversified systems.
- To improve biofertilizer technology to ensure high quality and improved delivery.
- To diversify biofertilizer research and application in drylands, degraded soils and tribal areas and checking efficiency of biofertilizers.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** state the usefulness of biofertilizer

**CO2[K2]:** explain the importance of biofertilizer in saving the nature

**CO3[K3]:** elucidate the techniques involved in mass production of Biofertilizers

**CO4[K4]:** analyse the quality control measures in biofertilizers

**CO5[K5]:** predict economical and environmental impacts of biofertilizers

**CO - PO Mapping table (Course Articulation Matrix)**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1 [K1]</b>	2	2	2	1	1	1	1
<b>CO2 [K2]</b>	2	2	2	1	1	1	1
<b>CO3 [K3]</b>	2	2	2	1	1	1	1
<b>CO4 [K4]</b>	2	3	2	1	1	1	1
<b>CO5 [K5]</b>	2	3	2	1	1	1	1
<b>Weightage of the course</b>	10	12	10	05	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	<b>1.73</b>	<b>2.41</b>	<b>2.48</b>	<b>1.51</b>	<b>1.79</b>	<b>1.75</b>	<b>1.85</b>

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

**UNIT I (3 hrs)**

Biofertilizer – Introduction, Scope and applications of Biofertilizers. *Azospirillum* – Isolation, Screening and Characterization from soil. Mass cultivation and carrier based inoculants.

**UNIT II (3 hrs)**

Phosphate solubilizing bacteria – *Pseudomonas* – Isolation, Screening and Characterization from soil. Mass cultivation and carrier based inoculants. Collection of Rhizosphere soil – Preparation of Nitrogen free malate medium and Pikovskaya medium – Mass production of *Azospirillum* and *Pseudomonas*.

**UNIT III (3 hrs)**

Mycorrhizal fungi as biofertilizers - Introduction, scope. A general account of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection, wet sieving and decanting method and inoculum production. Culture of mycorrhizae in Modified Melin - Norkrans (MMN) agar medium Isolation and method of inoculation of Arbuscular mycorrhizae (AM), Legume - AM interactions - Biofertilizers Production.

**UNIT IV (3 hrs)**

Azolla - Anabaena as biofertilizers. Isolation of cyanobacteria. Formation of Fogg's medium - Mass cultivation of Azolla - Cyanobacterial biofertilizers - Symbiotic association of Cyanobacteria - Field application of Cyanobacterial inoculants.

**UNIT V (3 hrs)**

Preparation of carrier (Rice husk ash) – Mixing of biofertilizer with carrier – Packing of carrier based inoculums. Mechanism of nitrogen fixation (free-living and symbiotic) - Biochemistry and molecular basis of nitrogen fixation - Phosphate solubilization and mobilization.

**TEXTBOOKS**

1. Dubey, R. C. *A Textbook of Biotechnology*. S. Chand & Co., New Delhi, 2008.
2. Newton, W. E. *Recent Developments in Nitrogen Fixation*. New York : Academic Press, 1977.
3. Schwintzer, C. R. and Tjepkema, J. D. *The Biology of Frankia and Actinorhizal Plants*. San Diego, USA : Academic Press Inc. , 1990.

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1. Subba Rao, N. S. *Soil Microbiology. Soil Microorganisms and Plant Growth*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi: 4th ed, 2002.



2. Subba Rao, N. S. and Dommergues, Y. R. *Microbial Interactions in Agriculture and Forestry*. Vol. I, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi: 1998.
3. Verma, A. *Mycorrhiza*. Springer Verlag, Berlin: 1999.

**Web sources**

1. <https://spark.adobe.com/page/2ja6zwVXjjHCh/>
2. <http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Introduction-and-Structure-of-Biofertilizers.pdf>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - III**  
**SKILL ENHANCEMENT COURSE - VI: PRACTICAL :**  
**BIOFERTILIZER PRODUCTION (23UBTS3P)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 2**

**CREDITS : 2**

**DURATION : 30 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS: 100**

**Course Objectives**

- To explain the role of microorganisms for improvement of biofertilizers.
- To understand socioeconomic constraints in organic farming.
- To understand the quality control measures involved in biofertilizer production.
- To aware students about applications of bio-fertilizers.
- To make skilled manpower for biofertilizer industry.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** explain the role of biofertilizers .

**CO2[K3]:** develop the skill in biofertilizer production.

**CO3[K4]:** determine and develop skill related to handling, cultivation and propagatin of quality Microbial inoculants

**CO4[K5]:** analyse the quality control measures and N, P, K levels of biofertilizers

**CO5[K6]:** determine professional competence and upgrade the knowledge of biofertilizer production.

**CO - PO Mapping table (Course Articulation Matrix)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K2]</b>	3	3	1	1	1	1	1
<b>CO2 [K3]</b>	3	2	2	2	1	1	1
<b>CO3 [K4]</b>	2	2	3	2	1	1	1
<b>CO4 [K5]</b>	2	2	2	2	1	1	1
<b>CO5 [K6]</b>	1	2	2	2	1	1	1
<b>Weightage of the course</b>	11	11	10	09	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	<b>1.9</b>	<b>2.21</b>	<b>2.48</b>	<b>2.71</b>	<b>1.79</b>	<b>1.75</b>	<b>1.85</b>

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

## **EXPERIMENTS**

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azotobacter* from soil samples
4. Isolation of *Trichoderma* (Lacto phenol cotton blue)
5. AMF roots Staining (decanting and seiveing method)
6. Effect of storage on biofertilizers
7. C, N, P and K analysis of organic manure
8. Quality test of biofertilizers
9. Designing of pot experiments for efficacy study of Biofertilizers

## **TEXTBOOKS**

1. P.Hyma. *Biofertilizers: Commercial Production Technology and Quality Control*, 2017
2. S.Kaniyan, K.Kumar and K. Govindarajan . *BiofertilizersTechnology*. 2010,

## **REFERENCES**

### **Books**

1. Arun K.Sharma . *Biofertilizers for Sustainable Agriculture*. 2017.
2. Dwijendra Singh . *Advances In Plant Biopesticides* . Springer India , 2021
3. Ram Singh &VikasJindalG.S.Dhaliwal. *A Textbook of Integrated Pest Management*, 2013

### **Websites**

1. <https://www.youtube.com/watch?v=l2falR7qB3Q>
2. <https://nptel.ac.in/courses/126105014>
3. <https://www.youtube.com/watch?v=FCIE1masG5A>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF TAMIL**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER - IV**

**பொதுத்தமிழ் - IV (23UTAG41)**  
**(From 2023-2024 Batch onwards)**

<b>HOURS / WEEK</b>	<b>: 6</b>	<b>INT. MARKS : 25</b>
<b>CREDITS</b>	<b>: 3</b>	<b>EXT. MARKS : 75</b>
<b>DURATION</b>	<b>: 90 hrs</b>	<b>MAX. MARKS: 100</b>

**நோக்கங்கள்**

- இலக்கியங்களின் சிறப்பினை உணர்த்துதல்.
- சங்க இலக்கியத்தின் சிறப்பையும், நாடகம் என்னும் இலக்கிய வகையின் தன்மையையும் அகபுற இலக்கணங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.

**கற்றலின் விளைவுகள்**

- CO1[K1]:** சங்க இலக்கியத்தில் காணப்பெறும் அறக்கருத்துக்களை அறிந்து கொள்வர்.
- CO2[K2]:** சங்க இலக்கியங்கள் மற்றும் நாடக இலக்கியம் வாயிலாக மக்களின் வாழ்க்கை முறையினை எடுத்துரைப்பர்.
- CO3[K3]:** நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும், கலைத்தன்மையையும், படைப்பாற்றலையும் கற்பர். மேலும் மொழிபெயர்ப்பு ஆற்றலையும் பெறுவார்.
- CO4[K4]:** கலைச்சொற்களைக் கண்டறிந்து அவற்றோடு தொடர்புடைய சொல்லைப் பகுப்பர்.
- CO5[K5]:** சங்க இலக்கியம் மற்றும் நாடக இலக்கியங்களை மதிப்பீடு செய்வர்.

**CO/PO Mapping Table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	1	-	1	-	-	-
<b>CO2[K2]</b>	2	1	-	2	-	-	-
<b>CO3[K3]</b>	2	2	-	2	1	-	1
<b>CO4[K4]</b>	2	2	1	2	1	1	-
<b>CO5[K5]</b>	2	2	1	2	-	1	1
<b>Weightage of the Course</b>	10	8	2	9	2	2	2
<b>Weighted percentage of Course Contribution to Pos</b>	1.73	1.61	0.5	2.71	0.71	0.7	0.74

Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)

**கூறு I (18 hrs)**  
**எட்டுத்தொகை:** நற்றிணை (10,14,16பாடல்கள்), குறுந்தொகை (16,17,19,20,25,29,38,440), கலித்தொகை (38,51), அகநானூறு (15,33,55), புறநானூறு (37,86,112), பரிபாடல் (55)

**கூறு II (18 hrs)**  
**பத்துப்பாட்டு:** நெடுநல்வாடை - நக்கீரர்

**கூறு III (18 hrs)**  
**நாடகம்:** சபாபதி - பம்மல் சம்பந்த முதலியார்

**கூறு IV (18 hrs)**  
**சங்க இலக்கியம் தோற்றம் வளர்ச்சி - நாடகத்தின் தோற்றம் வளர்ச்சி**

**கூறு V (18 hrs)**  
**மொழித்திறன்:** மொழிபெயர்ப்பு - கலைச்சொற்கள், கொடுக்கப்பட்டுள்ள ஆங்கிலப் பகுதியைத் தமிழில் மொழிபெயர்தல், அலுவலகக் கடிதம் - தமிழில் மொழிபெயர்த்தல்.

#### **பாடநூல்கள்**

1. தமிழியல் துறையினர், *தொகுப்பு நூல்*, ஸ்ரீ காளீஸ்வரி கல்லூரி (தன்னாட்சி), சிவகாசி.
2. வாசுதேவன், கா. *பன்முக நோக்கில் தமிழ் இலக்கிய வரலாறு*, தேவன் பதிப்பகம், திருச்சிராப்பள்ளி, 2017.

#### **பார்வை நூல்கள்**

1. சிற்.பி. பாலசுப்பிரமணியன், *தமிழ் இலக்கிய வரலாறு*, கவிதா வெளியீடு, சென்னை.
2. தமிழண்ணல், *புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு*, சோலை பதிப்பகம், மதுரை
3. பாக்கியமேரி, *வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு*, பாரி நிலையம், சென்னை.

#### **வலைப்பதிவுகள் (Web Sources)**

1. Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org)  
<<http://www.tamilheritage.org>>
2. Tamil virtual University Library- [www.tamilvu.org/library](http://www.tamilvu.org/library)  
<http://www.virtualvu.org/library>
3. Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).
4. Chennai Library- [www.chennailibrary.com](http://www.chennailibrary.com)  
<<http://www.chennailibrary.com>>.
5. Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <<http://www.ulib.prg>>.
6. Tamil E-Books Downloads- [tamilebooksdownloads.blogspot.com](http://tamilebooksdownloads.blogspot.com)
7. Tamil Books on line- [books.tamilcube.com](http://books.tamilcube.com)
8. Catalogue of the Tamil books in the Library of British Congress  
[archive.org](http://archive.org)
9. Tamil novels on line - [books.tamilcube.com](http://books.tamilcube.com)

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF ENGLISH**  
**UG Programme - B.A./ B.COM/B.B.A./ B.SC./BCA**  
**SEMESTER- IV**  
**GENERAL ENGLISH –IV (23UENL41)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 6 (L-5, T-1)**

**INT. MARKS : 25**

**CREDITS : 3**

**EXT. MARKS : 75**

**DURATION : 90 hrs**

**MAX. MARKS: 100**

**Course Objectives**

- To help learners imbibe the rules of language unconsciously and tune to deduce language structure and usage.
- To use receptive skills through reading and listening to acquire good exposure to language and literature.
- To develop language skill for effective communication.
- To provide exposure to plays, autobiographies and expose them to value based ideas.
- To enhance the learner’s language skills especially in the areas of grammar and pronunciation.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1 [K1]:** state ideas effectively and appropriately in real life situations

**CO2 [K2]:** demonstrate speaking skills in appreciating literature

**CO3 [K3]:** use grammar and pronunciation effectively and appropriately

**CO4 [K4]:** examine the literary works to develop language skills

**CO5 [K6]:** construct grammatically correct and meaning full sentences

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	2	1	-	1	-	-	-
<b>CO2[K2]</b>	2	1	-	1	-	-	-
<b>CO3[K3]</b>	2	2	1	2	1	1	1
<b>CO4[K4]</b>	2	2	1	2	1	1	1
<b>CO5[K6]</b>	2	3	1	2	-	1	1
<b>Weightage of the course</b>	10	09	03	08	02	03	03
<b>Weighted percentage of Course contribution to Pos</b>	1.73	1.81	0.74	2.41	0.71	1.05	1.11

Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)

**UNIT I - LIFE WRITING (18 hrs)**

Malala Yousafzai - I am Malala - Chapter 1  
Nikola Tesla - My Inventions - Chapter 2

**UNIT II - ONE ACT PLAYS (18 hrs)**

Edward Albee - The Zoo Story  
Anton Chekhov - The Proposal

**UNIT III - INTERVIEWS (18 hrs)**

Nelson Mandela's Interview with Larry King  
Rakesh Sharma's Interview with Indira Gandhi from Space  
Lionel Messi with Sid Lowe (Print)

**UNIT IV - LANGUAGE COMPETENCY (18 hrs)**

Refuting, Arguing & Debating, Making Suggestions & Responding to  
Suggestions, Asking for and Giving Advice or Help, Interviews (face  
to face, telephone and video conferencing)

**UNIT V - ENGLISH FOR WORKPLACE (18 hrs)**

Job Applications: Covering letters, CV and Resume  
Creating a digital profile - LinkedIn  
Filling Forms (Online & Manual): creation of account, railway reservation,  
ATM, Credit/debit card  
Body Language -Practical Skills for Interviews

**TEXTBOOKS**

1. Yousafzai, Malala, and Christina Lamb. *I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban*. New York: Little Brown, 2013.
2. Tesla , Nikola. *My Inventions*. London: Ingram Short Title, 2011.

**REFERENCES**

**Books**

1. Taylor, Mary Borg, & Francis, *Writing Your Life: A Guide to Writing Autobiographies*. Routledge, 2021.
2. Bert, A. Norman. *One-act Plays for Acting Students: An Anthology of Short one- Act Plays for one, Two or Three actors*. Christian Publisher LLC, 1987.
3. Dolley, Colin. and Rex Welford. *The One-Act Play Companion: A Guide to plays, Play wrights and Performance*. Bloomsbury Publishing, 2015.
4. Bernis, Jeanne Kelly. Editor. *How to Build a Professional Digital Profile*. Bernish, Bernish Communications Associates, LLC, 2012
5. Yardley, M Yardley - Matwiejczuk, *Role Play-Theory and Practice*. SAGE publications ltd, 1997.

## Web Sources

1. For Readers' Theatre:  
<https://www.youtube.com/watch?v=JaLQIt8orSw&t=469s>(the link to the performance; refer scripts by Aaron Sheperd) <http://BBC learn English.com>
2. <https://www.infoplease.com/dictionary/brewers/animals-cries>
3. <http://onestopenglish.com>
4. <http://hearn-english-today.com>
5. <http://talkenglish.com>



**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**

**DEPARTMENT OF BIOTECHNOLOGY**

**UG Programme- B.Sc. Biotechnology**

**SEMESTER - IV**

**CORE COURSE - VII: GENETIC ENGINEERING AND rDNA TECHNOLOGY (21UBTC41)  
(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 4(L-3, T-1)**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS : 100**

**Course Objectives**

- To assimilate the concept of gene and their manipulation.
- To understand the basic steps of gene cloning and the role of enzymes and vectors responsible for gene manipulation.
- To obtain knowledge on gene transfer methods.
- To acquire theoretical knowledge in the techniques, tools, application and safety measures related to genetic engineering.
- To describe gene expression system and their applications.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** explain the strategies of genetic engineering

**CO2[K2]:** select the suitable bio analytical tools in gene expression studies

**CO3[K3]:** compare the central dogma of cell in prokaryotes and eukaryotes

**CO4[K4]:** illustrate the appropriate gene transfer method for prokaryotes and eukaryotes

**CO5[K5]:** explain the applications of genetic engineering

**CO - PO Mapping table (Course Articulation Matrix)**

<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1 [K1]</b>	3	1	2	1	-	-	1
<b>CO2 [K2]</b>	3	2	2	1	2	1	-
<b>CO3 [K3]</b>	3	3	2	1	1	-	1
<b>CO4 [K4]</b>	3	2	3	1	2	1	1
<b>CO5 [K5]</b>	2	3	3	1	2	1	1
<b>Weightage of the course</b>	15	11	12	05	07	03	04
<b>Weighted percentage of course contribution to Pos</b>	<b>2.59</b>	<b>2.21</b>	<b>2.97</b>	<b>1.51</b>	<b>2.5</b>	<b>1.05</b>	<b>1.48</b>

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

**UNIT I (12 hrs)**

Genetic Engineering – Introduction. Tools in recombinant DNA technology – recombinant DNA – cloning strategies (enzymes, vectors, host) – introduction of rDNA into host cells.

**UNIT II (12 hrs)**

Identification of recombinants, selection and screening for Recombinants. DNA sequencing – Construction of Genomic DNA library and cDNA library), Chromosome walking. Human Genome Project. Polymerase Chain reaction-Methodology and its Types.

**UNIT III (12 hrs)**

Gene transfer techniques – Viral mediated gene transfer, Selectable markers and reporter genes - Non viral mediated gene transfer - Physical methods: Microinjection - Electroporation - Particle Bombardment, Chemical methods: Calcium phosphate - DEAE dextran - Liposomes.

**UNIT IV (12 hrs)**

Gene Expression – Expression system and their applications - protein based products – Protein engineering– production of protein from cloned genes. Site directed Mutagenesis, Restriction Fragment Length Polymorphism (RFLP).

**UNIT V (12 hrs)**

Application of Recombinant DNA technology in medicine, industry, agriculture and r-DNA technology - merits and demerits.

**TEXTBOOKS**

1. Brown T.A. *Gene Cloning and DNA Analysis: An Introduction*. 7th edition, Wiley – Blackwell, 2015
2. Desmond S.T. Nicholl. *An Introduction to Genetic Engineering*. 3rd edition, Cambridge university press, 2008
3. R.W. Old & S.B. Primrose. *Principles of Gene Manipulation*. Fifth Edition, Blackwell Science.
4. Setlow, Jane K. *Genetic Engineering Principles and Methods* .(Volume 24).
5. Keya Chaudhuri. *Recombinant DNA Technology*, 2012

**REFERENCES****Books**

1. David Clark Nanette Pazdernik Michelle McGehee. *Molecular Biology techniques*, 3<sup>rd</sup> edition, 2018.
2. Anton Byron. *Introduction to Gene Cloning*. Oxford Book Company, 2019.
3. Monika Jain. *Recombinant DNA technology*. I edition, Alpha Science International. ISBN-13 : 978-1842656679, 2012.
4. Primrose.S.B .*Principles of gene manipulation*. 7th edition, Blackwell Scientific limited, Germany. ISBN: 978-1-405-13544-3, 2014.

**Web sources**

1. <https://www.britannica.com/recombinant-DNA-technology>
2. <https://www.le.ac.uk/recombinant-dna-and-genetic-techniques>
3. <https://www.ncbi.nlm.nih.gov>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - IV**  
**CORE COURSE-VIII: PRACTICAL:**  
**GENETIC ENGINEERING AND rDNA TECHNOLOGY (23UBTC4P)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 3**

**CREDITS : 3**

**DURATION : 45 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS: 100**

**Course Objectives**

- To gain hands on experience in DNA and RNA isolation.
- To conduct gene amplification experiments by PCR analysis.
- To learn identification methods of bacterial transformation into suitable bacteria for selection of recombinant clones.
- To conduct Restriction Fragment Length Polymorphism techniques.
- To provide the practical applications in biotechnological research

**COURSE OUTCOMES (CO)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** illustrate r DNA techniques and their application in the field of genetic engineering

**CO2[K3]:** write about plasmids and their construction

**CO3[K4]:** explain gene manipulation methods

**CO4[K5]:** discuss about the principles of recombinant DNA technology and different type of vectors

**CO5[K6]:** elaborate the concept of different cloning strategies and their expression

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K2]</b>	3	2	2	1	-	-	1
<b>CO2 [K3]</b>	3	2	2	1	2	1	-
<b>CO3 [K4]</b>	3	3	2	1	1	-	1
<b>CO4 [K5]</b>	3	2	3	1	2	1	1
<b>CO5 [K6]</b>	3	3	3	1	2	1	1
<b>Weightage of the course</b>	15	12	12	05	07	03	04
<b>Weighted percentage of course contribution to Pos</b>	2.59	2.41	2.97	1.51	2.5	1.05	1.48

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

## **EXPERIMENTS**

1. Isolation of genomic DNA
2. Isolation of plasmid DNA
3. Isolation of RNA
4. Production of competent cells for transformation
5. Bacterial transformation
6. Restriction Digestion of DNA
7. Restriction Fragment Length Polymorphism (DEMO)
8. PCR (Demonstration)

## **TEXTBOOKS**

1. Dubey R. C. *A Text Book of Biotechnology*. New Delhi : 2014.
2. Satyanarayana U. *Biotechnology*. Books and Allied (P) Ltd, 2020 .
3. Rastogi V.B. *Fundamentals of Molecular Biology*. New Delhi: Ane Books Pvt. Ltd., 2010

## **REFERENCES**

### **Books**

1. John vennison. S. *Laboratory Manual for genetic engineering*. 1st edition, 2009.
2. Glick *et al*. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. Taylor and Francis publications, 2017.

### **Web sources**

1. <https://nptel.ac.in/courses/102/103/102103013/>
2. <https://nptel.ac.in/content/storage2/courses/102103012/module1/lec1/3.html> 3
3. <https://nptel.ac.in/content/storage2/courses/104108056/module8/PNR%20lecture%2029.pdf>
4. <https://nptel.ac.in/courses/102/103/102103017/>
5. <https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod5.pdf>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - IV**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC-IV:**  
**BIOINFORMATICS AND BIOSTATISTICS (23UBTA41)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 4(L-3, T-1)**

**CREDITS : 3**

**DURATION : 60 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS: 100**

**Course Objectives**

- To acquire knowledge on the basic principles and concepts of bioinformatics and biostatistics
- To aware students about computer modeling, development of new algorithms and analysis methods.
- To explain databases like NCBI, EMBI, UniProt, GenBank, Protein Data Bank, CATH.
- To conceptualize the application of statistical concepts, diagrammatic and graphic representation of biological data

**Course Outcomes (Co)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** outline the scope and application of bioinformatics

**CO2[K2]:** explain the role of molecular docking and drug design

**CO3[K3]:** apply the bioinformatics tools in sequence alignment

**CO4[K4]:** analyse the role of statistical software

**CO5[K5]:** differentiate parametric and nonparametric statistics

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K1]</b>	2	2	3	1	1	1	1
<b>CO2 [K2]</b>	2	2	2	1	1	1	1
<b>CO3 [K3]</b>	2	2	2	1	1	1	1
<b>CO4 [K4]</b>	1	1	2	1	1	1	1
<b>CO5 [K5]</b>	1	2	2	1	1	1	1
<b>Weightage of the course</b>	08	09	11	05	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	<b>1.38</b>	<b>1.81</b>	<b>2.72</b>	<b>1.51</b>	<b>1.79</b>	<b>1.75</b>	<b>1.85</b>

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

**UNIT I (12 hrs)**

Introduction to Bioinformatics – Genome, Transcriptome and Proteome, Gene prediction rules and software. Nucleic acid Databases – Primary and Secondary Databases – Structure Database – CATH, SCOP – Data base Searching – BLAST and FASTA, BLOSSUM.

**UNIT II (12 hrs)**

Sequence analysis (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction - Homology modeling of proteins, visualization tools (RASMOL).

**UNIT III (12 hrs)**

Multiple Sequences alignment – method of multiple sequences alignment- Evolutionary analysis, clustering methods Phylogenic trees - Methods to generate phylogenetic tree- Tools for multiple sequences alignment and phylogenetic analysis - History of Drug Discovery, Steps in Drug design - Chemical libraries – Role of molecular docking in drug design.

**UNIT IV (12 hrs)**

Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – Graphs – Sampling method and standard error. Measures of central tendency – measures of dispersion.

**UNIT V (12 hrs)**

Correlations and regression. Probability distribution - Binomial, Negative binomial, multinomial distribution, Poisson distribution. Tests of significance – t tests – F tests – Chi square test. Analysis of variance – Statistical Softwares.

**TEXTBOOKS**

1. Pennington, S.R. and Punn, M.J. *Proteomics: from protein sequence to function*. Viva books Pvt. Ltd, 2002.
2. Shuba G. *Bioinformatics*. Tata McGraw Hill publishing, India, 2010.
3. Rastogi, S.C, Mendiratta, N, Rastogi, P. *Bioinformatics methods and application*. Prentice-Hall of India private limited, New Delhi, 2004.
4. N.Gurumani. *An Introduction to Biostatistics*. MJP Publishers, 2011.

**REFERENCES****Books**

1. Attwood, T.K. and Parry-Smith, D.J. *Introduction to Bioinformatics*. Pearson Education, 2008.
2. David Mount. *Bioinformatics: sequence and genome analysis*, second edition, UK: Taylor & Francis, 2009.

3. D.R.Westhead. *Instant Notes in Bioinformatics*. second edition,UK: Taylor & Francis, 2009.

**Web sources**

1. <https://youtu.be/sREv4rfpbCY>
2. <https://drive.google.com/file/d/1t2R0CcKNCqn6EvCkRNkAbQGK1lMeD8In/view>
3. [https://drive.google.com/file/d/1KQjd\\_lJm8y4pLkGwU2vUyXGYbTDnWFvc/view](https://drive.google.com/file/d/1KQjd_lJm8y4pLkGwU2vUyXGYbTDnWFvc/view)



**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme- B.Sc. Biotechnology**  
**SEMESTER - IV**  
**ELECTIVE COURSE GENERIC / DISCIPLINE SPECIFIC -IV: PRACTICAL:**  
**BIOINFORMATICS AND BIOSTATISTICS (23UBTA4P)**  
**(From 2023 – 2024 Batch onwards)**

<b>HOURS/WEEK</b> : 2	<b>INT. MARKS</b> : 25
<b>CREDITS</b> : 2	<b>EXT. MARKS</b> : 75
<b>DURATION</b> : 30 hrs	<b>MAX. MARKS</b> : 100

**Course Objectives**

- To demonstrate an understanding of biological and computer science concepts.
- To integrate and manage data from different genomic and proteomic research.
- To understand the bioinformatics tools include mapping and analyzing of DNA and protein databases.
- To construct and viewing the model of 3D protein structures.
- To develop computational techniques and diversified bioinformatics tools for processing data.

**Course Outcomes (Co)**

On successful completion of the course, the learners will be able to

**CO1[K2]:** explain the concept of genomics and proteomics

**CO2[K3]:** apply the knowledge to address frontline problems in bioinformatics

**CO3[K4]:** point out the steps in drug designing

**CO4[K5]:** create bar diagram, line diagram and pie diagram using MS EXCEL.

**CO5[K6]:** predict the structure of protein using bioinformatics tools

**CO - PO Mapping table (Course Articulation Matrix)**

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K2]</b>	3	3	1	1	1	1	1
<b>CO2 [K3]</b>	3	2	2	2	1	1	1
<b>CO3 [K4]</b>	2	2	3	2	1	1	1
<b>CO4 [K5]</b>	2	2	3	2	1	1	1
<b>CO5 [K6]</b>	2	2	3	2	1	1	1
<b>Weightage of the course</b>	12	11	12	09	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	2.07	2.21	2.97	2.71	1.79	1.75	1.85

**Based on the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

## **EXPERIMENTS**

1. Biological databases (NCBI, Swissprot and PDB)
2. BLAST
3. FASTA
4. Identification of functional domains in nucleotide binding proteins using a domain analysis server like SMART
5. Preparation of bar diagram, line diagram and pie diagram using MS EXCEL.
6. Calculation of Central tendency- mean, geometric mean, median using MS EXCEL
7. Calculation of dispersion – Mean deviation, quartile deviation and standard deviation using MS EXCEL
8. Calculation of student's t test using MS EXCEL

## **TEXTBOOKS**

1. Paul G and Teresa K. *Bioinformatics and molecular Evolution*. Blackwell Publishing, 2012.
2. David M Mount. *Bioinformatics sequence and genome analysis*. England: Gold Spring Harbor Press Publishers, 2009.

## **REFERENCES**

### **Book**

1. Christina Marshall. *Recent Advance in Bioinformatics*. Syrawood Publishing House, 2019.

### **Web sources**

1. [https://libraryguides.umassmed.edu/research/NCBI\\_databases](https://libraryguides.umassmed.edu/research/NCBI_databases)
2. <https://www.youtube.com/watch?v=JmKD5SnQtFE>
3. [https://www.youtube.com/watch?v=t\\_VE0xsgjC8](https://www.youtube.com/watch?v=t_VE0xsgjC8)
4. <https://www.youtube.com/watch?v=hbnFS4YBi0w>
5. <https://www.youtube.com/watch?v=2rD3OWsVXT0>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - IV**  
**SKILL ENHANCEMENT COURSE –VII:**  
**CLINICAL NUTRITION AND DIETARY MANAGEMNET (23UBTS41)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEK : 2**

**CREDITS : 2**

**DURATION : 30 hrs**

**INT. MARKS: 25**

**EXT. MARKS: 75**

**MAX. MARKS: 100**

**Course objectives**

- To make the student aware about different forms of food and their importance.
- To learn scientific approaches to analyses biomolecules, present in different foods.
- To predict the food allergies and the impacts of LDL and HDL
- To understand the food dietary management.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** list out of the nutritional requirements

**CO2[K2]:** describe the biomolecules classification and deficiency disease

**CO3[K3]:** plan the dietary management

**CO4[K4]:** analyze different forms of nutrients and their requirement

**CO5[K5]:** Evaluate the importance of nutrients for the growth and maintenance of human body

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1 [K1]	2	2	2	1	1	1	1
CO2 [K2]	2	2	2	1	1	1	1
CO3 [K3]	2	1	2	1	1	1	1
CO4 [K4]	2	1	2	1	1	1	1
CO5 [K5]	2	1	2	1	1	1	1
Weightage of the course	10	07	10	05	05	05	05
Weighted percentage of course contribution to Pos	1.73	1.41	2.48	1.51	1.79	1.75	1.85

**Based On the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

## **UNIT I (6 hrs)**

Definition of Nutrition, overview of Balanced diet, Collecting and analyzing Nutritional information- physical examination, Anthropometric measurements.

## **UNIT II (6 hrs)**

Carbohydrate, protein, fat, vitamin and minerals (Calcium, phosphorous, sodium, potassium, iron, iodine, fluorine)- sources, classification, function, deficiencies of these nutrients, functions of water and dietary fiber. BMR (energy requirements).

## **UNIT III (6 hrs)**

Common food allergies, food intolerance- lactose intolerance, cardiovascular diseases- arteriosclerosis and myocardial infarction, foods that increase LDL and HDL.

## **UNIT IV (6 hrs)**

Bulimia and Anorexia Nervosa. Dietary management with reference to Constipation, Diarrhoea, Dehydration, Peptic Ulcer, Hepatitis, Gall bladder diseases and Renal failure.

## **UNIT V (6 hrs)**

Dietary management with reference to Hypertension, Diabetes Mellitus, AIDS and Cancer, Surgery and Nutritional support, outline of Enteral Nutrition and parenteral Nutrition.

## **TEXTBOOKS**

1. Garrow, Js, James and Ralph A. *Human nutrition and dietetics*. Churchill Livingstone, 10<sup>th</sup> ed, 2000.
2. Dr. M. Swaminathan. *Hand book of Food and Nutrition*. Bappco publisher, 2014.

## **REFERENCES**

### **Books**

1. Dr. M. Swaminathan. *Hand book of Food and Nutrition*. Bappco publisher, 2014
2. B. Srilakshmi, *Nutrition Science- 7<sup>th</sup> edition*, new age International Publisher, 2017.
3. Staci Nix McIntosh, William's. *Basic Nutrition and Diet Therapy*, First South Asian Edition, Elsevier Publisher, 2016.
3. Packenpaugh. *Nutrition essentials and diet therapy*. 11<sup>th</sup> edition, Saunders publishers, 2009.

### **Web sources**

1. [https://onlinecourses.swayam2.ac.in/cec21\\_hs09/preview](https://onlinecourses.swayam2.ac.in/cec21_hs09/preview)
2. <https://iamherbalifenutrition.com/nutrition-facts/balanced-diet-daily-nutrition/>
3. <https://study.com/learn/lesson/balanced-diet.html>

4. <https://world-heart-federation.org/what-is-cvd/>
5. <https://www.carewell.com/resources/blog/enteral-vs-parenteral/>

**SRI KALISWARI COLLEGE (AUTNOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. biotechnology**  
**SEMESTER - IV**  
**SKILL ENHANCEMENT COURSE –VIII: CLINICAL MICROBIOLOGY (23UBTS42)**  
**(From 2023 – 2024 Batch onwards)**

**HOURS/WEEKS : 2**

**CREDITS : 2**

**DURATION : 30 hrs**

**INT. MARKS : 25**

**EXT. MARKS : 75**

**MAX. MARKS: 100**

**Course objectives**

- To gain in-depth knowledge about clinical microbiology techniques.
- To make expertise in handling biological samples and understand their applications.
- To describe the basic fundamentals of transmission of pathogens.
- To discuss bacterial diseases such as tuberculosis, typhoid etc.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** state the pathogenic mechanism of disease cycle

**CO2[K2]:** explain the association of microorganisms in human host as normal and pathogenic flora

**CO3[K3]:** apply the epidemiology of infectious agents

**CO4[K4]:** analyse the phases of infection, lifecycle and treatment strategies

**CO5[K5]:** predict therapeutic management and contemporary diagnosis of pathogenic microbes

**CO - PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K1]</b>	2	2	2	1	1	1	1
<b>CO2 [K2]</b>	2	2	2	1	1	1	1
<b>CO3 [K3]</b>	2	2	2	1	1	1	1
<b>CO4 [K4]</b>	2	2	2	1	1	1	1
<b>CO5 [K5]</b>	2	1	2	1	1	1	1
<b>Weightage of the course</b>	10	09	10	05	05	05	05
<b>Weighted percentage of course contribution to Pos</b>	1.73	1.81	2.48	1.51	1.79	1.75	1.85

**Based On the Level contribution ('3'- High, '2'-Medium, '1'-Low, '-No Correlation)**

**UNIT I (6 hrs)**

The History of Infectious Diseases: Human and microbe interactions – Normal flora in human body – Mechanism of pathogenesis – Host – defense mechanisms. Epidemiology of infectious diseases – Nosocomial infections.

**UNIT II (6 hrs)**

Bacterial diseases: Cultural and Biochemical characteristics, Transmission, diagnosis, Clinical symptoms and Treatment of bacterial diseases- Tuberculosis, Cholera, Typhoid, Syphilis, UTI (*E.coli*), Staphylococcal and Streptococcal diseases.

**UNIT III (6 hrs)**

Viral diseases: Etiology, Prophylaxis, Clinical symptoms and Treatment for human viral diseases - Rabies, Hepatitis, Poliomyelitis, Dengue Fever, Flu Fever (H1N1) & COVID-19.

**UNIT IV (6 hrs)**

Fungal diseases: Superficial mycoses: Pityriasis versicolor & Piedra - Cutaneous mycoses: Dermatomycosis - Subcutaneous mycoses: Sporotrichosis & Mycetoma - Systemic mycoses: Histoplasmosis & Coccidioidomycosis - Opportunistic mycoses: Aspergillosis and Candidiasis.

**UNIT V: (6 hrs)**

Protozoan diseases: Lifecycle, diagnosis and treatment of protozoan diseases – Amoebiasis, Malaria, Filariasis, Kala – azar and Trypanosomiasis, Ascariasis & Enterobiasis.

**TEXTBOOKS**

1. Rajan, S, *Medical Microbiology*, 2<sup>nd</sup> edition. New Delhi, 2021.
2. Rajesh Karyakarte, P. *Medical Parasitology*, 3<sup>rd</sup> edition. Kolkata, 2012.

**REFERENCES****Books**

1. Jawetz, E., Melnick, J.L., & Adelberg, E.A. *Medical microbiology*, New York McGraw Hill Companies, 28<sup>th</sup> edition, 2019.
2. David Greenwood, *Medical Microbiology*, Churchill Livingstone publisher, 18<sup>th</sup> edition, 2012.
3. Patrick Murray, R, *Medical Microbiology*, the C.V. Mosby Company, 8<sup>th</sup> edition, 2015.
4. Ananthanarayanan, R., & Jayaram Panicker, C.K. *Textbook of Microbiology*, 11<sup>th</sup> edition. Hyderabad 2020.

**Websites**

1. [https://www.youtube.com/watch?v=KlBrSa\\_YhUQ](https://www.youtube.com/watch?v=KlBrSa_YhUQ)
2. <https://www.youtube.com/watch?v=2Tqi41HyAjM>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**UG PROGRAMME**  
**SEMESTER - IV**  
**ENVIRONMENTAL STUDIES (23UESR41)**  
**(From 2023 - 2024 Batch onwards)**

**HOURS/WEEK :2**  
**CREDITS : 2**  
**DURATION : 30 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To provide a comprehensive understanding of various environmental issues, including pollution, deforestation, climate change, loss of biodiversity, water scarcity, and resource depletion
- To encourage sustainable practices in various sectors, such as energy, transportation, agriculture, and waste management.
- To promote the conservation and preservation of natural resources, habitats, and ecosystems
- To foster a sense of environmental ethics and values.
- To encourage individuals to, participate in community initiatives, and contribute to sustainable development at local, national, and global levels

**Course Outcomes (CO)**

On successful completion of the course, the learners should be able to

- CO1[K1]:** recognize the importance of environment and role of Individuals in its protection.
- CO2[K2]:** explain the key concepts of Ecosystem, biodiversity and climatic change
- CO3[K3]:** apply the right measures for the sustainable use of natural resources.
- CO4[K4]:** analyse the ethical, cross-cultural, and historical context of environmental issues and the links between Human and Natural Systems.
- CO5[K5]:** evaluate the impact of human action on the biological environment

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K1]</b>	2	1	-	2	2	1	1
<b>CO2 [K2]</b>	2	1	-	2	1	1	1
<b>CO3 [K3]</b>	2	1	-	1	1	1	1
<b>CO4 [K4]</b>	1	1	1	1	2	1	1
<b>CO5 [K5]</b>	1	1	-	1	2	1	1
<b>Weightage of the course</b>	08	5	1	7	08	05	05



<b>Weighted percentage of Course contribution to Pos</b>	<b>1.38</b>	<b>1</b>	<b>0.25</b>	<b>2.11</b>	<b>2.86</b>	<b>1.75</b>	<b>1.85</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

#### **UNIT I – NATURAL RESOURCES (6 hrs)**

**Natural resources:** Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. **Biotic resources:** Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. **Water resources:** Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water.

#### **UNIT II –SUSTAINABLE DEVELOPMENT (6 hrs)**

Soil as a resource and its degradation. **Energy resources:** Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. **Introduction to sustainable development:** Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.

#### **UNIT III – ENVIRONMENTAL ISSUES LOCAL, REGIONAL AND GLOBAL (6 hrs)**

Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. **Pollution:** Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans boundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. **Biodiversity loss:** past and current trends, impact. Global change: Ozone layer depletion; Climate change.

#### **UNIT IV – CONSERVATION OF BIODIVERSITY AND ECOSYSTEM (6 hrs)**

**Biodiversity and its distribution:** Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. **Ecosystems and ecosystem services:** Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Threats to biodiversity and

ecosystems. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas.

## **UNIT V – CLIMATE CHANGE: IMPACTS, ADAPTATION AND MITIGATION**

**(6 hrs)**

**Climate change:** Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; **Mitigation of climate change** - Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs)

### **TEXTBOOKS**

1. Chiras D. D and Reganold J. P, *Natural Resource Conservation: Management for a Sustainable Future*, 10<sup>th</sup> Edition, Pearson, 2010.
2. Harris, Frances, *Global Environmental Issues*, 2<sup>nd</sup> Edition, Wiley-Blackwell

### **REFERENCES**

#### **Books**

1. Krishnamurthy K. V, *Textbook of Biodiversity*, Science Publishers, Plymouth, UK.
2. Pittock, Barrie, *Climate Change: The Science, Impacts and Solutions*, 2<sup>nd</sup> Edition, Routledge.

#### **Web Sources**

1. <https://www.youtube.com/watch?v=QewEi2U1jLs>
2. <https://www.unep.org/news-and-stories/story/marine-biodiversity-gets-lifeline-high-seas-treaty>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**CORE COURSE - IX: PLANT BIOTECHNOLOGY (23UBTC51)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L – 3, T – 1)**  
**CREDITS : 4**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce plant genome organization.
- To gain knowledge on plant tissue culture techniques.
- To explore different methods of gene transfer in plants.
- To understand the importance of transgenic plants.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** describe the history of plant biotechnology and state the importance of organization of plant genome

**CO2[K2]:** illustrate the molecular basics of action of hormones and gene expression

**CO3[K3]:** determine various culture medium preparations, haploid, triploid plant production and its application

**CO4[K4]:** analyze the symbiotic organisms as a vector for gene transfers

**CO5[K5]:** develop skills for molecular techniques in crop improvement and transgenic plant production

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	2	3	1	1	2	1
<b>CO2[K2]</b>	3	2	3	1	1	2	2
<b>CO3[K3]</b>	3	3	2	2	2	3	2
<b>CO4[K4]</b>	3	3	2	3	2	3	2
<b>CO5[K5]</b>	3	3	3	2	2	3	2
<b>Weightage of the course</b>	15	13	13	09	08	13	09
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.61	3.22	2.71	2.86	4.55	3.32

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I****(12 hrs)**

History of plant biotechnology, Conservation of Plant using Biotechnology. Plant genome organization: structural features of a representative plant gene, gene families in plants. Organization of chloroplast genome and mitochondrial genome.

**UNIT II****(12 hrs)**

Auxins, cytokinins and gibberlins – molecular basis of action – phytochrome – role in photomorphogenesis – abscisic acid – and stress – induced promoter switches in the control of gene expression – Ethylene and fruit ripening.

**UNIT III****(12 hrs)**

Media composition (MS media) - Micropropagation techniques - direct and indirect organogenesis - somoclonal variation - somatic embryogenesis - haploid and triploid - Protoplast isolation, fusion and culture - hybrid and cybrid production, Synthetic seed production. Secondary metabolite production.

**UNIT IV****(12 hrs)**

Agrobacterium and crown gall tumors – Mechanism of T-DNA transfer to plants, Ti and Ri Plasmid vectors and their utility – Plant viral vectors. Symbiotic nitrogen fixation in Rhizobia, nif gene.

**UNIT V****(12 hrs)**

Crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Transgenic plants- plant vaccines, genetically modified food - future perspectives & ecological impact of transgenic plants.

**TEXTBOOKS**

1. Sudhir M. *Applied Biotechnology and plant Genetics*. Dominant publishers and distributors, 2000.
2. Trivedi P.C. *Applied Biotechnology: Recent Advances*. Panima Publishing corporation, 2000.
3. Chawla, H.S. *Introduction to Plant Biotechnology*. 3rd Edition, Science Publishers, 2009.

**REFERENCES****Books**

1. Kojima, Lee H, Kun Y. *Photosynthetic microorganisms in Environmental Biotechnology*. Springer – Verlag, 2006.
2. Stewart Jr C.N. *Plant Biotechnology and Genetics: Principles, Techniques and Applications*. Wiley-Interscience, 2008

### **Web Sources**

1. <https://nptel.ac.in/courses/102103016>
2. <https://science.umd.edu/classroom/bsci124/lec41.html>
3. <https://www.nifa.usda.gov/grants/programs/biotechnology-programs/plant-biotechnology>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - V**  
**CORE COURSE - X: ANIMAL BIOTECHNOLOGY (23UBTC52)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L - 3, T - 1)**

**CREDITS : 3**

**DURATION : 60 hrs**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS : 100**

**Course Objectives**

- To introduce animal tissue culture techniques.
- To learn the vectors and gene transfer methods in animal cell.
- To understand the importance of transgenic animals and their products.
- To explore the methods of AI, IVF and ICSI.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain the basic concepts of animal cell culture and cell

**CO2[K2]:** describe the media preparation, preservation, and culture of cell lines

**CO3[K3]:** list out the strategies for gene transfer and their applications

**CO4[K4]:** illustrate the genetic modification and stem cell technology in production of transgenic animals

**CO5[K5]:** discuss the assisted reproductive technology and its applications

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	3	2	2	3	3	3
<b>CO2[K2]</b>	3	3	3	2	3	3	3
<b>CO3[K3]</b>	3	3	3	2	3	3	3
<b>CO4[K4]</b>	3	3	3	2	3	3	3
<b>CO5[K5]</b>	3	3	3	2	3	3	3
<b>Weightage of the course</b>	15	15	14	10	13	15	15
<b>Weighted percentage of Course contribution to POs</b>	2.59	3.01	3.47	3.01	4.64	5.24	5.54

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Animal cell culture – History and development, Pluripotency, Media, balanced salt solutions, Physical, chemical and metabolic functions of constituents of culture media, Role of carbon dioxide, Serum, growth factors and amino acids in media. Serum containing and serum free media. Constitution of a media for cell line. Essential equipments required for animal cell culture.

**UNIT II (12 hrs)**

Types of cell culture- Primary, Secondary, Organ culture and cell lines. Role of feeder layers in cell culture, Cell separation techniques, cell synchronization, Cell counting methods, cryopreservation, Cell banking procedures. Biology of cultured cells- Apoptosis and cell death.

**UNIT III (12 hrs)**

Transfection of cells in culture- Animal viral vectors for transfection, Physical methods of transfection, HAT selection, selectable markers. Micro manipulation of cells, Gene targeting, gene silencing and Gene knockout and their applications.

**UNIT IV (12 hrs)**

Protein production by genetically engineered mammalian cell lines, Stem cells and their applications-; Cell culture as a source of valuable products - Transgenic Animals.

**UNIT V (12 hrs)**

Collection and preservation of embryos, Semen banking, AI, IVF and ICSI. Case Study-any two relevant studies.

**TEXTBOOKS**

1. Ramasamy.P. *Trends in Biotechnology*. University of Madras of Publications, Pearl Press, 2001
2. K. Srivastava *et al.* *Animal Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd, 2009
3. Traven. *Biotechnology*. Tata McGraw – Hill, 2001

**REFERENCES****Books**

1. Glick B.R, Pasternark. *Molecular Biotechnology: Principle and applications of recombinant DNA*, McGraw – Hill , 2002
2. Kreuzer.H, .Massey A. *Recombinant DNA and Biotechnology: A guide for teachers*, 2nd edition. Washington : ASM Press, 2002

### **Web Sources**

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=350>
2. <https://microbenotes.com/animal-cell-culture/>
3. [https://biocyclopedia.com/index/biotechnology/animal biotechnology/manipulation of reproduction and transgenic animals/biotech in vitro fertilization technology.php](https://biocyclopedia.com/index/biotechnology/animal%20biotechnology/manipulation%20of%20reproduction%20and%20transgenic%20animals/biotech%20in%20vitro%20fertilization%20technology.php)
4. <https://thebiologynotes.com/embryo-transfer/>



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**

**DEPARTMENT OF BIOTECHNOLOGY**

**UG Programme - B.Sc. Biotechnology**

**SEMESTER – V**

**CORE COURSE - XI:**

**ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY (23UBTC53)**

**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L - 3, T- 1)**

**INT.MARKS : 25**

**CREDITS : 3**

**EXT. MARKS : 75**

**DURATION : 60 hrs**

**MAX.MARKS :100**

**Course Objectives**

- To examine the global environmental changes and challenges.
- To identify the methods of waste water treatment.
- To explore different types of Bioreactors.
- To discover the production process of fermented foods and beverages.
- To obtain knowledge on mass production of enzymes and fertilizers.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain about the environment, its issues and management

**CO2[K2]:** illustrate the process of water treatment and solid waste management

**CO3[K3]:** find out the significance of bioreactors in bioprocess engineering and culture methods

**CO4[K4]:** summarize Downstream processing of fermented Products

**CO5[K5]:** assess the role and importance of microorganisms behind the ore leaching production of food products and biofertilizers

**CO-PO Mapping table (Course Articulation Matrix)**

<b>PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO</b>							
<b>CO1[K1]</b>	3	3	3	2	3	2	1
<b>CO2[K2]</b>	3	3	3	2	3	1	1
<b>CO3[K3]</b>	3	3	3	2	2	2	1
<b>CO4[K4]</b>	3	3	3	2	2	2	1
<b>CO5[K5]</b>	3	3	2	2	2	2	1
<b>Weightage of the course</b>	15	15	14	10	12	09	05
<b>Weighted percentage of Course contribution to POs</b>	<b>2.59</b>	<b>3.01</b>	<b>3.47</b>	<b>3.01</b>	<b>4.29</b>	<b>3.15</b>	<b>1.85</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Environmental Pollution – Sources and types - Water, Air, Thermal, Industrial and Radiation - Global environmental changes. Global warming, Greenhouse effect, acid rain, ozone depletion, and photochemical smog. Environmental issues, management strategies and safety, Biotechnological approaches for management.

**UNIT II (12 hrs)**

Waste water treatment: Aerobic and anaerobic methods (Primary, Secondary and Tertiary) –Use of aquatic plants in waste water treatment. Solid waste management. Bioenergy and SCP from waste. Drinking water treatment. Biotechnological approach to industrial effluent (Paper, Tannery, Textile) Pesticide waste disposal.

**UNIT III (12 hrs)**

Bioprocess Engineering-Steps in bioprocess development. Design of bioreactors - Basic objective of fermenter design, aseptic operation & containment, body construction, agitator and sparger design, baffles, stirrer glands and bearings. Bioreactor configurations and types: Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Animal and plant cell bioreactors. Factors affecting broth viscosity, Mixing in Fermenters. Fermentation systems Batch culture, Continuous culture, Fed-batch culture,

**UNIT IV (12 hrs)**

Downstream processing Filtration, Centrifugation, Cell disruption, Liquid-liquid extraction, Chromatography, membrane processes, Drying, Crystallization, Whole broth processing. Different types of fermented foods produced from microorganisms- Idli, Sauerkraut - Dairy products- Cheese and Yoghurt. Microbial biomass, Microbial enzymes– Amylase & protease, Immobilization of enzymes: Methods, Properties, Applications, Advantages and Disadvantages of Immobilization, Biosensors and Biochips -Types and applications. Microbial Polysaccharide production: Xanthan, Dextran.

**UNIT V (12 hrs)**

Ore leaching (methods and examples), MEOR, Production of antibiotics – Penicillin - streptomycin. Alcoholic beverages: Wine, Beer –Biofertilizers- Rhizobium & Azotobacter. Biopesticides – *Bacillus thuringiensis* and microbial toxin production and their applications - Biosurfactants, Vitamins- Folic acid & Vitamin B12, Organic acids.

**TEXTBOOKS**

1. Chatterji A.K. *Introduction to Environmental Biotechnolog.*, New Delhi: Prentice-Hall of India, 2002.
2. MurugesanA.G, Rajakumari C. *Environmental Science and Biotechnology Theory and Techniques*. Chennai: MJP publishers, 2005.
3. T.Satyanarayana, Bhavdish Narain Johri, Anil Prakash. *Microorganisms in Sustainable Agriculture and Biotechnology*, 2012.

4. Madigan, Michael, Martinko, John, Brock. *biology of microorganism*. 11th edition, 2005.

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1. Alan Scragg. *Environmental Biotechnology*. England: Pearson Education Limited, 1991.
2. Peter F, Stanbury, Allan Whitaker, Stephen J, Hall. *Principles of Fermentation Technology* . Second Edition, Elsevier Science Ltd, 2013.
3. Michael J, Waites, Neil L, Morgan, John S, Rockey Gary Higton. *Industrial Microbiology: An Introduction*. Blackwell Science Ltd, 2001.

### Web Sources

1. <https://nptel.ac.in/courses/120/108/120108004/>
2. <https://www2.hcmuaf.edu.vn/data/quoctuan/Environmental%20Biotechnology%20%20Theory%20and%20Application,%20G%20M%20Evans%20&%20J%20C%20Furlong.pdf>
3. [www.Prenhall.com/Madigan](http://www.Prenhall.com/Madigan)
4. [www.e-bug.eu/](http://www.e-bug.eu/)

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**CORE COURSE –XII: PRACTICAL:**  
**PLANT BIOTECHNOLOGY AND ANIMAL BIOTECHNOLOGY (23UBTC5P)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS :100**

**Course Objectives**

- To know the media formulation for plant and animal tissue culture.
- To explore the protoplast isolation and cryopreservation methods.
- To develop skill on Molecular techniques.
- To perform the cell viability and toxicity assay.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K2]:** illustrate the protoplast isolation and nucleus localization

**CO2[K3]:** prepare plant and animal tissue culture media

**CO3[K4]:** evaluate viability and toxicity of cells using assays

**CO4[K5]:** develop technical skills in isolation of DNA and RNA from plants and animal

**CO5[K6]:** discuss the importance of trypsinization and cryopreservation

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K2]</b>	3	3	2	2	2	2	1
<b>CO2[K3]</b>	3	2	2	2	1	1	1
<b>CO3[K4]</b>	3	3	2	2	1	2	1
<b>CO4[K5]</b>	3	2	2	2	3	2	1
<b>CO5[K6]</b>	3	2	2	1	3	3	1
<b>Weightage of the course</b>	15	12	10	09	10	10	05
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.41	2.48	2.71	3.57	3.5	1.85

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

- 1) Plant tissue culture media preparation & sterilization techniques.  
Callus induction
- 2) Isolation of plant protoplast & viability test.  
Localization of nucleus using nuclear stain
- 3) Preparation of Animal Tissue culture medium and membrane filtration  
Preparation of Single Cell Suspension & Cell counting  
Cell viability Test
- 4) Isolation of plant DNA and plant RNA(Demo)  
Isolation of Agrobacterium plasmid DNA (Demo)
- 5) Trypsinization of monolayer and subculturing (Demo)  
Measurement of phagocytic activity (Demo)  
MTT Assay (Demo)  
Cryopreservation and thawing (Demo)

### **TEXTBOOKS**

1. Madhavi Adhav. *Practical Biotechnology and Plant Tissue Culture*. S.Chand & Company Ltd, 2009.
2. C. C. Giri, Archana Giri, *Plant Biotechnology: Practical Manual*. I.K. International Pvt Ltd, 2007.
3. Karl-Hermann Neumann, Ashwani Kumar, Jafargholi Imani. *Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application*. Springer, 2009.

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1. S. Lal, Vikas. *Public Health Management Principles And Practice*. 2nd Edition, CBS Publishers and Distributors Pvt Ltd, 2002.
2. S.Harisha. *Biotechnology procedures and experiments handbook*. 2012.

#### **Web Sources**

1. <https://www.plantcelltechnology.com/pct-blog/different-types-of-tissue-culture-processes/>
2. <https://www.thermofisher.com/in/en/home/references/gibco-cell-culture-basics.html>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**CORE COURSE –XIII : PRACTICAL:**  
**ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY (23UBTC5Q)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4**

**CREDITS : 4**

**DURATION : 60 hrs**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS :100**

**Course Objectives**

- To perform growth curve test of bacteria and yeast.
- To know the methods of wine and biofertilizer preparation.
- To understand the quality analysis of milk and water.
- To get knowledge on immobilization methods.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K2]:** examine the microorganisms and determine their growth curve, generation time

**CO2[K3]:** perform immobilization, compost production and water quality analysis

**CO3[K4]:** focus on biofertilizer production techniques and microbial identification.

**CO4[K5]:** predict pasteurization efficacy and other quality checks of raw milk

**CO5[K6]:** develop skills to perform efficiency tests of biofertilizers biopesticides, and microbial polysaccharide

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K2]</b>	2	3	2	2	1	2	3
<b>CO2[K3]</b>	2	3	2	2	1	2	2
<b>CO3[K4]</b>	2	2	3	2	1	2	3
<b>CO4[K5]</b>	3	2	3	2	1	2	2
<b>CO5[K6]</b>	3	2	3	2	1	2	3
<b>Weightage of the course</b>	12	12	13	10	05	10	13
<b>Weighted percentage of Course contribution to POs</b>	2.07	2.41	3.22	3.01	1.79	3.5	4.8

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

- 1) Isolation of Air borne Pathogens, Study of Growth Curve and Generation time of Bacteria/ Yeast using turbidometry.
- 2) Water analysis – MPN and BOD. Immobilization of whole yeast cells/ enzyme by Alginate beads.
- 3) Production of wine, Production of Biogas – *In vitro* & Compost Making Biofertilizer production/Spirulina production - field visit. (Report should be included in the record). Isolation and identification of starter organisms from Idli batter/ curd.
- 4) Grading of raw milk (Dye reduction test), Determination of efficiency of Pasteurization by quantitative phosphatase test.
- 5) Preparation and Efficiency testing of Biofertilizer/ Biopesticide. (Demo) , Production of microbial Polysaccharide. (Demo).

### **TEXTBOOKS**

1. Aneja K R. *Laboratory Manual of Microbiology and Biotechnology*. MEDTECH.ISBN-13 : 978-9381714553, 2014.
2. Vijaya Ramesh. *Food Microbiology*. Chennai: MJP Publishers. ISBN-13 : 978-8180940194, 2007.
3. Ashish S.Verma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. New Delhi: S.Chand & Company, 2014.

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1. Raghuramulu N, Madhavan Nair, K Kalyanasundaram S. *A Manual of Laboratory Techniques*. ICMR, Hyderabad: National Institute of Nutrition, 1983.
2. P.Chellapandi. *Laboratory manual in Industrial Biotechnology*. Pointer Publishers, 2007.

#### **Web Sources**

1. <https://www.youtube.com/watch?v=3UafRz3QeO8>
2. <https://www.youtube.com/watch?v=jpuNYpvBmDM>
3. <https://www.youtube.com/watch?v=tUCfkNKyQyc>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - V:**  
**NANOBIOTECHNOLOGY (23UBT051)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L - 3, T - 1)**  
**CREDITS : 2**  
**DURATION : 60hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce nanotechnology and their applications.
- To explore methods of nanoparticle synthesis.
- To get knowledge on characterization of nanoparticle.
- To know about the different forms of nanomaterial.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain about nanobiotechnology and its research applications

**CO2[K2]:** illustrate the characterization methods of nanoparticles using advanced instrumentation

**CO3[K3]:** find out the need of designing the nanodevices and materials

**CO4[K4]:** summarize the applications of Nanobiotechnology

**CO5[K5]:** discuss about the Nano biosensors and their applications

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	2	1	2	2	3
<b>CO2[K2]</b>	2	2	1	1	2	2	2
<b>CO3[K3]</b>	2	2	2	1	2	2	2
<b>CO4[K4]</b>	2	2	1	1	2	2	2
<b>CO5[K5]</b>	3	1	2	1	1	2	2
<b>Weightage of the course</b>	11	09	08	05	09	10	11
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>1.81</b>	<b>1.98</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>4.06</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)



**UNIT I (12 hrs)**

Glimpse of Nanotechnology based material in ancient India: Wootz steel (iron carbide) and the Delhi iron pillar (anticorrosive nanomaterial), Bhasma (nanomaterial as medicine). Contributions of Indian Research Institutes in the field of nanobiotechnology.

**UNIT II (12 hrs)**

Metals: Silver nanoparticle synthesis and its analyses by UV-spectroscopy and FTIR. Self-Assembly nanomaterial: Cell membrane and its analyses by SEM

**UNIT III (12 hrs)**

Nano-thin films: Chitosan thin film, Nanodevices (nanorobots), Nanotubes: Microtubules assembly and its importance, Nanoshells- Dendrimers: Liposomes, Nanofibers: Collagen, Fibronectin & elastin, nanofluidics: Extracellular matrix assembly and its importance,

**UNIT IV (12 hrs)**

Agriculture: Crop production- Nanofertilizers technology, Biomaterial to improve shelf life of vegetables. Medicine: Collagen thin films in wound healing mechanism, Nanoscale devices – DNA microarray for disease diagnosis, Antibodies and Targeted drug delivery system

**UNIT V (12 hrs)**

Nanobiosensors (Firefly-luciferase) and its applications, Introduction to Biomimetics (Gecko foot effect, Lotus leaf effect: Paint and fabrics, Box fish based Car).

**TEXTBOOKS**

1. Vasantha Pattabhi, N.Gautham. *Biophysics*. New Delhi : Narosa Publishing House , 2009.
2. Narayanan .P. *Essentials of Biophysics*. New Delhi : New Age International (P) Ltd. Publishers, 2010.
3. Niemeyer C.M, Mirking C.A. *Nanobiotechnology concepts, Applications and Perspectives*, 2004.
4. Shanmugam.S. *Nanotechnology*. MJP publishers, 2010.

**REFERENCES**

**Books**

1. D.Voet , J.G.Voet. *Biochemistry*. New York: John Wiley & Sons, 2010.
2. Lubert Stryer .*Biochemistry*. 4<sup>th</sup> Ed. WH.Freeman, 1995.
3. David S, Goodsell. *Bionanotechnology*. John Wiley & Sons Inc., publications, 2004.

### **Web Sources**

1. [http://vvm.org.in/study\\_material/ENG%20%20Indian%20Contributions%20to%20Science](http://vvm.org.in/study_material/ENG%20%20Indian%20Contributions%20to%20Science).
2. [https://www.jabonline.in/admin/php/uploads/16\\_pdf.pdf](https://www.jabonline.in/admin/php/uploads/16_pdf.pdf)
3. <https://www.youtube.com/watch?v=gSpHINVmgoE>
4. <https://www.youtube.com/watch?v=ITtGJUGXFKc>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - V:**  
**ENZYMOLGY (23UBT052)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L – 3, T – 1)**  
**CREDITS : 2**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce the classification and nomenclature of enzymes.
- To learn about the enzyme substrate specificity.
- To explore the enzyme kinetics and Michaelis-Menten equation.
- To be familiar with the Enzyme extraction and immobilization methods.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** describe fundamentals of enzymology

**CO2[K2]:** illustrate characteristic features and classification of enzymes

**CO3[K3]:** practice on enzyme kinetics

**CO4[K4]:** comment on various methods of enzyme extraction

**CO5[K5]:** explain the application of enzymology in industries

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	2	1	2	2	3
<b>CO2[K2]</b>	2	2	1	1	2	2	2
<b>CO3[K3]</b>	2	2	2	1	2	2	2
<b>CO4[K4]</b>	2	2	1	1	2	2	2
<b>CO5[K5]</b>	3	1	2	1	1	2	2
<b>Weightage of the course</b>	11	09	08	05	09	10	11
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>1.81</b>	<b>1.98</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>4.06</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I (12 hrs)**

Nomenclature and classification of enzymes. Properties of enzymes and factors that influence rate of enzyme action (pH, temperature, substrate concentration, enzyme concentration, activators and inhibitors). Definitions - Apoenzyme, holoenzyme, zymogens. Coenzymes - (Vitamin and Non vitamin origin). Transition state theory, standard free energy, activation energy.

**UNIT II (12 hrs)**

Active site (definition, characteristic features), Enzyme specificity. Bisubstrate and multisubstrate reactions. ES complex formation, lock and key model and induced fit model. Enzyme units - IU & Katal. Turnover number. Isoenzymes (LDH & CPK), Definition - Ribozymes & Abzymes.

**UNIT III (12 hrs)**

Enzyme Kinetics - Michaelis-Menten equation and its derivation, significance of  $K_m$  and  $V_{max}$ , Lineweaver- Burk plot and Eadie- Hofstee plot, Hanes-Woolf plot. Enzyme inhibition - competitive, Non- competitive, Uncompetitive - (Derivations not included). Allosteric inhibition - sequential model, concerted model, feedback inhibition.

**UNIT IV (12 hrs)**

Membrane bound proteins - Fluid mosaic model. Extraction of enzymes - Chemical agents and Physical methods of extraction, French pressure cell and ultrasonication. Nature of the extraction medium. Technique for enzyme isolation, separation of cellular organelles by differential centrifugation, purification of enzymes- dialysis, chromatography, electrophoresis. Intracellular localization of enzymes and marker enzymes.

**UNIT V (12 hrs)**

Immobilization of enzymes- Chemical and Physical methods. Clinical and industrial applications of immobilized enzymes. Enzyme engineering and Designer enzymes. Pharmaceutical, Clinical and Industrial uses of enzymes.

**TEXTBOOKS**

1. Satyanarayana. U. *Biochemistry*. 4<sup>th</sup> edition, Elsevier India, 2013.
2. Jain J L. *Fundamentals of Biochemistry*. 7<sup>th</sup> edition. S.Chand publishing, 2014.
3. Rodwell V.W, Bender D.A, Botham K.M. Harper's. *Illustrated Biochemistry*. 30<sup>th</sup> edition, McGraw-Hill Education, 2015.
4. Nicholas C, Price, Lewis Stevens. *Fundamentals of Enzymology*. New Delhi: Oxford University Press, 2005.

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### Books

1. Palmer. *Enzyme*. 18th edition. London: Portland Press, 2004.
2. Jeremy M Berg, John L Tymoczko, Lubert Stryer. *Biochemistry*. 6th Edition, Freeman Publications, 2006.
3. Ralph A. Messing. *Immobilised Enzymes*. New York: Academic Press, 2012.
4. Jeremy M Berg, Stryer L. *Biochemistry*. 8<sup>th</sup> edition. Macmillan Learning, 2015

### Web Sources

1. <https://www.youtube.com/watch?v=AD3-v1oKjSk>
2. <https://www.youtube.com/watch?v=tPCOEUo6J8s>
3. <https://www.youtube.com/watch?v=ALwziZSRiqM>
4. <https://www.youtube.com/watch?v=0ZiCqwtFMTs>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VI:**  
**BIOETHICS & BIOSAFETY (23UBT053)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L – 3, T – 1)**  
**CREDITS : 2**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce the human rights and their classification.
- To understand the bioethics of gene cloning.
- To know about IPR, patents and copy rights.
- To get knowledge on the DBT guidelines on Biosafety.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** describe the concepts in bioethics and biosafety

**CO2[K2]:** illustrate the bioethics in gene cloning

**CO3[K3]:** practice on patent filling

**CO4[K4]:** elucidate the ethical clearance and guidelines

**CO5[K5]:** assess the biosafety and good laboratory practices

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	2	1	2	2	3
<b>CO2[K2]</b>	2	2	1	1	2	2	2
<b>CO3[K3]</b>	2	2	2	1	2	2	2
<b>CO4[K4]</b>	2	2	1	1	2	2	2
<b>CO5[K5]</b>	3	2	2	1	1	2	2
<b>Weightage of the course</b>	11	10	08	05	09	10	11
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>2.01</b>	<b>1.98</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>4.06</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I (12 hrs)**

Human Rights: Definition, Classification and Scope of Human Rights. United Nations Commission for Human Rights, National and State Human Rights Commission. Article 21 of Indian Constitution – UDHR. Social issues of Human rights.

**UNIT II (12 hrs)**

Impact of gene cloning & Bioethics-Issues concerning reproduction, Birth, life and Death (Artificial insemination, egg donation, IVF, embryo transplants, Prenatal diagnosis and sex selection & Abortion).

**UNIT III (12 hrs)**

Bioethics of IPR - ethical criteria in biotechnology- animal ethics; Licensing of animal house - Human cloning - Ethical issues - Ethical clearance norms for conducting studies on human subjects

**UNIT IV (12 hrs)**

Patents - Introduction -Treaties and Conventions of Patents, Patent Cooperation Treaty - TRIPS Basis of Patentability - Non Patentable Inventions - Patent Application Procedure in India. Other Forms of IP: Copyright - Trade Mark – Industrial designs – Farmer’s Rights. Patenting of Biotechnology products and processes

**UNIT V (12 hrs)**

Biosafety - General guidelines - DBT guidelines on biosafety in conducting research in biology / biotechnology - Risk assessment studies- Hazardous materials used in Biotechnology- Handling and Disposal - Good manufacturing practices & Good Laboratory practices, Containment facilities and Biosafety practices - Regulation on field experiments and release of GMO’s - Labelling of GM foods - Guidelines for research in transgenic plants and Animals.

**TEXTBOOKS**

1. Ignacimuthu S. *Bioethics*. Narosa Publication house, ISBN: 978-81-7319-966-0, 2009.
2. V. Sree Krishna. *Bioethics and Biosafety in Biotechnology*, 1st ed. New Age International Private Limited, 2007.
3. Manual of patent practice and procedure. IPR India, 2005.

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1. Traylor, Fredric, Koch. *Biosafety*. USA: Michigan state University pub, 2002.
2. Beauchamp, Leroy . *Contemporary issues in Bioethics*. California: Wardsworth Pub. Co. Belmont, 1999.

### **Web Sources**

1. [www.ipr-helpdesk.org/](http://www.ipr-helpdesk.org/)
2. [www.patentoffice.nic.in/ipr/patent/patents.htm](http://www.patentoffice.nic.in/ipr/patent/patents.htm)
3. [www.bangalorebio.com/GovtInfo/ipr.htm](http://www.bangalorebio.com/GovtInfo/ipr.htm)



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – V**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VI:**  
**CANCER BIOLOGY (23UBT054)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L- 3, T- 1)**  
**CREDITS : 2**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To differentiate normal and cancer cells.
- To understand the genetic defects and chromosome abnormalities.
- To learn about different types of cancer.
- To explore diagnosis, treatment and prevention strategies for cancer.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** outline the basics of cancer biology

**CO2[K2]:** describe cancer at the molecular level

**CO3[K3]:** list out different types of cancer

**CO4[K4]:** point out detection and treatment methods of cancer

**CO5[K5]:** explain prevention methods of cancer

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	2	2	2	1	2	2	3
<b>CO2[K2]</b>	2	2	1	1	2	2	2
<b>CO3[K3]</b>	2	2	2	1	2	2	2
<b>CO4[K4]</b>	2	2	1	1	2	2	2
<b>CO5[K5]</b>	3	2	2	1	1	2	2
<b>Weightage of the course</b>	11	10	08	05	09	10	11
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>2.01</b>	<b>1.98</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>4.06</b>

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I (12 hrs)**

Cancer: Introduction; Origin of Cancer- The Mutation Concept, The Epigenetic Concept, Viral Concept, Unified genetic concept of cancer; Difference between Normal and Cancer cells; Signs and symptoms..

**UNIT II (12 hrs)**

Cancer as a genetic disease; Genetic Alterations in Cancer cells, Point mutation, splice mutation, alternating splicing; Mutation in regulatory sequences, deletions, Insertion, Chromosome abnormalities, Genetic defects and the time course of hereditary cancer.

**UNIT III (12 hrs)**

Types of Cancer: - Blood & Lymph – Leukemia, Malignant lymphoma, Bone- Soft tissue Sarcoma, Thorax- Breast cancer, Male genitalia- Prostate cancer, Female genitalia- Cervical cancer; Tumor suppressor genes; Classification of Tumor suppressor genes.

**UNIT IV (12 hrs)**

Detection and Treatment:- Early detection, Molecular detection of Carcinomas, Cancer warning signals; Markers in blood urine; Therapies- Chemotherapy, Gene therapy, Radiotherapy, Biological therapy (Immuno therapy).

**UNIT V (12 hrs)**

Prevention:- Tobacco smoking, sunlight, diet, ionizing radiation, alcohol drugs, promiscuity, lifestyle and cancer prevention, Environmental factors and cancer, potentially carcinogenic substances for humans.

**TEXTBOOKS**

1. A. Sarkar. *Biology of Cancer*. New Delhi:Discovery Publishing House, 2011.
2. Ranajit Sen. *Principles and Management of Cancer*. New Delhi: B.I. Publications Pvt Ltd, 2004.
3. Dr M.R.Ahuja. *Cancer- Causes and Prevention*. UBS Publishers Distributors Pvt. Ltd, 1997.

**REFERENCES****Books**

1. Francesco Pezzella, Mahvash Tavassoli, David J. Kerr. *Textbook of Cancer Biology*. Oxford University Press, 2019.
2. Albert DeNittis, MD, Joel W. Goldwein, MD, Thomas J. Dilling MD. *The Biology of Cancer*. 2002.
3. Robin Hesketh. *Introduction to Cancer Biology*. Cambridge University Press, 2012.

### **Web Sources**

1. <http://csbl.bmb.uga.edu/mirrors/ILU/DragonStar2017/download/introduction-to-cancer-biology.pdf>
2. <http://webserver1.oneonta.edu/faculty/bachman/cancer/207lectures.htm>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**UG PROGRAMME**  
**SEMESTER -V**  
**VALUE EDUCATION (23UVED51)**  
**(From 2023 - 2024 Batch onwards)**

**HOURS/WEEK :2 (T-2, L-)**  
**CREDITS :2**  
**DURATION : 30 hrs**

**INT. MARKS : 25**  
**EXT. MARKS : 75**  
**MAX. MARKS : 100**

**Course Objectives**

- To inculcate the values towards personal development.
- To know the social values for the global development.
- To ensure the modern challenges of Adolescent.
- To be aware of human right.
- To enrich the knowledge to control the mind.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1[K1]:** identify the basic human values and ethics necessary for harmonious human relationship

**CO2 [K2]:** explain the significance of social values and religious tolerance to live in peace

**CO3[K3]:** articulate the life-changing principles of brotherhood, honesty, loyalty and community solidarity

**CO4[K4]:** analyse emotional, social, spiritual attribute to acquire well balanced personality

**CO5[K5]:** assess the importance of harmonious living in the multi-cultural pluralistic society

**CO-PO Mapping table (Course Articulation Matrix)**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1 [K1]</b>	2	1	-	1	1	-	2
<b>CO2 [K2]</b>	2	1	-	1	2	1	2
<b>CO3 [K3]</b>	2	1	-	1	2	1	1
<b>CO4 [K4]</b>	1	1	1	1	2	1	1
<b>CO5 [K5]</b>	1	1	-	1	2	1	1
<b>Weightage of the course</b>	08	05	01	05	09	04	07
<b>Weighted percentage of Course contribution to Pos</b>	<b>1.38</b>	<b>1</b>	<b>0.25</b>	<b>1.51</b>	<b>3.21</b>	<b>1.4</b>	<b>2.58</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

## **UNIT I – CONCEPT OF HUMAN VALUES, VALUE EDUCATION TOWARDS**

### **PERSONAL DEVELOPMENT**

**(6 hrs)**

Aim of Education and Value Education; Evolution of Value Oriented Education; Concept of Human Values; Types of Values; Components of Value Education. **Personal Development:** Self Analysis and Introspection; Sensitization Towards Gender Equality, Physically Challenged, Intellectually Challenged. Respect to - Age, Experience, Maturity, Family Members, Neighbours, Co-Workers. **Character Formation towards Positive Personality:** Truthfulness, Constructivity, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.

## **UNIT II – VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT**

**(6 hrs)**

**National and International Values:** Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity. Social Values - Pity and probity, self-control, universal brotherhood. Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith. Religious Values - Tolerance, wisdom, character. Aesthetic values - Love and appreciation of literature and fine arts and respect for the same. National Integration and international understanding.

## **UNIT III – IMPACT OF GLOBAL DEVELOPMENT ON ETHICS AND VALUES**

**(6 hrs)**

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise. Modern Challenges of Adolescent Emotions and behavior; Sex and spirituality: Comparison and competition; positive and negative thoughts. Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance

## **UNIT IV – THERAUPATIC MEASURES**

**(6 hrs)**

Control of the mind through

1. Simplified physical exercise
2. Meditation – Objectives, types, effect on body, mind and soul
3. Yoga – Objectives, Types, Asanas
4. Activities: (i) Moralisation of Desires (ii) Neutralisation of Anger (iii)Eradication of Worries (iv)Benefits of Blessings

## UNIT V – HUMAN RIGHTS

(6 hrs)

Concept of Human Rights – Indian and International Perspectives - Evolution of Human Rights - Definitions under Indian and International documents - **Broad classification of Human Rights and Relevant Constitutional Provisions** - Right to Life, Liberty and Dignity - Right to Equality - Right against Exploitation - Cultural and Educational Rights - Economic Rights - Political Rights - Social Rights - **Human Rights of Women and Children** - Social Practice and Constitutional Safeguards - Female Foeticide and Infanticide - Physical assault and harassment - Domestic violence - Conditions of Working Women - **Institutions for Implementation** - Human Rights Commission – Judiciary - Violations and Redressal - Violation by State - Violation by Individuals - Nuclear Weapons and terrorism - Safeguards.

### REFERENCES

#### BOOKS

1. Pitchaikani Prabhakaran, A. Babu Franklin, M.Archana Devi, *Value education*, Sri Kaliswari College (Autonomous), Sivakasi, 2017.
2. Subramanyam, K. *Values in Education*, Ramana Publications, 1995
3. Swamy Chidbhavananda, *Indian National Education*, Publication by Ramakirshna Tapovanam.

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1. <https://www.youtube.com/watch?v=ruKY3GqBvYQ>.
2. <https://www.republicworld.com/technology-news/science/15-famous-indian-scientists-list-know-what-were-their-innovations.html>.
3. [https://www.youtube.com/watch?v=M9\\_I9DDvEsw](https://www.youtube.com/watch?v=M9_I9DDvEsw).

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B. Sc. Biotechnology**  
**SEMESTER- V**  
**INTERNSHIP / INDUSTRIAL TRAINING (23UBTJ51)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK:**

**CREDITS : 2**

**DURATION : 25 Days**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS :100**

**Course Objectives**

- To learn and develop new skills relevant to the field of study or career interests.
- To broaden knowledge and explore potential career paths.
- To apply the knowledge gained in academic studies to real-world scenarios.
- To bridge the gap between classroom learning and professional life.
- To gain exposure to different tasks, projects, and challenges relevant to the chosen field.

**Course Outcomes (CO)**

On successful completion of the course, the learners should be able to

**CO1[K1] :** identify different career paths within the industry and gain insights into potential future roles

**CO2[K3] :** apply theoretical concepts and academic knowledge to real-world situations and challenges encountered during the internship

**CO3[K4] :** analyse problems, generate innovative solutions, and make informed Decisions

**CO4[K5] :** evaluate how to manage time effectively and prioritize tasks to meet deadlines and deliver quality work

**CO5[K6] :** create a portfolio of the work, projects, and achievements during the internship

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	3	2	-	1	1	1	2
<b>CO2[K3]</b>	2	3	-	1	-	1	2
<b>CO3[K4]</b>	2	2	-	2	-	1	1
<b>CO4[K5]</b>	-	2	1	-	-	1	1
<b>CO5[K6]</b>	1	3	3	3	-	1	2
<b>Weightage of the course</b>	08	12	04	07	01	05	08
<b>Weighted percentage of Course contribution to POs</b>	1.38	2.41	0.99	2.11	0.36	1.75	2.95

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

### **Rules and Regulations**

1. Each Student has to undergo 25 days institutional/industry based training during the fourth semester summer vacation.
2. Internships could be undertaken in different organizations, industries and agencies which should be approved by the department.
3. Students should keep a detailed record of activities performed and hours spent in training and report the same to the Faculty Coordinator/Mentor/Guide regularly about the progress of internship on weekly basis
4. At the end of the internship, the student must submit a full-fledged detailed internship report (not exceeding 20 pages) along with attendance certificate
5. The Internship carries 100 marks out of which 25 marks for Internal and 75 Marks for External.
5. The viva voce board shall consist of the Head of the Department and the Internal Examiner (Senior Faculty member)
6. The training programme shall be evaluated as per the following pattern

#### **Internal (25 Marks)**

Training Review : 15 Marks  
Daily Log Report : 5 Marks  
PPT Presentation :5 Marks

#### **External (75 Marks)**

Training Report :25 Marks  
Viva Voce : 50 Marks

#### **EACH INTERNSHIP REPORT WILL FOLLOW THE FORMAT DESCRIBED:**

- Title Page
- College Certificate Page
- Internship Certificate provided by the internship institution
- Declaration Page
- Acknowledgement
- Company Profile
- Organizational structure of the concern
- Weekly work plan
- List of figures, List of Tables
- Index
- Chapters

#### **List of Chapters**

1. Introduction
2. Nature of work
3. Role in the organization
4. Questionnaires and Observations about work
5. Operating Environment
6. Detailed Description of Technology used
7. Implementation
8. Conclusion
9. Appendix

Text Format in the report : Times New Roman 12 with 1.5 line  
Margins 1.5" left and 1" all other

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**



**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – VI**  
**CORE COURSE – XIV: BIOENTREPRENEURSHIP (23UBTC61)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK: 6 (L – 5, T – 1)**  
**CREDITS : 4**  
**DURATION : 90 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To get knowledge on bio entrepreneurship and biotechnological industries.
- To develop business plans and analyze it's feasibility.
- To learn Vermicomposting and mushroom cultivation.
- To know SCP production and marketing.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain about bioentrepreneurship and biotech industries

**CO2[K2]:** discuss about the Vermicomposting and sericulture

**CO3[K3]:** develop plans for start-ups and know about accounting and IPR

**CO4[K4]:** illustrate the cultivation of mushrooms and aquaponics

**CO5[K5]:** justify the importance of mass production of Single cell protein

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	3	3	2	1	2	1
<b>CO2[K2]</b>	3	3	3	2	1	2	1
<b>CO3[K3]</b>	3	3	3	2	2	2	1
<b>CO4[K4]</b>	3	2	3	2	1	3	1
<b>CO5[K5]</b>	3	2	3	2	2	3	2
<b>Weightage of the course</b>	15	13	15	10	07	12	06
<b>Weighted percentage of Course contribution to POs</b>	<b>2.59</b>	<b>2.61</b>	<b>3.71</b>	<b>3.01</b>	<b>2.5</b>	<b>4.2</b>	<b>2.21</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (18 hrs)**

Basics of Bio entrepreneurship -Biotechnology in a Global scale; types of Bio-industries – Biopharma, Bioagri and Bioservice innovations – Successful Entrepreneur – Creativity, Leadership, Managerial skills, Team building, Decision making; Public and private funding agencies (MSME, DBT, BIRAC, Startup & Make in India).

**UNIT II (18 hrs)**

Business plan preparation; business feasibility analysis by SWOT, business plan proposal for virtual startup company; statutory and legal requirements for starting a company/venture; basics in accounting practices. Market Conditions, Identifying the need of the customers.

**UNIT III (18 hrs)**

Vermicomposting–Earthworms-Ecologicaltypes-Vermiculture, Compost pit – Vermibed - applications.Sericulture - Mulberry cultivation-Silk worm Rearing – Economics of silkworm Production-Chawki Rearing - Sericulture in India.

**UNIT IV (18 hrs)**

Phases of Mushroom Cultivation; Selection of an acceptable mushroom species/strains, Management of mushroom development, Mushroom harvesting; Mushroom diseases, Medicinal and Nutritional properties of mushroom. Aquaponics- Systems-Fish and Vegetables-Nutrients and Biofilters-Advantages and Disadvantages

**UNIT V (18 hrs)**

Single Cell Protein Production: Source: Algae, Bacteria, Yeast – Cultivation of Single Cell protein: Spirulina Cultivation – Production site, Microorganism, Experimental design; harvesting and Drying.

**TEXTBOOKS**

1. Shimasaki, C. D. *Biotechnology entrepreneurship: Starting, managing, and leading biotech companies*. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier, 2014.
2. Onetti A, Zucchella A. *Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge*. Routledge, 2014.
3. Ismail,S.A. *The Earthworm book*. Goa:India Press, 2012.

## REFERENCES

### Books

1. Adams, D. J, Sparrow J. C. *Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences*. Bloxham: Scion, 2011.
2. Jordan J. F. *Innovation. Commercialization, and Start-Ups in Life Sciences*. London: CRC Press, 2014.
3. Desai V. *The Dynamics of Entrepreneurial Development and Management*. New Delhi: Himalaya Publication House, 2011.

### Web Sources

1. [https://archive.india.gov.in > citizen > agriculture](https://archive.india.gov.in/citizen/agriculture)
2. <http://www.recirculatingfarms.org/resources/>
3. <https://academy.vertical-farming.net/intro-to-mushroom-growing/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – VI**

**CORE COURSE – XV : PHARMACEUTICAL BIOTECHNOLOGY (23UBTC62)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 6(L- 5, T-1)**

**CREDITS : 4**

**DURATION :90 hrs**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS :100**

**Course Objectives**

- To familiar with drug discovery, drug designing and drug delivery.
- To know about regulations and formulation of recombinant drugs.
- To learn the drug toxicity analysis.
- To explore the national and international Drug approval agencies.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** discuss about the drugs, its development and concepts involved in pharmacokinetics & pharmacodynamics

**CO2[K2]:** describe the formulation and production of biotechnology products

**CO3[K3]:** list out the different biotechnological products of the pharma industry.

**CO4[K4]:** evaluate drug toxicity and prevention of drug abuse

**CO5[K5]:** determine national and international drug approval agencies and pharmaceutical industries.

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	3	3	2	2	1	2	1
<b>CO2[K2]</b>	3	3	2	2	1	2	2
<b>CO3[K3]</b>	3	2	2	2	1	2	2
<b>CO4[K4]</b>	3	2	3	2	1	2	1
<b>CO5[K5]</b>	3	2	3	2	1	1	1
<b>Weightage of the course</b>	15	12	12	10	05	09	07
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.41	2.97	3.01	1.79	3.15	2.58

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (18 hrs)**

Objectives of Pharmaceutical Biotechnology - Generic and Biogeneric drugs. Stages in the drug development process -Drug discovery - Drug designing - Drug production - Preclinical trials - Clinical trials - Pharmacokinetics and Pharmacodynamics - Patenting & Drug Approval - Drug Marketing - Post clinical trials

**UNIT II (18 hrs)**

Production of recombinant proteins - Development of Nucleic acid based therapies - Biopharmaceutical considerations - Pharmaceutical regulations - Formulation of Biotechnology products - Drug delivery - Pharmacognosy.

**UNIT III (18 hrs)**

Human Insulin (Humulin), Growth hormones (Humatrope) - Blood coagulating factor (factor VIII - Kogenate) - Erythropoietin - (Epogen) Granulocyte colony stimulating factors (Neulasta) - Interferons (Avonex) - Antimicrobial peptides ( $\beta$  - defensin 2) - Vaccines (Pentavac), Biologics (Humira - Adalimumab), - Cancer based biologics (rituximab).

**UNIT IV (18 hrs)**

Drug toxicity analysis - Common side effects of drugs and managements - Drugs of abuse - Life changing complications - Prevention and management

**UNIT V (18 hrs)**

National and International Drug approval agencies - Top National and International pharmaceutical industries - Scope and career opportunities in pharmaceutical sectors

**TEXTBOOKS**

1. Chandrakant KokatE, Pramod H.J. *Text Book of Pharmaceutical Biotechnology*. 1<sup>st</sup> Edition, Elsevier, 2011.
2. Crommelin, Dean J. A., Sindelar, Robert, Meobohm, Bernd (Eds.) *Pharmaceutical Biotechnology: Fundamentals and Applications*. Springer, 2019.
3. Ashish Dixit, Pawan Tiwari, Vivekanand Kishan Chatap, *Textbook of Pharmaceutical Biotechnology*. Studium Press Pvt. Ltd, 2015.

**REFERENCES****Books**

1. Gary Walsh. *Biopharmaceuticals : biochemistry and Biotechnology*. John Wiley & Sons Ltd, 2003.
2. Oliver Kayser, Heribert Warzecha. *Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications*. Wiley – Blackwell, 2012.
3. Simon Wills. *Drugs of abuse*. Pharmaceutical Press, 2<sup>nd</sup> Edition , 2005

### **Web Sources**

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5178364/>
2. [https://www.patentdocs.org/biotech\\_news/](https://www.patentdocs.org/biotech_news/)
3. <https://www.pharmamanufacturing.com/>
4. <https://www.parexel.com/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - VI**

**CORE COURSE -XVI: PROJECT WITH VIVA VOCE (23UBTJ61)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK: 8**

**CREDITS : 5**

**DURATION : 120 hrs**

**INT.MARKS : 25**

**EXT. MARKS : 75**

**MAX.MARKS :100**

**Course Objectives**

- To apply their skills and knowledge acquired during the course.
- To design and develop the simple projects.
- To know about basic Research methodology.
- To interpret the results obtained from the project.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** demonstrate the acquired basic knowledge of technological tools and techniques in specific domain

**CO2[K2]:** apply the domain specific subject knowledge in project

**CO3[K3]:** present the solution orally and in the form of project report

**CO4[K4]:** choose alternative solution for the existing problem definition

**CO5[K6]:** prepare formal report which describes the work undertaken using ICT tools

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	3	2	1	1	1	1
<b>CO2[K2]</b>	3	3	2	1	1	2	1
<b>CO3[K3]</b>	3	3	2	2	1	1	1
<b>CO4[K4]</b>	3	2	3	3	1	1	1
<b>CO5[K6]</b>	3	2	3	3	1	1	1
<b>Weightage of the course</b>	15	13	12	10	05	06	05
<b>Weighted percentage of Course contribution to POs</b>	2.59	2.61	2.97	3.01	1.79	2.1	1.85

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

### **Guidelines**

1. Students will work individually on a semester-long project.
2. Depending on the interest of the students, project research areas will be chosen.
3. The Students must meet the guide periodically.
4. The project carries 100 marks of which 25 marks for Internal Assessment and 75 marks for External Examination.
5. There will be two project review sessions.
6. A draft of the final project report should be submitted to the Project Guide for review at least two weeks prior to the end of the semester.
7. The project report should be of minimum 25 pages (excluding bibliography & appendices )
8. Three copies of the final project report should be submitted.
9. The Head of the department and the Project Guide will evaluate the final Project report.
10. The viva-voce board shall consist of the External Examiner, the Head of the Department and the Internal Examiner

The following rubrics will be taken into account for the evaluation of Project work and viva-voce:

#### **Internal Assessment (25 Marks)**

Project Report & Review : 15 Marks  
Powerpoint Presentation : 5 Marks  
Demo/Performance : 5 Marks

#### **External Examination (75 Marks)**

Project Report : 20 Marks  
Viva : 30 Marks



**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – VI**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VII:**  
**MARINE BIOTECHNOLOGY (23UBT063)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4(L - 3, T - 1)**  
**CREDITS : 3**  
**DURATION : 60hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To understand the marine ecosystem, physical and chemical properties of sea water.
- To learn about the marine microbial habitats.
- To explore the antimicrobial and other beneficial compounds from marine organisms.
- To gain knowledge about marine resources, pharmacology, aquaculture and commercial development.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain about the marine ecosystem and its functioning

**CO2[K2]:** illustrate the marine microbial habitats

**CO3[K3]:** find out the bioactive compounds isolated from Marine Ecosystem

**CO4[K4]:** examine manipulations done in Marine organisms

**CO5[K5]:** evaluate the economic importance of marine seaweeds

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K2]</b>	2	2	2	1	2	2	1
<b>CO2[K3]</b>	2	2	1	1	2	2	1
<b>CO3[K4]</b>	2	1	2	1	2	2	1
<b>CO4[K4]</b>	2	1	2	1	2	2	2
<b>CO5[K5]</b>	2	2	2	1	1	2	2
<b>Weightage of the course</b>	10	08	09	05	09	10	07
<b>Weighted percentage of Course contribution to POs</b>	1.73	1.61	2.23	1.51	3.21	3.5	2.58

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Marine Ecosystems & Its functioning, Ocean currents, Physical & chemical properties of seawater, Ecological divisions of the Sea- Euphotic - Mesopelagic- Bathopelagic- Benthos-Intertidal, Estuarine- Salt Marsh- Mangrove- Coral Reef.

**UNIT II (12 hrs)**

Marine microbial habitats- Screening for Secondary metabolites from marine microbes (Bacteria, Fungi, Actinomycetes and marine microalgae). Biofouling, Biofilm, Antifouling, Anticorrosion. Probiotic bacteria and their importance in aquaculture.

**UNIT III (12 hrs)**

Definitions- medicinal compounds from flora (Seaweeds, Seagrass and Mangrove) and fauna (Sponges, Sea anemone and Corals)- marine toxins- antiviral and antimicrobial agents

**UNIT IV (12 hrs)**

Culture aspect-Seaweed (*Kappaphycus alvarezii*), Fish chromosome manipulation in aquaculture- Hybridization- Gynogenesis- Androgenesis- Polyploidy, Artificial Insemination, Eyestalk ablation- Trangenesis and Cryopreservation.

**UNIT V (12 hrs)**

Agar- Agarose - Alginate- Carrageenan- Chitin- Chitosan- Heparin

**TEXTBOOKS**

1. Italy, E. *New Developments in Marine Biotechnology*. Plenum Pub. Corp, 1998
2. Milton Fingerman , Rachakonda Nagabhushanam. *Molecular Genetics of Marine Organisms*. Science Pub Inc, 1996.
3. Y. Le Gal, H.O.Halvorson. *New Developments in Marine Biotechnology*. Springer, 1998
4. David H, Attaway. *Marine Biotechnology*. Volume 1, Pharmaceutical and Bioactive Natural Products, 2001

**REFERENCES**

**Books**

1. Scheupr, P.J. *Chemistry of Marine Natural Products, Chemical and Biological Perspectives*. Vol. I III. V New York: Academic Press, 1984.
2. Lalli C.M, T.R. Parsons. *Marine Biology- Biological Oceanography - An Introduction*. Elsevier, 314 pp, 1997.
3. Clark, R. B. *Marine pollution*. Fifth edition. New York : Oxford University press. 231pp, 2001.

## Web Sources

1. <http://www.bcb.iastate.edu/>
2. <http://www.nwfsc.noaa.gov/protocols/bioinformatics.html>
3. [http://www.ebi.ac.uk/ ExPASy.org/](http://www.ebi.ac.uk/ExPASy.org/)
4. <http://www.expasy.org/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - VI**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VII:**  
**FOOD TECHNOLOGY (23UBT064)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L - 3, T - 1)**  
**CREDITS : 3**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS:100**

**Course Objectives**

- To know about the role of biotechnology in food industries.
- To gain knowledge on food adulteration.
- To familiar with composition and processing of various food products.
- To understand the application of biosensors in food contamination.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** describe the relationship between biotechnology and the food industry

**CO2[K2]:** illustrate different food processing methods

**CO3[K3]:** articulate classification of fruits and vegetables and their changes during processing

**CO4[K4]:** outline the concept of non vegetarian foods and their processing types.

**CO5[K5]:** determine the different food adulterants

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	2	2	2	1	2	2	1
<b>CO2[K2]</b>	2	2	1	1	2	2	1
<b>CO3[K3]</b>	2	1	2	1	2	2	1
<b>CO4[K4]</b>	2	1	2	1	2	2	2
<b>CO5[K5]</b>	2	2	2	1	1	2	2
<b>Weightage of the course</b>	10	08	09	05	09	10	07
<b>Weighted percentage of Course contribution to POs</b>	1.73	1.61	2.23	1.51	3.21	3.5	2.58

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Biotechnology relating to the food industry – Role of bioprocess engineering in biotechnology industry- Regulatory and social aspects of biotechnology in foods- Application of biotechnology in waste treatment of food industries. Historical evolution of food processing technology.

**UNIT II (12 hrs)**

Cereals and Millets. Wheat- composition, types (hard, soft/ strong, weak). Malting, gelatinization of starch, types of browning- Maillard & caramelization. Rice- and composition, parboiling of rice- advantages and disadvantages. Structure and composition of pulses, toxic constituents in pulses, processing of pulses soaking, germination, decortications, cooking and fermentation. Fats and Oils. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

**UNIT III (12 hrs)**

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

**UNIT IV (12 hrs)**

Concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish - microbiological, physiological and biochemical. Composition and nutritive value of egg, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products. Chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

**UNIT V (12 hrs)**

Types of food adulterants – test to detect adulterants in foods – metal contaminants - contaminants of processed foods- Food products as analytical samples, general aspects of biosensors- biosensors for food contaminant analysis, commercially available biosensors for food analysis. Food additives, FSSAI regulations, Methods of fortifying and enriching foods.

## **TEXTBOOKS**

1. Bawa. A.S, O.P Chauhan et al. *Food Science*. New India Publishing agency. 2013.
2. Srilakshmi. *Food science*. New Age Publishers,2002.
3. Joshi V.K, Singh R.S. *Food Biotechnology: Principles and practices*. New Delhi : I.K.International Publishing House Pvt. Ltd., 2013.
4. Ravishankar Rai V. *Advances in Food Biotechnology*. First edition, John Wiley & Sons, Inc, 2005.

## **REFERENCES**

### **Books**

1. Roday,S. *Food Science*. Oxford publication, 2011.
2. Meyer. *Food Chemistry*. New Age,2004.
3. Foster G.N. *Food Biotechnology*. First edition, CBS Publishers & Distributors Pvt Ltd,2020.
4. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin. *Food Biotechnology*. 2<sup>nd</sup> edition, CRC Press, 2005.

### **Web Sources**

1. <https://nptel.ac.in/courses/103107088>
2. <https://www.cdc.gov/foodsafety/foodborne-germs.html>
3. <https://www.oecd.org/chemicalsafety/testing/good-laboratory-practiceglp.htm>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - VI**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VIII:**  
**MEDICAL BIOTECHNOLOGY(23UBT065)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L - 3, T - 1)**  
**CREDITS : 3**  
**DURATION : 60hrs**

**INT.MARKS : 40**  
**EXT. MARKS : 60**  
**MAX.MARKS :100**

**Course Objectives**

- To learn about vaccine production and their application.
- To explore molecular and Immuno diagnostic methods.
- To study production and application of therapeutic proteins.
- To understand the research ethics and clinical trials.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** define antibodies and vaccines

**CO2[K2]:** discuss about the molecular diagnosis of diseases

**CO3[K3]:** determine the diagnostic method for infectious Diseases

**CO4[K4]:** comment on production methodologies of therapeutic agents

**CO5[K5]:** evaluate the clinical Trials and ethic codes

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	2	2	1	2	2	1
<b>CO2[K2]</b>	3	2	1	1	2	2	1
<b>CO3[K3]</b>	2	2	2	1	2	2	1
<b>CO4[K4]</b>	2	2	2	1	2	2	2
<b>CO5[K5]</b>	2	2	2	1	1	2	2
<b>Weightage of the course</b>	12	10	09	05	09	10	07
<b>Weighted percentage of Course contribution to POs</b>	<b>2.07</b>	<b>2.01</b>	<b>2.23</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>2.58</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Antibodies and vaccines - Therapeutic production of antibodies, antibody mediated drug delivery of vaccines, different kind of vaccines and applications of recombinant vaccines. Diagnosis - Biochemical diagnostics, inborn errors of metabolism, haemoglobinopathies

**UNIT II (12 hrs)**

Molecular basis of disease, Recombinant DNA Technology in medicine, gene probes as molecular diagnostic reagents. Polymerase Chain Reaction in clinical diagnostics, DNA sequencing of representative clones to detect mutations.

**UNIT III (12 hrs)**

Diagnosis of infectious diseases, Viral diseases – HIV, influenza; bacterial diseases - enteric diseases, mycobacterium diseases; immunoarrays. FACs immunocytochemical staining, ELISA, FISH techniques

**UNIT IV (12 hrs)**

Immunoblot analysis of antigens and allergens. Production of therapeutic agents – Production and application of therapeutic agents, Production of cytokines and interferons.

**UNIT V (12 hrs)**

Principles of project management in Clinical trials and its application. Principles of research ethics; Ethical issues in clinical trials; Animal rights and use of animals in the advancement of medical technology. Use of humans in Scientific Experiments; Introduction to ethical codes and conduct.

**TEXTBOOKS**

1. Patrick, R.M. Kenneth, S.R, Michael, A.P. *Medical Microbiology*. 8<sup>th</sup> edition, USA: Elsevier Publishers, 2016.
2. Pamela G. Michelle M, *Molecular Therapeutics: 21st century medicine*. 1st Edition. Hoboken, New Jersey: Wiley Publishers, 2009.
3. Lela B, Maribeth, L. F. *Molecular Diagnostics: Fundamentals, Methods and Clinical Applications*. 1st Edition. USA: F A Davis Company, 2011.

**REFERENCES****Books**

1. Bernard, R. G. Terry, L.D, Cheryl, L.P. *Medical Biotechnology*. 2<sup>nd</sup> edition, 2014.
2. Roli M. *National Ethical Guidelines for Biomedical and Health Research Involving Human Participants*. 2017.
3. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E, Levin. *Food Biotechnology*. 2<sup>nd</sup> edition, CRC Press, 2005.



## **Web Sources**

1. <https://www.ncbi.nlm.nih.gov/books/NBK26837/>
2. <https://www.sciencedirect.com/topics/medicine-and-dentistry/dna-sequencing>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2881260/>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – VI**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VIII:**  
**FORENSIC BIOTECHNOLOGY (23UBTO66)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L - 3, T -1)**  
**CREDITS : 3**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce the history and scope of forensic biotechnology.
- To gain knowledge on crime scene investigation.
- To learn the collection and identification of blood strains.
- To explore the instruments used in forensic biotechnology.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** explain the scope of forensic biotechnology

**CO2[K2]:** examine the crime scene investigations

**CO3[K3]:** outline the role of serology in forensic biotechnology

**CO4[K4]:** summarize the techniques used in forensic biotechnology

**CO5[K5]:** discuss about the applications of forensic biotechnology

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	2	2	1	2	2	1
<b>CO2[K2]</b>	3	2	1	1	2	2	1
<b>CO3[K3]</b>	2	2	2	1	2	2	1
<b>CO4[K4]</b>	2	2	2	1	2	2	2
<b>CO5[K5]</b>	2	2	2	1	1	2	2
<b>Weightage of the course</b>	12	10	09	05	09	10	07
<b>Weighted percentage of Course contribution to POs</b>	2.07	2.01	2.23	1.51	3.21	3.5	2.58

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

**UNIT I (12 hrs)**

Definition and scope of Forensic Biotechnology, History and development, Forensic genetics, Forensic agriculture.

**UNIT II (12 hrs)**

Crime scene investigation; collection, preservation, packing and forwarding of physical and trace evidence. Questioned documents – identification of handwriting, signature and detection of forgery..

**UNIT III (12 hrs)**

Serology - Fresh blood grouping and typing, stains of bloods. Identification of blood stains, collection and storage of allied body fluids (semen, saliva and blood). Case studies

**UNIT IV (12 hrs)**

PCR, RFLP, AFLP, Microscopy (Electron, Fluorescent) and Chromatography (Paper, TLC & HPLC) in forensic investigation

**UNIT V (12 hrs)**

DNA Profiling, Isolation of DNA from blood samples, DNA testing in cases of disputed paternity and maternity

**TEXT BOOKS**

1. Nageshkumar G Rao, *Textbook of Forensic Medicine & Toxicology*. Jaypee, 2013.
2. K.S. Narayan reddy, O.P. Murty, *The Essentials of Forensic Medicine & Toxicology*. 35th Edition, Jaypee, 2017.
3. Alan Gunn. *Essential Forensic Biology*. 3<sup>rd</sup> Edition, Wiley Publication, 2009.

**REFERENCES**

**Books**

1. Jim Fraser. *Forensic Science: A very short introduction*. Oxford university press, 2010.
2. William Goodwin, Adrian Linacre, SibteHadi. *An introduction to Forensic Genetics*. John Wiley & Sons Ltd, 2007.

**Web Sources**

1. <http://www.forensicsciencesimplified.org>
2. [www.nfstc.org](http://www.nfstc.org)
3. [https://archive.org/details/FBI\\_Handbook\\_of\\_ForensicScience](https://archive.org/details/FBI_Handbook_of_ForensicScience)

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER – VI**  
**ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - VIII:**  
**GOOD LABORATORY PRACTICES (23UBT067)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK : 4 (L – 3, T- 1)**  
**CREDITS : 3**  
**DURATION : 60 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To introduce types of labs, chemicals and their arrangements.
- To learn the documentation and calculations.
- To know about the principles, use and maintenance of laboratory instruments.
- To study good lab guidelines and disposal of wastes.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

**CO1[K1]:** describe the types of labs associated with Biotechnology

**CO2[K2]:** explain about the methods and types of documentations

**CO3[K3]:** illustrate the SOP of lab instruments .

**CO4[K4]:** point out the Good Lab Guidelines

**CO5[K5]:** discuss about the Management and Disposal of wastes

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	P01	P02	P03	P04	P05	P06	P07
<b>CO1[K1]</b>	3	2	2	1	2	2	1
<b>CO2[K2]</b>	3	2	1	1	2	2	1
<b>CO3[K3]</b>	2	2	2	1	2	2	1
<b>CO4[K4]</b>	2	2	2	1	2	2	2
<b>CO5[K5]</b>	2	2	2	1	1	2	2
<b>Weightage of the course</b>	12	10	09	05	09	10	07
<b>Weighted percentage of Course contribution to POs</b>	2.07	2.01	2.23	1.51	3.21	3.5	2.58

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

**UNIT I (12 hrs)**

Types of labs associated with Biotechnology (General lab, microbial culture lab, plant tissue culture lab, Fermentation lab, computational stimulation lab), Types of Chemical (Analytical grade, molecular grade) and its various arrangement (Arrangement of basic chemicals, solvent, acid and base, fine chemicals like dyes, protein and enzyme storage units), Physical chemical characteristics: hygroscopic, corrosive, volatile properties; Fire and explosion hazard data, Health hazards (how to use UV-illuminator), Fumigation technique

**UNIT II (12 hrs)**

Methods and types of documentation (pre-lab writes, result recording and post lab report: interpretation of result), Dilution factor calculation, Molarity, percentage, dilution of concentrated solution, metric units (kg to gms and vice versa).

**UNIT III (12 hrs)**

Principles, use and maintenance of laboratory instruments like Autoclave, hot air oven, Incubators, Water bath, Refrigerator, Centrifuge, Calorimeter, pH meter, Haemocytometer, Microtomes, Electronic balances, Biosafety cabinets. SOP preparation for instrumentation

**UNIT IV (12 hrs)**

Good Laboratory guidelines, Elements of GLP, Standard Operating Procedures and its importance, Quality Assurance & Quality control, Internal audit basics, ISO, BIS and HACCP standards

**UNIT V (12 hrs)**

Definition of waste, types of waste: Biological and chemical waste, methods of Safe Disposal of biological and chemical waste: treatment methods of Ethidium Bromide solutions, Electrophoresis Gels, Contaminated Gloves, debris, Wastes containing sodium azide, Silver staining solutions, Perchloric acid, Nanoparticle wastes, Spill management, Awareness and training for personnel.

**TEXTBOOKS**

1. WHO training manual on Good Laboratory Practices, 2<sup>nd</sup> Edition.
2. Jurg P.Seiler. *Good Laboratory Practice – The Why and the How*. Springer, 2001.
3. OCED Principals for Guidance and Monitoring, 2005.

**REFERENCES****Book**

1. Milton A. Anderson GLP Essentials: A Concise Guide to Good Laboratory Practice, Second Edition. CRC press, 2005.

### **Web Sources**

1. <https://www.who.int/tdr/publications/documents/glp-trainer.pdf>"glp
2. <https://www.who.int/tdr/publications/documents/glp-trainer.pdf>"-  
trainer
3. [www.who.int/tdr/publications/documents/glp-handbook.pdf](http://www.who.int/tdr/publications/documents/glp-handbook.pdf)
4. [www.intechopen.com](http://www.intechopen.com).

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**UG Programme - B.Sc. Biotechnology**  
**SEMESTER - VI**  
**SKILL ENHANCEMENT COURSE - IX:**  
**QUALITY CONTROL AND TESTING (23UBTS61)**  
**(From 2023-2024 Batch onwards)**

**HOURS/WEEK: 2**  
**CREDITS : 2**  
**DURATION : 30 hrs**

**INT.MARKS : 25**  
**EXT. MARKS : 75**  
**MAX.MARKS :100**

**Course Objectives**

- To learn the microbial quality control methods.
- To understand the basic principles and working conditions of industry.
- To be familiar with the instruments used in quality control.
- To know about the specialized media used to detect pathogens.

**Course outcomes (CO)**

On successful completion of the course, learners will be able to

- CO1[K1]:** find the assessment of microbial quality methods  
**CO2[K2]:** describe the quality control of food and pharmaceutical products.  
**CO3[K3]:** explain identification methods of pathogenic microorganisms  
**CO4[K4]:** point out the test for the pharmaceutical products  
**CO5[K5]:** discuss the safety management and regulations of food and pharmaceutical industry

**CO-PO Mapping table (Course Articulation Matrix)**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1[K1]</b>	3	1	1	1	2	2	3
<b>CO2[K2]</b>	2	1	1	1	2	2	2
<b>CO3[K3]</b>	2	2	2	1	2	2	2
<b>CO4[K4]</b>	2	2	2	1	2	2	1
<b>CO5[K5]</b>	2	2	2	1	1	2	1
<b>Weightage of the course</b>	11	08	08	05	09	10	09
<b>Weighted percentage of Course contribution to POs</b>	<b>1.9</b>	<b>1.61</b>	<b>1.98</b>	<b>1.51</b>	<b>3.21</b>	<b>3.5</b>	<b>3.32</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

## **UNIT I**

**(6 hrs)**

Microbial quality control: definition, history and introduction. Standard Methods involved in assessment of microbial quality control. Q.A and Q.C definitions and importance. Traditional Microbiological Quality Controlling methods: Sampling methods, TVC, APC and serial dilution techniques. Good laboratory practices, Good microbiological practices.

## **UNIT II**

**(6 hrs)**

Instruments associated in QC & QA: Principle involved, working conditions, uses and precautions of Laminar Air Flow (LAF), Autoclave, Incubator, pH meter, Colony counter, Hot air oven, Centrifuges, colorimeter/spectrophotometer, ELISA and storage devices. Methodology of Disinfection, Autoclaving & Incineration.

## **UNIT III**

**(6 hrs)**

Culture media used in QC and QA: Design of specialized media for identification of pathogens. Good laboratory practices in culture media preparation: raw material, water, pH. Uses of media. Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Mannitol salt agar, EMB agar, McConkey Agar, Sabouraud Agar.

## **UNIT IV**

**(6 hrs)**

Determining Microbes in Pharmaceutical Samples: Sterility testing for pharmaceutical products, Bioburden, pyrogen test, in process and final process control, safety and sterility test.

## **UNIT V**

**(6 hrs)**

HACCP for Food Safety and Microbial Standards: Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations. Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water. Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centers.

## **TEXTBOOKS**

1. Kulkarni A. K, Bewoor V. A. *Quality Control*. Wiley India Pvt. Ltd, 1998.
2. Chandrakant Kokare . *Pharmaceutical Microbiology*. 1st Edition. Nirali Publication, 2016.
3. Brown.M.R.W. *Microbiological Quality Assurance A Guide Towards Relevance and Reproducibility of Inocula*. 1st Edition. CRC press, 2017.
4. Dev Raj Rakesh Sharma, V K Joshi .*Quality Control For Value Addition In Food Processing*. New India Publishing Agency, 2011.



5. W.B.Hugo, A.D.Russell. *Pharmaceutical Microbiology*.6<sup>th</sup>Edition. Blackwell scientific Publications, 1998.

## REFERENCES

### Books

1. Rosamund M,Baird, Norman A Hodges, Stephen P. Denyer. *Handbook of Microbiological Quality Control in Pharmaceuticals and Medical Devices*. 1<sup>st</sup> Edition. CRC Press, 2000.
2. Konieczka,. *Quality Assurance and Quality Control in the Analytical Chemical Laboratory A Practical Approach* . Taylor and Francis group, 2012.
3. Singh Gajjar, Budhrani, Usman. *Quality Control And Quality Assurance*. SVikas And Company, 2021.
4. David Roesti, Marcel Goverde . *Pharmaceutical Microbiological Quality Assurance and Control: Practical Guide for Non-Sterile Manufacturing*. Wiley publication, 2019.
5. Amihud Kramer, Bernard A. Twigg. *Quality Control For The Food Industry Fundamentals & Applications*. Vol.1. 3rd Edition. MEDTEC publication, 2017.

### Web sources

1. <https://www.study.com/microbiology-quality-control-testing-definition-procedures>.
2. <https://www.sigmaaldrich.com>
3. <https://www.coursera.org>
4. <https://www.atcc.org>

**SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI**  
**UG Programme**  
**SEMESTER V & VI**  
**PART V – EXTENSION**  
**(From 2023 -2024 Batch Onwards)**

**HOURS/WEEK :**

**CREDIT : 1**

**DURATION : 60 hrs**

**INT. MARKS: 100**

**Course Objectives**

- To promote community involvement, encourage civic participation, and foster a sense of ownership and responsibility.
- To involve the learners in organizing campaigns, seminars, or public events to educate the public, promote understanding, and advocate for positive change.
- To create platforms for knowledge sharing, partnership development, and collective action.
- To encourage environmental conservation, promote responsible resource management, or foster sustainable livelihoods.
- To raise awareness about social issues, advocate for marginalized groups, or implement programs that promote inclusivity and equal opportunities.

**Course Outcomes (CO)**

On successful completion of the course, the learners will be able to

**CO1 [K1]:** recognize the importance of community service through training and education

**CO2 [K2]:** interpret ecological concerns, consumer rights, gender issues & legal protection

**CO3 [K3]:** develop team spirit, verbal/nonverbal communication and organizational ethics by participating in community service

**CO4 [K4]:** examine the necessity of professional skills & community-oriented services for a holistic development

**CO5 [K6]:** create awareness on human rights, legal rights, First Aid, Physical fitness and wellbeing

**CO-PO Mapping table (Course Articulation Matrix)**

<b>CO \ PO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>	<b>P06</b>	<b>P07</b>
<b>CO1 [K1]</b>	2	-	-	2	2	1	1
<b>CO2 [K2]</b>	2	1	-	2	1	1	1
<b>CO3 [K3]</b>	2	-	-	1	2	2	1
<b>CO4 [K4]</b>	1	1	1	1	2	2	1
<b>CO5 [K6]</b>	1	-	-	1	2	2	1
<b>Weightage of the course</b>	08	02	01	07	09	08	05
<b>Weighted percentage of Course contribution to Pos</b>	<b>1.38</b>	<b>0.4</b>	<b>0.25</b>	<b>2.11</b>	<b>3.21</b>	<b>2.8</b>	<b>1.85</b>

**Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)**

#### **Details of the Courses**

- 1 National Cadet Corps (NCC) – 190 hrs
- 2 National Service Scheme (NSS) – 240 hrs
- 3 Physical Education
- 4 Red Ribbon Club (RRC)
- 5 Youth Red Cross (YRC)
- 6 Fine Arts Club
- 7 Library and Information Service Club
- 8 Yoga Club
- 9 ECO Club
- 10 Consumer Club
- 11 Human Rights Club
- 12 Women Empowerment Cell
- 13 Legal Awareness League