SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

AFFILIATED TO MADURAI KAMARAJ UNIVERSITY,MADURAI

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

Programme Scheme, Scheme of Examination and Syllabi

(From 2023-2024 Batch onwards)

Department of Biotechnology

PG Programme

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

Curriculum Design and Development Cell

Annexure K

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

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HOD	Dean of Pure science	Dean of Academic Affairs	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
Members		
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

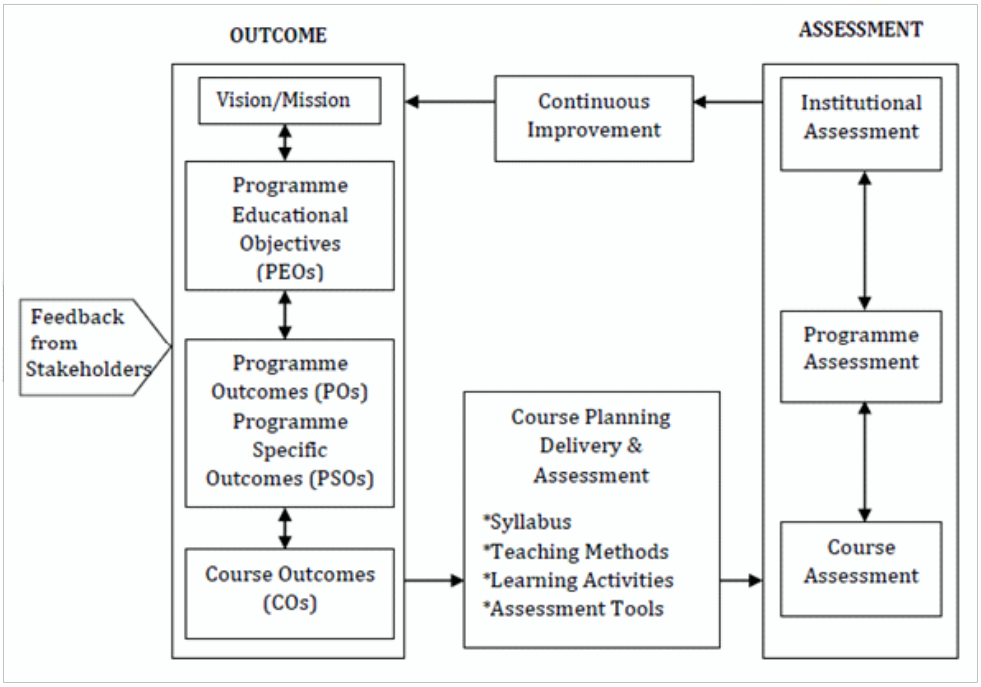
SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY, MADURAI
RE-ACCREDITED WITH 'A' GRADE (THIRD CYCLE) BY NAAC WITH CGPA 3.11)
DEPARTMENT OF BIOTECHNOLOGY
PG Programme – M.Sc. Biotechnology
GUIDELINES FOR OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(From 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 (CGPA3.11) 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

PEO 1: demonstrate comprehensive knowledge of basic and applied aspects of Biotechnology and allied fields

PEO 2: apply the knowledge and skills in the process of research, its methodology, structure, and tools and use them to design, conduct the experiments interpret and analyze the data for the development of innovative products within the realistic constraints.

PEO 3: acquire ability to use theoretical knowledge, practical skills, and recent technological tools in solving any technological challenges and problems in the social context

PEO 4: strengthen the employability skills necessary to take up a profession in the field of Industry, Academy, Research, and Entrepreneurship.

PEO 5: develop critical thinking, entrepreneurship abilities, ethical values, and lifelong learning skills towards holistic approaches contributing to the welfare of the society.

VII. PROGRAMME OUTCOMES (POs)

PO1: Disciplinary knowledge

Acquire specialized and scientific knowledge in the field of Science.

PO2: Critical thinking, Problem solving and Analytical reasoning

Engage in critical investigation through principle approaches or methods and draw realistic conclusions of problems by employing highly developed analytical and quantitative skills.

PO3: Scientific reasoning and Research related skills

Ability to analyze, draw conclusions from qualitative/quantitative data and critically evaluate ideas and also acquire necessary research skills to carry out an experiment or investigation.

PO4: Communication skills and Digital literacy

Communicate effectively on scientific achievements, basic concepts and recent developments with society at large and make use of appropriate software to prepare project report.

PO5: Ethics, Values and Multicultural competence

Embrace ethical principles in all their activities, commit to professional and research ethics and practice tolerance and respect differences.

PO6: Team Work, Leadership and Employability skills

Recognize the opportunities and contribute positively in collaborative scientific research and acquire the pre-requisite skills required for placements and higher education.

PO7: Self-directed and Life-long learning

Recognize the need for engaging in independent and life-long learning in the emerging areas of the field of specialization.

VIII. PROGRAMME SPECIFIC OUTCOMES (PSOs) – M.Sc. Biotechnology

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

PSO 1: acquire knowledge and nuances of applied aspects of Biotechnology – cell and molecular biology, microbial technology, genomics, proteomics, genetic engineering, advanced plant and animal sciences, computational biology, etc.

PSO 2: exhibit critical thinking and analytical skills on the broad spectrum of Biotechnology, so as to meet the global demands of industry and academia.

PSO 3: administer skill sets to use research-based knowledge including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO 4: equip themselves to read, write, and prepare scientific papers and present effectively in various forums and to tabulate and interpret the Biological data using computer software.

PSO 5: appraise the impact of the biological solutions/needs in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development and show commitment to professional ethics and moral values.

PSO 6: exhibit contemporary knowledge and skills in Biotechnology to work in the pharmaceutical and biotechnological industries and function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PSO 7: obtain ability to think independently and develop lifelong learning skills in data collection, analysis, evaluation of the Biotechnological concepts, and apply them in real-time situations.

IX. PO-PSO Mapping Matrix – M.Sc. Biotechnology

PO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
PO1	✓						
PO2		✓					
PO3			✓				
PO4				✓			
PO5					✓		
PO6						✓	
PO7							✓

X.PO-PEO Mapping Matrix – M.Sc. Biotechnology

PO \ PEO	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	✓	✓	✓		
PO2		✓	✓		✓
PO3		✓	✓	✓	✓
PO4		✓		✓	
PO5			✓	✓	✓
PO6			✓	✓	✓
PO7		✓			✓

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme – M.Sc. Biotechnology

REGULATIONS

Duration of the Programme **:** Two years (equivalent to four semesters)

Eligibility

Candidate should have passed B.Sc. degree in Botany, Zoology, Biochemistry, Biotechnology or any branch of Life sciences, Chemistry, Mathematics and Physics with any subject in Life sciences as ancillary subject.

Candidates secured at least 60% of marks in aggregate are eligible to apply.

A relaxation of 10% marks in the aggregate will be given to SC/ST/PH students.

Medium of Instruction : English

Age Limit

Maximum age limit : No Age limit

Transitory Permission

Students joined from 2023 - 2025 may be permitted to write their examinations in this pattern up to April 2028.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme – M.Sc. Biotechnology
SCHEME OF EXAMINATION

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

For all Theory Courses: Internal Marks: 25; External Marks: 75

For Courses with both Theory and Practical, assessment will be for both Theory and Practical.

For Skill Enhancement Professional Competency Course: Internal Assessment for 100 Marks in Online Mode will be conducted (Objective Type Questions)

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

Internal Mark Distribution for Theory Courses

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
Seminar	5 marks	One Seminar for each course
Viva/ Oral Exam/ Group Discussion/ Role Play	5 marks	Test will be conducted in any one of the Oral Mode

Internal Mark Distribution for Practical Courses

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

PG Programme - M.Sc. Biotechnology

QUESTION PAPER PATTERN

Internal Test – 40 Marks – 1 hr 45 mins Duration

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 5 questions Answer in a Word/Sentence – 4 questions	 05 04
2.	Short Answer–2 questions –either or type	3x7=21
3.	Long Answer–1 question – either or type	1x10=10

Summative Examinations 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

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme – M.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,

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

Percentage attainment of each Course outcome for Internal Assessment tools = Average of percentage attainment of all Internal Assessment tools

For Summative Examinations,

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

Formula for calculating Attainment Percentage of Course outcome of a course

Percentage Attainment of Course outcome for Internal Assessment tools	=	Average of percentage attainment of all COs
Percentage Attainment of Course outcome for Summative Examinations	=	Average of percentage attainment of all COs

Final Direct Assessment of Course outcome Attainment

For Theory Courses

Percentage Attainment of Course outcome through Direct Assessment	=	(0.6 x percentage attainment of CO for internal assessment tool)+ (0.4 x percentage attainment of CO for summative examinations)

For Practical Courses

Percentage Attainment of Course outcome through Direct Assessment	=	0.7 x percentage attainment of CO for Internal Assessment tools + 0.3 x 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

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 A

Average course attainment = 0.7 x Direct assessment of CO attainment + 0.3 x 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 = $\frac{\text{Weighted Percentage of contribution of the course in attainment of each PO x average course attainment}}{100}$

Percentage attainment = $\frac{\text{Total weightage of all courses contributed to each PO}}{\text{Total weightage of all courses contributed to all POs}}$ x 100 x Weighted conrtibution 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

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

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DEPARTMENT OF BIOTECHNOLOGY

PG Programme - M.Sc. Biotechnology

CURRICULUM STRUCTURE

OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

(From 2023-2024 Batch onwards)

Courses	Sem I	Sem II	Sem III	Sem IV	Credits
Core Courses	5 (4) 5 (4) 5 (4) 5P (3)	4 (4) 4 (4) 4 (4) 6P(4)	6 (4) 6 (4) 6 (4) 6P(4)	6(5) 6(5)	57
Project with Viva Voce	-	-	-	10 (7)	7
Elective Courses	5 (3) 5 (3)	4(3) 4(3) 4(2)NME I	3 (3) 3(2) NME II	4(3)	22
Skill Enhancement Course/ Professional Competency Skill	-			4(2)	2
Internship/ Industrial Training	-	-	(2)	-	2
Extension Activity	-	-		(1)	1
Total Hours(Per week)/Credits	30(21)	30(24)	30(23)	30(23)	91 120

Self-paced Learning (Swayam Course)	-	-	2 Credits	-	2 Credits

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DEPARTMENT OF BIOTECHNOLOGY

PG Programme - M.Sc. Biotechnology

CURRICULUM PATTERN

OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

(From 2023-2024 Batch onwards)

PROGRAMME CODE – PBT

Semester	Course code	Course Name	Hours	Credits	Internal Marks	External Marks
I	23PBTC11	**Core Course - I:** Biochemistry	5	4	25	75
	23PBTC12	**Core Course - II:** Molecular Genetics	5	4	25	75
	23PBTC13	**Core Course - III:** Molecular Cell Biology	5	4	25	75
	23PBTC1P	**Core Course - IV: Practical :** Biochemistry, Molecular Genetics and Molecular Cell Biology	5	3	25	75
	23PBTO11 23PBTO12	**Elective Courses Generic/Discipline specific - I:** 1. Bioinstrumentation 2. Biostatistics	5	3	25	75
	23PBTO13 23PBTO14	**Elective Courses Generic/Discipline specific - II:** 1. Enzymology 2. Inheritance and Evolutionary Biology	5	3	25	75
		Total	**30**	**21**		
II	23PBTC21	**Core Course - V:** Microbiology	4	4	25	75
	23PBTC22	**Core Course - VI:** Plant and Animal Biotechnology	4	4	25	75
	23PBTC23	**Core Course - VII:** Genetic Engineering	4	4	25	75
	23PBTC2P	**Core Course - VIII: Practical**: Microbiology, Plant and Animal Biotechnology and Genetic Engineering	6	4	25	75
	23PBTO21 23PBTO22	**Elective Courses Generic/Discipline specific - III:** 1.Regulatory affairs and Industrial Standards 2. Pharmaceutical Biotechnology	4	3	25	75
	23PBTO23 23PBTO24	**Elective Courses Generic/Discipline specific - IV:** 1. Environmental Biotechnology 2. Agricultural Biotechnology	4	3	25	75

	23PBTN21	**Non-Major Elective Course - I:** Gene Manipulation Technology	4	2	25	75
		Total	**30**	**24**		
III	23PBTC31	**Core Course - IX:** Bioinformatics	6	4	25	75
	23PBTC32	**Core Course - X:** Immunology	6	4	25	75
	23PBTC33	**Core Course - XI:** Bioprocess Technology	6	4	25	75
	23PBTC3P	**Core Course - XII: Practical :** Bioinformatics, Immunology and Bioprocess Technology	6	4	25	75
	23PBTO31 23PBTO32	**Elective Courses Generic/Discipline specific - V:** 1. Nano Biotechnology 2. Molecular Developmental Biology	3	3	25	75
	23PBTN31	**Non-Major Elective Course - II:** Tissue Engineering	3	2	25	75
	23PBTJ31	Internship/Industrial Training	-	2	25	75
		Total	**30**	**23**		
IV	23PBTC41	**Core Course - XIII:** Research Methodology	6	5	25	75
	23PBTC42	**Core Course - XIV:** Biostatistics	6	5	25	75
	23PBTJ41	**Core Course - XV:** Project with Viva Voce	10	7	25	75
	23PBTO41 23PBTO42	**Elective Courses Generic/Discipline specific - VI:** 1. Stem cell Biology 2. Bioethics, Biosafety, Clinical Trials, IPR and Entrepreneurship	4	3	25	75
	23PBTS41	**Skill Enhancement Course**: **Professional Competency Course:** Preparatory course for SET/NET in Life Sciences	4	2	100	-
		Extension Activity	-	1	100	-
		Total	**30**	**23**		

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
(From2023-2024 Batch onwards)
PROGRAMME ARTICULATION MATRIX (PAM)

Semester	Course code	Course name	PO1	PO2	PO3	PO4	PO5	PO6	PO
I	23PBTC11	**Core Course - I:** Biochemistry	15	12	12	7	9	3	1
	23PBTC12	**Core Course - II:** Molecular Genetics	15	12	12	6	5	3	5
	23PBTC13	**Core Course - III:** Molecular Cell Biology	15	12	12	6	5	3	5
	23PBTC1P	**Core Course - IV: Practical :** Biochemistry, Molecular Genetics and Molecular Cell Biology	15	13	11	10	10	10	4
	23PBTO11 23PBTO12	**Elective Courses Generic/Discipline specific - I:** 1. Bioinstrumentatio 2. Biostatistics	13	11	11	10	10	13	7
	23PBTO13 23PBTO14	**Elective Courses Generic/Discipline specific - II:** 1. Enzymology 2.Inheritance and Evolutionary Biology	12	9	10	5	0	3	6
II	23PBTC21	**Core Course - V:** Microbiology	13	12	13	10	9	8	8
	23PBTC22	**Core Course - VI:** Plant and Animal Biotechnology	13	13	12	6	6	5	7
	23PBTC23	**Core Course - VII:** Genetic Engineering	13	12	12	8	9	10	8

	23PBTC2P	**Core Course - VIII: Practical:** Microbiology, Plant and Animal Biotechnology and Genetic Engineering	15	12	15	9	3	11	5
	23PBTO21 23PBTO22	**Elective Courses Generic/Discipline specific - III:** 1.Regulatory affairs and Industrial standards 2. Pharmaceutical Biotechnology	11	10	10	6	5	5	7
	23PBTO23 23PBTO24	**Elective Courses Generic/Discipline specific - IV:** 1. Environmental Biotechnology 2.Agricultural Biotechnology	12	9	10	6	3	5	7
	23PBTN21	**Non-Major Elective Course - I:** Gene Manipulation Technology	12	8	10	6	4	5	7
III	23PBTC31	**Core Course - IX:** Bioinformatics	12	11	12	8	6	6	5
	23PBTC32	**Core Course - X:** Immunology	12	13	12	7	3	4	7
	23PBTC33	**Core Course - XI:** Bioprocess Technology	15	15	15	12	10	15	10
	23PBTC3P	**Core Course - XII: Practical :** Bioinformatics, Immunology and Bioprocess Technology	15	15	15	10	10	15	15
	23PBTO31 23PBTO32	**Elective Courses Generic/Discipline specific - V:** 1. Nano Biotechnology 2. Molecular Developmental Biology	11	10	10	14	7	6	5
	23PBTN31	**Non-Major Elective Course - II:** Tissue Engineering	11	10	09	14	2	3	8

	23PBTJ31	Internship/Industrial Training	8	9	4	7	1	5	8
	23PBTC41	**Core Course - XIII:** Research Methodology	15	11	13	10	6	15	12
	23PBTC42	**Core Course - XIV:** Biostatistics	15	11	13	10	6	15	7
	23PBTJ41	**Core Course - XV:** Project with Viva Voce	14	10	11	12	6	5	5
	23PBTO41 23PBTO42	**Elective Courses Generic/Discipline specific - VI:** 1. Stem cell Biology 2. Bioethics, Biosafety, Clinical Trials, IPR and Entrepreneurship	11	9	9	8	5	7	8
	23PBTS41	**Skill Enhancement Course**: **Professional Competency Course:** Preparatory course for SET/NET in Life Sciences	10	9	9	8	3	4	15
		Extension Activity	8	2	1	7	9	8	5
Total Weightage of all courses contributing to PC			329	281	284	222	152	192	187

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
(From2023-2024 Batch onwards)
PROGRAMME ARTICULATION MATRIX – WEIGHTED PERCENTAGE

Semester	Course code	Course name	PO1	PO2	PO3	PO4	PO5	PO6	PO7
I	23PBTC11	**Core Course - I:** Biochemistry	3.95	4.63	4.58	3.15	5.92	1.56	0.53
	23PBTC12	**Core Course - II:** Molecular Genetics	4.56	4.27	4.23	2.7	3.29	1.56	2.67
	23PBTC13	**Core Course - III:** Molecular Cell Biology	4.56	4.27	4.23	2.7	3.29	1.56	2.67
	23PBTC1P	**Core Course - IV: Practical :** Biochemistry, Molecular Genetics and Molecular Cell Biology	4.56	4.63	3.87	4.5	6.58	5.21	2.14
	23PBTO11 23PBTO12	**Elective Courses Generic/Discipline specific - I:** 1. Bioinstrumentation 2. Biostatistics	3.95	3.91	3.87	4.5	6.58	6.77	3.74
	23PBTO13 23PBTO14	**Elective Courses Generic/Discipline specific - II:** 1. Enzymology 2. Inheritance and Evolutionary Biology	3.65	3.2	3.52	2.25	0	1.56	3.21
II	23PBTC21	**Core Course - V:** Microbiology	3.95	4.27	4.58	4.5	5.92	4.17	4.28
	23PBTC22	**Core Course - VI:** Plant and Animal Biotechnology	3.95	4.63	4.23	2.7	3.95	2.6	3.74
	23PBTC23	**Core Course - VII:** Genetic Engineering	3.95	4.27	4.23	3.6	5.92	5.21	4.28

	23PBTC2P	**Core Course - VIII: Practical:** Microbiology, Plant and Animal Biotechnology and Genetic Engineering	4.56	4.27	5.28	4.05	1.97	5.73	2.67
	23PBTO21 23PBTO22	**Elective Courses Generic/Discipline specific - III:** 1.Regulatory affairs and Industrial standards 2.Pharmaceutical Biotechnology	3.34	3.56	3.52	2.7	3.29	2.6	3.74
	23PBTO23 23PBTO24	**Elective Courses Generic/Discipline specific - IV:** 1. Environmental Biotechnology 2. Agricultural Biotechnology	3.65	3.2	3.52	2.7	1.97	2.6	3.74
	23PBTN21	**Non-Major Elective Course - I:** Gene Manipulation Technology	3.65	2.85	3.52	2.7	2.63	2.6	3.74
III	23PBTC31	**Core Course - IX:** Bioinformatics	3.65	3.91	4.23	3.6	3.95	3.13	2.67
	23PBTC32	**Core Course - X:** Immunology	3.65	4.63	4.23	3.15	1.97	2.08	3.74
	23PBTC33	**Core Course - XI:** Bioprocess Technology	4.56	5.34	5.28	5.41	6.58	7.81	5.35
	23PBTC3P	**Core Course - XII: Practical :** Bioinformatics, Immunology and Bioprocess Technology	4.56	5.34	5.28	5.41	6.58	7.81	8.02
	23PBTO31 23PBTO32	**Elective Courses Generic/Discipline specific - V:** 1. Nano Biotechnology 2.Molecular Developmental Biology	3.34	3.56	3.52	6.31	4.61	3.13	2.67
	23PBTN31	**Non-Major Elective Course - II:** Tissue Engineering	3.34	3.56	3.17	6.31	1.32	1.56	4.28

	23PBTJ31	Internship/Industrial Training	2.43	3.2	1.41	3.15	0.66	2.6	4.28
	23PBTC41	**Core Course - XIII:** Research Methodology	4.56	3.91	4.58	4.5	3.95	7.81	6.42
	23PBTC42	**Core Course - XIV:** Biostatistics	4.56	3.91	4.58	4.5	3.95	7.81	3.74
	23PBTJ41	**Core Course - XV:** Project with Viva Voce	4.24	3.56	3.87	5.41	3.95	2.6	2.67
	23PBTO41 23PBTO42	**Elective Courses Generic/Discipline specific - VI:** 1. Stem cell Biology 2. Bioethics, Biosafety, Clinical Trials, IPR and Entrepreneurship	3.34	3.2	3.17	3.6	3.29	3.65	4.28
	23PBTS41	**Skill Enhancement Course**: **Professional Competency Course:** Preparatory course for SET/NET in Life Sciences	3.04	3.2	3.17	3.6	1.97	2.08	8.02
		Extension Activity	2.43	0.71	0.35	3.15	5.92	4.17	2.67
Total Weighted percentage of Course contribution to POs			100	100	100	100	100	100	100

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
CORE COURSE – I: BIOCHEMISTRY (23PBTC11)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 5 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To understand physical and chemical nature of biomolecules.
- To acquire knowledge on various types of biomolecules.
- To develop knowledge on intermediary metabolism of CHO, proteins, and lipids.
- To create awareness on enzymes and their classifications.
- To inculcate techniques involved in clinical biochemistry.

Course Outcomes (CO)

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

CO1[K2]: illustrate the basic principles of carbohydrate metabolism.

CO2[K3]: manipulate basic knowledge about lipid metabolism and related significance.

CO3[K4]: analyze the importance of bio-energetics and Biological oxidation pathways**.**

CO4[K5]: evaluate the structure, physical and chemical properties of biomolecules.

CO5[K6]: compile overall metabolism of biomolecules through biological pathways.

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	2	-	-
CO2[K3]	3	3	2	1	2	1	-
CO3[K4]	3	2	3	1	2	1	-
CO4[K5]	3	3	3	2	-	-	-
CO5[K6]	3	2	2	1	3	1	1
Weightage of the course	15	12	12	7	9	3	1
Weighted percentage of Course contribution to POs	3.95	4.63	4.58	3.15	5.92	1.56	0.53

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

UNIT I **(15 hrs)**

pH, pK. acid, base Buffers- Henderson - Haselbach equation, biological buffer system – Phosphate buffer system, protein buffer system, bicarbonate buffer system, amino acid buffer system and Hb buffer system. Water, Carbohydrates: Nomenclature, classification, structure, chemical and physical properties of carbohydrates. Metabolisms: glycogenesis, glycogenolysis, gluconeogenesis, pentose phosphate pathway.

UNIT II **(15 hrs)**

Lipids: Nomenclature, classification, structure, chemical and physical properties of fatty acids. Metabolisms: biosynthesis of fatty acids, triglycerols, phospholipids, glycol lipids. Cholesterol biosynthesis, bile acids and salt formation. Eicosanoids, sphingolipids and steroid hormones.

UNIT III **(15 hrs)**

Bioenergetics – Concept of energy, Principle of thermodynamics, Relationship between standard free energy and Equilibrium constant, ATP as universal unit of free energy in Biological systems. Biological oxidation: Electron transport chain, oxidative phosphorylation, glycolysis, citric acid cycle, cori cycle, glyoxalate pathway. Oxidation of fatty acids- mitochondrial and peroxisomal ß-oxidation, alpha and beta oxidation, oxidation of unsaturated and odd chain fatty acids, ketone bodies. Photosynthesis, urea cycle, hormonal regulation of fatty acids and carbohydrates metabolisms, mineral metabolism.

UNIT IV **(15 hrs)**

Amino acids and Protein: Nomenclature, Classification, structure, chemical and physical properties of amino acids and proteins. Metabolisms: Biosynthesis of amino acids. Degradation of proteins, nitrogen metabolisms and carbon skeleton of amino acids. Over all in born error metabolisms.

UNIT V **(15 hrs)**

Nucleic acids: Nomenclature, Classification, structure, chemical and physical properties of purine and pyrimidines. In *de novo* and salvage synthesis of purines, pyrimidine bases, nucleosides and nucleotides. Catabolisms of purines and pyrimidines bases. Synthetic analogues of nitrogenous bases.

TEXTBOOKS

1. JainJ.L, Sunjay Jain and Nitin Jain. *Fundamentals of Biochemistry*. S.Chand and company Ltd, Sixth Edition, 2016.
2. Lehninger.A.L, Nelson.D.L and Cox M.M. *Principles of Biochemistry*, NewYork : W.H. Freeman and company, Fourth Edition, 2017.
3. Jain, J. L, Sunjay Jain and Nitin Jain. *Fundamentals of biochemistry*. S. Chand Publishing, 2016.

4. Satyanarayana, U, and Chakrapani U. *Essentials of biochemistry*. Book and Allied, Kolkata, India, 2019.

REFERENCES

Books

1. Cox, Michael M., and David L. Nelson. *Lehninger principles of biochemistry*.Vol. 5. New York: Wh Freeman, 2017.
2. Murray, Robert K. *Harper's illustrated biochemistry*. Mcgraw-hill, 2014.
3. Voet, Donald, Judith G. Voet, and Charlotte W. Pratt. *Fundamentals of biochemistry: life at the molecular level*.Johnwiley and sons, 2013.
4. LubertStryer. *Biochemistry*. Stanford university, New York :W.H.Freeman company, 2015.

Web Sources

1. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%204.pdf
2. https://nptel.ac.in/courses/104/105/102105034/
3. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod11.pdf
4. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod10.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
CORE COURSE – II: MOLECULAR GENETICS (23PBTC12)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 5 **INT.MARKS :25**
CREDITS : 4 **EXT. MARKS :75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To provide comprehensive background on salient features of nucleic acids.
- To impart knowledge on key events of molecular biology comprising of mechanism of DNA replication, transcription and translation in prokaryotes and eukaryotes.
- To provide adequate knowledge about post transcriptional modifications and processing of eukaryotic RNA.

Course Outcomes (CO)

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

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

CO2[K3]: identify genetic regulatory mechanisms at different levels, the processes behind mutations and various chromosomal abnormalities.

CO3[K4]: analyze different types of DNA damage and tools for their detection.

CO4[K5]: appraise the concepts of the transposons and their applications.

CO5[K6]: hypothesize the allele frequencies and genotype frequencies in populations and concepts behind the theory of evolution.

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	2	2	-	-	1
CO2[K3]	3	3	2	2	-	-	1
CO3[K4]	3	2	3	-	1	-	1
CO4[K5]	3	2	3	1	2	1	1
CO5[K6]	3	2	2	1	2	2	1
Weightage of the course	15	12	12	6	5	3	5
Weighted percentage of Course contribution to POs	4.56	4.27	4.23	2.7	3.29	1.56	2.67

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

UNIT I **(15 hrs)**

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

UNIT II **(15 hrs)**

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

UNIT III **(15 hrs)**

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

UNIT IV **(15 hrs)**

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

UNIT V **(15 hrs)**

Extra chromosomal heredity: Biology of Plasmids, their discovery, types and structure of F factor, R factor, *col* factors and Ti – Replication and partitioning, Incompatibility and copy number control-natural and artificial plasmid transfer and their applications- Human Genome Project, Genomics and Modern methodologies in understanding genome.

TEXTBOOKS

1. Simmons, Michael J., and D. Peter Snustad. *Principles of genetics*. John Wiley & Sons, 2006.
2. Cooper, Geoffrey M. and Robert E. Hausman. *The Cell: A Molecular Approach*. 3rd ed. Washington, D.C. : Sunderland, Mass., ASM Press, 2004.
3. Kavitha B and Ahluwalia. *Genetics*. New Age International Pvt Ltd and Publishers, New Delhi, 2010.
4. Agarwal, V. K. *Genetics*. India: S. Chand Limited, 2009.

REFERENCES

Books

1. Brooker Robert J. *Genetics*. United Kingdom: McGraw-Hill Higher Education, 2004.
2. Hood, Leroy E.., Goldberg, Michael L.., Fischer, Janice A. Hartwell, Leland. *Genetics: From Genes to Genomes*. United Kingdom: McGraw-Hill Education, 2017.
3. Rastogi, Smita., Pathak, Neelam. *Genetic Engineering*. India: Oxford University Press, 2009.
4. CSHLP, Inglis., Bell, StephenP., Losick, Richard., Gann, Alexander., Watson, Ja mes D., Levine, Michael., Baker, Tania A. *Molecular Biology of the Gene*. United States: Benjamin-Cummings Publishing Company, 2012.

Web Sources

1. https://onlinecourses.swayam2.ac.in/cec21_bt02/preview
2. https://onlinecourses.swayam2.ac.in/cec20_bt03/preview
3. https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/lecture-notes/lecture26.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
CORE COURSE – III: MOLECULAR CELL BIOLOGY (23PBTC13)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 5 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To understand the basic concepts of the prokaryotic and eukaryotic cells.
- To understand the functions of various cell organelles.
- To familiarize the student with various aspects of cell and molecular biology.
- To develop a comprehensive understanding of cellular and molecular functions of cell organelles.
- To impart molecular biology knowledge in applications of various human health care.

Course Outcomes (CO)

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

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

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

CO3[K4]: analyze the principles and basic mechanisms of nuclear envelope and its functions.

CO4[K5]: interpret the metabolic pathway and the process of transmission of extracellular signals.

CO5[K6]: compose various stages of cancer development.

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	2	2	-	-	1
CO2[K3]	3	3	2	2	-	-	1
CO3[K4]	3	2	3	-	1	-	1
CO4[K5]	3	2	3	1	2	1	1
CO5[K6]	3	2	2	1	2	2	1
Weightage of the course	15	12	12	6	5	3	5
Weighted percentage of Course contribution to POs	4.56	4.27	4.23	2.7	3.29	1.56	2.67

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

UNIT I **(15 hrs)**

Introduction to cell Biology- Basic properties of cells-Cellular dimension-Size of cells and their composition-Cell origin and Evolution (Endosymbiotic theory)–Microscopy- Light Microscopy, Electron Microscopy, application of Electron Microscopy in cell biology, Phase Contrast Microscopy, Fluorescence Microscopy, Flow Cytometry and FRET. Organelles of the eukaryotic cell and its functions; Biomembranes - structural organization, transport across membrane (Passive, Active and Bulk transport); Cell-Cell adhesion- Cell junctions (Tight junctions, gap junctions, desmosomes, adherens); Extra cellular matrix (ECM)-components and role of ECM in growth.

UNIT II **(15 hrs)**

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

UNIT III **(15 hrs)**

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

UNIT IV **(15 hrs)**

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

UNIT V **(15 hrs)**

Cancer Biology: Multistage cancer development Mitogens, carcinogens, oncogenes and proto-oncogenes, tumor suppressor genes-Rb, p 53, apoptosis and significance of apoptosis.

TEXTBOOKS

1. Ajay Paul M. *Text book of cell and molecular biology*. Kolkata: Books and Allied Pvt. Ltd, 2015.
2. Gupta P.K. *Cell and Molecular biology*. India: Rastogi publication, Fifth edition, 2016.

3. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P. *Molecular Biology of the cell*. New York : W.W. Norton, Sixthedition, 2014.

REFERENCES

Books

1. Lodish,H., Berk, A., Zipursky, S.L., Matsudaira, P., Kaiser, A., Krieger, Scott and Darnell, J. *Molecular Cell Biology*. Media Connected, sixth edition. W.H.Freeman and Company, 2007.
2. De Robertis, E.D.P, E.M.F. De Robertis. *Cell and molecular biology.* Eighth International edition, 2017.
3. Geoffrey.M.Cooper, Robert.E.Hausman. *The Cell-A Molecular Approach*, Fourth edition. Sinauer Associates, 2007.
4. Luiz Carlos Uchoa, Janqueira, Jose, Carneiro. *Basic Histology Text and Atlas*. McGraw-Hill Professional, 2005.

Web Sources

1. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/32%3A_Plant_Reproductive_Development_and_Structure/32.2%3A_Pollination_and_Fertilization/32.2D%3A_Double_Fertilization_in_Plants
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2117903/
3. https://www.researchgate.net/publication/320913000_Senescence_and_aging_Causes_consequences_and_therapeutic_avenues

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
CORE COURSE - IV: PRACTICAL : BIOCHEMISTRY, MOLECULAR GENETICS AND MOLECULAR CELL BIOLOGY (23PBTC1P)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 5 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To understand the principles and procedure for estimation of biomolecules.
- To provide knowledge on isolation and quantification of DNA .
- To study different chromatographical separation methodologies.
- To understand the principles of electrophoresis methods.
- To inculcate knowledge on PCR method for amplification of DNA.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate basic calculations and procedures in biochemistry
CO2[K3]: estimate biomolecules by various methods
CO3[K4]: isolate and analyze DNA, RNA and protein
CO4[K5]: evaluate the quality and purity of DNA, RNA and protein
CO5[K6]: prepare single cell suspension and perform histochemical staining

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	2	2	-
CO2[K3]	3	3	2	2	2	2	1
CO3[K4]	3	3	2	2	2	2	1
CO4[K5]	3	2	3	2	2	2	1
CO5[K6]	3	3	2	2	2	2	1
Weightage of the course	15	13	11	10	10	10	4
Weighted percentage of Course contribution to POs	4.56	4.63	3.87	4.5	6.58	5.21	2.14

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

Experiments

(A) Biochemistry - Practical

1. Basic calculations in Biochemistry - Normality, Molarity, Molality percent Solutions (v/v, w/v).
2. Calibration of pH meter
3. Transition interval of commonly used pH indicators
4. Preparation of biological buffer - phosphate buffer

5a. Extraction of Proteins from biological materials

5b. Protein separation methods:-Ammonium sulphate Precipitation

5c. Membrane Dialysis

5d. SDS PAGE

6. Urea-SDS PAGE for separation of low molecular weight proteins
7. Estimation of Proteins by Lowry's method
8. Estimation of Proteins by Biuret method
9. Estimation of Proteins by Bradford method
10. Estimation of RNA by orcinol method
11. Estimation of DNA by diphenylamine method
12. Estimation of Carbohydrate by Anthrone method
13. Purity check of DNA & RNA by UV Spectrophotometry - A260/280
14. Separation of amino acids by Paper Chromatography
15. Separation of sugars by Paper Chromatography
16. Separation of amino acids by Thin layer chromatography
17. Separation of sugars by Thin layer chromatography
18. Thermal Denaturation of DNA and UV absorption studies

Demo Experiments

1. Gel permeation chromatography,
2. Affinity chromatography,
3. Ion.exchange chromatography
4. Western blotting
5. PCR

(B) Molecular Genetics - Practical

1. Isolation of DNA from bacteria
2. Isolation of DNA from plants
3. Isolation of DNA from animal tissue
4. Isolation of DNA from blood
5. Plasmid DNA isolation.
6. Agarose gel electrophoresis of DNA
7. Transfer of DNA from gel – Southern Blotting
8. Isolation of RNA
9. Glyoxal denatured Agarose gel electrophoresis of RNA
10. Formaldehyde denatured Agarose gel electrophoresis of RNA
11. Urea denatured Agarose gel electrophoresis of RNA
12. Transfer of RNA from gel – Northern Blotting

13. Restriction digestion of DNA
14. Radiation induced genetic damage assessment
15. Chemical induced genetic damage assessment.
16. Preparation of metaphase chromosomes form blood

(C) Molecular Cell Biology -Practical

1. Introduction to Microtome and types
2. Microtomy-Fixation of tissue
3. Microtomy -Embedding
4. Microtomy-Sectioning of tissue
5. H&E Staining of tissues
6. Histochemical staining to localize proteins
7. Histochemical staining to localize carbohydrates
8. Histochemical staining to localize lipids.
9. Subcellular fractionation and marker enzyme detection (mitochondria).
10. Giant chromosome studies in Chironomous larvae
11. Meiotic study in flower bud sand cockroach or grasshopper
12. Preparation of tissue culture medium and membrane filtration
13. Preparation of single cell suspension from spleen and thymus;
14. Cell counting and cell viability;
15. Embryonic development and stem cells (serpulid polychaete Hydroides elegans/chick/ frog)

REFERENCES

Books

1. Sambrook J and Green M.R. *Molecular Cloning: A Laboratory Manual*. Cold Spring Harbor Laboratory Press, 2012.
2. Keith Wilson, John Waler. *Principles and Techniques of Practical Biochemistry*. Cambridge University Press, Fifth Edition, 2005.
3. Dr.P.Palanivelu. *Analytical biochemistry and separation techniques*. Twenty first Century Publications, 2000.

Web Sources

1. https://nptel.ac.in/content/storage2/courses/102103038/download/module5.pdf
2. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod2.pdf
3. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod4.pdf
4. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod3.pdf
5. https://nptel.ac.in/content/storage2/courses/102101040/downloads/Handouts/Lec-34.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – I:
BIOINSTRUMENTATION (23PBTO11)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 5 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To understand the principles behind the working mechanism of instruments.
- To impart technical skills on various spectroscopic technique.
- To make students aware of principles and applications of chromatographic techniques.
- To impart knowledge on concepts and measurement of radioactivity.

Course outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: demonstrate the working mechanism of bioinstruments
CO2[K3]: determine the principle and application of centrifugation and chromatographic techniques
CO3[K4]: analyze the applications of electrophoresis, blotting and PCR techniques
CO4[K5]: appraise the principles and applications of spectrophotometry
CO5[K6]: propose the biological applications of radioisotopic techniques

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	2	3	1
CO2[K3]	3	2	2	2	2	3	2
CO3[K4]	2	2	3	2	2	3	2
CO4[K5]	3	3	2	2	2	2	1
CO5[K6]	2	2	2	2	2	2	1
Weightage of the course	13	11	11	10	10	13	7
Weighted percentage of Course contribution to POs	3.95	3.91	3.87	4.5	6.58	6.77	3.74

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

UNIT I **(15 hrs)**

Microscopic Techniques: Principles and Applications: Compound, Light, Stereo, Phase Contrast, Fluorescent Microscopy, Scanning and Transmission Electron Microscopy, Scanning Electron Microscopy, Atomic Force Microscopy, Confocal Microscopy, FRET and Flow Cytometry.

UNIT II **(15 hrs)**

Centrifugation: pH meter, Principle and Applications of various types of centrifugation, Sedimentation Coefficient, Svedberg unit, RCF, Density Gradient Centrifugation. Chromatography Techniques: Principle and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GC & HPLC.

UNIT III **(15 hrs)**

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

UNIT IV **(15 hrs)**

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

UNIT V **(15 hrs)**

Radio-isotopic Techniques: Introduction to Radioisotopes, Uses and their Biological Applications, Radioactive Decay – Types and Measurement , Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry, Health effects of Radiations.

TEXTBOOKS

1. Boyer R. *Modern experimental Biochemistry*. Pearson education publication, 2014.
2. Jayaraman J. *Laboratory Manual in Biochemistry*, New Delhi :New Age International (P) Limited Publishers, 2011.
3. Ranallo, Ryan T and Farrell, Shawn O. *Experiments in Biochemistry: A Hands-on Approach: a Manual for the Undergraduate Laboratory*. United States: Harcourt Brace & Company, 2000.

REFERENCES

Books

1. Veerakumari, L. *Bioinstrumentation*. India: MJP Publisher, 2021.
2. Becker, Jeffery M. *Biotechnology: A Laboratory Course*. United Kingdom: Elsevier Science, 2012.
3. Holcapek, M and Byrdwell, Wm, C. *Handbook of Advanced Chromatography /Mass Spectrometry Techniques*, Elsevier, 2017.

Web Sources

1. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf
2. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod3.pdf
3. https://nptel.ac.in/courses/113/101/113101096/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – I: BIOSTATISTICS
(23PBTO12)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 5 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To discuss and explain what biostatistics is and how it is used in the field of public health.
- To make students to understand the common statistical techniques.
- To create awareness on basic principles of probability and how they relate to biostatistics.
- To make familiar with the sources of vital statistics data, how to interpret such data and how to perform basic tests to evaluate them.

Course Outcomes (CO)

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

CO1[K2]: illustrate the major methods of collection and presentation of data

CO2[K3]: compute different methods of analysis of variance

CO3[K4]: analyze the application of test of significance to interpret large and small samples

CO4[K5]: assess role of computational software and databases for statistical functions

CO5[K6]: hypothesize by testing large scale data and calculate errors

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	2	3	1
CO2[K3]	3	2	2	2	2	3	2
CO3[K4]	2	2	3	2	2	3	2
CO4[K5]	3	3	2	2	2	2	1
CO5[K6]	2	2	2	2	2	2	1
Weightage of the course	13	11	11	10	10	13	7
Weighted percentage of Course contribution to POs	3.95	3.91	3.87	4.5	6.58	6.77	3.74

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

(15 hrs)

UNIT I

Statistics – Scope –collection, classification, tabulation of Statistical Data – Diagrammatic representation – graphs – graph drawing – graph paper – plotted curve –Sampling method and standard errors –random sampling – use of random numbers –expectation of sample estimates – means – confidence limits – standard errors – variance. Measures of central tendency – measures of dispersion – skewness, kurtosis, moments.

UNIT II **(15 hrs)**

Correlation and regression – correlation table – coefficient of correlation – Z transformation – regression – relation between regression and correlation. Probability – Markov chains applications – Probability distributions – Binomial (Gaussian distribution) and negative binomial, compound and multinomial distributions – Poisson distribution.

UNIT III **(15 hrs)**

Normal distribution – graphic representation.– frequency curve and its characteristics –measures of central value, dispersion, coefficient of variation and methods of computation – Basis of Statistical Inference – Sampling Distribution – Standard error – Testing of hypothesis – Null Hypothesis –Type I and Type II errors.

UNIT IV **(15 hrs)**

Tests of significance for large and small samples based on Normal, t, z distributions with regard to mean, variance, proportions and correlation coefficient – chi-square test of goodness of fit – contingency tables – c2 test for independence of two attributes – Fisher and Behrens 'd' test – 2×2 table – testing heterogeneity – r X c table – chi-square test in genetic experiments – partition X 2 – Emerson's method.

UNIT V **(15 hrs)**

Tests of significance –t tests – F tests – Analysis of variance – one way classification – Two way classification, CRD, RBD, LSD. Spreadsheets – Data entry –mathematical functions – statistical function – Graphics display – printing spreadsheets – use as a database word processes – databases – statistical analysis packages graphics/presentation packages.

TEXTBOOKS

1. Veer bala Rastogi. *Fundamentals of Biostatistics*, Ane books Pvt Ltd, Chennai, 2011.
2. Rosner, B. *Fundamentals of Biostatistics*, Duxbury Press, 2005.
3. Warren, J., Gregory, E., Grant, R. *Statistical Methods in Bioinformatics*, Springer, 2004.

REFERENCES

Books

1. Milton, J.S. *Statistical methods in the Biological and Health Sciences*, ,Mc Graw Hill, 1992.
2. Sundar Rao P. S.S., Jesudian G. & Richard J. *An Introduction to Biostatistics*, Prestographik, Vellore, India, 1987.
3. Zar, J.H. *Bio Statistical Methods*, Prentice Hall, International Edition, 1984.

Web Sources

1. www.statsoft.com/textbook/ biosun1.harvard.edu/
2. www.bettycjung.net/Statsites.htm
3. www.ucl.ac.uk/statistics/biostatistics

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – II: ENZYMOLOGY
(23PBTO13)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 5 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS :100**

Course Objectives

- To understand the classification, structure and properties of enzymes.
- To understand the kinetics, catalysis and inhibition activities of enzymes.
- To understand physical properties, downstream process and purification of enzymes.
- To expedite how enzymes are used as co-factors.
- To enrich the students' knowledge with applications of enzymes.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate the nomenclature of enzymes and its types
CO2[K3]: determine the mechanism of enzyme inhibition
CO3[K4]: analyze the significance of active sites and its orientation effects
CO4[K5]: appraise the competitive and non-competitive inhibition of enzymes
CO5[K6]: propose and prove Michaelis - Menton equation

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	2	1	-	1	2
CO2[K3]	3	2	2	1	-	1	1
CO3[K4]	2	2	2	1	-	1	1
CO4[K5]	2	2	2	1	-	-	1
CO5[K6]	2	2	2	1	-	-	1
Weightage of the course	12	9	10	5	0	03	06
Weighted percentage of Course contribution to POs	3.65	3.2	3.52	2.25	0	1.56	3.21

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

UNIT I **(15 hrs)**

Introduction to enzymes, classification, nomenclature and general properties like effects of pH, substrate and temperature on enzyme catalysed reactions. Extraction Isolation and purification of enzymes by precipitation, centrifugation, chromatography and electrophoresis and liquid-liquid extraction methods.

UNIT II **(15 hrs)**

Kinetics of catalysed reaction : Single substrate reactions, bisubstrate reactions, concept of Michaelis - Menten, Briggs Haldane relationship, Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics, line weaver burk plot, Hanes wolf equation, Eadie hoofstee equation, Inhibition of enzyme activity.

UNIT III **(15 hrs)**

Enzyme catalysis: enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis.

UNIT IV **(15 hrs)**

Theories on mechanism of catalysis.-Mechanism of enzymes action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymerase. Multienzymes system, Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complex.

UNIT V **(15 hrs)**

Coenzyme action. Enzyme regulation: General mechanisms of enzyme regulation, Allosteric enzymes, sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of allosteric enzymes. Reversible and irreversible covalent modification of enzymes, Immobilized enzymes and their industrial applications.Clinical and industrial applications of enzymes, Enzyme Engineering.

TEXTBOOKS

1. Trevor Palmer and Philip L Bonner. *Enzymes Biochemistry, Biotechnology and Clinical chemistry*. Swaranjali Publication, 2021.
2. Sriram Sridhar. *Enzymes Biotechnology*. New Delhi: Dominant publishers and Distributors, First Edition, 2005.

REFERENCES

Books

1. Malcolm,Dixon and Edwin C Webb. *Enzymes* New York : Academic press, , Fifth Edition, 1971.
2. Nicholas C Price and Lewis Stevens. *Fundamentals of Enzymology*. Oxford University Press, Third Edition, 1999.
3. Dr.P. Palanivelu. *Analytical biochemistry and separation techniques*. Twenty first Century Publications, 2000.

Web Sources

1. https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC-07-PPT.pdf
2. https://nptel.ac.in/courses/102/102/102102033/
3. https://nptel.ac.in/content/storage2/courses/103105054/assignments/Q_&_A_Set_8.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - I
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – II: INHERITANCE AND EVOLUTIONARY BIOLOGY (23PBTO14)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 5 **INT. MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 75 hrs **MAX.MARKS : 100**

Course Objectives

- To understand the principles of mendelian inheritance.
- To know the definition and significance of pedigree analysis and evolution.
- To understand the various types of non-mendelian inheritance.
- To be familiar with the concept of behavior and altruism during evolution.

Course Outcomes (CO)

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

CO1[K2]: illustrate the concepts of inheritance with Mendelian principles

CO2[K3]: apply the principles of inheritance at the molecular, cellular and organism levels

CO3[K4]: analyse the major events in the evolutionary time scale

CO4[K5]: examine the approaches and methods in human behaviour

CO5[K6]: assess historical and current knowledge regarding human heredity

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	2	1	-	1	2
CO2[K3]	3	2	2	1	-	1	1
CO3[K4]	2	2	2	1	-	1	1
CO4[K5]	2	2	2	1	-	-	1
CO5[K6]	2	2	2	1	-	-	1
Weightage of the course	12	9	10	5	0	03	06
Weighted percentage of Course contribution to POs	3.65	3.2	3.52	2.25	0	1.56	3.21

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

UNIT I **(15 hrs)**

Mendelian principles- Dominance, segregation, independent assortment, Allele, multiple alleles, pseudoallele. Complementation tests – Co-dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, linkage and crossing over, Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids.

UNIT II **(15 hrs)**

Inheritance of Mitochondrial and chloroplast genes – maternal Inheritance - Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Polygenic inheritance, heritability and its measurements, QTL mapping. Lamarck - Darwin–concepts of variation, adaptation, struggle, fitness and natural selection, Spontaneity of mutations - The evolutionary synthesis.

UNIT III **(15 hrs)**

Origin of basic biological molecules - Abiotic synthesis of organic monomers and polymers - Concept of Oparin and Haldane - Experiement of Miller (1953) - The first cell - Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes.

UNIT IV **(15 hrs)**

The evolutionary time scale - Eras, periods and epoch - Major events in the evolutionary time scale. Origin of unicellular and multi cellular organisms - Major groups of plants and animals - Stages in primate evolution including *Homo sapiens*.

UNIT V **(15 hrs)**

Approaches and methods in study of behaviour - Proximate and ultimate causation. altruism and evolution - Group selection, Kin selection, Reciprocal altruism, neural basis of learning, memory, cognition, sleep and arousal, Biological clocks.

TEXTBOOKS

1. Gardener A.J, Simmons M.J and Snusted. Principles of Genetics. NewYork : John Willey and sons,2012.
2. Snustad, Simmons. Principal of Genetics. John Wiley and Sons, Fourth Edition, 2008.
3. Tamarin M, Robert J Thomson. Principles of Genetics. Seventh Edition, 2012.

REFERENCES

Books

1. Hartwell, Lelandet al. *Genetics: from genes to genomes.* McGraw-Hill Education, 2018.
2. Provine, William B. *The origin of Dobzhansky's Genetics and the Origin of Species.* Princeton University Press, 2014.
3. Slatkin, Montgomery. *Gene Flow and Population Structure- Ecological genetics.* Princeton University Press, 2017.

Web Sources

1. https://onlinecourses.swayam2.ac.in/cec21_bt02/preview
2. https://onlinecourses.swayam2.ac.in/cec20_bt03/preview
3. https://ocw.mit.edu/courses/biology/7-03-genetics-all2004/lecturenotes/lecture26.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
CORE COURSE – V: MICROBIOLOGY (23PBTC21)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To understand the history of Microbiology.
- To aware students about the nutritional classification of bacteria.
- To obtain knowledge about sterilization and disinfection.
- To obtain knowledge on microbial diversity.
- To know the basic microbial community in natural habitats.

Course Outcomes (CO)

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

CO1[K2]: illustrate the major discoveries in microbiology, microbial diversity, microbial growth and metabolism.

CO2[K3]: determine the role of microbial pathogens in human diseases

CO3[K4]: analyze host microbe interaction and epidemiology of microbial disease

CO4[K5]: assess the role of novel microbes in environment and integrate them in specific innovative approaches

CO5[K6]: develop diagnosis and control measures of epidemic and pandemic diseases

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	1	-	3
CO2[K3]	3	3	2	2	2	2	2
CO3[K4]	2	2	3	2	2	2	1
CO4[K5]	2	2	3	2	2	2	1
CO5[K6]	3	3	3	2	2	2	1
Weightage of the course	13	12	13	10	9	8	8
Weighted percentage of Course contribution to POs	3.95	4.27	4.58	4.5	5.92	4.17	4.28

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

UNIT I **(12 hrs)**

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

UNIT II **(12 hrs)**

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

UNIT III **(12 hrs)**

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

UNIT IV **(12 hrs)**

Microbial Diseases: Microbial diseases - General characteristics, pathogenesis, laboratory diagnosis and control measures of Pandemic and Epidemic diseases: Tuberculosis, Leprosy, Cholera, Typhoid, COVID-19, Yellow Fever, Flu, AIDS, Ebola, Zika Virus, Small Pox, Dengue, Chickungunya, Malaria, filariasis, Candidiasis, superficial mycosis.

UNIT V **(12 hrs)**

Agricultural and Environmental Microbiology: Biological nitrogen fixation, free living, symbiotic nitrogen fixation, mechanism of Nitrogen, Biofertilizers- types and applications; Rhizosphere effect. Biogeochemical cycles- Carbon, Nitrogen, Sulphur and Phosphorous; Methanogenic bacteria Extremophiles- Thermophiles, Acidophiles, Halophiles and alkalophiles; Biotechnological application of extremophiles.

TEXTBOOKS

1. Sharma.P.D, *Microbiology* : *A Text Book for University Students*. Rastogi Publications, 2016.
2. Watson J.D, Baker T.A, Bell S.P, Gann A, Levine M, and Losick R, Cummings B. *Molecular Biology of the Gene*. Pearson Publisher, seventh Edition, 2013.
3. Freifelder D. *Molecular Biology*. USA : Jones and Barlett Publishers, 2004.

REFERENCES

Books

1. Prescott, Lansing M., John P. Harley, and Donald A. Klein. *Microbiology*.ke-6. Mc. Grow-Hill. New York, 2019.
2. Cullis T, Burton,Guhman, S, Griffiths A and Suzuk D. *Genetics: A Beginner's guide.*One world publication Ltd, 2003.
3. Gerar J. Tortora, Berdell R. Funke, Christine and L. Case. *Microbiology - An Introduction*. Benjamin Cummings , Tenth Edition ,2016.
4. Madigan Michael T, Martinko John M. *Biology of Microorganisms – Microbiology.* Fourteenth Edition, Pearson publishers, 2017.

Web Sources

1. https://nptel.ac.in/courses/102/103/102103015/
2. https://dth.ac.in/medical/courses/Microbiology/block-1/1/index.php
3. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod1.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
CORE COURSE – VI: PLANT AND ANIMAL BIOTECHNOLOGY (23PBTC22)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 4 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course objectives

- To introduce students about the principles and applications of plant tissue culture and animal cell culture.
- To develop plant transformation vectors specifically designed to facilitate transfer of improved genetic traits to plants.
- To familiarize with knock-out and transgenic animals and study of gene function.

Course Outcomes (CO)

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

CO1[K2]: illustrate theoretical knowledge on various techniques of plant biotechnology like tissue culture and plant genetic transformation

CO2[K3]: use gene transfer techniques for developing disease and Pest resistance plants

CO3[K4]: analyze the role of reporters and marker genes in gene transfer

CO4[K5]: appraise the concepts of disaggregation of tissues, scaling up of cell culture and cloning mechanism

CO5[K6]: propose the application of animal cell culture to improve sustainability, productivity, suitability for pharmaceutical and industrial applications

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	2	1	1	1	2
CO2[K3]	3	3	3	2	1	1	2
CO3[K4]	3	3	3	1	2	1	1
CO4[K5]	2	2	2	1	1	1	1
CO5[K6]	2	2	2	1	1	1	1
Weightage of the course	13	13	12	06	06	05	07
Weighted percentage of Course contribution to POs	3.95	4.63	4.23	2.7	3.95	2.6	3.74

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

UNIT I **(12 hrs)**

Introduction of plant tissue culture, composition of media, Micropropagation, organogenesis, somatic embryogenesis, haploid and triploid production, protoplast isolation and fusion, hybrid and cybrid, synthetic seed production. Secondary metabolites in plants - Phytochemicals- Glycosides and Flavonoids; Anthocyanins and Coumarins - Lignans, Terpenes, Volatile oils and Saponins; Carotenoids and Alkaloids: biogenesis, therapeutic applications.

UNIT II **(12 hrs)**

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

UNIT III **(12 hrs)**

Animal health disease diagnosis, hybridoma technique, monoclonal antibodies, application of probes for disease diagnosis of existing and emerging animal diseases. Prophylaxis - Vaccines, Oral vaccines DNA Vaccines in animal disease. Cell culture: primary and established culture; organ culture; tissue culture.

UNIT IV **(12 hrs)**

Disaggregation of tissue and primary culture; cell separation, Slide and coverslip cultures, flask culture, test tube culture techniques, cell synchronization, cryo preservation. Scaling up of animal cell culture, cell line and cloning micromanipulation and cloning, somatic cell cloning. Karyotyping; measuring parameters for growth, measurement of cell death, apoptosis and its determination, cytotoxicity assays.

UNIT V **(12 hrs)**

Nuclear magnetic resonance methods of monitoring cell metabolism culturing animal cells in fluidised bed reactors. Application of animal cell culture for in vitro testing of drugs, in production of human and animal viral vaccines and pharmaceutical proteins. Culture Scale up and mass production of biologically important compounds. Harvesting of products, purification and assays. Transgenic animals: Production and application; transgenic animals in livestock improvement, transgenic animals as model for human diseases; Stem Cells- Properties, Types, Therapy, Prospects and Ethics in stem cell research.

TEXTBOOKS

1. Razdan. M. K. *Plant tissue culture*. Oxford and IBH publishing Company Pvt. Ltd, New Delhi, 2011.
2. Chawla. H. S. *Introduction to plant biotechnology*. Oxford and IBH publishing company pvt. Ltd, New delhi, 2010.
3. Ian Freshney. *Culture of animal cells*. 6th edition, Wiley-Blackwell publishers, 2010.

REFERENCES

Books

1. Slater. *Plant Biotechnology: The Genetic manipulation of plants*, Second Edition, Oxford University Press, USA, 2008.
2. Watson, James D. *Recombinant DNA*. United States: W. H. Freeman, 1992.
3. K. Dass. *Text book of Biotechnology*, Second Edition, Wiley Dreamtech, India (P) Ltd, 2005.

Web Sources

1. https://nptel.ac.in/courses/102/103/102103015/
2. https://dth.ac.in/medical/courses/Microbiology/block-1/1/index.php
3. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod1.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
CORE COURSE – VII: GENETIC ENGINEERING (23PBTC23)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 4 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To understand the role of enzymes in genetic engineering.
- To understood the cloning vectors.
- To obtain knowledge about gene cloning strategies and transformation techniques.
- To obtain the knowledge of selection, screening, and analysis of recombinants.
- To aware students about genetic engineering techniques and its applications.

Course Outcomes (CO)

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

CO1[K2]: explain the strategies of genetic engineering.

CO2[K3]: apply suitable bioanalytical tools in gene expression studies.

CO3[K4]: compare the central dogma of cell in prokaryotes and eukaryotes.

CO4[K5]: choose the appropriate gene transfer method for prokaryotes and eukaryotes

CO5[K6]: appraise the applications of genetic engineering in the generation of recombinant molecules

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	3	2	2	2	2
CO2[K3]	2	3	3	2	1	2	1
CO3[K4]	2	2	2	-	-	1	1
CO4[K5]	3	3	2	2	3	2	2
CO5[K6]	3	2	2	2	3	3	2
Weightage of the course	13	12	12	8	9	10	8
Weighted percentage of Course contribution to POs	3.95	4.27	4.23	3.6	5.92	5.21	4.28

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

UNIT I **(12 hrs)**

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

UNIT II **(12 hrs)**

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

UNIT III **(12 hrs)**

Cloning in yeast *Saccharomyces cerevisae*. Life cycle and types of vectors; Eukaryotic vectors. SV40 (molecular genetics and expression); Specialized cloning vector for cDNA; Synthesis of specific RNA *in vitro*; Vectors for cloning promoters and terminators; vectors with adjustable copy number.

UNIT IV **(12 hrs)**

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

UNIT V **(12 hrs)**

Site directed mutagenesis; DNA microarray; chromosome walking and jumping. Molecular techniques in prenatal diagnosis gene therapy, Transgenic animals (knockout mice) and plants (Flavr savr tomato), Pharmaceutical products (Vaccine, Humulin, etc), Crop improvement. Pesticide resistance, herbicide resistance, transgenic animals and GM foods; Modern Concepts in genetic analysis.

TEXTBOOKS

1. Dubey R.C. *A Text Book of Biotechnology*. New Delhi : S. Chand & Co Ltd, 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. Primrose S.B. and TwymanR.M. *Principles of Gene Manipulation and Genomics*. Blackwell Scientific Publications, 2013.
2. Glick. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. Taylor and Francis publications, 2017.
3. Brown T. A. *Gene Cloning and DNA Analysis-An Introduction*. Blackwell Scientific Publications, 2016.

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. 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 (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
CORE COURSE – VIII: PRACTICAL: MICROBIOLOGY, PLANT AND ANIMAL BIOTECHNOLOGY AND GENETIC ENGINEERING (23PBTC2P)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 6 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS :100**

Course Objectives

- To understand the principles and procedure for isolation of DNA and RNA.
- To teach restriction digestion technique.
- To obtain knowledge about sterilization and disinfection.
- To obtain knowledge of microbial diversity.

Course Outcomes (CO)

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

CO1[K2]: illustrate the methods to isolate and identify microbes from various sources

CO2[K3]: determine the cell viability and toxicity

CO3[K4]: separate nucleic acids and proteins from biological sources

CO4[K5]: perform the micropropagation in plant tissue culture

CO5[K6]: elaborate the microbial gene transfer techniques

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	3	1	-	2	1
CO2[K3]	3	2	3	2	1	1	1
CO3[K4]	3	3	3	2	-	2	1
CO4[K5]	3	2	3	2	-	3	1
CO5[K6]	3	2	3	2	2	3	1
Weightage of the course	15	12	15	9	3	11	5
Weighted percentage of Course contribution to POs	4.56	4.27	5.28	4.05	1.97	5.73	2.67

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

Experiments

(A) Microbiology-Practical

1. Sterilization of glassware using dry heat- hot air oven
2. Sterilization of media using moist heat – autoclave
3. Filter sterilization
4. Liquid media preparation – nutrient broth
5. Solid media preparation – SDA plates
6. Preparation of Agar slants
7. Streak plate method
8. Pour plate method
9. Spread plate method
10. Enumeration of total count of the bacteria
11. Isolation of microbes from soil
12. Isolation of microbes from water
13. Isolation of microbes from air
14. Isolation of microbes from plant surface.
15. Isolation of pure culture of *E.coli*
16. Isolation of pure culture of *Aspergillus niger*
17. Isolation of pure culture of *Streptomyces*
18. Gram staining and morphological characterization of microbes.
19. Negative staining of bacteria
20. Determination of growth curve of bacteria – *E.coli*
21. IMViC test of enteric bacteria
22. Biochemical characterization of bacteria – Catalase test, oxidase test, sugar fermentation and starch hydrolysis
23. Growth curve analysis and measurement of growth rate.
24. Antibiotic susceptibility test
25. Bacterial conjugation
26. Isolation of bacteriophage and plaque analysis
27. Bacterial gene induction

Demonstration

16srRNA sequencing

(B) Plant and Animal Biotechnology - Practical:

1. Plant tissue culture media preparation
2. Plant tissue culture sterilization techniques.
3. Generation of Callus from leaf
4. Generation of Callus from root
5. Generation of Callus from bud
6. Generation of Callus from shoot apex
7. Maintenance of callus culture
8. Cell suspension culture
9. Anther culture
10. Pollen culture

11. Embryo culture
12. Isolation of plant protoplast
13. Culture of plant protoplast
14. Protoplast viability test
15. Localization of nucleus using nuclear stain
16. Agrobacterium culture maintenance and isolation of plasmid DNA
17. Mass culture of Chlorella /Spirulina
18. Introduction to Animal Cell culture: Procedure for handling cells and medium.
19. Cleaning and sterilization of glassware and plastic tissue culture flasks
20. Preparation of tissue culture media
21. Preparation of sera for animal cell culture
22. Preparation of single cell suspension from chicken liver (Primary cell culture).
23. Trypsinization of established cell culture.
24. Cell counting and viability - staining of cells (a) Vital Staining (Trypan blue, Erythrosin (b) Giemsa staining.
25. MTT Assay

(C) Genetic Engineering - Practical

1. Preparation of plasmid DNA by alkaline lysis method
2. Agarose gel electrophoresis
3. Silver staining of gels
4. Methylene blue DNA staining
5. Elution of DNA from agarose gel
6. Restriction enzyme digestion
7. Restriction mapping of plasmid DNA
8. Ligation.
9. Competent cell preparation
10. Transformation and selection of recombinants.
11. Cloning of fragments in PBR322
12. Insertional inactivation/Blue white screening
13. RAPD
14. RFLP
15. Amplification of DNA - PCR
16. Determination of molecular weight of DNA

Demonstration:

RT-PCR for COVID-19

REFERENCES

Books

1. Garg F.C. *Experimental Microbiology*. CBS Publisher, 2017.
2. Nikunjpatel and Nikulchavada. Experimental microbiology, Educreation publishing, 2019.
3. J.G. Cappuccino and N. Sherman. *Microbiology: A Laboratory Manual* Addison Wesley, 2002.
4. L. Fletcher, E. Goss, P. Phelps, A. Wheeler, S.O. Grady*. Introduction to biotechnology – a laboratory manual*, 2011.
5. R.I. Freshney. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications.*John Wiley & Sons, Sixth Edition, 2010.
6. S. Harisha. *Biotechnology procedures and experiments hand book*. Infinity Science Press, 2007.

Web Sources

1. https://www.mdpi.com/journal/plants/special_issues/plant_tissue_culture
2. https://www.liverpool.ac.uk/~sd21/tisscult/what.htm
3. https://www.intechopen.com/books/new-insights-into-cell-culture-technology/history-of-cell-culture
4. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod6.pdf
5. https://nptel.ac.in/courses/102/103/102103015/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC– III: REGULATORY AFFAIRS AND INDUSTRIAL STANDARDS (23PBTO21)
(From 2023-2024 Batch onwards)

HOURS/WEEK: 4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To gain essential skills required to work in regulatory environment.
- To acquire skills in areas including medical products development, pharmaceutical formulations, sales, strategic marketing and clinical investigations.
- To know about regulatory process in drug development, formulations, and API.

Course Outcomes (CO)

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

CO1[K2]: outline the basic requirements of establish laboratory for testing samples as per the regulatory body's requirements

CO2[K3]: determine the Scientific, technical knowledge about various food preservation techniques

CO3[K4]: analyze the basic concepts of packing of food materials, various parameters observed during packaging

CO4[K5]: evaluate the methods for testing of food materials and identifying microbial food contaminant

CO5[K6]: elaborate the importance of food safety management system, good manufacturing practice and good hygienic practices

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	2	1	1	-	1
CO2[K3]	2	2	2	2	1	1	2
CO3[K4]	2	2	2	1	-	1	1
CO4[K5]	2	2	2	1	1	2	1
CO5[K6]	3	2	2	1	2	1	2
Weightage of the course	11	10	10	06	05	05	07
Weighted percentage of Course contribution to POs	3.34	3.56	3.52	2.7	3.29	2.6	3.74

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

UNIT I **(12 hrs)**

Planning, Organisation and setting of Food testing laboratory and laboratory safety: Understand the requirements for setting up a laboratory for the legal defensibility of analytical data. The ideal structure design, environment, layout for microbiological testing and Air handling etc., Introduction about accreditation, Different accreditation bodies (NABL, APLAC, ILAC), Requirements for ISO/IEC 17025:2017, documentation, pre-requisites for accreditation, management requirements, technical requirements, measurement of traceability, Laboratory safety: Personnel and laboratory hygiene, emergency planning, general hazards in a food laboratory, safety equipment, storage of chemicals, acids, flammables etc, handling and biological spills and waste disposal.

UNIT II **(12 hrs)**

Principles of Food Preservation technology: Heat: Principles of Heat transfer, Blanching, Pasteurization, Heat sterilization, thermal extrusion, cooking. Water Removal: Forms of Water in Foods, Sorption of water in foods, Water activity, drying and evaporation technology. Temperature reduction: Chilling, Freezing, Radiation: Ionizing Radiation, Microwave, Use of chemicals: Class-I & Class-II preservatives, smoke other chemical additives, New non-thermal methods: High hydrostatic pressure, modified atmosphere, high intensity pulsed electric fields, intense pulsed light, oscillating magnetic fields, hurdle technology, ultrasonic and ohmic heating etc.

UNIT III **(12 hrs)**

Principles of Food Packaging technology: Effect of environment on food stability: light, oxygen, water, temperature, sensitivity to mechanical damage and attack by biological agents, Different packaging materials used for food packaging and their properties including barrier properties, strength properties, optical properties: Glass, metals, paper, plastics, biodegradable and edible films and coatings aseptic packaging and combinations, Selection of packaging material and design for various food commodities including fresh produce (Fruits and vegetables), milk and milk products (dairy), cereal, pulses, oil, meat, fish, poultry, water and processed foods, Evaluation of quality and safety of packaging materials- different testing procedures, Function of packaging: Protective packaging and active packaging smart and intelligent packaging, Newer packaging technologies-CAP/MAP packaging aseptic processing and packaging, irradiated packaging, retort pouch and microwaveable packaging.

UNIT IV **(12 hrs)**

Food Microbiology and testing: Introduction of Food microbiology: Classification and nomenclature of microorganisms. Morphology and structure of microorganisms in foods (yeast and Molds, Bacterial cells viruses), Important genera of mold, yeast, bacteria (Gram positive and Gram negative, facultative aerobic and anaerobic, endospore forming bacteria and non-sporulating bacteria), Bacterial groups (lactic acid, acetic acid, butyric acid etc.,), thermophilic, proteolytic, saccharomyticetc, coliforms, faecal coliforms, enteric pathogens and emerging microbes, Sources of microorganisms in food chain (raw materials, water, air, equipment etc) and microbiological quality of foods, Microbial growth characteristics: Reproduction and growth (fission, generation time optimum growth, growth curve etc). Microbial growth in foods: intrinsic (pH, Moisture content, oxidation-reduction potential, nutrient content, antimicrobial constituents and extrinsic parameters (temperature of storage, relative humidity of environment, presence and concentration of gases in the environment, Thermal destruction of microorganisms: Thermal death time, D Value, Z- Value, F-Value, thermal death time curve, 12 D Concept, Microbial food spoilage and food borne diseases, food pathogens, bacillus *cereus and other bacillus species, campylobacter, clostridium species, Enterobacteriaceae, E. coli, listeria monocytogens, salmonella, shigella, staphylococcus aureus, vibrio species, yersinia enterocolitica, fungi, virus etc.,* Methods for the Microbiological examination of foods: Sampling activity and sampling plan, pure culture isolation: streaking, serial dilution and plating, cultivation, maintenance and preservation/stocking of pure culture, Observation of Indicator organisms: Direct examination, enumeration methods, plate count, MPN, biochemical test, Rapid methods detection of specific organisms.

UNIT V **(12 hrs)**

HACCP and Food safety management systems: ISO 22000: Importance of implementing a HACCP system and how it can be applied to various products. Prerequisite programs, HACCP principles, some limitation of HACCP food safety objective (FSO). Food safety audits: Management review, audit certification and importance. Good manufacturing practices (GMP), Good hygienic practices (GHP), Food safety plan, food safety management risk analysis. Traceability food products recall and sanitation.

TEXTBOOKS

1. Mantus, D., Pisano, D. J. *FDA Regulatory Affairs*. CRC Press, 2014.
2. Herschdoerfer, S. *Quality Control in the Food Industry V2*. Elsevier, 2012.
3. Vasconcellos, J. A. *Quality assurance for the food industry: a practical approach*. CRC press, 2003.

REFERENCES

Books

1. Pomeranz, Y. *Food analysis: theory and practice*. Springer Science & Business Media, 2013.
2. Nielsen, S. S. *Food analysis laboratory manual*. Springer, 2017.

Web Sources

1. https://nptel.ac.in/courses/102/103/102103013/
2. https://archive.nptel.ac.in/courses/127/106/127106137/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER – II
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC– III: PHARMACEUTICAL BIOTECHNOLOGY (23PBTO22)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To understand the various techniques in biotechnology and their applications in the manufacturing of biopharmaceuticals and biomedical research.
- To gain knowledge in some of the physicochemical properties, pharmacology and the formulation of commonly used biopharmaceuticals.
- To understand the principle mechanism of biotechnologically derived diagnostic aids/tests.

Course Outcomes (CO)

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

CO1[K2]: explain the basic components of pharmaceutical and biotechnology industry and methods and applications of biosensor

CO2[K3]: describe the scientific, technical and economic aspects of vaccine & rDNA technology

CO3[K4]: analyze the concepts of protein Engineering, therapeutic proteins and enzyme immobilization techniques

CO4[K5]: determine the importance of hybridoma technology, microbial biotransformation and microbial biotransformed products

CO5[K6]: elaborate the concepts of somatic gene therapy, Xeno-transplantation, fermentor and bio safety methods

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	2	1	1	-	1
CO2[K3]	2	2	2	2	1	1	2
CO3[K4]	2	1	2	1	-	1	1
CO4[K5]	2	2	2	1	1	2	1
CO5[K6]	3	2	2	1	-	1	2
Weightage of the course	11	10	10	06	05	05	07
Weighted percentage of Course contribution to POs	3.34	3.56	3.52	2.7	3.29	2.6	3.74

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

UNIT I **(12 hrs)**

Introduction to concepts and technologies in pharmaceutical biotechnology and industrial applications, Biosensors- Working and applications of biosensors in pharmaceutical Industries; Pharmacology and Ethnopharmacology: Scope, applications and Importance.

UNIT II **(12 hrs)**

Scientific, technical and economic aspects of vaccine research and development, Preparation of bacterial vaccines, toxoids, viral vaccine and antitoxins, Storage conditions and stability of vaccines, Recombinant DNA technology, Application of rDNA technology and genetic engineering in the production of: (i) Interferon (ii) Vaccines - hepatitis- B (iii) Hormones – Insulin, Brief introduction to Protein Engineering, Therapeutic proteins, Production of Enzymes- General consideration – Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase, Methods of enzyme immobilization and applications.

UNIT III **(12 hrs)**

Hybridoma technology - Production, Purification and Applications, Formulation of biotech products - Rituximab, Introduction to Microbial biotransformation and applications, Study of the production of – penicillins, citric acid, Vitamin B12, Glutamic acid and Griseofulvin Somatic gene therapy, Xenotransplantation in pharmaceutical biotechnology, Large scale production fermenter design and its various controls, Bio safety in pharmaceutical industry.

UNIT IV **(12 hrs)**

Pharmacological activity of Plant drugs, Plant Chemicals in modern pharmacology; biochemistry and pharmacology of atropine, caffeine, ephedrine, opioids, taxol, vinca alkaloids, synthetic substitutes for therapeutically active plant constituents; drug improvement by structure modification and bio-transformation. Criteria for pharmacological evaluation of drugs.

UNIT V **(12 hrs)**

Clinical Pharmacology, Drug therapy, therapeutic situation, benefits and risk of use of drugs, Mechanism of drug action, Therapeutic efficacy, Therapeutic index, tolerance, dosage forms and routes of drug action, factors affecting drug action; Adverse Drug reactions and drug poisoning-classification and causes of ADR; principle clinical manifestations and treatment of ADR, General principles of management of drug poisoning; antidotes, classification of drugs.

TEXTBOOKS

1. Harbans lal. *Pharmaceuticals biochemistry*. CBS Publishers and distributors Pvt. Ltd, Chennai, 2011.
2. Carlos A. Guzmán and Giora Z. Feuerstein. *Pharmaceutical Biotechnology*, 1st edition, Springer, 2009.
3. Daniel Figeys. *Industrial Proteomics: Applications for Biotechnology and Pharmaceuticals.* Wiley, John & Sons, Incorporated, 2005.

REFERENCES

Books

1. Kayser, O and Muller R.H. *Pharmaceutical Biotechnology Drug Discovery and Clinical Applications*. WILEY-VCH, 2004.
2. Leon Shargel, Andrew B. C. Yu, Susanna Wu-Pong, and Yu Andrew B. C. *Applied Biopharmaceutics & Pharmacokinetics*. McGraw-Hill Companies, 2004.
3. Gary Walsh. *Biopharmaceutical, Biochemistry & Biotechnology*. 2003.

Web Sources

1. https://tugasakhirsttifbogor.files.wordpress.com/2018/08/pharmaceutical-biotechnology.pdf
2. http://library.nuft.edu.ua/ebook/file/Gad2007.pdf
3. https://oasis.iik.ac.id:9443/library/repository/a932eb462c49885a2c72755977036b81.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER – II
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – IV: ENVIRONMENTAL BIOTECHNOLOGY (23PBTO23)
(From 2023-2024 Batch onwards)

HOURS/WEEK:4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To elaborate the fundamental concepts and applications of biotechnology in environment.
- To familiarize the students a broad sense of understanding on how modern biotechnology is developed to achieve better environmental protection and sustainability.
- To understand the bioremediation and biodegradation principles, processes and its applications.
- To adopt production processes that make optimal use of natural resources, by recycling biomass, recovering energy and minimizing waste generation.
- To explain the environmental biotechnology role in providing alternating solutions for sustainable development.

Course Outcomes (CO)

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

CO1[K2]: illustrate various waste management methods
CO2[K3]: determine potential biotechnological approaches to degrade xenobiotic compounds
CO3[K4]: examine the techniques involved in waste water management
CO4[K5]: assess the methods of monitoring pollution and its control
CO5[K6]: elaborate the methods of bioremediation to control the polluted environment

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	1	1	1	1
CO2[K3]	2	2	2	1	1	1	1
CO3[K4]	3	1	2	1	-	1	2
CO4[K5]	2	2	2	1	1	1	1
CO5[K6]	2	2	2	2	-	1	2
Weightage of the course	12	9	10	06	03	05	07

Weighted percentage of Course contribution to POs	3.65	3.2	3.52	2.7	1.97	2.6	3.74

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

UNIT I **(12 hrs)**

Environment: Basic concepts and issues; Environmental management and Conservation, Environmental Laws & Agencies involved in conservation. Environmental Pollution: Types of pollution & its control strategies -Air pollution, Soil pollution, Water pollution, Oil pollution & Radioactive pollution.

UNIT II **(12 hrs)**

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

UNIT III **(12 hrs)**

Waste water management, source of waste water, Waste water treatment- physical, chemical and biological treatment. Microbiology of Waste water; Aerobic and anaerobic process, BOD and COD.

UNIT IV **(12 hrs)**

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

UNIT V **(12 hrs)**

Bioremediation; *In-situ and Ex-situ* Bioremediation of contaminated soils and waste land; Microbiology of degradation of Xenobiotics in environment; Pesticides, Surfactants, Degradative plasmids. Solid waste: Composting, Vermiculture and methane production.

TEXTBOOKS

1. M. Moo-Young, W.A. Anderson, A.M. Chakrabarty. *Environmental Biotechnology: Principles and Applications*. Springer, 2010.
2. M. H. Fulekar. *Environmental Biotechnology*. Science Publishers Department of Life Sciences, University of Mumbai, India, 2010.

REFERENCES

Books

1. Bruce E. Rittmann and Perry L. McCarty. *Environmental Biotechnology: Principles and applications*. McGraw Hill, Newyork, 2001.
2. Ahmed N, Qureshi, F.M. and Khan, O.Y. *Industrial and Environmental Biotechnology*. Horizon Press, 2001.

Web Sources

1. https://youtu.be/u9YbWIkfYKk
2. https://youtu.be/a4YFqd-1ixA
3. https://youtu.be/S2XSgbXAf-Y

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - II
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC – IV: AGRICULTURAL BIOTECHNOLOGY (23PBTO24)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS : 100**

Course Objectives

- To provide the students the knowledge in biotechnological innovations pertaining to issues in agriculture.
- To enable the students learn role of genetics in the plant evolution.
- To enable the students to understand the concepts of molecular biology.
- To explore the disease resistant crop production methods.
- To understand the techniques used to screening disease resistant crops.

Course Outcomes (CO)

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

CO1[K2]: explain the importance of agriculture and need for biotechnology in agriculture

CO2[K3]: discover the basics concepts of plant system and their genetics

CO3[K4]: differentiate the importance of genome, plasmids and vectors

CO4[K5]: measure different ways of gene transfer methods and transgenesis

CO5[K6]: build a suitable methods of biotechnology in the identification of plant hybridization

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	1	1	1	1
CO2[K3]	2	2	2	1	1	1	1
CO3[K4]	2	1	2	1	-	1	2
CO4[K5]	3	2	2	1	1	1	1
CO5[K6]	2	2	2	2	-	1	2
Weightage of the course	12	9	10	06	03	05	07
Weighted percentage of Course contribution to Pos	3.65	3.2	3.52	2.7	1.97	2.6	3.74

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

UNIT I **(12 hrs)**

History, scope and importance of biotechnology in Agriculture – Application of biotechnology in Agriculture

UNIT II **(12 hrs)**

Mendelian genetics, allosomes, linkage and extra chromosomal inheritance-Introduction to genetics -Earlier concepts of inheritance– cell and cell organelles- Cell division, Mendel‟s laws.

UNIT III **(12 hrs)**

Nucleic acid structure and its function-Modes of DNA replication- Genetic code - Central dogma of life – Transcription – Translation- Recombinant DNA technology - DNA modifying enzymes – Cloning Vectors –Plasmids-cosmids-phagemids-Shuttlevectors- BAC-YAC-HAC-applications.

UNIT IV **(12 hrs)**

Gene transfer methods – *Agrobacterium* - mediated gene transfer, direct gene transfer, gene silencing – Principles of QTL and Marker Assisted Selection (MAS) –Achievements - Transgenic plants –Achievements – Current trends.

UNIT V **(12 hrs)**

Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning- Nucleic acid hybridization and immunochemical detection- DNA sequencing.

TEXT BOOKS

1. Benjamin Lewin, Gene IX, 9thEdition, Jones and Barlett Publishers, 2007.
2. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6thEdition, Benjamin Cummings Publishing Company Inc, 2007.
3. Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002.
4. Esau's Plant Anatomy; Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development, 3rdEdition, John Wiley & Sons, 2006.
5. Martin J Ingrouille and William Eddie, Plants: Diversity and Evolution

REFERENCES

Books

1. Brown CM, Campbell I and Priest FG. Introduction to Biotechnology. Panima Publications, 2005
2. Bhojwani and Dantu. Plant tissue culture: An introductory text, Springer, New Delhi, 2013
3. Singh, B.D., Fundamentals of genetics 2014, Kalyani Publishers, New Delhi.
4. Gardner, E.J. & Snustad, D.P. 1991. Principles of Genetics. John Wiley & Sons, USA.
5. Chawla, H.S. 2008. Introduction to Plant Biotechnology, 3rd Ed. Oxford IBH, India.69.

Web Sources

1. https://www.isaaa.org/resources/publications/agricultural_biotechnology/download/A gricultural_Biotechnology.pdf.
2. https://www.researchgate.net/publication/267338355_Book_Review_Agriculture_Biotechnology_and_Develop me

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER – II
NON-MAJOR ELECTIVE COURSE I: GENE MANIPULATION TECHNOLOGY
(23PBTN21)
(From 2023-2024 Batch onwards)

HOURS/WEEK:4 **INT.MARKS : 25**
CREDITS : 2 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS :100**

Course Objectives

- To gain knowledge about GMOs and GM organisms.
- To illustrate the use of modern tools and techniques for manipulation and analysis of genomic sequences.
- To expose students to application of recombinant DNA technology in biotechnological research.
- To gain the potential risks and benefits of GMOs on the environment.
- To train students in strategizing research methodologies employing genetic engineering techniques.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate various gene cloning methods and enzymes
CO2[K3]: determine applications of gene cloning, gene libraries
CO3[K4]: analyze the techniques involved in sequencing the DNA
CO4[K5]: appraise the methods of protein engineering techniques
CO5[K6]: construct the methods of gene cloning and its ethics

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	2	1	1	2
CO2[K3]	2	2	2	1	1	1	2
CO3[K4]	2	2	2	1	-	1	1
CO4[K5]	3	1	2	1	-	1	1
CO5[K6]	2	1	2	1	2	1	1
Weightage of the course	12	8	10	06	04	05	07
Weighted percentage of Course contribution to POs	3.65	2.85	3.52	2.7	2.63	2.6	3.74

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

UNIT I **(12 hrs)**

Basics of Gene Manipulation Technology-Restriction Enzymes-Cutting and Joining Reactions-Vectors-Selection of Recombinants- Agarose Gel Electrophoresis-Southern Blotting- Hybridization-Autoradiography-PCR- Native Page- SDS-Page-2D Gel Electrophoresis- Western Blotting.

UNIT II **(12 hrs)**

Constructions of DNA Libraries- Vectors Used In the Construction of CDNA and Genomic DNA Libraries- Chromosome Walking- Positive Selection and Subtractive Hybridization- Preparation Of (BAC/YAC Library).

UNIT III **(12 hrs)**

Genome Sequencing and Transcriptomics- Sanger's Sequencing, Whole Genome Shot gun Sequencing- Comparative Genome Sequencing- Transcriptome Analysis- DNA Microarray- Expression of Recombinant Proteins.

UNIT IV **(12 hrs)**

Protein Engineering & Pharmaceutical Products- Site Directed Mutagenesis- Protein Analysis- Therapeutic Protein- Vaccines.

UNIT V **(12 hrs)**

Applications of Gene Cloning- creating Transgenic Animals and Plants- Reporter Genes- Animal Cloning, Gene expression in plants- Biosafety and Bioethics.

TEXTBOOKS

1. Sambrook J and Green M.R. *Molecular Cloning: A Laboratory Manual*. Cold Spring Harbor Laboratory Press, 2012.
2. T.A.Brown. Gene Cloning and Introduction, 1995

REFERENCES

Books

1. Bruce E. Rittmann and Perry L. McCarty. *Environmental Biotechnology: Principles and applications*. McGraw Hill, Newyork, 2001.
2. Ahmed N, Qureshi, F.M. and Khan, O.Y. *Industrial and Environmental Biotechnology*. Horizon Press, 2001.

Web Sources

1. https://www.youtube.com/watch?v=-bEjgxX81_U&pp=ygUTZ2VuZSBjbG9uaW5nIG1ldGhvZA%3D%3D
2. https://www.youtube.com/watch?v=KTstRrDTmWI&pp=ygUKc2VxdWVuY2luZw%3D%3D
3. https://www.youtube.com/watch?v=6aQbxWKgHEg&pp=ygUkcHJvdGVpbiBlbmdpbmVlcmluZyBpbiBiaW90ZWNobm9sb2d5

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
CORE CORSE -IX: BIOINFORMATICS (23PBTC31)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS : 100**

Course Objectives

- To know the importance of the protein and nucleotide databases.
- To understand the basic concept on sequence alignment.
- To provide the basic knowledge on finding genes in prokaryotic and eukaryotic genomes.
- To emphasize the knowledge on molecular visualization tools.
- To enable the students to know the medical applications of bioinformatics tools.

Course Outcomes (CO)

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

CO1[K2]:demonstrate the basic concepts of bioinformatics and its significance in biological data analysis
CO2[K3]: find the role of internet in bioinformatics
CO3[K4]: analyze the regulatory sequences in both prokaryotes and eukaryotes
CO4[K5]: evaluate different types of biological databases
CO5[K6]: construct the methods involved in computer aided drug designing

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	1	1	1	1
CO2[K3]	3	2	3	2	2	2	2
CO3[K4]	2	3	3	2	1	1	1
CO4[K5]	2	2	2	1	1	1	-
CO5[K6]	2	2	2	2	1	1	1
Weightage of the course	12	11	12	8	6	6	5
Weighted percentage of Course contribution to POs	3.65	3.91	4.23	3.6	3.95	3.13	2.67

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(18 hrs)**

Database concepts - Introduction to internet and its application - Introduction to bioinformatics, Protein and nucleotide databases, Information retrieval from biological databases, Sequence alignment and database searching-similarity searches using BLAST and FASTA. Artificial Intelligence: Introduction to biological neural network, motivation for artificial neural network (ANN), Big data analysis - DNA/RNA/protein sequence or structure data, gene expression data, protein-protein interaction (PPI) data, pathway data and gene ontology (GO) data.

UNIT II **(18 hrs)**

Sequence alignment basics, match, mismatch, similarity, scoring an alignment, gap penalty, protein vs DNA alignments, Dot-matrix alignment, pairwise alignment. Global and local alignment algorithms, multiple sequence alignment-progressive alignment and Iterative alignment algorithms, consensus sequence, patterns and profiles, Database searching: Pairwise alignment based rigorous algorithm (Smith and Waterman) and Heuristic algorithms (FASTA and Blast). Multiple sequence alignment based database searching. PSI- Blast, PAM and Blosum matrices.

UNIT III **(18 hrs)**

Bioinformatics for genome sequencing, EST Clustering and analyses, Finding genes in prokaryotic and eukaryotic genomes, Regulatory sequence analysis, Bioinformatics for Genome maps and markers, Bioinformatics for understanding Genome variation, Protein structure-X-ray crystallography, The protein databank and the PDBSum-SCOP, CATH, DALI and HSSP ;Visualization of molecular structures-RasMol and Pymol; Protein secondary structure prediction, Fold Recognition; Transmembrane topology prediction.

UNIT IV **(18 hrs)**

Molecular visualization tools. Rasmol, Chime and Spdb viewer. Structure analysis tools. VAST and DALI, Structural biology - Homology modeling, Bioinformatics for micro array designing and transcriptional profiling, Bioinformatics for metabolic reconstruction, Bioinformatics for phylogenetic analysis.

UNIT V **(18 hrs)**

Medical application of Bioinformatics. Disease genes, Drug Discovery. History. Steps in drug discovery. Target Identification. Target Validation. QSAR. Lead Identification. Preclinical pharmacology and toxicology. ADME. Drug designing. Rational drug design. Computer aided drug design. Ligand based approach. Target based approach.

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

REFERENCES

Books

1. Dassanayake S. Ranil, Y.I. N. Silva Gunawarden. *Genomic and Proteomic Techniques*, Narosa Publishing House Pvt. Ltd, New Delhi, 2011.
2. Thiagarajan B, Rajalakshmi.P.A. *Computational Biology*, MJP publishers, Chennai, 2009.
3. Bosu Orpita, Simminder Kaur Thukral, 2007. *Bioinformatics Databases, Tools and Algorithms*, Oxford University press, New Delhi, 2007.
4. Rastogi. S. C, Mendiratta. N, Rastogi. P. *Bioinformatics methods and applications*, Prentice-Hall of India private limited, New Delhi, 2004.
5. Lohar s. Prakash. *Bioinformatics*, MJP Publishers, Chennai. 2009.

Web Sources

1. https://youtu.be/5wZD_svbT2w
2. https://youtu.be/NDDn-iUgUCE
3. https://youtu.be/RzC-V67z5LA

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
CORE COURSE -X: IMMUNOLOGY (23PBTC32)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS : 100**

Course Objectives

- To enable the students to learn the functions of immune system and types of immunity.
- To provide the basic knowledge on biology of antigen structure and function of different immunoglobulins.
- To enable the students to understand the role different vaccines, transplantation immunology and tumor immunology.
- To understand the basic concept of macrophages activation and cell mediated immunity, hyper sensitivity reaction and their types.
- To enrich the students' knowledge with respect to the various immunological techniques and their applications.

Course Outcomes (CO)

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

CO1[K2]: illustrate the various mechanisms that regulate the immune responses

CO2[K3]: find the key events and cellular players in antigen presentation

CO3[K4]: analyze the concepts of cellular and molecular processes that represents the human immune system.

CO4[K5]: evaluate the process of immunological regulation and tolerance at a Cellular and molecular level

CO5[K6]: Compile the concepts of immunological principles and diagnosis

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	1	-	1	2
CO2[K3]	3	3	3	2	-	1	2
CO3[K4]	2	3	3	1	-	-	1
CO4[K5]	2	3	2	1	2	1	1
CO5[K6]	2	2	2	2	1	1	1
Weightage of the course	12	13	12	7	3	4	7
Weighted percentage of Course contribution to POs	3.65	4.63	4.23	3.15	1.97	2.08	3.74

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

UNIT I **(18 hrs)**

History and overview of the immune system. Types of immunity - innate, acquired, passive and active, self vs non-self-discrimination. Physiology of immune response: HI and CMI specificity and memory. Cells and organs of the immune system. Lymphoid tissue, origin and development. Hematopoiesis and differentiation of lymphocytes

UNIT II **(18 hrs)**

Lymphocyte-sub-populations of mouse and man. APC cells, lymphokines, Phagocytic cells, macrophage, dendritic cells, K and NK Cells. Nature and biology of antigens, epitopes, haptens, adjuvents. Immunoglobulins- structure, distribution and function. Immunoglobulin super family Isotypic, Allotypic and Idiotypic variants, generation of antibody diversity.

UNIT III **(18 hrs)**

Monoclonal antibody production and its applications. Types of vaccine and vaccination schedule. Role of MHC antigens in immune responses, Structure and function of class I and class II MHC molecules. MHC antigens in transplantation and HLA tissue typing. Transplantation immunology- immunological basis of graft rejection, cinical transplantation and Immunosuppressive therapy. Tumour Immunology - Tumour antigen, Immune response to tumours.

UNIT IV **(18 hrs)**

Effector mechanisms in immunity - macrophage activation, cell mediated cytotoxicity, cytotoxicity assay. Hypersensitivity reactions and types. The complement system, mode of activation, classical and alternate pathway, biological functions of C proteins.

UNIT V **(18 hrs)**

Immunotechniques- Principle and Applications: Immuno diffusion, Immuno fluorescence, Insitu localization technique - FISH and GISH. RIA and ELISA, FACS, Western blot, ELISPOT assay. Agglutination tests. VDRL test. Purification of antibodies, Quantitation of immunoglobulin by RID, EID and nephelometry, CMI techniques and Immunotherapy.

TEXTBOOKS

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

REFERENCES

Books

1. Kannan. I. *Immunology*. MJP Publishers, Chennai, 2010.
2. Abbas, A. K., A. H. L. Lichtman and S. Pillai. *Cellular and MolecularImm*unology. 6th Edition. Saunders Elsevier Publications, Philadelphia, 2010.
3. Seemi Garhat Bashir. *Text Book of Immunology*, PHI Learning Pvt. Ltd. New Delhi, 2009.
4. Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby, 2006. Kuby Immunology, 6th edition, W. H. Freeman & Company. 2009.
5. Nandini Shetty, *Immunology: introductory textbook - I*. New Age International, New Delhi, 1996.

Web Sources

1. www.library.csusm.edu/course guides/biology
2. www.immunologylink.com
3. http://www.wiley.com/college/bio/karp12791/weblinks.html

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
CORE COURSE - XI: BIOPROCESS TECHNOLOGY (23PBTC33)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS :100**

Course Objectives

- To enable the students, to learn fermentation process and general requirements for fermentation.
- To make the students to learn types of bioreactors and design of bioreactor.
- To provide the knowledge on extraction of bioproducts.
- To import knowledge on down stream processing.
- To provide knowledge about production of primary and secondary metabolites.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate the general requirement for fermentation process
CO2[K3]: discuss the production process of insulin
CO3[K4]: identify the principle behind the aqueous two phase extraction
CO4[K5]: assess the role of different dryers in down stream processing
CO5[K6]: compile the methods involved the effluent treatment

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	3	3	2	3	2
CO2[K3]	3	3	3	3	2	3	1
CO3[K4]	3	3	3	2	2	3	1
CO4[K5]	3	3	3	2	2	3	3
CO5[K6]	3	3	3	2	2	3	3
Weightage of the course	15	15	15	12	10	15	10
Weighted percentage of Course contribution to POs	4.56	5.34	5.28	5.41	6.58	7.81	5.35

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(18 hrs)**

Introduction to fermentation. General requirements of fermentation. Microbial growth kinetics of batch and continuous culture. Solid substrate, slurry fermentation and its application. Microbial cell culture. Immobilization of cells and enzymes. Food Safety: Introduction to food safety aspects and food related hazards – HACCP and ISO.

UNIT II **(18 hrs)**

Types of bioreactors: Submerged reactors, surface reactors, mechanically agitated reactors, non-mechanically agitated reactors. Design of fermenters, body construction. Production of citric acid, penicillin and insulin. Isolation and improvement of Industrially important Micro-organisms, Media for Industrial fermentation and Sterilization.

UNIT III **(18 hrs)**

Introduction to bioproducts and bioseparation. Primary recovery process: Cell disruption methods. Cell lysis and Flocculation: Osmotic and mechanical methods of lysis. Flocculation by electrolysis; polymorphic flocculation. Precipitation methods. Filtration: Principles, Conventional, Crossflow filtration. Sedimentation: Principles, Sedimentation coefficients. Extraction Principles, Liquid liquid extraction, aqueous two phase extraction, supercritical fluid extraction.

UNIT IV **(18 hrs)**

Down Stream Processing: Chromatography Techniques, Membrane separation, ultrafiltration. Drying, Principles and operation of vacuum dryer, shelf dryer, rotary dryer, freezer and spray dryer. Crystallization and Whole broth processing.

UNIT V **(18 hrs)**

Aerobic and anaerobic fermentation processes and their application in the field of biotechnology industry. Production of commercially important primary and secondary metabolites, Effluent Treatment and Fermentation Economics.

TEXTBOOKS

1. Kalichelvan P. T, Arul Pandi I. *Bioprocess Technology*. Chennai: MJP Publishers, 2019.
2. Sathyanarayana U. *Biotechnology*. Kolkata: Books and allied Pvt. Ltd, 2020.
3. Doran. *Bioprocess Engineering Principles*. Academic Press, 2012.

REFERENCES

Books

1. Min-tzeLiong. *Bioprocess Sciences and Technology*. Nova Science Pub Inc, 2011.
2. Michael L. Shuler, Fikret Kargi. Bioprocess Engineering. PHI publishers. 2003.

3. P. A. Belter, E. L. Cursler, and W.S.Hu. *Bioseparation: Downstream processing for Biotechnology*, 2003.
4. R.G. Harrison, P.Todd, SR.Rudge and D.P. Petrides. *Bioseparation science and engineering*. Oxford Press, 2003.

Web Sources

1. www.wildfermentation.com/John Schollar and Benedikte Watmore, Practical Fermentation-a technical guide
2. web.mit.edu/professional/short.../fermentation_technology.html

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
CORE COURSE - XII: PRACTICAL : BIOINFORMATICS, IMMUNOLOGY AND BIOPROCESS TECHNOLOGY (23PBTC3P)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 4 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS : 100**

Course Objectives

- To expedit**e** the students to understand the various bioinformatics tools.
- To enrich the student knowledge with respect to the characterization of gene and protein sequences.
- To provide basic knowledge on the identification and enumeration of different immune cells.
- To enable the students to learn the immunological techniques.
- To create the awareness on fermentation technique and media preparation and production of various bioproducts.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: demonstrate the methods involved in the preparation of serum and plasma
CO2[K3]: determination of lymphocyte viability by trypan blue method
CO3[K4]: distinguish the methods involved in the isolation of plasma and serum
CO4[K5]: assess the function of different parts of a bioreactor
CO5[K6]: construct the method for the production of penicillin

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	3	3	2	2	3	3
CO2[K3]	3	3	3	2	2	3	3
CO3[K4]	3	3	3	2	2	3	3
CO4[K5]	3	3	3	2	2	3	3
CO5[K6]	3	3	3	2	2	3	3
Weightage of the course	15	15	15	10	10	15	15
Weighted percentage of Course contribution to POs	4.56	5.34	5.28	4.5	6.58	7.81	8.02

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT A

(A) Bioinformatics-practical

1. Sequence retrieval from Genbank
2. Sequence retrieval from Uniprot.
3. Sequence identity search- Sequence similarity search using BLAST
4. Sequence similarity search using FASTA
5. Sequence similarity search using PSI BLAST
6. Sequence similarity search using PHI- BLAST.
7. Prediction of signal sequence using SignalP online tool
8. Pattern Search (Domains & Motifs) using Pfam
9. ORF gene Search - Genscan
10. Sequence translation using ExPASy translate tool
11. Characterization of retrieved protein sequence by ProtParam tool.
12. Pair-wise global sequence alignment using EBI-EMBOSS Needleman Wunsch tool
13. Pair-wise local sequence alignment using EBI-EMBOSS Smith Waterman tool

UNIT B

(B) Immunology - practical

1. Identification of various immune cells from human peripheral blood.
2. Lymphocyte separation and identification
3. Determination of lymphocyte viability by trypan blue method
4. WBC counting
5. Preparation of serum and plasma
6. Electrophoretic profile of human serum in native PAGE
7. Preparation of cellular antigen – human RBC
8. Preparation of antigen-adjuvent mixture for production of polyclonal antibody
9. Isolation of IgG molecule from serum
10. Immunodiagnostics: CRP
11. Immunodiagnostics: ASO
12. Immunodiagnostics: Widal
13. Immunodiagnostics: RA
14. Immunodiagnostics: Blood grouping and typing
15. Immunodiagnostics: hCG
16. ELISA
17. Radial Immunodiffusion
18. Ouchterlony Immunodiffusion
19. Immunoelectrophoresis
20. Rocket electrophoresis
21. Counter current immunoelectrophoresis.
22. Bioassays for cytokines
23. Radioimmunoassays (Demonstration)

UNIT C

(C) Bioprocess Technology

1. Parts and design of fermenter
2. Solid state fermentation
3. Submerged fermentation
4. Foaming and antifoaming agents

5. Media preparation and sterilization
6. Isolation of industrially important microorganisms for microbial processes.
7. Conservation of Bacteria by Lyophilization.
8. Production and estimation of protease
9. Production and estimation of amylase.
10. Production of wine using grapes
11. Production of penicillin
12. Determination of penicillin activity
13. Citric acid production
14. Use of alginate for cell immobilization.
15. Media standardization (C:N ratio) for maximum biomass production of an industrially important microorganism.
16. Cell disruption (Sonication)
17. Aqueous Two Phase Extraction of enzymes

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.
3. *Christina Marshall. Recent Advance in Bioinformatics*.Syrawood Publishing House, 2019.
4. Bhatia A. *Manual of Practical Immunology*. Palani Paramount Publication, 2000.
5. Sambrook J and Green M.R. *Molecular Cloning: A Laboratory Manual*. Cold Spring Harbor Laboratory Press, 2012.

REFERENCES

Books

1. Sambrook J and Green M.R. *Molecular Cloning: A Laboratory Manual*. Cold Spring Harbor Laboratory Press, 2012.
2. Sittampalam G.S *et al*. *Assay Guidance Manual*. Eli Lilly and Company, 2017.
3. Bhatia A. *Manual of Practical Immunology*. Palani Paramount Publication, 2000.
4. L. Fletcher, E. Goss, P. Phelps, A. Wheeler, S.O. Grady. *Introduction to biotechnology – a laboratory manual*, 2011.
5. Sittampalam G. S*et al*. *Assay Guidance Manual*. Eli Lilly and Company, 2017.
6. R.I. Freshney. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications.* John Wiley & Sons, Sixth Edition, 2010.
7. S. Harisha. *Biotechnology procedures and experiments hand book*. Infinity Science Press, 2007.

Web Sources

1. https://nptel.ac.in/content/storage2/courses/102103038/download/module5.pdf
2. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod2.pdf
3. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod4.pdf
4. https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod3.pdf
5. https://nptel.ac.in/content/storage2/courses/102101040/downloads/Handouts/Lec-34.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
ELECTIVE COURSE : GENERIC/DISCIPLINE SPECIFIC- V:
NANO BIOTECHNOLOGY (23PBTO31)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 3 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 45 hrs **MAX.MARKS : 100**

Course Outcomes

- To provide the knowledge on nanotechnology and types of nanomaterials.
- To emphasize the knowledge on preparation of nanomaterials.
- To enable the students to learn the application of nanomaterials in different field.
- To create awareness on the importance of nanomaterials in the medical field.
- To enable the students to gain the knowledge in the nanotoxicology and risk assessment and safety regulation of nanoparticles.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: classify the different types of nanomaterials
CO2[K3]: find the role of nanomaterial in drug delivery process
CO3[K4]: analyze the function of nanomaterial in bone tissue grafting
CO4[K5]: evaluate the role of nanomaterial in cancer treatment
CO5[K6]: compile the impact of nanomaterial in the mammalian system

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	2	2	-	1	1
CO2[K3]	2	2	2	3	2	1	1
CO3[K4]	2	2	2	3	2	2	1
CO4[K5]	3	2	2	3	2	1	1
CO5[K6]	2	2	2	3	1	1	1
Weightage of the course	11	10	10	14	7	6	5
Weighted percentage of Course contribution to POs	3.34	3.56	3.52	6.31	4.61	3.13	2.67

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(9 hrs)**

Introduction to Nanotechnology- Scientific revolution, Feynman's vision, Classification of nanobiomaterials -Types of nanomaterials – nanoparticles, nanotubes, nanowires, Nanofibers, Size deoendent variation in the properties of Nanomaterials, Nature's Nanophenomena.

UNIT II **(9 hrs)**

Preparation of Nanomaterials, Top down and bottom up approaches, Biosynthesis, Nanobiomaterials- Polymer, Ceramic, Metal based Nanobiomaterials, Carbon based Nanomaterials, DNA based Nanostructures, Protein based Nanostructures, Quantum dots, Magnetic Nanoparticles, Nanofibres, Hydrogels, Films and Scaffolds.

UNIT III **(9 hrs)**

Application of Nanomaterials in Bone substitutes and Dentistry, Food and Cosmetic applications, Bio-sensors and Lab-on-a-chip, Bio-devices and implantable devices, Bioremediation, Nanomaterials for anti-microbial coating – medical implants and paints, Application of Nanotechnology in textile industry.

UNIT IV **(9 hrs)**

Nanomaterials for diagnosis and therapy, Implications of drug delivery, Nano-carriers for application in medicine, polymeric nanoparticles as drug carriers, Drug release mechanism, Targeted Drug Delivery using nanocarriers, Nanoparticle technologies for cancer therapy and diagnosis, Point of Care and Personalized medicine, Magnetic nanoparticles for imaging and Hyperthermia.

UNIT V **(9 hrs)**

Nanotoxicology, Portals of Entry of the nanoparticles into the Human Body, Bio-toxicity of Nanoparticles, Nanoparticles in Mammalian systems and Health threats, Biological response and cellular interaction of implant materials and scaffolds, Risk assessment and Safety Regulation of nanoparticles.

TEXTBOOKS

1. Dupas, C, Houdy, P., Lahmani, M. *Nanoscience: —Nanotechnologies and Nanophysic*s, Springer-Verlag Berlin Heidelberg, 2007.
2. Sharon, M and Sharon, M. *Bio-Nanotechnology- Concepts and Applications*, CRC Press. 2012.
3. Atkinson, W.I. *Nanotechnology*. Jaico Book House, New Delhi, 2011.
4. Nalwa, H. S. *Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology*. American Scientific Publ, 2005.
5. Lindsay, S.M. *Introduction to Nanoscience*. Oxford universal Press, First Edition, 2011.

REFERENCES

Books

1. S .Shanmugam, *Nanotechnology.* Mjp publication, 2011.
2. T. Laurencin, Lakshmi S. Nair. *Nanotechnology and tissue engineering*, CRC press. 2012.
3. Oded Shoseyov (Editor), Ilan Levy. *Nano Bio Technology: Bio Inspired Devices and Materials of the Future*, Humana Press, 2010.
4. Chad A. Mirkin and Christof M. Niemeyer. *Nanobiotechnology II*: *More Concepts and Applications*, Wiley-VCH, 2007.
5. Challa S.S.R.Kumar (Ed). *Biologicals and pharmaceutical nanomaterials*, Wiley-VCH Verlag Gmbh & Co, KgaA, 2006.

Web Source

1. http://www.zyvex.com/nanowww.fda.gov/nanotechnology/www.nature.com/nnano/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC - V: MOLECULAR DEVELOPMENTAL BIOLOGY (23PBTO32)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 3 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 45 hrs **MAX.MARKS : 100**

Course Objectives

- To enable the students to learn the structure and function of oocytes and sperm.
- To enrich the students' knowledge on the fertilization process.
- To enable the students to gain the knowledge of xenopus, chick and mammals.
- To provide the basic knowledge in the vertebrate development.
- To emphasize the knowledge in developmental disorders.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate gametogenesis process
CO2[K3]: write about the fertilization process in animals
CO3[K4]: analyze the morphogenetic movements in mammals
CO4[K5]: evaluate the mechanism of vertebrate eye development
CO5[K6]: predict the symptoms of the developmental disorders of Spina bifida

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	2	2	-	1	1
CO2[K3]	2	2	2	3	2	1	1
CO3[K4]	2	2	2	3	2	2	1
CO4[K5]	3	2	2	3	2	1	1
CO5[K6]	2	2	2	3	1	1	1
Weightage of the course	11	10	10	14	7	6	5
Weighted percentage of Course contribution to POs	3.34	3.56	3.52	6.31	4.61	3.13	2.67

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(9 hrs)**

Definition and scope of developmental biology. Gametogenesis - Spermatogenesis and Oogenesis. Structure of Sperm and oocyte. Instructive and permissive interactions, competence, epithelial - mesenchymal interactions. Important signaling pathways in vertebrate development.

UNIT II **(9 hrs)**

Fertilization - Definition, mechanism of fertilization in mammal & sea urchin. Types of fertilization. Nieuwkoop center, Molecular role of organizer.

UNIT III **(9 hrs)**

Cleavage in Xenopus, Chick and mammals, Regulation of cleavage cycle. Morphogenetic movements, Gastrulation in Xenopus, Chick and mammals. Fate Maps.

UNIT IV **(9 hrs)**

Vertebrate Development: Formation of the neural tube, myogenesis, and hematopoiesis. Mechanism of vertebrate eye development.

UNIT V **(9 hrs)**

Drosophila Maternal effect genes, induction at single cell level - differentiation of photoreceptors in ommatidia. Developmental disorders Spina bifida, Anenecephaly, and craniorachischis, Cyclopia, Thanotrophic dysplasia.

TEXTBOOKS

1. Karp, G. *Cell and Molecular Biology: Concepts and Experiments.6th edition*. John Wiley & Sons, 2010.
2. Chawla, H. *Introduction to Biotechnology*. 2nd edn. Oxford IBH, ISBN: 978-81-204- 1732-8, 2009.
3. Roy, S.C and Kumar, K.D.C. *Cell Biology*, New Central Book Agency, Calcutta, 1997.

REFERENCES

Books

1. Scott F.Gilbert. *Developmental Biology, 9th edition*, Sinauer Associates Inc, 2010.
2. Subramoniam, T. *Developmental Biology. 1st edition*. Narosa publications, 2002.
3. Richard M. Twynman, *Developmental Biology. (2 nd edition)*. Viva Publications, New Delhi, 2001.

Web Source

1. sackler.tufts.edu/.../Cell-Molecular-and-Developmental-Biology www.devbio.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - III
NON MAJOR ELECTIVE COURSE –II: TISSUE ENGINEERING (23PBTN31)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 3	**INT.MARKS : 25**
CREDITS : 2	**EXT. MARKS : 75**
DURATION : 45 hrs	**MAX.MARKS :100**

Course Objectives

- To enable the students to understand the basics of tissue engineering.
- To enrich the students' knowledge on tissue culture methods.
- To enable the students, gain the knowledge of the use of tissue in medical field.
- To provide the basic knowledge in the renal replacement devices.
- To emphasize the knowledge in bone regeneration through cellular engineering.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: illustrate about morphogenesis
CO2[K3]: write about the tissue assembly in microgravity
CO3[K4]: analyze the methods involved in the transplantation of engineered cells
CO4[K5]: evaluate the substitutes of red blood cell
CO5[K6]: assemble the steps of skin tissue engineering

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	2	2	1	-	1
CO2[K3]	3	2	2	3	1	1	-
CO3[K3]	2	2	2	3	-	1	2
CO4[K4]	2	2	2	3	-	-	3
CO5[K5]	2	2	1	3	-	1	2
Weightage of the course	11	10	9	14	2	3	8
Weighted percentage of Course contribution to POs	3.34	3.56	3.17	6.31	1.32	1.56	4.28

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(9 hrs)**

Basic biology of tissue engineering: The basis of growth and differentiation-morphogenesis and tissue engineering.

UNIT II **(9 hrs)**

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

UNIT III **(9 hrs)**

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

UNIT IV **(9 hrs)**

Bioartificial pancrease, Hepatassist liver support system, Artificial Womb, Heamatopoietic system: Red blood cell substitutes, Renal replacement devices.

UNIT V **(9 hrs)**

Structural tissue engineering-Bone regeneration through cellular engineering, Skin tissue engineering, Brain implants-Neural stem cells, Periodontal applications.

TEXTBOOKS

1. Sylvia, S. Mader. *Human Biology*, *Twelfth edition*, Mc Graw Hill, USA, 2011
2. Robert P. Lanaza, Robert Langer and Joseph Vacanti. *Principles of Tissue Engineering*. Third edition Academic Press, 2007.
3. Micklem.H.S., Loutit John.F. *Tissue grafting and radiation,* Academic Press, New York.. 2004.

REFERENCES

Books

1. Penso.G., Balducci.D. *Tissue cultures in biological research*. Elsevier, Amsterdam 2004.
2. Cecie Starr. *Biology, Third edition* , Wordsworth, America, 1996.

Web source

1. www.nuigalway.ie/anatomy/tissue_engineering.htm

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER – III
INTERNSHIP/INDUSTRIAL TRAINING (23PBTJ31)
(From 2023-2024 Batch onwards)

HOURS/WEEK : **INT.MARKS : 100**
CREDITS : 2 **MAX.MARKS : 100**
DURATION :

Course Objectives:

- To learn and develop new skills relevant to the field of study or career interests.
- To understand different departments, roles, and functions within the organization 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 will be able to

CO1[K2]: 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]: analyze 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	-	1	1	1	2
CO2[K3]	2	2	-	1	-	1	2
CO3[K4]	2	2	-	2	-	1	1
CO4[K5]	-	2	1	-	-	1	1
CO5[K6]	1	2	3	3	-	1	2
Weightage of the course	8	9	4	07	01	05	08
Weighted percentage of Course contribution to POs	2.43	3.2	1.41	3.15	0.66	2.6	4.28

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

Rules and Regulations

1. Each Student has to undergo 25 days institutional/industry based training during the second semester summer vacation.
2. Internships could be undertaken in different media organizations, industries and educational institutions 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.
6. The viva voce board shall consist of the Head of the Department and the internal Examiner (Senior Faculty member)
7. The training programme shall be evaluated as per the following pattern

Internal (25 Marks)		**External (75 Marks)**	
Training Review	: 15 Marks	Training Report	: 25 Marks
Daily Log Report	: 5 Marks	Viva Voce	: 50 Marks
PPT Presentation	: 5 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

<u>List of Chapters</u>

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
PG Programme - M.Sc. Biotechnology
SEMESTER - IV
CORE COURSE-XIII –: RESEARCH METHODOLOGY (23PBTC41)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 5 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS : 100**

Course Objectives

- To make the students understand the bases for research.
- To enable the students know about research proposal and dissertation writing.
- To make the students learn the statistical application in research.
- To make the students to know about office tools used in research.
- To enable the students to know about search engines.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: classify the types of research
CO2[K3]: identify the components of research report
CO3[K4]: analyze the statistical tools used in research
CO4[K5]: assess the application, features and functions MS EXCEL in research
CO5[K6]: compile the applications of google search engine

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	3	2	2	3	3
CO2[K3]	3	1	1	2	1	3	2
CO3[K4]	3	3	3	2	1	3	2
CO4[K5]	3	3	3	2	1	3	2
CO5[K6]	3	3	3	2	1	3	3
Weightage of the course	15	11	13	10	6	15	12
Weighted percentage of Course contribution to POs	4.56	3.91	4.58	4.5	3.95	7.81	6.42

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(18 hrs)**

Research Methodology - An Introduction: Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Importance of knowing how research is done, Research Process, Criteria of good research. Defining the Research Problem; Research Design; Sampling Design; Methods of Data Collection; Processing and Analysis of Data; Sampling Fundamentals.

UNIT II **(18 hrs)**

Review of literature, Writing the Research Report (Thesis and publications): Components of research report - Title, Authors, Addresses, Abstract, Keywords, Introduction, Materials and Methods, Results, Discussion, Summary, Acknowledgements and Bibliography.

UNIT III **(18 hrs)**

Standard Deviation- T test. Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, Model adequacy checking. Two factor Factorial Design, Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two factor factorial design.

UNIT IV **(18 hrs)**

Spreadsheet Tool: Introduction to spreadsheet application, features and functions, Using formulas and functions, Data storing, Features for Statistical data analysis, Generating charts/ graph and other features. Presentation Tool: Introduction to presentation tool, features and functions, Creating presentation, Customizing presentation, Showing presentation. Tools used may be Microsoft Power Point, Open Office or similar tool.

UNIT V **(18 hrs)**

Web Search: Introduction to Internet, Use of Internet and WWW, Using search engine like Google, Yahoo, Pubmed, Science direct, Scopus etc, and Using advanced search techniques.

TEXT BOOKS

1. Holmes, Debbie, Peter Moody, Diana Dine, and Laurence Trueman. *Research methods for the biosciences*. Oxford university press, 2017.
2. Kothari C.K. *Research Methodology: Methods and Techniques*. New Age International, 2013.
3. Krishnaswamy K.N, Mathiranjan M and Sivakumar A.I. *Management Research Methodology - Integration of Principles, Methods and Techniques.* Pearson Education, 2011.

REFERENCES

Books

1. Montgomery, Douglas C. *Design and Analysis of Experiments.* Wiley India, 2007.
2. Montgomery, Douglas C. & Runger, George C. *Applied Statistics & Probability for Engineers (Wiley India)*, 2007.
3. Kothari C.K. *Research Methodology- Methods and Techniques*. New Age International, New Delhi, 2004.
4. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjan M. *Management Research Methodology; Integration of Principles, Methods and Techniques*. Pearson Education, New Delhi, 2006.

Web Source

1. www.ask.com/Methodology+Researchwww.qmethod.org/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - IV
CORE COURSE-XIV –: BIOSTATISTICS (23PBTC42)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 6 **INT.MARKS : 25**
CREDITS : 5 **EXT. MARKS : 75**
DURATION : 90 hrs **MAX.MARKS : 100**

Course Objectives

- To understand the major methods of collection and presentation of data.
- To provide knowledge on methods of analysis of variance.
- To enlighten the students about the methods of setting hypothesis and calculation of errors.
- To update the knowledge on test of significance for large and small samples.
- To assess and appraise the role of novel microbes in environment and integrate them in specific innovative approaches.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: explain the different types of sampling methods
CO2[K3]: find the relation between correlation and regression
CO3[K4]: analyze the characteristics of frequency curve
CO4[K5]: evaluate the application of chi-square test
CO5[K6]: construct the steps involved in the ANOVA

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	3	2	2	3	2
CO2[K3]	3	1	1	2	1	3	2
CO3[K4]	3	3	3	2	1	3	1
CO4[K5]	3	3	3	2	1	3	1
CO5[K6]	3	3	3	2	1	3	1
Weightage of the course	15	11	13	10	6	15	7
Weighted percentage of Course contribution to Pos	4.56	3.91	4.58	4.5	3.95	7.81	3.74

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(18 hrs)**

Statistics – Scope –collection, classification, tabulation of Statistical Data – Diagrammatic representation – graphs – graph drawing – graph paper – plotted curve –Sampling method and standard errors –random sampling – use of random numbers –expectation of sample estimates – means – confidence limits – standard errors – variance. Measures of central tendency – measures of dispersion – skewness, kurtosis, moments.

UNIT II **(18 hrs)**

Correlation and regression – correlation table – coefficient of correlation – Z transformation – regression – relation between regression and correlation. Probability – Markov chains applications – Probability distributions – Binomial (Gaussian distribution) and negative binomial, compound and multinomial distributions – Poisson distribution.

UNIT III **(18 hrs)**

Normal distribution – graphic representation.– frequency curve and its characteristics –measures of central value, dispersion, coefficient of variation and methods of computation – Basis of Statistical Inference – Sampling Distribution – Standard error – Testing of hypothesis – Null Hypothesis –Type I and Type II errors.

UNIT IV **(18 hrs)**

Tests of significance for large and small samples based on Normal, t, z distributions with regard to mean, variance, proportions and correlation coefficient – chi-square test of goodness of fit – contingency tables – c2 test for independence of two attributes – Fisher and Behrens 'd' test – 2×2 table – testing heterogeneity – r X c table – chi-square test in genetic experiments – partition X 2 – Emerson's method.

UNIT V **(18 hrs)**

Tests of significance –t tests – F tests – Analysis of variance – one way classification – Two way classification, CRD, RBD, LSD. Spreadsheets – Data entry –mathematical functions – statistical function – Graphics display – printing spreadsheets – use as a database word processes – databases – statistical analysis packages graphics/presentation packages.

TEXTBOOKS

1. Milton,J.S. *Statistical methods in the Biological and Health Science, 2nd edition* ,Mc Graw Hill, 1992.
2. Sundar Rao P. S.S., Jesudian G. & Richard J *An Introduction to Biostatistic, 2nd edition*. Prestographik, Vellore, India, 1987.
3. Zar, J.H. *Bio Statistical Method*, Prentice Hall, International Edition, 1984.

REFERENCES

Books

1. Veer bala Rastogi. *Fundamentals of Biostatistics*. Ane books Pvt Ltd, Chennai, 2011
2. Rosner,B. "*Fundamentals of Biostatistics*", Duxbury Press, 2005
3. Warren,J; Gregory,E; Grant,R, "*Statistical Methods in Bioinformatics*",1st edition, Springer, 2004.

Web Sources

1. www.statsoft.com/textbook/ biosun1.harvard.edu/
2. www.bettycjung.net/Statsites.htm
3. www.ucl.ac.uk/statistics/biostatistics

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER- IV
CORE COURSE –XV: PROJECT WITH VIVA VOCE : (23PBTJ41)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 10 **INT. MARKS : 25**
CREDITS : 7 **EXT. MARKS : 75**
DURATION : 150 hrs **MAX. MARKS : 100**

Course Objectives:

- To familiarize the students with the objectives and stages in formulating a Research Project.
- To enable the learners to identify the different stages of Research Methodology.
- To adhere to the rules formulated in the latest edition of MLA hand book.
- To employ the accurate documentation in executing Research project.

Course Outcomes (CO)

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

CO1[K1]: identify the unexplored areas of research
CO2[K2]: outline the objectives in formulating a research paper
CO3[K3]: apply the latest rules of documentation to cite Print, Non-print and Web Publications in a research paper
CO4[K4]: analyze the stages in writing a thesis – collecting and evaluating Sources and drafting documentation
CO5[K6]: prepare a rightly documented research project with adequate discussion, interpretation and evaluation

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	3	2	1	2	1	1	1
CO2[K2]	3	2	2	2	1	1	1
CO3[K3]	3	2	2	2	1	1	1
CO4[K4]	3	2	3	3	1	1	1
CO5[K6]	2	2	3	3	2	1	1
Weightage of the course	14	10	11	12	6	5	5
Weighted percentage of Course contribution to POs	4.26	3.56	3.87	5.41	3.95	2.6	2.67

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

Guidelines

1. Students are required to submit a project at the end of the IV semester. The student will work under a faculty member as the research guide.
2. Depending on the interest of the students, project research areas will be chosen.
3. 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. Each student must either present paper or participate in Conferences/Seminars related to his Project work.
7. A draft of the final project report should be submitted to the Project Guide for review at least three weeks prior to the end of the semester.
8. The project report should be of minimum 40 pages (excluding bibliography &appendices)
9. Three copies of the final project report should be submitted.
10. The Head of the department and the Project Guide will evaluate the final Project Report.
11. The viva voce board shall consist of the External Examiner, the Head of the Department and the Internal Examiner (Research Project Guide)

The following rubrics will be taken into account for the evaluation of Project work and viva-voce:

Internal Assessment (25 Marks)		**External Examination (75 Marks)**	
Project Report & Review	: 15 Marks	Project Report	: 25 Marks
PowerPoint Presentation	: 5 Marks	Viva Voce	: 50 Marks
Participation/Publications in Conferences or Seminars	: 5 Marks		

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - IV
ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC- VI : STEM CELL BIOLOGY(23PBTO41)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS : 100**

Course Objectives

- To understand the major discoveries related to stem cell biology.
- To provide knowledge about stem cell niche and functions.
- To enlighten the students on stem cell isolation and culture techniques.
- To update the students' knowledge on stem cell cycle.
- To know the importance of embryonic stem cells.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: classify the types of stem cells
CO2[K3]: Identify the characters of drosophila germ line stem cells
CO3[K4]: illustrate the stem cell culture techniques
CO4[K5]: evaluate the role of LIF pathway in cell cycle control
CO5[K6]: compile the applications of bone marrow and stem cells

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	1	1	2	1	1	1
CO2[K3]	3	2	1	1	1	1	2
CO3[K4]	2	2	3	2	1	3	2
CO4[K5]	2	2	2	2	1	1	1
CO5[K6]	2	2	2	1	1	1	2
Weightage of the course	11	9	9	8	5	7	8
Weighted percentage of Course contribution to POs	3.34	3.2	3.17	3.6	3.29	3.65	4.28

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(12 hrs)**

Stem cells - Definition, Characterization, Pluripotency, Self-renewal and differentiation. Types of stem cells- Embryonic stem cells, Adult stem cells and mesenchymal stem Cells, Adipose stem cells.

UNIT II **(12 hrs)**

Stem cell niche, Niche specification - Drosophila germ line stem cells. Receptors, genes and markers of stem cells.

UNIT III **(12 hrs)**

Stem cell isolation and culture techniques. Characterization of stem cells.

UNIT IV **(12 hrs)**

Stem cell cycle. Chromatin modification and transcriptional regulation, chromatin modifying factors, Chromosomal inactivation. JAK -STAT pathway, Ras\Raf pathway, PI3K cell signaling, p53 check points, Role of LIF pathway in cell cycle control.

UNIT V **(12 hrs)**

Applications of Embryonic stem cells, Bone marrow stem cells, Adipose derived stem cells and Hematopoietic stem cells. Ethics in human stem cell research.

TEXTBOOKS

1. Munsie M. *The Australian Stem cell Handbook*. National Stem Cell Foundation of Australia, 2015.
2. Mary L, Clarke and Jonathan Frampton. *Stem cell biology and application.*Garland science, First edition, 2020.
3. Kursad Turksen. *Tissue specific stem cell Niche*. Springer softcover reprint of the original First edition, 2016.
4. Turksen K. *Embryonic Stem Cells-Methods and Protocols*. Vol.185, Humana press, 2012.

REFERENCES

Books

1. Quesenberry PJ, Stein GS, eds. *Stem Cell Biology and Gene Therapy*. Wiley, 1998.
2. Stewart Sell, *Stem Cells Handbook*. Humana Press; Totowa NJ, USA, 2003.

Web Sources

1. https://www.youtube.com/watch?v=evH0I7Coc54&pp=ygUJc3RlbSBjZWxs
2. https://www.youtube.com/watch?v=qpnP8lSjxa0&pp=ygURamFrIHN0YXQgcGF0aHdheSA%3D.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI DEPARTMENT OF BIOTECHNOLOGY

PG Programme - M.Sc. Biotechnology

SEMESTER - IV

ELECTIVE COURSE GENERIC/DISCIPLINE SPECIFIC- VI: BIOETHICS, BIOSAFETY, CLINICAL TRIALS, IPR AND ENTREPRENEURSHIP (23PBTO42)

(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS : 25**
CREDITS : 3 **EXT. MARKS : 75**
DURATION : 60 hrs **MAX.MARKS : 100**

Course Objectives

- To provide the basic knowledge on bioethics, GMO, genetically modified foods and food crops.
- To enable students to gain the knowledge in bioethics, cloning permissions and procedures.
- To expedite the students to understand the biosafety and biological risk assessment.
- To provide knowledge on intellectual property rights and patenting.
- To emphasize knowledge on geographical indications.

Course Outcomes (CO)

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

CO1[K2]: explain the GMO issues

CO2[K3]: find the applications of Human Genome Project

CO3[K4]: analyze the regulation of national and international guidelines of biosafety

CO4[K5]: evaluate the benefits of GM technology

CO5[K6]: construct the procedure for the registration of geographical indications

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	1	1	2	1	1	1
CO2[K3]	3	2	1	1	1	1	2
CO3[K4]	2	2	3	2	1	3	2
CO4[K5]	2	2	2	2	1	1	1
CO5[K 6]	2	2	2	1	1	1	2
Weightage of the course	11	9	9	8	5	7	8
Weighted percentage of Course contribution to POs	3.34	3.2	3.17	3.6	3.29	3.65	4.28

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' NoCorrelation)

UNIT I **(12 hrs)**

Introduction to bioethics- Need for bioethics in social and cultural issues. Bioethics & GMO's Issues and concerns pertaining to genetically modified foods & food crops, organisms and their possible health implications and mixing up with the gene-pool. Bioethics in medicine Protocols of ethical concerns related to prenatal diagnosis, gene therapy, organ transplantation, xenotransplantation, containment facilities for genetic engineering experiments, regulations on field experiments and release of GMO`s labeling of GM foods.

UNIT II **(12 hrs)**

Clinical trials – regulations. Bioethics and cloning permissions and procedures in animal cloning, human cloning, risks and hopes. Bioethics in research stem cell research, Human Genome Project, use of animals in research, human volunteers for clinical research, studies on ethnic races. Ethics in patient care, informed consent.

UNIT III **(12 hrs)**

Biosafety – Biological risk assessment. Biological agents and Hazard groups. Criteria in biological risk assessment. Guidelines for categorization of genetically modified plants for field test. Regulation, national and international guidelines of Biosafety, rDNA guidelines, Regulatory requirements for drugs and Biologics GLP. Biosafety levels. Safety equipment's and Biological Safety cabinets.

UNIT IV **(12 hrs)**

IPR: Introduction to intellectual property rights, patenting – factors for patentability – novelty, non-obviousness, marketability. Procedures for registration of patents. Copyright works, ownership, transfer and duration of copyright. Renewal and termination of copyright. Industrial designs - need for protection of industrial designs. Procedure for obtaining design protection. Infringement, right of goodwill, passing off. Trademarks - introduction to trademarks. Need for protection of trademarks. Classification of trademarks. Indian trademarks law. Procedural requirements of protection of trademarks.

UNIT V **(12 hrs)**

Geographical indications - indication of source and geographical indication. Procedure for registration, duration of protection and renewal. Infringement, penalties and remedies. Layout- designs of integrated circuits: conditions and procedure for registration. Duration and effect of registration protection of plant variety and plant breeders' rights in India. Protection of traditional knowledge, bioprospecting and biopiracy. India's new IP policy (2016), Govt. of India's steps to promote IPR. Career opportunities in IP. Entrepreneurship: definition and importance, characteristics and functions of an entrepreneur.

TEXTBOOKS

1. Dubey R .C .*A text Book of Advanced Biotechnology*. New Delhi: S. Chand and Co. Pvt. Ltd, 2014.
2. Deepa G, Shomini P. *IPR, Biosafety and Bioethics*. New Delhi: Dorling Kindersley Pvt. Ltd, 2013.
3. V.K.Ahuja. *Law related to Intellectual Property.* New Delhi: Nexis Publishers, 2017.

REFERENCES

Books

1. Sateesh MK. *Bioethics & Biosafety*. IK International publications, 2008.
2. Ajit Parulekar. *Indian Patent Law: Legal and Business Implications*. Sarita D'Souza Macmillan India publication, 2006.
3. Santaniello, V., Evenson, R.E., Zilberman, D. and Carlson, G.A. *Agriculture and Intellectual Property Rights.* University Press publication, 2003.
4. Ganguli P, *Intellectual Property Rights*, Tata Mcgraw Hill, 2001.
5. Ramesh Chandra. *Issues Of Intellectual Property Rights*, Isha Books, 2004.

Web Sources

1. www.uspto.gov/patft
2. patinfo.nic.in
3. www.ipindia.nic.in

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER - IV
SKILL ENHANCEMENT COURSE : PROFESSIONAL COMPETENCY COURSE
-:PREPARATORY COURSE FOR SET/NET IN LIFE SCIENCES (23PBTNS41)
(From 2023-2024 Batch onwards)

HOURS/WEEK : 4 **INT.MARKS :100**
CREDITS : 2 **MAX.MARKS :100**
DURATION : 60 hrs

Course Objectives

- To enable the students to know about composition, structure, and function of biomolecules.
- To enrich the students knowledge with respect to cell organelles and their function.
- To emphasize the knowledge of molecular process that occurs in the cell.
- To provide the basic knowledge on cell communication and cell signaling.
- To aware the students about morphogenesis and organogenesis in animals.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: outline structure of atoms, molecules, and chemical
CO2[K3]: find the structure and functions of cell membrane
CO3[K4]: analyze the process of post-translational modification of proteins
CO4[K5]: evaluate the role of B and T cells in immune system
CO5[K6]: compile the process of root and shoot development

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	2	1	2	-	1	3
CO2[K3]	2	1	2	2	-	1	3
CO3[K5]	2	2	2	1	1	-	3
CO4[K5]	2	2	2	1	1	1	3
CO5[K6]	2	2	2	2	1	1	3
Weightage of the course	10	9	9	8	3	4	15
Weighted percentage of Course contribution to POs	3.04	3.2	3.17	3.6	1.97	2.08	8.02

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

UNIT I **(12 hrs)**

Molecules and their interaction relevant to biology- Structure of atoms, molecules, and chemical bonds. Composition, structure, and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids, and vitamins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes Conformation of proteins (Ramachandran plot, secondary structure, domains, motif, and folds).Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).Stability of proteins and nucleic acids. Metabolism of carbohydrates, lipids, amino acids nucleotides, and vitamins.

UNIT II **(12 hrs)**

Cellular organization-Membrane structure and function: structure of model membrane, lipid bilayer, and membrane protein diffusion, osmosis; ion channels; active transport; membrane pumps; mechanism of sorting and regulation of intracellular transport; electrical properties of membranes. Structural organization and function of intracellular organelles (cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of the cytoskeleton and its role in motility). Organization of genes and chromosomes: Operon, unique and repetitive DNA, interrupted genes, gene families, the structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons). Cell division and the cell cycle: mitosis and meiosis, their regulation, steps in the cell cycle, regulation, and control of the cell cycle. Microbial Physiology: Growth yield and characteristics, strategies of cell division, stress response.

UNIT III **(12 hrs)**

Fundamental processes - DNA replication, repair, and recombination: Unit of replication, enzymes involved, replication origin and replication fork, the fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination. RNA synthesis and processing: Transcription factors and machinery, a formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure, and function of different types of RNA, RNA transport). Protein synthesis and processing: Ribosome, the formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proofreading, translational inhibitors, Post-translational modification of proteins). Control of gene expression at transcription and translation level: Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, the role of chromatin in gene expression and gene silencing).

UNIT IV **(12 hrs)**

Cell communication and cell signaling: Host-parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis, and quorum sensing.

Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer, and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Innate and adaptive immune system: Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity, and immunogenicity. B and T cell epitopes, structure, and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines. antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

UNIT V **(12 hrs)**

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

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

in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

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

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum Programmed cell death, aging, and senescence.

TEXT BOOKS

1. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. *The Embryology of Angiosperms (6th revised and enlarged edition)*. Vikas Publishing House, New Delhi, 2005.
2. Maheshwari, P. *Recent Advances in Embryology of Angiosperms*. Intl. Soc. Plant Morphologists, New Delhi, 1963.
3. Roy, S.C and Kumar, K.D.C. *Cell Biology*. New Central Book Agency, Calcutta, 1977.
4. Karp, G. *Cell and Molecular Biology: Concepts and Experiments.6th edition.* John Wiley & Sons, 2010.

REFERENCES

Books

1. Karp, G. *Cell and Molecular Biology: Concepts and Experiments. 6th Edition*. John Wiley & Sons. Inc, 2010.
2. Gupta. P.K. *Cell and Molecular Biology*, Rastogi Pub. Meerut, 2000.
3. Ignacimuthu, S. *Basic Bioinformatics*, Narosa publishing house, 2005.
4. Lesk, A.M. *Introduction to Bioinformatics*. Oxford University press, 2002.

Web Sources

1. https://youtu.be/GzuM_nfrXLk
2. https://youtu.be/z1_acvRB6Jo

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
PG Programme - M.Sc. Biotechnology
SEMESTER – IV
EXTENSION ACTIVITY
(From 2023 -2024 Batch Onwards)

HOURS/WEEK :
CREDIT 1
DURATION : 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)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1 [K1]	2	-	-	2	2	1	1
CO2 [K2]	2	1	-	2	1	1	1
CO3 [K3]	2	-	-	1	2	2	1
CO4 [K4]	1	1	1	1	2	2	1
CO5 [K6]	1	-	-	1	2	2	1
Weightage of the course	8	2	1	7	9	8	5
Weighted percentage of Course contribution to POs	2.43	0.71	0.35	3.15	5.92	4.17	2.67

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

Details of the Courses

1 Physical Education
2 Red Ribbon Club (RRC)
3 Youth Red Cross (YRC)
4 Fine Arts Club
5 Library and Information Service Club
6 Yoga Club
7 ECO Club
8 Consumer Club
9 Human Rights Club
10 Women Empowerment Cell
11 Legal Awareness League