V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th Cycle) by NAAC
VIRUDHUNAGAR
Quality Education with Wisdom and Values

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
(with effect from Academic Year 2025 - 2026)

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

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

A. CHOICE BASED CREDIT SYSTEM (CBCS)

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

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

UG PROGRAMMES

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

PG PROGRAMMES

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

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

1. Core Courses
2. Elective Courses
   - Generic Elective Courses
   - Discipline Specific Elective Courses (DSEC)
   - Non Major Elective Courses (NMEC)
3. Skill Enhancement Courses (SEC)
4. Environmental Studies (EVS)
5. Value Education
6. Self-Study Courses (Online)
7. Extra Credit Courses (Self Study Courses) (Optional)

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

UG PROGRAMMES

Name of the Course	Course Code	Semester	Department
Introduction to Tourism	24UHIN11	I	History (E.M)
Indian Constitution	24UHIN21	II	
சுற்றுலா ஓர் அறிமுகம்	24UHIN11	I	History (T.M)
இந்திய அரசியலமைப்பு	24UHIN21	II	
Popular Literature and Culture	24UENN11	I	English
Philosophy for Literature	24UENN21	II	
அடிப்படைத் தமிழ் இலக்கணம் – I எழுத்தறிதல்/ பேச்சுக்கலைத்திறன்	24UBTN11/ 24UTAN11	I	Tamil
அடிப்படைத்தமிழ் – மொழித் திறனறிதல் / பயன்முறைத் தமிழ்	24UBTN21/ 24UTAN21	II	

Basic Hindi - I	24UBHN11	I	Hindi
Basic Hindi - II	24UBHN21	II	
Everyday Banking/ Practical Banking	24UCON11N/ 24UCON11	I	Commerce (Aided)
Basic Accounting Principles	24UCON21	II	
Everyday Banking	24UCON11N	I	Commerce (Self)
Emotional Intelligence	24UCON21N	II	
Everyday Banking/Self- Employment and Startup Business	24UCON11N/ 24UCCN11	I	Commerce C.A.(Self)
Fundamentals of Marketing	24UCCN21	II	
Everyday Banking/ Practical Banking	24UCPN11N/ 24UCPN12N	I	Commerce Professional Accounting
Basic Accounting Principles	24UCPN21N	II	
Basics of Event Management	24UBAN11	I	Business Administration
Managerial Skill Development	24UBAN21	II	
Quantitative Aptitude -I	24UMTN11	I	Mathematics
Quantitative Aptitude - II	24UMTN21	II	
Physics for EveryDay Life	24UPHN11	I	Physics
Astrophysics	24UPHN21	II	
Food Chemistry	24UCHN11	I	Chemistry
Dairy Chemistry	24UCHN21	II	
Ornamental fish farming and Management	24UZYN11	I	Zoology
Biocomposting for Entrepreneurship	24UZYN21	II	
Foundations of Baking and Confectionery	24UHSN11	I	Home Science – Nutrition and Dietetics
Women's Health and Wellness	24UHSN21	II	
Nutrition and Health	24UBCN11	I	Biochemistry
Life Style Diseases	24UBCN21	II	
Social and Preventive Medicine	24UMBN11	I	Microbiology
Nutrition and Health Hygiene	24UMBN21	II	
Herbal Medicine	24UBON11	I	Biotechnology
Organic Farming and Health Management	24UBON21	II	
Basics of Fashion	24UCFN11	I	Costume Design And Fashion
Interior Designing	24UCFN21	II	
Introduction to HTML	24UCSN11N	I	Computer Science

Office Automation	24UCSN21N	II	
Basics of Internet	24UITN11N	I	Information Technology
Data Analysis using Spreadsheet	24UITN21N	II	
Fundamentals of Information Technology	24UDSN11	I	Data Science
Computer Fundamentals	24UDSN21	II	
Web Designing	24UCAN11N	I	B.C.A.
Fundamentals of Computers	24UCAN21N	II	
Organic Farming	24UBYN11	I	Botany
Nursery and Landscaping	24UBYN12	I	
Mushroom Cultivation	24UBYN21	II	Botany
Medicinal Botany	24UBYN22	II	
Library and Information Science - I	24ULSN11	I	Library Science
Library and Information Science - II	24ULSN21	II	
Cadet Corps for Career Development I	24UNCN11	I	National Cadet Corps
Cadet Corps for Career Development II	24UNCN21	II	

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

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

Vision of the Institution

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

Mission of the Institution

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

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

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

Vision of the Department of Biotechnology

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

Mission of the Department of Biotechnology

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

B.1.1 Programme Educational Objectives (PEOs)

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

Programme Educational Objectives (PEOs) of Course Designer Programme

The students will be able to

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

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

B.1.2 Programme Outcomes (POs)

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge, Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co- operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

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

1 apply effectively the acquired knowledge and skill in the field of Arts, Physical Science, Life Science, Computer Science, Commerce and Management for higher studies and employment. (*Disciplinary Knowledge*)

2 articulate innovative thoughts and ideas proficiently in both in spoken and written forms. (*Communication Skills)*

3 identify, formulate and solve problems in real life situations scientifically / systematically by adapting updated skills in using modern tools and techniques. (*Scientific Reasoning and Problem Solving)*

4 critically analyse, synthesize and evaluate data, theories and ideas to provide valid suggestions through assignments, case studies, Internship and projects for the fullfillment of the local, national and global developmental needs. (*Critical Thinking and Analytical Reasoning)*

5 use ICT in a variety of self-directed lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning)*

6 self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence)*

7 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness)*

B.1.3 Programme Specific Outcomes (PSOs)

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

On completion of Course Designer Programme, the students will be able to

PO1: Disciplinary knowledge

PSO1a: Apply the knowledge on fundamental concepts of life sciences such as **Biochemistry**, Microbiology, Genetics and Molecular biology and its related courses in higher studies.

PSO1b: Understand the principles and handling of various instruments used in Biochemistry, Microbiology and chemistry laboratory and to equip the practical skills in Biotechnology

PO2: Communication Skills.

PSO2: Explain various concepts and processes of Biological sciences both in verbal and written form and illustrate the techniques related to Biotechnology.

PO3: Scientific Reasoning and Problem Solving

PSO3a: apply their theoretical knowledge and transferable skills to identify and solve problems in day today life

PSO3b: Employ interdisciplinary knowledge to provide better solutions and new ideas in various branches of Biotechnology innovatively to work in a biotechnology laboratory or in an industry.

PO4: Critical thinking and Analytical Reasoning

PSO4a: critically think and apply the concepts in life sciences in identifying the problems which can be addressed through Biotechnology to become an entrepreneur

PSO4b: Analyse the organization of plant, animal and microbes from cellular level upto genome level and their inter relationship to carry out various research and development activities

PO5: Digital Literacy, Self - directed and Lifelong learning

PSO5: Make use of modern ICT tools and to adapt to the technological advancements in the emerging areas of Biotechnology.

PO6: Cooperation / Team Work and Multi-Cultural Competence

PSO6: Work effectively as a member or leader of a team in institution, industry, society through the acquired skills from paper presentation, Industrial visit and Internship programme.

PO7: Moral and Ethical awareness

PSO7: Understand the IPR, ethics in life science and adapting ecofriendly techniques for sustainable development.

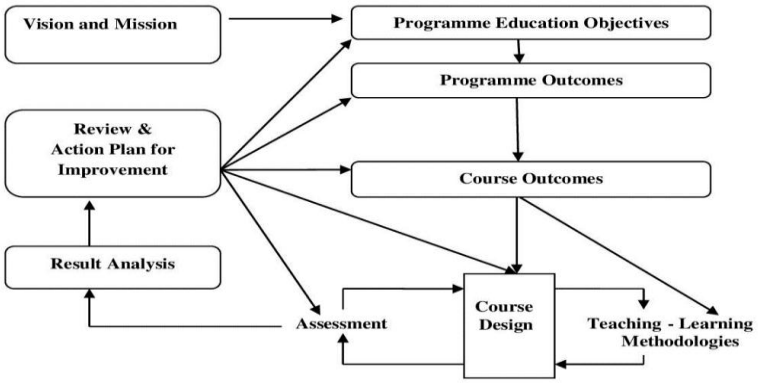
PO-PEO Mapping Matrix

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

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

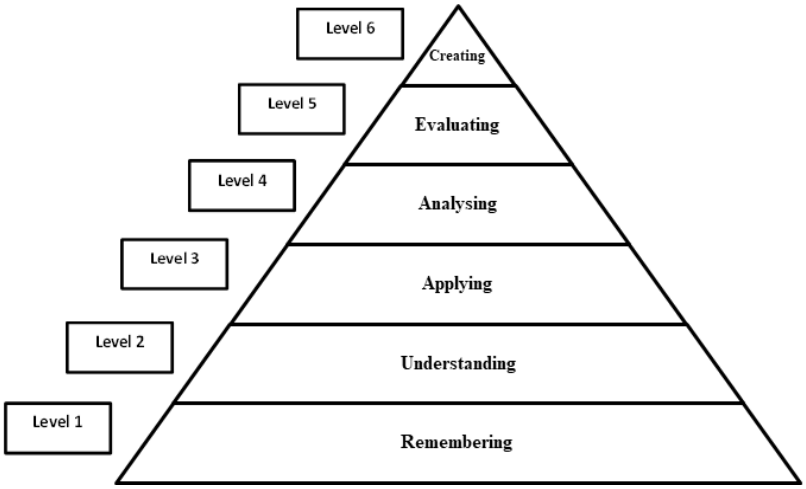
B.1.4 Course Outcomes (COs)

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



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

BLOOM'S TAXONOMY



CO – PO Mapping of Courses

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

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

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

ELIGIBILITY FOR ADMISSION

The candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Tamil Nadu or any other equivalent examination accepted by the Academic Council with Biology as one of the subjects in Higher Secondary Course.

DURATION OF THE PROGRAMME

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

MEDIUM OF INSTRUCTION

English

COURSES OFFERED

Part I	:	Tamil/Hindi Course
Part II	:	English
Part III	:	Core Courses
		Elective Courses • Generic Elective Courses • Discipline Specific Elective Courses
		Self-Study Course - online
Part IV	:	Skill Enhancement Courses (SEC)
		Elective Courses (NMEC)
		Environmental Studies Value Education
		Internship/Industrial Training
		Self-Study Course - online
Part V	:	National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Club/ Health and Fitness Club/ National Cadet Corps/ Rotaract Club

B.2 EVALUATION SCHEME

B.2.1.PART II

Components	Internal Assessment Marks	Summative Examination Marks	Total Marks
Theory	15	60	100
Practical	5	15	
Assignment	5	-	

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

B.2.2.Part I & PART III - Core Courses, Elective Courses (Generic, DSEC)

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	**100**

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			Marks
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

Mode of Evaluation		Marks
Practical Test*	:	30
Record & Performance	:	10
Total	**:**	**40**

*Average of the two practical tests will be considered

Question Pattern for Internal Tests **Duration: 2 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 4	Multiple Choice	4	4	1	4
B	5 -6	Internal Choice - Either … or Type	3	3	7	21
C	8 -9	Internal Choice - Either… or Type	2	2	10	20
					Total	**45***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Question Pattern **Duration: 3 Hours**

Section	Questions No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 -10	Multiple Choice	10	10	1	10
B	11 - 15	Internal Choice – Either …or Type	5	5	7	35
C	16 - 18	Internal Choice – Either… or Type	3	3	10	30
					Total	**75**

PROJECT

Assessment by Internal Examiner Only

Internal Assessment- Distribution of Marks

Mode of Evaluation	:	Marks
Project work and Report	:	60
Presentation and Viva –Voce	:	40
Total	:	100

B.2.3 PART IV - Skill Enhancement Courses, Non Major Elective Courses and Foundation Course

B.2.3.1 FOUNDATATION COURSE

INTERNAL ASSESSMENT - Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K2 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered
Two Assignments - Better of the two will be considered
Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.3.2 Skill Enhancement Course - Entrepreneurial skills

INTERNAL ASSESSMENT ONLY
Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	15
Assignment	:	5
Quiz	:	5
Model Examinations	:	60
Online Quiz (Multiple Choice Questions - K2 Level)	:	15
Total	**:**	**100**

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30**

The total marks obtained in the Periodic Test will be calculated for 15 marks

Two Periodic Tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Two Quiz Tests - Better of the two will be considered

Question Pattern for Model Examination **Duration: 2 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1-5)	Internal Choice – Either Or Type	5	5	6	30
B Q. No.(6- 8)	Internal Choice – Either Or Type	3	3	10	30
Total					**60**

B.2.3.3 Skill Enhancement Courses/ Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K2 Level	:	5
Total		**:**	**25**

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.4 PART IV- ENVIRONMENTAL STUDIES / VALUE EDUCATION

INTERNAL ASSESSMENT ONLY

Evaluation Pattern

Mode of Evaluation		Marks
Periodic Test	:	15
Assignment - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10

Report - K3 Level		10
Model Examination	:	30
Total	**:**	**100**

Three Assignment - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30**

Two Periodic tests - Better of the two will be considered

*The total marks obtained in the Periodic Test will be calculated for 15 marks

Question Pattern for Model Examination **Duration: 2 ½ Hours**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 8	Internal Choice – Either… or Type	3	3	10	30
	Total					**60***

*The total marks obtained in the Model Examination will be calculated for 30 marks

B. 2. 5 PART IV- Internship / Industrial Training

Internship / Industrial Training is mandatory for all the Students

- **Internship:** Students have to involve in a designated activity, working in an organization under the guidance of an identified mentor for a period of 15 days.
- **Industrial Training:** Student has to undertake in-plant training in industries individually or in group for a period of 15 days.
- Internship / Industrial Training must be done during the fourth semester holidays
- **Internal Assessment only.**

Mode of Evaluation		Marks
Onsite Learning/Survey	:	50
Report	:	25
Viva-Voce	:	25
Total		**100**

B.2.5 SELF STUDY COURSE

B.2.5.1 PART III – Discipline Specific Quiz – Online

- Assessment by Internal Examiner only
- Question Bank is prepared by the Faculty Members of the Departments for all the Core and Elective Courses offered in all the Semesters.
- No. of Questions to be taken 700.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in VI Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.5.2 PART IV - Practice for Competitive Examinations – Online

- Assessment by Internal Examiner only
- Question Bank prepared by the Faculty Members of the respective Departments will be followed.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in V Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Subject wise Allotment of Marks

Subject		Marks
Tamil	:	10
English	:	10
History	:	10
Mathematics	:	10
Current affairs	:	10
Commerce, Law & Economics	:	10
Physical Sciences	:	10
Life Sciences	:	15
Computer Science	:	5
Food and Nutrition	:	5
Sports and Games	:	5
Total	**:**	**100**

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.6. Part V – Extension Activities
INTERNAL ASSESSMENT ONLY
Distribution of Marks

Mode of Evaluation		Marks
Attendance	:	5
Performance	:	10
Report/Assignment/Project/Camp/Practical	:	10
Total	**:**	**25***

*The marks obtained will be calculated for 100 marks

B.2.7 Transfer of credits earned through MOOC (UGC recognized Courses)

- Students can opt for minimum of
    - 12 weeks Courses for Core Courses
    - 8 weeks Courses for Elective Courses
    - 4 weeks Courses for Skill Enhancement Course
- The Online Courses opted by the students will be verified and approved by the Head of the Department and forwarded to the Controller of Examinations through the Principal.
- Students are required to register for the equivalent Online Courses through the Institution's SWAYAM-NPTEL Local Chapter after submitting a Permission letter to the Head of the Department.
- The Course should be completed before the beginning of that particular Semester in which the selected Course is offered.
- The student should submit the Course Completion Certificate immediately after receiving it, to the Department.
- The Head of the Department has to send the list of the students and their Course Completion Certificates to the Controller of Examinations through the Principal.
- The students who have submitted the Completion Certificate are exempted from appearing the Periodic Tests and Summative Examinations of the respective course but without any exemption for class attendance.
- Credits allotted for the particular Course in the Curriculum will be transferred after the completion of the Online Course
- Students can earn up to 10 credits within the mandatory credits requirements of the Degree Programme by completing UGC recognised Online Courses.

B.2.8 EXTRA CREDIT COURSES (OPTIONAL)

2.8.1 Extra Credit Course offered by the Department.

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

Distribution of Marks

Mode of Evaluation		**Marks**
Quiz (Multiple Choice Questions)	:	25
Model Examination	:	75
Total	**:**	**100**

Question Pattern for Model Examination

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

2.8.2 Extra credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first V Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 10 credits)**

4weeks Course - 1 credit

8 weeks Course - 2 credits

12 weeks Course - 3 credits

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.
- No Pass minimum for Internal Assessment.
- Pass minimum for External Examination is 27 marks out of 75 marks for Core Courses, Elective Courses (Generic Elective, DSEC Courses)
- Pass minimum for External Examination is 18 marks out of 50 marks for Skill Enhancement Courses and Non Major Elective Courses (NMEC).
- The aggregate minimum pass percentage is 40 marks for all Courses.
- Pass minimum for External Practical Examination is 21 marks out of 60 marks.

Attendance

- The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
- The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
- The students who have attended the classes for 59 days and less - up to 45 days

(50%- 65%) can appear for the Summative Examinations only after getting special permission from the Principal.

- The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.
- For Part V in UG Programmes, the students require 75 % of attendance to get a credit.
- For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

B.3 ASSESSMENT MANAGEMENT PLAN

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

B.3.1 Assessment Process for CO Attainment

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

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

Indirect Assessment – Done through Course Exit Survey.

CO Assessment Rubrics

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

CO Attainment

Direct CO Attainment

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

Target Setting for Assessment Method

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

Formula for Attainment for each CO

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

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

Attainment Levels of COs

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

Indirect CO Attainment

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

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

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

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

B.3.2 Assessment Process for Overall PO Attainment

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

PO Assessment Tools

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

Programme Articulation Matrix (PAM)

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

Indirect Attainment of POs for all Courses

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

Attainments of POs for all Courses

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

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

Expected Level of Attainment for each of the Programme Outcomes

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

Level of PO Attainment

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level of PO is Achieved?

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the Courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 5 years of completion of the Programme only through indirect methods.

Target for PEO Attainment

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

Attainment of PEOs

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

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

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

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

Expected Level of Attainment for each of the Programme Educational Objectives

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

Level of PEO Attainment

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

C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

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

BACHELOR OF SCIENCE BIOTECHNOLOGY (2026)

Outcome Based Education with Choice Based Credit System

Programme Structure - Allotment of Hours and Credits

For those who join in the Academic Year 2024-2025

Components	Semester						Total Number of Hours (Credits)
	I	II	III	IV	V	VI	
Part I : Tamil /Hindi	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24 (12)
Part II : English	6 (3)	6(3)	6 (3)	6 (3)	-	-	24 (12)
Part III : Core Courses, Elective Courses and Self-Study Course							
Core Course	5 (5)	5 (5)	5 (5)	4 (4)	6 (6)	6 (5)	31 (30)
Core Course	-	-	-	-	5 (5)	6(5)	11 (10)
Core Course	-	-	-	-	5 (4)	-	5(4)
Core Course Practical	3(2)	3 (2)	3 (2)	3 (2)	3 (2)	6 (5)	21(15)
Core Course Project	-	-	-	-	1 (1)	-	1 (1)
Elective Course (DSEC)	-	-	-	-	4(3)	5 (5)	9 (8)
Elective Course (DSEC Practical)	-	-	-	-		5(4)	9(7)
Elective Course I (Allied)	4(3)	4(3)	-	-	-	-	8(6)
Elective Course I Practical I(Allied)	2(1)	2(1)	-	-	-	-	4 (2)
Elective Course II(Allied)	-	-	4 (3)	4 (3)	-	-	8(6)
Elective Course II Practical II(Allied)	-	-	2 (1)	2 (1)	-	-	4 (2)
Self-Study Course	-	-	-	-	-	0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Elective Courses, Environmental Studies, Value Education , Self-Study Course and Internship/Industrial Training							
SEC	2 (2)	-	1 (1)	2 (2)	-	-	5(5)
SEC	-	2 (2)	2 (2)	2 (2)	-	2 (2)	8 (8)
Elective Course(NME)	2 (2)	2 (2)	-	-	-	-	4 (4)
Value Education	-	-	-	-	2 (2)	-	2 (2)
Environmental Studies	-	-	1 (0)	1 (2)	-	-	2 (2)
Self Study Course	-	-	-	-	0 (1)	-	0 (1)
Internship/Industrial Training	-	-	-	-	0 (1)	-	0 (1)
Part V : Extension Activities	-	-	-		-	0 (1)	0 (1)
Total	**30 (21)**	**30 (21)**	**30 (20)**	**30 (22)**	**30 (28)**	**30 (28)**	**180 (140)**
Extra Credit Course (Self Study Course)	-	-	-	-	0(2)	-	0(2)

DSEC: Discipline Specific Elective Course SEC: Skill Enhancement Course
NMEC: Non Major Elective Course

Course Designer– 2026
PROGRAMME CONTENT
SEMESTER III
For those who join in 2024-2025

S. No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/Hindi	24UTAG31/ 24UHDG31	6	3	3	25	75	100
2.	**Part II**		English	24UENG31	6	3	3	25	75	100
3	**Part III**	Core Course -1II	Immunology and Immunotechnology	24UBOC31	5	5	3	25	75	100
4.		Core Course -III Practical-I	Immunology and Immunotechnology Practical	24UBOC31P	3	2	3	40	60	100
5.		Elective Course	Bioinstrumentation	24UBOA31	4	3	3	25	75	100
6		Elective Course–3 Practical III	Bioinstrumentation Practical	24UBOA31P	2	1	3	40	60	100
7	**Part IV**	SEC-3	Mushroom Cultivation	24UBOS31	1	1	3	100	-	100
8		SEC- 4	Food and Bioprocess Technology	24UBOS32	2	2	3	25	75	100
9			Environmental studies	24UGES41	1	0	-	-	-	-
				Total	**30**	**20**				**800**

Course Designer - SEMESTER IV

S. No.	Components		Title of the Course	Course Code	Hour Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	24UTAG41/ 24UHDG41	6	3	3	25	75	100
2.	**Part II**		English	24UENG41	6	3	3	25	75	100
3.	**Part III**	Core Course -4	Genetic Engineering and rDNA Technology	24UBOC41	4	4	3	25	75	100
4.		Core Course -4 Practical-I	Genetic Engineering and rDNA Technology Practical	24UBOC41P	3	2	3	40	60	100
5.		Elective Course-4	Bioinformatics and Biostatistics	24UBOA41	4	3	3	25	75	100
6		Elective Course - 4 Practical-II	Bioinformatics and Biostatistics Practical	24UBOA41P	2	1	3	40	60	100
7.	**Part IV**	SEC – 4	Aquaculture	24UBOS41	2	2	3	25	75	100
8.		SEC – 5	Poultry science and management	24UBOS42	2	2	3	25	75	100
9.			Environmental Studies	24UGES41	1	2	3	100	-	100
				Total	**30**	**22**				**800**

SEMESTER V

2024-2025 onwards

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course -9	Plant Biotechnology	24UBOC51	6	6	3	25	75	100
2		Core Course - 10	Animal Biotechnology	24UBOC52	5	5	3	25	75	100
3		Core Course -11	Pharmaceutical Biotechnology	24UBOC53	5	4	3	25	75	100
		Core Course -12 Practical 5	Plant Biotechnology and Animal Biotechnology Practical	24UBOC51P	3	2	3	40	60	100
		Core course -13 Project	Project	24UBOC54PR	1	1	-	100	-	100
4		Elective Course DSEC-1	Bioethics and Biosafety /Food Technology	24UBOE51/ 24UBOE52	4	3	3	25	75	100
5		Elective Course DSEC-2	Nano Biotechnology / Cancer Biology	24UBOE53/ 24UBOE 54	4	3	3	25	75	100
7	**Part IV**	AECC	Value education	24UGVE51	2	2	-	100	-	100
8		Self-study course-	Practice for Competitive Examinations - Online	24UGCE51	-	1	-	100	-	100
9.		Internship /Industrial Training	Internship	24UBOI51	-	1	-	100	-	100
				Total	**30**	**28**				**900**
	Extra Credit Course (Self-Study Course)		Enzymology	24UBOO51	**-**	**2**	**-**	**100**	**-**	**100**

Course Designer - SEMESTER VI

S. No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course - 14	Bioentrepreneurship	24UBOC61	6	5	3	25	75	100
2		Core Course - 15	Environmental and Industrial Biotechnology	24UBOC62	6	5	3	25	75	100
3.		Core Course -16	Environmental and Industrial Biotechnology Practical	24UBOC61P	6	5	3	40	60	100
4.		Elective Course DSEC-3	Marine Biotechnology /Medical Biotechnology	24UBOE61 / 24UBOE62	5	5	3	25	75	100
5.		Elective Course DSEC-4	Good Laboratory Practices (GLP) / Forensic Biotechnology	24UBOE63/ 24UBOE64	5	4	3	25	75	100
6.			Discipline Specific Quiz - online	24UBOQ61	-	1	3	40	60	100
7.	**Part-IV**	SEC -7	Vermitechnology	24UBOS61	2	2	2	25	75	100
8.		Extension Activities	Extension Activities		0	1	-	-	-	-
				Total	**30**	**28**				**700**

B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: III	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	Hours/Week: 5	
Core course III		Credits: 5	
Course code- **24UBOC31**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Define the basic concepts of Immunology. [K1]

CO2: Explain the structural properties and functions of immune cells and antigen antibody interaction. [K2]

CO3: Discuss the complement system and immunological disorder and gain new insights into Antigen -Antibody interactions and to demonstrate immunological techniques. [K2]

CO4: Examine the immunological response, regulation and malfunction of the immune system. [K3]

CO5: Assess the techniques involved in antigen–antibody interactions and immunological disorders. [K3]

UNIT I

Introduction to Immunology. Cells involved in immune response. Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen. Hematopoiesis – development of B and T lymphocytes. Types of immunity – Innate and acquired. (15 Hours)

UNIT II

Immunogenicity, Cell mediated and Humoral immunity, Antigenicity, Properties of antigen, Haptens, Adjuvants and Epitope. Antibody – Structure, Types, Properties and their Biological Function. Antigen-Antibody Interaction. Precipitation, Agglutination. (15 Hours)

UNIT III

The complement system and activation and regulation. Types – Classical, alternative and Lectin pathway. Biological function of C' proteins. Cytokines- Structure and Function. Major Histocompatibility complex – Organization and structure of Class I, II and III Antigen presentation - Endogenous antigen, Exogenous antigen. (15 Hours)

UNIT IV

Hypersensitivity - types, Immune tolerance, Organ Specific Autoimmunity (Myasthenia gravis), Systemic Autoimmune disease (Rheumatoid arthritis). Transplantation Immunology – Graft acceptance and Rejection. (15 Hours)

UNIT V

Immunological techniques: Radioimmunoassay, ELISA, Western blotting, immunoelectrophoresis, Immunoprecipitation, Immunofluorescence, Flow cytometry and Immunoelectron Microscopy. Production of antibodies- Hybridoma technology: Applications of Monoclonal antibodies in biomedical research, Vaccines – Types, Production and application. (15 Hours)

TEXT BOOKS

1. Khan R .(2022). Immunology. 2nd Edition, Pearson India.
2. Bhende P.M & Lele M.J. (2016). Basic Immunology. 1st Edition , Himalaya Publishing House.
Curriculum for M.Sc. Biotechnology 28 20th Academic Council Meeting 30.05.2025
3. Rao C.V,.(2010).An Introduction to Immunology. 1st Edition , Narosa Publishing House.
4. Joshi K.R. (2019).Fundamentals of Immunology and Immunotechnology. 2nd Edition , McGraw Hill Education.
5. Kakrani S.L. & Gupta R.K.(2017).Immunology and Serology. 1st Edition , Jaypee Brothers Medical Publishers.

REFERENCE BOOKS

1. Kuby, J. (2018). Immunology.8th edition. Newyork: W. H. Freeman & Co.
2. Roitt, I. (2017). Essentials of immunology. IV Edition. New York:Wiley Blackwell. Sci.
3. Abbas, K.A.,Lichtman, H.A.,& Pillai. (2019). Basic Immunology. 6th edition. Elsevier

Web resources

https://www.ncbi.nlm.nih.gov/books/NBK279395

https://med.stanford.edu/immunol/phd-program/ebook.html

https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/

Course Code 24UBOC31	PO1		PO2	PO3		PO4		PO5	PO 6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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

B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester III	**IMMUNOLOGY AND IMMUNOTECHNOLOGY PRACTICAL**	Hours/Week: 3	
Core Practical – 3		Credits: 2	
Course Code **24UBOC31P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: Apply the basic concepts learnt in theory for the practicals related to animal tissue culture and immunology. [K2]

CO2: Identify the given spotters and explain. [K2]

CO3: perform blood grouping, and immunological techniques. [K3]

CO4: Infer the results and completion of record work. [K3]

CO5:. Perform blood cell counting[K3]

1. Preparation of serum and plasma
2. WBC counting
3. RBC counting
4. Blood grouping
5. Widal test.
6. Single Immunodiffusion
7. Double and radial immunodiffusion
8. Rocket immunoelectrophoresis.
9. ELISA
10. Western blotting (Demonstration)

REFERENCE BOOKS

1. Weir,D.M. (1986).Handbook of experimental immunology, Vol.I to IV.Blackwell Scientific publishers.
2. Hay, F.C. & Westwood, O.M.R. (2002) 4th edition Practical immunology, Blackwell Publishing.

Course Code 24UBOC31P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: III	**BIOINSTRUMENTATION**	Hours/Week: 4	
Elective Paper III		Credits: 3	
Course Code - **24UBOA31**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Define the basic principles and terminologies associated with colorimetry, chromatography, centrifugation, electrophoresis and tracer techniques. [K1]

CO2: Describe the components of bioinstruments and their maintenance. [K2]

CO3: Explain the principle and operation methods of bioinstruments. [K2]

CO4: Apply the knowledge of biotechniques to estimate and separate biomolecules following good laboratory practices. [K3]

CO5: Compare the merits of bio instruments and their applications in the laboratory.[K3]

UNIT I

pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope. (12 Hours)

UNIT II

Spectra – Absorption and Emission Spectra – Beer Lambert's law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR) LC-MS (MALDI-TOF) (12 Hours)

UNIT III

Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Principle, Paper Electrophoresis – Cellulose Acetate Electrophoresis - Agarose Gel Electrophoresis – SDS- PAGE and Iso-electric focusing. (12 Hours)

UNIT IV

Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient centrifugation – Ultra Centrifuge. Preparative centrifugation, analytical centrifugation.isopycnic centrifugation and applications. (12 Hours)

UNIT V

Radioactivity – Isotopes – Clinically important isotopes Radioactive substances – Radioactivity. Methods for detecting radioactivity- GM and Scintillation counters, Applications of radioisotopes, Autoradiography – application, safety, Good laboratory practices, personal protection equipments. Care and maintenance of laboratory equipments, Laboratory safety symbols, Potential hazards of laboratory techniques. (12 Hours)

TEXT BOOKS

1. Upadhyay and UpadhyayNath. (2023). “Biophysical Chemistry”, Principles and Techniques. Himalaya Publishing House.
2. Veerakumari, L. (2019) “Bioinstrumentation” MJP publishers , Kindle Edition.
3. Skoog D.A.F.James Holler and Stanky,R.Crouch, (2019) “Instrumental Methods of Analysis” Cengage Learning.
4. Mahin Basha (2021). Analytical Biochemistry & Separation Techniques, 4th edition, Twenty first century publications.

5. Prakash M, (2009). Understanding Bioinstrumentation, 1st edition, Discovery Publishing House Pvt Ltd

REFERENCE BOOKS

1. Keith Wilson,John Walker, (2018) .Principles and techniques of Biochemistry and Molecular Biology"8th edition.Cambridge University Press.
2. David L.Nelson, Michael M Cox.Lehninger (2017)."Principles of Biochemistry",7th edition W.H.Freeman, Newyork.
3. Khandpur R S, (2014). Handbook of Biomedical Instrumentation, 3rd edition, McGraw Hill Education (India).
4. Sharma B K, (2014). Instrumental Methods of Chemical Analysis, 24th Edition, GOEL Publishing House.

Course Code 24UBOA31	PO1		PO2	PO3		PO4		PO5	PO6	
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Gurupavithra
Course Designer

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

B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: III	**BIOINSTRUMENTATION PRACTICAL**	Hours/Week: 2	
Elective Course Practical II		Credits: 1	
Course Code-24UBOA31P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: know the basic principles of the basic instruments in the laboratory such as weighing balance, pH meter, shaker, incubator etc. (K2)

CO2: u nderstand the components and working of instruments (K2)

CO3 : employ the separation techniques for separating biomolecules based on chromatography. (K3)

CO4: infer the result and complete the record work. (K3)

CO5: Employ the separation techniques for separating biomolecules by centrifugation and electrophoresis.(K3)

1. Preparation of Buffer (Phosphate Buffer)
2. Determination of pH of biological samples using pH meter
3. Chromatography analysis of sugar, amino acids, lipids by paper chromatography.
4. Chromatography analysis of sugar, amino acids, lipids by Thin layer chromatography.
5. Gel filtration chromatography
6. Fractionation of biological material into its various components by Centrifuge.
7. Estimation of proteins by Lowry method
8. SDS PAGE

TEXT BOOKS

Sharda University Abstract Laboratory Manual for Bio-instrumentation, Biochemistry, Microbiology, Cell Biology and Enzyme Technology.2018

REFERENCE BOOKS

1. P. Palanivelu (2017), *Analytical Biochemistry and Separation techniques – A laboratory manual*, (5th Edition), Twentyfirst century publishers, ISBN: 978-81-908489-0-

Course Code 24UBOC31P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

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

Head of the Department **Course Designer**

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester III	**MUSHROOM CULTIVATION**	Hours/Week: 1
Skill Enhancement Course		Credits: 1
Course Code **24UBOS31**		Internal 100

COURSE OUTCOMES

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

CO1: recall the identification, cultivation, economics and nutritional value of mushrooms. [K1]

CO2: describe the edible mushrooms, their production, profit and food value of mushrooms. [K1]

CO3: illustrate the cultivation methods, and the operation of mushroom industry and nutritional benefits of mushrooms. [K2]

CO4: understand the edibility of mushrooms, mushroom cultivation system for various types of mushrooms and mushroom industry. [K2]

CO5: analyze the mushroom industry operation, cultivation methods, value added products and recipes from mushroom. [K3]

UNIT I

Introduction: History of edible mushrooms – Major genera of edible mushrooms – Structure and key for identification. Medicinal and poisonous mushrooms – identification and effects example: *Amanita. Milky*, Straw& Oyster mushroom - General morphology, distinguishing characteristics, spore germination and life cycle. (3 Hours)

UNIT II

Fundamentals of cultivation system- small village unit & larger commercial unit. Principles of mushroom farm layout- location of building plot, design of farm, bulk chamber, composting platform, equipments and facilities, pasteurization room & growing rooms.

(3 Hours)

UNIT III

Cultivation of button & Oyster mushrooms – Mushroom mother stock culture, preparation of spawn. collection of raw materials, substrate preparation, spawning, Incubation, Cropping, insect and pest control, harvesting. (3 Hours)

UNIT IV

Mushroom industry – Preservation and packaging of Mushroom. Economics of mushroom production and marketing, mushroom spent waste-uses (3 Hours)

UNIT V

Nutritional value of mushroom: Medicinal value of mushrooms – *Ganoderma*-cosmetic value, antiviral value, antibacterial effect, antifungal effect, anti-tumour effect. Preparation of mushroom soup, biscuit, pulav, Mushroom gravy etc. (3 Hours)

REFERENCE BOOKS

1. Aneja, K.R, (2008). *A Textbook of Basic and Applied Microbiology,*New Delhi: Ne Age International.

2. Pathak, V.N., N. Yadav & M. Gaur, (2010). *Mushroom Production and Processing Technology.* New Delhi:Vedams E-books Pvt Ltd.

Course Code 24UBOS31	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2	3	1

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

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Head of the Department

Dr.V.Jeyasimga
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester III	**FOOD AND BIOPROCESS TECHNOLOGY**	Hours/Week: 2	
Skill Enhancement Course		Credits: 2	
Course Code **24UBOS32**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: know the basics of bioprocess technology (K1)

CO2: Define the scope and importance of food technology and industrial fermentation (K1)

CO3: understand the bioreactors, Upstream and downstream processing (K2)

CO4: illustrate the production methods of fermented foods and industrial products (K2)

CO5: apply the basic knowledge of fermentation and food processing for the production and recovery of bioproducts (K3)

UNIT I

Introduction to Bioprocess Technology: History and Scope- Bioreactor: Design, parts and accessories, functions- Types of reactors - Bubble column, Fluidized bed reactor. (6 Hours)

UNIT II

Fermentation media design, sterilization and media requirement for industrial fermentation, Main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes. Immobilization – Types of immobilization, various methods - Applications of immobilized enzyme technology. (6 Hours)

UNIT III

Downstream processing: Cell disruption methods for intracellular products, removal of insolubles, biomass separation techniques, flocculation and sedimentation, centrifugation and filtration methods. crystallization, mixing, dialysis, distillation and drying. (6 Hours)

UNIT IV

Production of microbial enzymes (Amylase) applications, production of organic solvents (Ethanol,) – production of organic acids (Citric acid)- Single cell protein production – *Spirulina*, Beverages production – Beer and Wine. (6 Hours)

UNIT V

Processing of Milk – Pasteurization and homogenization - Modifying milk composition – Production of milk products – Curd, cheese, yogurt, and flavoured milk. Bakery products – Bread making. Probiotics and Role of Food technology in bio-defense programs. (6 Hours)

TEXT BOOKS

Srivastava.,M.L., (2010). Fermentation Technology, Narosa Publications.

REFERENCE BOOKS

1. Chien Wei Ooi, Pau Loke Show, Tau Chuan ling (2021). Bioprocess engineering CRC Press
2. Pauline M. Doran., 2009.Bioprocess Engineering Principles. Academic Press Inc.,
3. El-Mansi& Bryce C.F.A., 2007. Fermentation Microbiology and Biotechnology., 2nd edition, Taylor and Francis Publishing.

Course Code 24UBOS32	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2	3	1

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

SEMESTER –IV	**GENETIC ENGINEERING AND r-DNA TECHNOLOGY**	Hours/Week: 4	
Core Paper IV		Credits: 4	
Course code **24UBOC41**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the main principles, methods for preparation and cloning of DNA in various organisms. [K1]

CO2: recall the tools and methods of gene transfer involved in r-DNA technology and recombinant products. [K2]

CO3: illustrate the types of vectors, restriction enzymes and the transfer of DNA into the host cell. [K2]

CO4: apply the concepts of vectors, Restriction enzymes, gene transfer methods.[(K3]

CO5: discuss the suitability of vectors, restriction endonucleases, methods of gene transfer for the production of recombinant products with ethical concern [K3]

UNIT I

Genetic Engineering – Introduction. Tools in recombinant DNA technology – Restriction enzymes, DNA polymerases-DNA ligase, Reverse transcriptase, Terminal transferase, T4 polynucleotide kinases, & Alkaline phosphatase, DNA dependent RNA polymerases. Taq DNA polymerases,.Plasmids-Properties, Cosmids- Ti plasmid, Phagemids – M13 phages, expression vectors, artificial chromosome – YAC, BAC. (12 Hours)

UNIT II

preparation and purification of DNA from living cellsGene transfer techniques – Biological method of gene transfer –Ti plasmid,Viral mediated gene transfer, Selectable markers and reporter genes - Non viral mediated gene transfer - Physical methods:

Microinjection - Electroporation - Particle Bombardment, Chemical methods: Calcium phosphate - DEAE dextran - Liposomes. (12 Hours)

UNIT III

Identification of recombinants, selection and screening for Recombinants. recombinants-α
complementation, blue white selection. Analysis of recombinants: Principles of hybridization. Northern blotting, Southern blotting, and Western blotting. DNA sequencing- Construction of Genomic DNA library and cDNA library), Chromosome walking. Human Genome Project. Polymerase Chain reaction- Methodology and its Types. (12 Hours)

UNIT IV

Gene Expression – Expression vectors for prokaryotes & Eukaryotes.DNA cloning - Sticky end and blunt end Ligation, Expression system and their applications - protein based products – Protein engineering– production of protein from cloned genes. Site directed Mutagenesis, Restriction Fragment Length Polymorphism (RFLP). (12 Hours)

UNIT V

Application of Recombinant DNA technology in medicine, industry, agriculture and r-DNA technology - merits and demerits.Biotechnological applications of rDNA technology: Synthesis and purification of proteins from cloned genes- Native and fusion protein. Gene therapy- Delivery techniques – *Ex vivo & In vivo*, Therapeutic products for use in human health care- insulin, alpha interferon, Hepatitis B vaccine, Corona virus vaccine, recombinant DNA debate and bio ethics. (12 Hours)

TEXT BOOKS

1. Brown T.A, 2015. Gene Cloning and DNA Analysis: An Introduction, 7th edition, Wiley – Blackwell
2. Desmond S.T. Nicholl, (2023). An Introduction to Genetic Engineering, 4th edition, Cambridge university press
3. R.W. Old & S.B. Primrose, (2014) Principles of Gene Manipulation, Fifth Edition, Blackwell Science
4. Setlow, Jane K. (2012) Genetic Engineering Principles and Methods Keya Chaudhuri, 2012. Recombinant DNA Technology.

REFERENCE BOOKS

1. David Clark Nanette Pazdernik Michelle McGehee (2018), *Molecular Biology techniques*, (3rd edition).
2. Anton Byron (2019), *Introduction to Gene Cloning*, Publisher: Oxford Book Company
3. Monika Jain (2011), *Recombinant DNA technology*, (I edition), Alpha Science International. ISBN-13 : 978-1842656679.
4. Primrose.S.B (2014), *Principles of gene manipulation*, (7th edition), Blackwell Scientific limited, Germany. ISBN: 978-1-405-13544-3

Web Sources:

https://www.britannica.com/recombinant-DNA-technology

https://www.le.ac.uk/recombinant-dna-and-genetic-techniques

https://www..ncbi.nlm.nih.gov

Course Code 24UBOC41	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO 1	2	2	2	2	1	2	3	2	2	1
CO 2	2	2	2	3	2	3	2	3	2	1
CO 3	3	3	2	3	2	3	2	3	2	2
CO 4	2	2	2	3	1	2	2	2	1	1
CO 5	2	3	3	3	2	3	3	3	2	1

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

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

Dr.S.Gurupavithra — **Course Designer**

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester IV	**Genetic Engineering and rDNA Technology Practical**	Hours/week-3	
Core-Practical -IV		Credits-2	
Course Code- **24UBOC41P**		Internal 40	External 60

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the basic concepts in Genetic Engineering and rDNA Technology. [K2]

CO2: identify the given spotters and explain. [K2]

CO3: experiment with the isolation of DNA,RNA, DNA amplification. [K3]

CO4: infer the results and complete the record work. [K3]

CO5:Demonstrate bacterial transformation and restriction digestion[K3]

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

TEXT BOOK

John venison ,S,(2009) Laboratory Manual for GENETIC ENGINEERING 1st Edition, Kindle Edition

Course Code 24UBOC41P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2	3	-

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

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

SEMESTER –IV	**BIOINFORMATICS AND BIOSTATISTICS**	Hours/Week: 4	
Elective Paper IV		Credits: 3	
Course code- **24UBOA41**		Internal 25	External 75

COURSE OUTCOMES:
On completion of the course the students will be able to

CO1: Acquire knowledge about the Developments and Applications of Bioinformatics. [K1]

CO2: Gain knowledge about the importance of the bioinformatics, databases, tools and software of bioinformatics and explain different types of Biological Databases. [K2]

CO3: Understand the basics of sequence alignment, sequence analysis and Protein structure prediction method. [K2]

CO4: illustrate the basic methods of data collection, graph construction and sampling techniques and Calculate measures of central tendency [K3]

CO5: Correlate and analyze biological data through various statistical methods and interpret biological data via various probabilistic distribution methods. [K3]

UNIT I

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

(12 Hours)

UNIT II

Sequence analysis (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction - Homology modeling of proteins, visualization tools (RASMOL). (12 Hours)

UNIT III

Multiple Sequences alignment – method of multiple sequences alignment- Evolutionary analysis, clustering methods Phylogenetic trees - Methods to generate phylogenetic tree- Tools for multiple sequences alignment and phylogenetic analysis - History of Drug Discovery, Steps in Drug design - Chemical libraries – Role of molecular docking in drug design. (12 Hours)

UNIT IV

Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – Graphs – Sampling method and standard error. Measures of central tendency – measures of dispersion. (12 Hours)

UNIT V

Correlation and regression. Probability distribution-Binomial, Negative binomial, multinomial distribution, Poisson distribution. Tests of significance – t tests – F tests – Chi square test. Analysis of variance – Statistical Soft wares – SPSS. (12 Hours)

TEXT BOOKS

1. Pennington, S.R. and Dunn, M.J. (2023).Proteomics: from protein sequence to function. Routledge.
2. Shuba G.,2010. Bioinformatics., Tata McGraw Hill publishing.India.
3. Rastogi, S.C, Mendiratta, N,Rastogi, P., 2004. Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.
4. N.Gurumani (2011) "An Introduction to Biostastistics" MJP Publishers
5. VeerbalaRastogi .(2015).”Biostatistics”, Medtech Publishers.

REFERENCE BOOKS

1. Attwood, T.K. and Parry-Smith, D.J.2008. Introduction to Bioinformatics. Pearson Education.
2. David Mount., Bioinformatics: sequence and genome analysis, second edition.,(2009) Taylor & Francis, UK;.
3. D.R.Westhead. Instant Notes in Bioinformatics.,(2009) second edition., Taylor & Francis, UK;
4. Zar,J.H.(2014).”Biostatistical Analysis” Fifth Edition, Pearson Education Pvt Ltd, Indian Branch, NewDelhi
5. Arora,P.N and Malhan. P.K.(2013)"Biostatistics"Himalaya publishing House.

Course Code 24UBOA41	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	2	2	3	2	-	1	3	
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2		-

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

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Head of the Department

Dr.D.Karthiyaini
Course Designer

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(2024-2025 onwards)

SEMESTER –IV	**BIOINFORMATICS AND BIOSTATISTICS PRACTICAL**	Hours/Week: 2	
Elective Course Practical IV		Credits: 1	
Course code- **24UBOA41P**		Internal 40	External 60

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: Understand the theoretical concepts of Bioinformatics and biostatistics [K2]

CO2: perform BLAST and FASTA [K2]

CO3: Represent data in to graphical form[K3]

CO4: Test the level of significance of biological data,interpret the results and completion of record [K3]

CO5: analyse the problems and situations in related subject area [K3]

1. Biological databases (NCBI, Swissprot and PDB)
2. BLAST
3. FASTA
4. Pairwise sequence Alignment
5. Multiple sequence alignment using CLUSTAL – W
6. Preparation of bar diagram, line diagram and pie diagram using MS EXCEL. Calculation of Central tendency- mean, geometric mean, median using MS EXCEL
7. Calculation of dispersion – Mean deviation, quartile deviation and standard deviation using MS EXCEL. Calculation of student's t test using MS EXCEL

Text Books

1. Pennington, S.R. and Punn, M.J. 2002.Proteomics: from protein sequence to function. Viva books Pri. Ltd.

2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2nd edition. Bios Scientific Publishers Ltd
3. Misener, S. and Krawetz. S.A. 2000. Bioinformatics: Methods and Protocols. Humana press.
4. Zar,J.H.(2014).”Biostatistical Analysis” Fifth Edition, Pearson Education Pvt Ltd, Indian Branch, NewDelhi
5. Arora,P.N and Malhan. P.K.(2013)"Biostatistics"Himalaya publishing House.

REFERENCE BOOKS

Attwood, T.K. and Parry-Smith, D.J.(2008). Introduction to Bioinformatics. Pearson Education.

Web Resources

1. Bishop, M.J. and Rawhings. C.J. 1997. DNA and protein sequence analysis: A practical approach.Oxford University press. New press. Kolodne
2. Kolodner, R.M. 1997. Computer in Health care: Computerizing large integrated health networks. Springer – Verlag, New York

Course Code 24UBOC41P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	-
CO2	2	3	3	2	1	2	1	1	3	-3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2	3	-

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

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

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

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SEMESTER –IV	**AQUACULTURE**	Hours/Week: 2	
SEC - 5		Credits: 2	
Course code-**24UBOS41**		Internal 25	External 75

COURSE OUTCOMES:

On completion of the course, the students shall be able to

CO1: define the basic concepts and importance of aquaculture [K1]

CO2: describe the theoretical and practical aspects of aquaculture . [K1]

CO3: select the advanced techniques used in aquaculture to increase the rate of production. [K2]

CO4: apply the basic aspects of fish pond construction and management. [K2]

CO5: make use of the acquired knowledge to promote self employment.[K3]

UNIT I

Aquaculture-Global scenario, Origin and growth of aquaculture, Present status in India and Tamil Nadu; Fish pond construction- site selection; types of ponds, water quality analysis, liming and fertilization, morphology and commercial characteristics of cultivable fishes, culture practice, predator fishes, weed fishes control, Environmental impacts.

(6 Hours)

UNIT II

Fin fish culture - Composite fish culture (Indian Major Carps and Murrells); Sewage fed fish culture and integrated fish culture, Marine water fish culture. Shellfish and seaweed culture- Culture of marine prawns, edible and pearl oysters; Seaweeds- types and their culture practices. (6 Hours)

UNIT III

Live feed organisms – Artemia and rotifers culture; Classification of fish feed- Artificial feeds-Types, Feed formulation – feeding methods. Artificial seed production –Breeding under control conditions, induced breeding technique. (6 Hours)

UNIT IV

Infectious diseases - Bacterial,Fungal, Viral, Protozoan; Non-infectious - environmental and nutritional diseases. Disease diagnosis, prevention and control measures. General preventive methods and prophylaxis against the occurrence of diseases. Best pond management practices- Eco-friendly and sustainable aquaculture. Quarantine measures. (6 Hours)

UNIT V

Applied aquaculture: Morphometry of pond (Enclosed rectangular method/Shore length/ shore area and shore line development).Fishing technology (crafts and gears). Aquarium- Aim, Requirements and settings . Agencies involved in aquaculture- CMFRI, CIBA, CIFRI (6 Hours)

TEXT BOOK

1. Aliva Patnaik , Dr. C.S.K. Mishra , Tanushree Moharana (2023) Fisheries and Aquaculture: A Textbook for Undergraduate and Postgraduate students.1st edition, The Readers Paradise publishers.
2. Srinivasulu, M., Reddy, K.R.S., Rao, S. (2004). Text book of Aquaculture, Discovery Publishing House, New Delhi.

REFERENCE BOOKS

1. Sandhya S Kadam (2017). Fish and Fisheries of India. Zaccheus Entertainment
2. Hute, M. and Kahn, H. (2000) Textbook of fish culture, Blackwell Scientific Publication, Australia.
3. Biswas, K. P. (2000). Prevention and control of fish and prawn diseases. Narendra publishing house, New Delhi.
4. Ninawe, A. S and Khadkar, G. D. (2009). Nutrition in Aquaculture, First Edition, Narendra publishing House, New Delhi.
5. Jameson, J.D. and Santhanam. R. (1996), Manual of ornamental fishes and farming, Technologies Peejay, Thoothukkudi.

Web resources

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf
2. https://nou.edu.ng/coursewarecontent/BIO%20410%20FISHERIES%20AND%20AQUACULTURE%20corrected_0.pdf

Course Code 24UBOS41	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	1
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	-
CO5	3	2	3	2	1	3	1	2	3	-

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

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

Dr.S.Jeyaruby — **Course Designer**

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

B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

SEMESTER –IV	**POULTRY SCIENCE AND MANAGEMENT**	Hours/Week: 2	
SEC- 6		Credits: 2	
Course Code-**24UBOS42**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the fundamental concepts in poultry science. [K1]

CO2: explain the scope, classification, chick rearing and poultry diseases. [K1]

CO3: understand the poultry nutrition, rearing methods, disease management and plan for a poultry farm to promote self employment . [K2]

CO4: illustrate the breeding methods, nutrient requirement and troubleshooting of the problems encountered in poultry farms. [K2]

CO5: apply the knowledge of rearing methods disease management to bring out more productivity. [K3]

UNIT I

Poultry science-definition, importance, Poultry industry in India, present status and future prospects of poultry industry, Classification of chicken based on international standards. External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system. (6 Hours)

UNIT II

Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character) breeding methods – systems of breeding – modern method of breeding. choosing commercial layers and broilers – Desirable qualities of commercial layers and broilers. Poultry housing – deep litter and cage system-merits and demerits. (6 Hours)

UNIT III

Practical aspects of chick rearing –brooding management- grower and layers – management of broilers – lighting, summer winter management – debeaking. Sexing-Vent Sexing, Colour Sexing and Feather sexing and its Advantages. (6 Hours)

UNIT IV

Poultry Nutrition: Energy – protein and amino acids – Vitamins – essential organic elements – Non – nutritive feed additives – feedstuffs for poultry – feed formulation. Nutrient deficiency diseases- Perosis and Goitre. (6 Hours)

UNIT V

Diseases: Viral, bacterial, fungal and parasitic disease- causative agents, symptoms and control measures. Vaccines and vaccination programmes. (6 Hours)

TEXT BOOK

Gnanamani M.R., (1998), Modern aspects of commercial poultry keeping, Giri.

REFERENCE BOOKS

1. Banerjee G.C., (2018) Poultry, Oxford and IBH, New Delhi
2. Chauhan H.V.S. and S.Roy (2024), Poultry diseases, diagnosis and treatment, New Age International private limited.
3. John William S. (2003). Poultry for sustainable Food Production and livelihood. Loyola Publication, Chennai.

Course Code 24UBOS42	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	2	3	2	-	1	3	-
CO2	2	3	3	2	1	2	1	1	3	3
CO3	2	3	3	2	1	2	1	1	3	-
CO4	1	3	3	2	1	2	1	1	3	1
CO5	3	2	3	2	1	3	1	2	3	

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Jeyaruby
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**PLANT BIOTECHNOLOGY**	**Hours/Week: 6**	
Core course 9		**Credits: 6**	
Course code- **24UBOC51**		**Internal** 25	**External** 75

COURSE OUTCOMES

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

CO1: define the concepts in Plant Biotechnology. **[K1]**

CO2: understand the Plant genome organisation, micropropagation techniques and genetically modified plants. **[K2]**

CO3: describe the Plant tissue culture techniques for the conservation of endangered plants and development of improved crop varieties **[K2]**

CO4: Illustrate the plant tissue culture and gene transfer techniques. **[K3]**

CO5: apply the plant tissue and cell culture techniques in agriculture and secondary metabolite production. **[K3]**

UNIT I

History of Plant Biotechnology, Conservation of Plant using Biotechnology. Plant genome organization: structural features of a representative plant gene, gene families in plants. Organization of chloroplast genome and mitochondrial genome. (18 hours)

UNIT II

Auxins, cytokinins and gibberellins – molecular basis of action – phytochrome – role in photomorphogenesis – abscisic acid and stress induced promoter switches in the control of gene expression – Ethylene and fruit ripening. (18 hours)

UNIT III

Plant tissue culture-totipotency-types of media- Media composition (MS media) -
Micropropagation techniques - direct and indirect organogenesis - somaclonal variation - somatic

embryogenesis - haploid and triploid - Protoplast isolation, fusion and culture - hybrid and cybrid production, Synthetic seed production. Secondary metabolite production. (18 hours)

UNIT IV

Plant gene transfer methods- physical, chemical and biological. *Agrobacterium* and crown gall tumors – Mechanism of T-DNA transfer to plants, Ti and Ri Plasmid vectors and their utility – Plant viral vectors. Symbiotic nitrogen fixation in *Rhizobia*, nif gene. (18 hours)

UNIT V

Crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Transgenic plants- plant vaccines, genetically modified food - future perspectives & ecological impact of transgenic plants. (18 hours)

TEXT BOOKS

1. Sudhir, M. (2014). Applied Biotechnology and Plant Genetics. Dominant publishers and distributors.
2. Trivedi, P.C. (2005). Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
3. Ignacimuthu. (1997). Applied Plant Biotechnology. Tata McGraw – Hill.
4. Narayanaswamy S. (1994). Plant cell and tissue culture. Tata McGraw Hill Publishing Company limited, New Delhi
5. Chawla, H.S., (2020). Introduction to Plant Biotechnology. 3rd Edition, Science Publishers,

REFERENCE BOOKS

1. Kojima, Lee, H. and Kun, Y. (2001). Photosynthetic microorganisms in Environmental Biotechnology. Springer – Verlag.
2. Stewart Jr., C.N., (2016). Plant Biotechnology and Genetics: Principles, Techniques and Applications. Wiley-Interscience,
3. Heldt H.W. (1997). Plant Biochemistry & Molecular Biology, Oxford University Press.
4. Trigiano, R.N. and Gray, D.J. (2010). Plant Tissue Culture, Development and Biotechnology. CRC Press, Boca Raton, 186.
5. Street, H.E. (1977). Plant tissue culture. Blackwell Scientific Publications, Oxford, London.

Web resources

https://nptel.ac.in/courses/102103016
https://science.umd.edu/classroom/bsci124/lec41.html
Plant Biotechnology | NIFA
http://mydunotes.blogspot.com/p/plant-biotechnology.html

Course Code 24UBOC51	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**ANIMAL BIOTECHNOLOGY**	**Hours/Week: 5**	
Core course 10		**Credits: 5**	
Course code- **24UBOC52**		**Internal** 25	**External** 75

COURSE OUTCOMES

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

CO1: define the fundamentals of animal cell culture, cell lines and animal cell culture laboratory. **[K1]**

CO2: recall the various animal cell culture techniques and applications. **[K2]**

CO3: discuss the strategies to improve assisted reproductive technology and with ethical concern. **[K2]**

CO4: apply genetic modification and stem cell technology in production of transgenic animals and its ethical implications. **[K3]**

CO5: explain the gene transfer and gene expressions strategies in transgenic animals to produce biopharmaceuticals. **[K3]**

UNIT I

Animal cell culture – History and development, Laboratory design for animal cell culture, Pluripotency, different types of media, balanced salt solutions, Physical, chemical and metabolic functions of constituents of culture media, Role of carbon dioxide, Serum, Growth factors and Amino acids in media. Serum containing and serum free media. Constitution of a media for cell line. Essential equipment required for animal cell culture. (15 hours)

UNIT II

Types of cell culture- Primary, Secondary, Organ culture and cell lines. Role of feeder layers in cell culture, Cell separation techniques, cell synchronization, Cell counting methods, cryopreservation, Cell banking procedures. Biology of cultured cells- Apoptosis and cell death. (15 hours)

UNIT III

Transfection of cells in culture- Animal viral vectors for transfection, Physical methods of transfection, HAT selection, selectable markers. Micro-manipulation of cells, Gene targeting, Gene silencing and Gene knockout and their applications. (15 hours)

UNIT IV

Protein production by genetically engineered mammalian cell lines, Stem cells - types, properties and their applications, Cell culture as a source of valuable products -Transgenic Animals. (15 hours)

UNIT V

Collection and preservation of embryos, Semen banking, AI, IVF and ICSI. Case Study - any two relevant studies. (15 hours)

TEXT BOOKS

1. Ramasamy. P. (2002). Trends in Biotechnology, University of Madras of Publications, Pearl Press
2. Ignacimuthu. (1996). Basic Biotechnology. Tata McGraw-Hill.
3. K. Srivastava et al., (2009) Animal Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd.
4. B.C. Currell et al., (1994) In vitro Cultivation of Animal Cells (Biotol), Butterworth-Heinemann Ltd.
5. Jenkins, N. (ed). (1999) Animal cell Biotechnology: Methods and protocols. Humana press, New Jesey.

REFERENCE BOOKS

1. R. Ian Freshney. (2010) Culture of Animal cells – A Manual of Basic Technique Fourth Edition, WILEY LISS & Publications.
2. Glick, B.R. and Pasternark. (2002) Molecular Biotechnology: Principle and applications of recombinant DNA. 3rd edition. American Society for Microbiology.
3. Kreuzer, H. and Massey, A. (2001) Recombinant DNA and Biotechnology: A guide for teachers, 2nd edition. ASM Press Washington.
4. Traven. (2001). Biotechnology. Tata McGraw – Hill.
5. Walker,J.M. and Gingold, E.B. (1999) Molecular biology and Biotechnology, 3rd edition. Panima Publishing Corporation.

Web Resources

1. http://ecoursesonline.iasri.res.in/course/view.php?id=350
2. https://microbenotes.com/animal-cell-culture/
3. https://biocyclopedia.com/index/biotechnology/animal_biotechnology/manipulation_of_reproduction_and_transgenic_animals/biotech_in_vitro_fertilization_technology.php

4. https://thebiologynotes.com/embryo-transfer/
5. https://people.ucalgary.ca/~browder/transgenic.html

Course Code 24UBOC52	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	3	3	1	1	1	2	1	1
CO2	2	2	3	3	2	1	1	3	1	1
CO3	3	3	3	3	2	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr. D. Karthiyaini
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: VI	**PHARMACEUTICAL BIOTECHNOLOGY**	Hours/Week: 5	
Core course 11		Credits: 4	
Course code- **24UBOC53**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall drug development process, pharmacokinetics, pharmacodynamics, patenting, drug approval, and marketing processes. [K1]

CO2: understand the principles of drug discovery, drug formulation, and clinical trial procedures, along with their regulatory considerations. [K2]

CO3: describe the production and applications of recombinant proteins, vaccines, and biologics in modern medicine, drug toxicity, common side effects, and strategies for drug safety and management. [K2]

CO4: illustrate the principles of drug discovery, development, and regulatory approval in knowledge of biopharmaceutical production and clinical applications, advancements in recombinant therapeutics and personalized medicine. [K3]

CO5: apply the knowledge of pharmaceutical regulations, industry trends, and career opportunities in the pharmaceutical sector. [K3]

UNIT I

Objectives of Pharmaceutical Biotechnology - Generic and Biogeneric drugs. Stages in the drug development process - Drug discovery - Drug designing - Drug production - Preclinical trials - Clinical trials - Pharmacokinetics and Pharmacodynamics - Patenting & Drug Approval - Drug Marketing - Post clinical trials**.**

(15 Hours)

UNIT II

Production of recombinant proteins - Development of Nucleic acid based therapies - Biopharmaceutical considerations - Pharmaceutical regulations - Formulation of Biotechnology products - Drug delivery - Pharmacognosy. (15 Hours)

UNIT III

Human Insulin (Humulin), Growth hormones (Humatrope) - Blood coagulating factor (factor VIII - Kogenate) - Erythropoietin - (Epogen) Granulocyte colony stimulating factors (Neulasta) - Interferons (Avonex) - Antimicrobial peptides (β - defensin 2) - Vaccines (Pentavac), Biologics (Humira - Adalimumab), - Cancer based biologics (rituximab), Enzyme (streptokinase). (15 Hours)

UNIT IV

Drug toxicity analysis - Common side effects of drugs and management - Drugs of abuse - Life changing complications - Prevention and management. (15 Hours)

UNIT V

National and International Drug approval agencies - Top National and International pharmaceutical industries - Scope and career opportunities in pharmaceutical sectors. (15 Hours)

TEXT BOOKS

1. Chandrakant Kokate and Pramod H.J. (2011). Text Book of Pharmaceutical Biotechnology, 1st Edition. Elsevier.

2. Crommelin, Dean J. A., Sindelar, Robert and Meobohm, Bernd (Eds.) (2019). Pharmaceutical Biotechnology: Fundementals and Applications, Springer.

3. Ashish Dixit, Pawan Tiwari and Vivekanand Kishan Chatap. (2015). Textbook of Pharmaceutical Biotechnology, Studium Press (India) Pvt. Ltd.

4. John F. Corpenter and Mark C. Manning. (2012). Rational Design of stable formulation Theory and Practice, 1st edition, US: Springer Science.

REFERENCE BOOKS

1. Gary Walsh (2003). Biopharmaceuticals; Biochemistry and Biotechnology. John Wiley & Sons Ltd.

2. Oliver Kayser and Heribert Warzecha (2012). Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications. Wiley - Blackwell.

3. Simon Wills, (2005). Drugs of abuse. 2nd Edition. Pharmaceutical Press

4. Hiten J. Gutka, Harry Yang and Shefali Kakar (2018). Biosimilars: Regulatory, Clinical, and Biopharmaceutical Development, 1st edition, USA: Springer.

5. Yui-Wing F. L. and Stuart S. (2019). Pharmacogenomics: Challenges and Opportunities in Therapeutic Implementation, 2nd Edition. TX, USA: Academic Press.

Web Resources

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5178364/
- https://www.patentdocs.org/biotech_news/
- https://www.pharmamanufacturing.com/
- https://www.parexel.com/
- https://nptel.ac.in/courses/102/103/102103013/

Course Code 24UBOC53	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1a	**PSO 1b**	**PSO2**	**PSO 3a**	**PSO 3b**	**PSO 4a**	**PSO 4b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

Dr.V.Jeyasimga
Head of the Department

Dr. R.Gloria Jemmi Christobel
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**PLANT BIOTECHNOLOGY AND ANIMAL BIOTECHNOLOGY PRACTICAL**	**Hours/Week: 3**	
Core course 12 Practical 5		**Credits: 2**	
Course code- **24UBOC51P**		**Internal** 25	**External** 75

COURSE OUTCOMES

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

CO1: explain plant tissue culture and Illustrate callus development and animal cell culture techniques. **[K2]**

CO2: develop technical skills in protoplast isolation and nucleus localization and DNA and RNA isolation from plants. **[K2]**

CO3: make use of the techniques used in preparing tissue culture medium, trypsinization and membrane filtration in culturing animal cells and p4repare single cell suspension and evaluate cell counting and viability and cryopreservation. **[K3]**

CO4: infer the results and completion of record work **[K3]**

CO5: analyse the problems and situations in related subject area **[K3]**

Contents:

1. Plant tissue culture media preparation & sterilization techniques.
2. Callus induction.
3. Isolation of plant protoplast & viability test.
4. Localization of nucleus using nuclear stain.
5. Preparation of Animal Tissue culture medium and membrane filtration
6. Preparation of Single Cell Suspension & Cell counting.
7. Cell Viability Test.
8. Isolation of plant DNA and plant RNA(Demo).
9. Isolation of Agrobacterium plasmid DNA (Demo).
10. Trypsinization of monolayer and subculturing (Demo).
11. Measurement of phagocytic activity (Demo).
12. MTT Assay (Demo).
13. Cryopreservation and thawing (Demo).

TEXT BOOKS

1. Madhavi Adhav, (2009). Practical Biotechnology and Plant Tissue Culture, S.Chand & Company Ltd.
2. C. C. Giri, Archana Giri, (2007). Plant Biotechnology: Practical Manual, I.K. International Pvt Ltd.
3. Karl-Hermann Neumann, Ashwani Kumar, Jafargholi Imani, (2009). Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application, Springer.
4. Debajit Borah (2018). Environmental Biotechnology Theory and Lab Practices, (2nd edition), Hardcover – Global Vision Publishing House.

REFERENCE BOOKS

1. S. Lal, Vikas. (2018). Public Health Management Principles And Practice, (2nd Edition), CBS Publishers and Distributors Pvt Ltd.
2. S. Harisha. (2012). Biotechnology procedures and experiments handbook. Laxmi Publications

Web Resources

1. https://www.plantcelltechnology.com/pct-blog/different-types-of-tissue-culture-processes/
2. https://www.thermofisher.com/in/en/home/references/gibco-cell-culture-basics.html

Course Code 24UBOC51P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	1	1	2	1	2	2	1
CO2	2	2	2	3	2	3	2	3	2	1
CO3	2	3	2	3	3	3	2	1	2	1
CO4	2	2	2	3	3	2	2	2	2	1
CO5	2	3	3	3	3	3	3	3	2	1

Dr.V.Jeyasimga
Head of the Department

Dr. D.Karthiyaini & Dr.S.Gurupavithra
Course Designer

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B.Sc. BIOTECHNOLOGY
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Semester V	**PROJECT**	Hours/Week: 1
Core Course - 13		Credits: 1
Course Code **24UBOC54PR**		Internal 100

COURSE OUTCOMES

On completion of the project, the students will be able to

CO1: apply the basic concepts learnt to select projects in Biotechnology and interdisciplinary fields. [K2]

CO2: apply the theoretical knowledge to design experiments to measure the required parameters accordingly. [K3]

CO3: execute the technical skills in handling the equipment, apparatus,and exhibit written communication skills acquired in the related project work and illustrate the work done by them by means of graphs tables and figures. [K3]

CO4: present the results and communicate academic and technological knowledge orally. [K3]

CO5: assess the project to meet the challenges at higher education level/societal level. [K4]

Students are expected to select a project in the field of Biotechnology. Two students can do one project. Minimum pages for a project report should be 20 pages. Two typed copies of the report on the completed project will be submitted to the Controller of Examination through the Head of the department in the month of November during V semester. Evaluation will be done internally.

Mode of Evaluation		**Marks**
Project work and report	:	60
Presentation and Viva-Voce	:	40

Course Code 24UBO54PR	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	2	1	2	2	1	1	1
CO2	3	3	3	2	1	2	3	1	-	1
CO3	3	3	3	2	1	2	3	-	1	2
CO4	3	3	3	1	2	1	2	1	1	-
CO5	3	3	3	1	2	1	2	1	2	-

Dr.V.Jeyasimga

Head of the Department

Dr.V.Jeyasimga

Course Designer

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B.Sc. BIOTECHNOLOGY
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Semester V	**BIOETHICS AND BIOSAFETY**	Hours/Week: 4	
Elective Course – DSEC-1		Credits: 3	
Course Code **24UBOE51**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: define the technological aspects of biosafety and bioethics. [K1]

CO2: understand the basic human rights and procedures in relation with patenting. [K2]

CO3: discuss the IPR associated issues and biosafety guidelines. [K2]

CO4: illustrate the DBT guidelines, regulatory procedures in handling and disposal of hazardous materials. [K3]

CO5: apply the theoretical knowledge to solve legal, scientific and technological issues [K3]

UNIT I

Human Rights: Definition, Classification and Scope of Human Rights. United Nations Commission for Human Rights, National and State Human Rights Commission. Article 21 of Indian Constitution – UDHR. Social issues of Human rights. (12 Hours)

UNIT II

Impact of genecloning & Bioethics-Issues concerning reproduction, Artificial insemination, egg donation, IVF, embryo transplants, Prenatal diagnosis and sex selection & Abortion. (12 Hours)

UNIT III

Bioethics of IPR - ethical criteria in Biotechnology- animal ethics; process of Patenting Licensing of animal house - Human cloning - Ethical issues - Ethical clearance norms for conducting studies on human subjects. Indian and international agencies involved in IPR & patenting. (12 Hours)

UNIT IV

Patents - Introduction -Treaties and Conventions of Patents, Patent Cooperation Treaty - TRIPS Basis of Patentability – Non Patentable Inventions - Patent Application Procedure in India. Other Forms of IP: Copyright - Trade Mark – Industrial designs – Farmer's Rights. Patenting of Biotechnology products and processes. (12 Hours)

UNIT V

Biosafety - General guidelines - DBT guidelines on biosafety in conducting research in biology / biotechnology - Risk assessment studies- Hazardous materials used in Biotechnology- Handling and Disposal - Good manufacturing practices & Good Laboratory practices, Containment facilities and Biosafety practices - Regulation on field experiments and release of GMOs - Labelling of GM foods - Guidelines for research in transgenic plants and animals. (12 Hours)

TEXT BOOKS

1. Ignacimuthu.S. (2009). Bioethics, Narosa Publication house.
2. Sree Krishna.V. (2007). Bioethics and Biosafety in Biotechnology, (1st ed.), New Age International Private Limited.
3. Rhona Smith. (2019). International Human Rights, Blackstone Press.
4. Manual of Patent Practice and Procedure. IPR India, 2005, Ministry of Commerce and Industry, New Delhi, pp.163.

REFERENCE BOOKS

1. Trayer, P.C, Fredrick.R and Koch, M. (2002). Biosafety. Michigan State University
2. Koch, (2002). Biosafety. Traylor, Fredric amp; Michigan state University pub., USA.
3. John.A.Thomas. (2002). Biotechnology and safety assessment. 3rd edition. Academic Press Inc; CBS Publishers and Distributors Pvt. Ltd.

Web Resources

1. www.ipr-helpdesk.org/
2. www.patentoffice.nic.in/ipr/patent/patents.htm
3. www.bangalorebio.com/GovtInfo/ipr.htm

Course Code 24UBOE51	PO1		PO2	PO3		PO4		PO5	PO 6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	3	1	1	3	3	3	3	3	1
CO2	2	1	2	3	3	3	3	3	3	3
CO3	3	3	2	1	2	3	3	3	2	3
CO4	3	3	2	3	3	3	3	2	1	3
CO5	3	3	3	3	3	3	3	3	3	3

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

Dr.V.Jeyasimga

Head of the Department

Ms.M.Afrose Banu

Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**FOOD TECHNOLOGY**	Hours/Week: 4	
DSEC 2 Elective Course: 2		Credits: 3	
Course code- **24UBOE52**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the principles of bioprocess engineering, Food Biotechnology regulations, cereal and pulse processing, oil refining, post-harvest changes in fruits and vegetables, meat and fish spoilage, milk processing, food adulteration detection, biosensors, and food fortification. [K1]

CO2: understand the evolution of food processing, the role of biotechnology in food industries, regulatory aspects, chemical and physical changes in food components. [K2]

CO3: summaries the storage and spoilage mechanisms in plant and animal-based foods, processing methods for dairy and meat, detection of food adulterants, biosensor applications, and food enrichment techniques. [K2]

CO4: apply bioprocess engineering in food production and waste treatment; implement processing techniques for cereals, pulses, oils, fruits, vegetables, meat, fish, and dairy industries. [K3]

CO5: develop methods to control food spoilage and rancidity, detect adulterants using biosensors, and design strategies for food fortification and enrichment. [K3]

UNIT I

Biotechnology relating to the food industry – Role of bioprocess engineering in biotechnology industry- Regulatory and social aspects of Biotechnology in foods - Application of biotechnology in waste treatment of food industries. Historical evolution of food processing technology.

` (12 Hours)

UNIT II

Cereals and Millets; Wheat- composition, types (hard, soft/ strong, weak). Malting, gelatinization of starch, types of browning- Maillard & caramelization. Rice- and composition, parboiling of rice-

advantages and disadvantages. Structure and composition of pulses, toxic constituents in pulses, processing of pulses soaking, germination, decortication, cooking and fermentation. Fats and Oils. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity – types- hydrolytic and oxidative rancidity and its prevention.

(12 Hours)

UNIT III

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fiber, Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables. (12 Hours)

UNIT IV

Concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat-rigor mortis, tenderization of meat, aging of meat. Aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish - microbiological, physiological and biochemical. Composition and nutritive value of egg, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products. Chemical composition of milk - its constituents, processing of milk, pasteurization and homogenization. Types of market milk and milk products.

(12 Hours)

UNIT V

Types of food adulterants – test to detect adulterants in foods – metal contaminants - contaminants of processed foods- Food products as analytical samples, general aspects of biosensors-biosensors for food contaminant analysis, commercially available biosensors for food analysis. Food additives, FSSAI regulations, Methods of fortifying and enriching foods. (12 Hours)

TEXT BOOKS

1. Bawa. A.S, O.P Chauhan et al. (2013). Food Science. New India Publishing agency,
2. B. Srilakshmi (2002). Food science. New Age Publishers
3. Joshi, V.K. and Singh, R.S., A. (2013). Food Biotechnology-Principles and practices. I.K.International Publishing House Pvt. Ltd., New Delhi.
4. RavishankarRai, V. (2015). Advances in Food Biotechnology. First edition. John Wiley & Sons, Inc.

5. Perry Johnson-Green (2018). Introduction to Food Biotechnology. Special Indian Edition, CRC Press.

REFERENCE BOOKS

1. Roday. S. (2011). Food Science, Oxford publication.

2. Meyer. (2004). Food Chemistry, New Age.

3. D Sukumar (2007). Outlines of Dairy Technology, Oxford University Press, 2007

4. Foster, G.N., (2020), Food Biotechnology, 1st edition. CBS Publishers & Distributors Pvt Ltd,

5. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath and Robert E. Levin. (2005). Food Biotechnology. 2nd edition, CRC Press.

5 Roday. S. (2011). Food Science. Oxford publication.

Web Resources

1. https://ifst.onlinelibrary.wiley.com/journal/13652621
2. https://app.knovel.com/web/browse-a-subject-area.v/catid:216/cat_slug:food-science/subcatid:27
3. https://www.springer.com/journal/13197
4. https://www.sciencedirect.com/referencework/9780081005965/food-science
5. https://www.ift.org/news-and-publications/food-technology-magazine

Course Code 24UBOE52	PO1		PO2	PO3		PO4		PO5	PO 6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	3	1	1	2	3	2	2	2	1
CO2	2	1	2	3	2	2	2	2	2	2
CO3	2	2	2	1	2	2	2	3	2	2
CO4	2	2	2	3	2	2	1	2	1	2
CO5	2	2	3	3	2	3	2	3	2	3

Dr.V.Jeyasimga
Head of the Department

Dr. Gloria Jemmi Christobel
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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**NANO BIOTECHNOLOGY**	Hours/Week:4	
Elective Course-2 DSEC-2		Credits:3	
Course code- **24UBOE53**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: define the aspects of nanobiotechnology and mechanisms behind the synthesis of nanoparticles. **[K1]**

CO2: Understand the basic principles, nanoparticle synthesis, characterization and their applications. **[K2]**

CO3: discuss the various forms of nanomaterials and its role in various fields. **[K2]**

CO4: illustrate the scope, synthesis and analysis of nanoparticles and its novel applications. **[K3]**

CO5: apply the acquired knowledge to solve problems in agriculture and medicine **[K3]**

UNIT I

History and Scope of Nanotechnology- Basics- Nanobiotechnological devices: Nanorobot and Nanoshell. Contributions of Indian Research Institutes in the field of nanobiotechnology. (12 Hours)

UNIT II

Metals: Silver nanoparticle synthesis and its analyses by UV-spectroscopy and FTIR. Self-Assembly nanomaterial: Cell membrane and its analyses by SEM. Introduction to 'Top down' vs. 'Bottom up' approach of synthesis with suitable examples. (12 Hours)

UNIT III

Nano-thin films: Chitosan thin film, Nanodevices (nanorobots), Nanotubes: Microtubules assembly and its importance, Nano shells- Dendrimers: Liposomes, Nanofibers: Collagen, Fibronectin & elastin, nano fluidics: Extracellular matrix assembly and its importance. (12 Hours)

UNIT IV

Agriculture: Crop production- Nano fertilizer technology, Biomaterial to improve shelf life of vegetables. Medicine: Collagen thin films-applications, Nanoscale devices – DNA microarrays: Types, Applications and their future scope, Antibodies and targeted drug delivery system. (12 Hours)

UNIT V

Nano biosensors –Types and applications, Biomimetics –concept and applications (Gecko foot effect, Lotus leaf effect: Paint and fabrics, Box fish based Car). (12 Hours)

TEXT BOOKS

1 Vasantha Pattabhi and N. Gautham. (2009). Biophysics, Narosa Publishing House, New Delhi.

2 Narayanan.P. (2010). Essentials of Biophysics, New Age International (P) Ltd. Publishers, New Delhi.

3 Rai, Mahendra, and Clemens Posten. (2013). Green biosynthesis of nanoparticles:Mechanisms and applications, CABI.

4. Pradeep T. (2012). Textbook of Nanoscience and Nanotechnology, McGraw Hill publications, ISBN: 9781259007323.

REFERENCE BOOKS

1. D.Voet, J.G.Voet. (2010). Biochemistry, John Wiley &Sons, New York.

2. David S. Goodsell, (2004). Bio nanotechnology. John Wiley & Sons Inc., publications.

Web Resources

1. http://vvm.org.in/study_material/ENG%20-20Indian%20Contributions% 20to% 20Science.
2. https://www.jabonline.in/admin/php/uploads/16_pdf.pdf
3. https://www.youtube.com/watch?v=gSpHINVmgoE
4. https://www.youtube.com/watch?v=ITtGJUGXFKc
5.https://www.youtube.com/watch?v=4cGROrskvLM

Course Code 24UBOE53	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	3	1	1	2	1	3	3	2	2
CO2	2	2	3	3	2	2	3	3	2	1
CO3	3	2	3	2	2	2	3	3	2	3
CO4	3	3	2	2	3	1	3	3	2	2
CO5	3	3	1	3	3	3	3	3	3	3

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

Dr.V.Jeyasimga

Head of the Department

Dr.S.Jeyaruby

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**CANCER BIOLOGY**	Hours/Week:4	
Elective Course - 2 DSEC 2		Credits: 3	
Course code- **24UBOE54**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: define basic knowledge about the cancer cells, types and concepts of cancer biology. **[K1]**

CO2: recall the environmental and hereditary factors involved in cancer metastasis **[K2]**

CO3: discuss the causes and role of markers in the diagnosis of cancer and its treatment **[K2]**

CO4: illustrate the differences between normal and cancer cells and the various treatment methods

[K3]

CO5: apply the knowledge of cancer biology to understand the dynamics of cancer cells.**[K3]**

UNIT - I

Cancer: Introduction; Origin of Cancer- The Mutation Concept, The Epigenetic Concept, Viral Concept, Unified genetic concept of cancer; Difference between Normal and Cancer cells; Cancer metastasis. Signs and symptoms. (12 Hours)

UNIT II

Cancer as a genetic disease; Genetic Alterations in Cancer cells, Point mutation, splice mutation, alternate splicing; Mutation in regulatory sequences, deletions, Insertion, Chromosome abnormalities, Genetic defects and the time course of hereditary cancer. (12 Hours)

UNIT III

Types of Cancer: - Blood and Lymph – Leukemia, Malignant lymphoma, Bone- Soft tissue Sarcoma, Thorax- Breast cancer, Male genitalia- Prostate cancer, Female genitalia - Cervical cancer; Tumor suppressor genes; Classification of Tumor suppressor genes**,** Tumor Associated gene, Tumour immunology. (12 Hours)

UNIT IV

Detection and Treatment: Early detection, tumour markers, Molecular detection of Carcinomas, Cancer warning signals; Markers in blood urine; Therapies - Chemotherapy, Gene therapy, Radiotherapy, Biological therapy (Immuno therapy). (12 Hours)

UNIT V

Causes and Prevention: Environmental factors and cancer, Carcinogens, Risk factors, Complications, Preventive measures; Lifestyle modifications, Healthy food habits, Cancer vaccine. Novel inventions in cancer treatment (12 Hours)

TEXT BOOKS

1. A. Sarkar, (2011). Biology of Cancer, Discovery Publishing House, New Delhi.

2. Ranajit Sen, (2004). Principles and Management of Cancer, B.I. Publications Pvt Ltd, New Delhi.

3.Dr M.R.Ahuja, 1997, Cancer- Causes and Prevention, UBS Publishers Distributors Pvt. Ltd.

REFERENCE BOOKS

1. Francesco Pezzella, Mahvash Tavassoli, David J. Kerr, (2019). Oxford Textbook of Cancer Biology, Oxford University Press

2. Albert DeNittis, MD, Joel W. Goldwein, MD, and Thomas J. Dilling, MD, (2002) The Biology of Cancer.

Web Resources

1.http://csbl.bmb.uga.edu/mirrors/JLU/DragonStar2017/download/introduction-to-cancer-biology.pdf.

2.http://webserver1.oneonta.edu/faculty/bachman/cancer/207lectures.html.

3.http://csbl.bmb.uga.edu/mirrors/JLU/DragonStar2017/download/introduction-to-cancer-biology.pdf.

4.http://webserver1.oneonta.edu/faculty/bachman/cancer/207lectures.html.

5. https://www.cancer.gov/about-cancer/understanding/what-is-cancer.

6.https://www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/known-and-probable-human-carcinogens.html.

Course Code 24UBOE54	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	3	2	2	2	1	3
CO3	3	1	2	3	3	2	3	3	2	3
CO4	2	2	3	3	1	2	3	2	1	3
CO5	2	2	2	2	3	3	3	2	2	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Jeyaruby
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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester V	**INTERNSHIP**	Hours/Week: -
Course Code **24UBOI51**		Credits: 1
		Internal 100

COURSE OUTCOMES

On completion of the Internship/Industrial Training students will be able to

CO1: relate their theoretical insights with hands-on experience. [K2]

CO2: develop technical skills to their respective field of study. [K3]

CO3: demonstrate the attributes such as observational skills, team spirit and interpersonal skills built through site visits. [K3]

CO4: exhibit the written communication skills acquired through Internship/Industrial Training. [K3]

CO5: analyze the observations and results and communicate their academic and technological knowledge appropriately through oral means. [K4]

Guidelines/ Regulations:

- Each student must go for Internship training in a reputed Industry / Company / Clinical Laboratory/ Organization/ Educational Institution.
- Students should produce the completion certificate after the completion of Internship period.
- A report of 10-15 pages must be submitted by each student after the completion of the Internship period.
- Internal Viva-voce examination will be conducted.
- Students with diverse disabilities must complete a 10 day internship programme at their preferred places.

Course Code-24UBOI51	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	3	1	2	1	1	1
CO2	3	3	1	2		-	1
CO3	3	3	1	2	1	1	2
CO4	3	3	1	2		1	-
CO5	3	3	1	1		2	-

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

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: V	**ENZYMOLOGY**	Hours/Week: -
Extra Credit Course 1		Credits: 2
Course code- **24UBOO51**		Internal 100

COURSE OUTCOMES

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

CO1: recall the classification, kinetics, catalytic mechanisms, techniques involved in enzymology and clinical, industrial applications of immobilized enzymes.

CO2: understand the appropriate methods for the isolation, purification, immobilization, mechanisms of enzyme engineering and how designer enzymes are developed.

CO3: summarise the enzyme classification, kinetics, catalysis and technology in enzymology

CO4: illustrate the enzyme classification and nomenclature, catalysis, kinetics and technology and discover the impact of rational enzyme design in creating biocatalysts for drug synthesis and industrial bioprocesses.

CO5: discuss the methods of inhibition and experiment with the isolation, purification for specific applications.

UNIT I

Nomenclature and classification of enzymes according to the International Union of Biochemistry and Molecular Biologists Convention. Properties of enzymes and factors that influence rate of enzyme action (pH, temperature, substrate concentration, enzyme concentration, activators and inhibitors). Definitions - Apoenzyme, holoenzyme, zymogens. Coenzymes – (Vitamin and Non vitamin origin). Transition state theory, standard free energy, activation energy.

UNIT II

Active site (definition, characteristic features), Enzyme specificity. Bisubstrate and multisubstrate reactions. ES complex formation, lock and key model and induced fit model. Enzyme units - IU & Katal. Turnover number. Isoenzymes (LDH & CPK), Definition – Ribozymes & Abzymes.

UNIT III

Enzyme Kinetics – Michaelis-Menten equation and its derivation, significance of Km and Vmax, Lineweaver- Burk plot and Eadie- Hofstee plot, Hanes-Woolf plot. Enzyme inhibition - competitive, Non-competitive, Uncompetitive – (Derivations not included). Allosteric inhibition - sequential model, concerted model, feedback inhibition.

UNIT IV

Membrane bound proteins – Fluid mosaic model. Extraction of enzymes – Chemical agents and Physical methods of extraction, French pressure cell and ultrasonication. Nature of the extraction medium. Technique for enzyme isolation, separation of cellular organelles by differential centrifugation, purification of enzymes-dialysis, chromatography, electrophoresis. Intracellular localization of enzymes and marker enzymes.

UNIT V

Immobilization of enzymes- Chemical and Physical methods. Clinical and industrial applications of immobilized enzymes. Enzyme engineering and Designer enzymes. Pharmaceutical, Clinical and Industrial uses of enzymes.

TEXT BOOKS

1. Satyanarayana. U. (2013). Biochemistry. 4th Edition, Elsevier India.
2. Jain J L, (2014). Fundamentals of Biochemistry, 7th Edition, S.Chand publishing.
3. Rodwell, V.W, Bender D.A, Botham K.M. (2015). Harper's Illustrated Biochemistry, 30th edition. McGraw-Hill Education.
4. Nicholas C. Price and Lewis Stevens (2009). Fundamentals of Enzymology. Oxford University Press, New Delhi.
5. Voet, D. and Voet, J.G. (2016). Biochemistry, 5th edition. John Wiley and Sons, Inc.,

REFERENCE BOOKS

1. Palmer (2004). Enzyme. 18th edition. London: Portland Press.
2. Jeremy M Berg, John L Tymoczko, and LubertStryer (2006). Biochemistry. 6th Edition. W.H. Freeman Publications.
3. Ralph A. Messing (2012) Immobilised Enzymes Academic Press, NY.
4. Nelson D.L., and Cox, M.M. (2013). Lehninger Principles of Biochemistry. 6th Edition. W.H. Freeman & Company.
5. Jeremy M Berg, Stryer, L. (2015). Biochemistry, 8th edition. Macmillan Learning.

Web Resources

1. https://www.youtube.com/watch?v=AD3-v1oKjSk
2. https://www.youtube.com/watch?v=tPCOEUo6J8s
3. https://www.youtube.com/watch?v=ALwziZSRiqM
4. https://www.youtube.com/watch?v=0ZiCqwtFMTs

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: VI	**BIOENTREPRENEURSHIP**	Hours/Week: 6	
Core Course 14		Credits: 5	
Course code- **24UBOC61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: know about the fields which are having entrepreneurial opportunities. [K1]

CO2: understand the Business proposal writing, vermicomposting, mushroom cultivation and SCP production for starting a company. [K2]

CO3: explain the components of entrepreneurship, funding agencies and develop skills in biological techniques. [K2]

CO4: illustrate the self employment opportunities in various fields of biology. [K3]

CO5: discuss the cultivation of earthworm, silk worm, mushroom and single cell protein and challenges in marketing of the bioproducts. [K3]

UNIT 1

Bio-industries – Biopharma, Bioagri and Bioservice innovations – Successful Entrepreneur – Creativity, Leadership, Managerial skills, Team building, Decision making; Public and private funding agencies (MSME, DBT, BIRAC, Startup & Make in India). (18 hours)

UNIT II

Business plan preparation; business feasibility analysis by SWOT, business plan proposal for virtual startup company; statutory and legal requirements for starting a company/venture; basics in accounting practices. Market Conditions, Identifying the need of the customers. (18 hours)

UNIT III

Sericulture -Selection of Mulberry Variety and Establishment of Mulberry Garden, Rearing House and Rearing Appliances. Disinfections, Silkworm Rearing Technology, Types of Mountages, Spinning, Harvesting and Storage of Cocoons. Economics of silk worm Production- Chawki Rearing-Sericulture in

India. Physical and commercial properties of silk, Pathogenesis, Control and Prevention of Diseases in silk worm and common silk worm pest. Raw silk testing –Classification of raw silk – Byproduct of silk. Commercial characteristics of cocoon- Assessment of shell Ratio- Renditta-Price fixation- silk market- Co operative marketing in price. (18 hours)

UNIT IV

Apiculture: The major types of economically important honeybees and their Identification, General morphology and behavior, Selection of bee species for apiculture. Artificial Bee Rearing (Newton and Langstroth box). Modern Bee Keeping Equipment and Methods. Disease Control and Preventive measures in honey bees. Qualities of Good Bee Flora. Some Important Bee Flora and Their General Characters. Products of Apiculture Industry and its Uses. Commercial value. (18 hours)

UNIT V

Single Cell Protein Production: Source: Algae, Bacteria, Yeast – Cultivation of Single Cell protein: Spirulina cultivation – Production site, Microorganism, Experimental design; harvesting and Drying. Aquaponics Systems: Fish and Vegetables- Nutrients and Biofilters -Advantages and Disadvantages.

(18 hours)

TEXT BOOKS

1. Shimasaki, C. D. (2014). Biotechnology entrepreneurship: Starting, managing, and leading biotech companies. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier
2. Onetti, A., & Zucchella, A. (2014). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge.
3. Ismail,S.A.(1993) The Earthworm book. other India Press. Goa
4. G.Ganga, J.Sulochana Chetty. (2023). An Introduction to sericulture. 2nd Edition. Oxford & IBH Publishing .
5. K. Murugesh Babu. (2018) Silk: Processing, Properties and Applications. Woodhead Publishing Ltd.

REFERENCE BOOKS

1. Adams, D. J., & Sparrow, J. C. (2008) Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion.
2. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.

3. Desai, V. (2011). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.
4. Stephen Rusell (2014). The Essential Guide to Cultivating Mushrooms: Simple and Advanced Techniques for Growing Shiitake, Oyster, Lion's Mane, and Maitake Mushrooms at Home.
5. Pushpa Srivastava (2017). Neutraceutical spirulina: Commercial cultivation using rural technology in india. Aavishkar Publishers.

Web Resources

1. https://archive.india.gov.in › citizen › agriculture
2. http://www.recirculatingfarms.org/resources/
3. https://academy.vertical-farming.net/intro-to-mushroom-growing/

Course Code 24UBOC61	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	-	-	-	3	1	3	-	3	2	2
CO2	-	-	-	2	1	3	-	3	2	2
CO3	2	2	2	1	2	3	2	3	2	3
CO4	2	2	2	1	1	2	2	3	1	3
CO5	2	2	2	1	2	3	3	3	2	3

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

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Dr.D.Karthiyaini
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B.Sc. BIOTECHNOLOGY
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Semester: VI	**ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY**	Hours/Week:6	
Core Course 15		Credits:5	
Course code-**24UBOC62**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Define the principles of ecosystem,Bioprocessing and pollution related issues. [**K1]**

CO 2: Understand the environmental issues, bioprocessing steps and fermentors. **[K2]**

CO 3: Illustrate the mechanisms behind wastewater treatment and bioreactors. **[K2]**

CO 4: Apply the acquired knowledge in the field of Industrial Biotechnology to develop products. **[K3]**

CO 5: Discuss the importance and applications of downstream processing. [**K3]**

UNIT I

Ecosystem: Concept; Energy flow. Environmental Pollution – Sources and types - Water, Air, Thermal, Industrial and Radiation - Global environmental changes. Global warming, Greenhouse effect, acid rain, ozone depletion, and photochemical smog. Environmental issues, management strategies and safety, Biotechnological approaches for management. (18 hours)

UNIT II

Waste water treatment: Aerobic and anaerobic methods (Primary, Secondary and Tertiary) –Use of aquatic plants in waste water treatment. Solid waste management. Bioenergy and SCP from waste. Drinking water treatment. Biotechnological approach to industrial effluent (Paper, Tannery, Textile) Pesticide waste disposal, Ore leaching (methods and examples), MEOR. (18 hours)

UNIT III

Bioprocess Engineering-Steps in bioprocess development. Design of bioreactors - Basic objective of fermentor design, aseptic operation & containment, body construction, agitator and sparger design, baffles, stirrer glands and bearings. Bioreactor configurations and types: Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Animal and plant cell bioreactors. Factors affecting broth viscosity, Mixing in Fermentors. Fermentation systems Batch culture, Continuous culture, Fed-batch culture. (18 hours)

UNIT IV

Downstream processing: Filtration, Centrifugation, Cell disruption, Liquid-liquid extraction, Chromatography, membrane processes, Drying, Crystallization, Whole broth processing. Different types of fermented foods produced from microorganisms- Idli, Sauerkraut - Dairy products- Cheese and Yoghurt. Microbial biomass, Microbial enzymes– Amylase & protease, Immobilization of enzymes: Methods, Properties, Applications, Biosensors and Biochips -Types and applications. Microbial Polysaccharide production: Xanthan, Dextran. (18 hours)

UNIT V

Production of antibiotics – Penicillin - streptomycin. Alcoholic beverages: Wine, Beer –Biofertilizers- Rhizobium & Azotobacter. Biopesticides – Bacillus thuringiensis and microbial toxin production and their applications - Biosurfactants, Vitamins- Folic acid & Vitamin B12. (18 hours)

TEXT BOOKS

1. Chatterji, A.K., (2002). Introduction to Industrial Biotechnology, Prentice-Hall of India, New Delhi.
2. Anil Kumar De., (2000). Environmental Chemistry, 4th Edition. New Age International, New Delhi.
3. Murugesan, A G., Rajakumari, C., (2005). Environmental Science and Biotechnology Theory and Techniques., MJP publishers, Chennai.
4.T.Satyanarayana, Bhavdish Narain Johri,Anil Prakash (2012), Microorganisms in Sustainable Agriculture and Biotechnology.
5. Madigan, Michael and Martinko, John,(2005). Brock biology of microorganism, 11th edition,

REFERENCE BOOKS

1. Alan Scragg, (1999). Environmental Biotechnology, Pearson Education Limited, England,
2. Peter F. Stanbury, Allan Whitaker, Stephen J. Hall (2013). Principles of Fermentation Technology Second Edition, Elsevier Science Ltd.,

3. Michael J. Waites, Neil L. Morgan, John S. Rockey Gary Higton (2001.), Industrial Microbiology: An Introduction. . Blackwell Science Ltd

4. Nduka Okafor, Modern Industrial Biotechnology & Microbiology (2017), Science Publishers, Edenbridge Ltd.

Web Resources:

1. https://nptel.ac.in/courses/120/108/120108004/
2. https://www2.hcmuaf.edu.vn/data/quoctuan/Environmental%20Biotechnology%20-%20Theory%20and%20Application,%20G%20M%20Evans%20&%20J%20C%20Furlong.pdf
3. www. Prenhall.com/Madigan
4. www.microbeworld.org/

Course Code 24UBOC62	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	2	2

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

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

Ms.M.Afrose Banu — **Course Designer**

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: VI	**ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY PRACTICAL**	Hours/Week:6	
Core Practical- VI		Credits:5	
Course code- **24UBOC61P**		Internal 40	External 60

COURSE OUTCOMES
On completion of the course, the students will be able to

CO1: demonstrate the production of microbial enriched products in a stepwise manner [K2]

CO2: write the procedure, formulae and perform the calculations in order to explain the required parameters. [K2]

CO3: Apply the acquired knowledge in order to perform experiments. [K3]

CO4: infer the result and complete the record work. (K3)

CO5: analyse the problems and situations in related subject area [K3]

1. Study of Growth Curve and Generation time of Bacteria/ Yeast using turbidometry.
2. Water analysis – MPN, BOD and COD.
3. Immobilization of whole yeast cells/ enzyme by Alginate beads.
4. Production of enzyme amylase
5. Production of wine
6. Production of Biogas – In vitro & Compost Making.
7. Biofertilizer production/Spirulina production - field visit. (Report should be included in the record)
8. Isolation and identification of starter organisms from Idli batter/ curd
9. Grading of raw milk (Dye reduction test).
10. Determination of efficiency of Pasteurization by quantitative phosphatase test.
11. Preparation and Efficiency testing of Biofertilizer/ Biopesticide. (Demo)
12. Production of microbial Polysaccharide. (Demo)

Course Code 24UBOC61P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	3	3	3	2	3	3
CO2	3	3	2	2	3	3	3	2	3	3
CO3	3	3	2	3	3	3	3	2	3	2
CO4	2	3	3	3	3	2	2	2	3	3
CO5	3	2	2	1	2	2	2	3	2	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Jeyaruby
Course Designer

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B.Sc. BIOTECHNOLOGY
(2024-2025 onwards)

Semester: VI	**MARINE BIOTECHNOLOGY**	Hours/Week:5	
Elective Course-3 DSEC 3		Credits:5	
Course code- **24UBOE61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the principle features of marine ecosystems and their role in maintaining healthy environment. [K1]

CO2: explain the applications of marine bioactive compounds in various fields. [K2]

CO3: describe the process of bioremediation and chromosome manipulation in aquaculture. [K2]

CO4: find the significance of marine natural resources, mass cultivation methods and marine pharmacognosy [K3]

CO5: develop the knowledge on present and future aspects in marine aquaculture. [K3]

UNIT I

Marine Ecosystems & Its functioning, Ocean currents, Physical & chemical properties of seawater, Ecological divisions of the Sea- Euphotic-Mesopelagic- Bathopelagic- Benthos-Intertidal, Estuarine-Salt Marsh- Mangrove- Coral Reef. (15 Hours)

UNIT II

Marine microbial habitats- Screening for Secondary metabolites from marine microbes (Bacteria, Fungi, Actinomycetes and marine microalgae). Biofouling, Biofilm, Antifouling, and anticorrosive properties of marine biota. Probiotic bacteria and their importance in marine aquaculture. (15 Hours)

UNIT III

Marine pharmacognosy -marine pharmaceuticals and nutraceuticals, marine toxins, marine cosmetic products. Novel marine bioactive compounds. (15 Hours)

UNIT IV

Fish chromosome manipulation in aquaculture-- Gynogenesis- Androgenesis- Polyploidy, Artificial Insemination, Eyestalk ablation- Trangenesis and Cryopreservation. Present status & future prospects in marine aquaculture (15 Hours)

UNIT V

Marine biomaterials -Agar- Agarose - Alginate- Carrageenan- Chitin- Chitosan- Heparin.Marine bioenergy-sources and production. Bioremediation in marine environment.

(15 Hours)

TEXT BOOKS

1. Italy, E (Eds). (1998). New Developments in Marine Biotechnology, Plenum Pub. Corp.
2. Y. Le Gal and H.O.Halvorson. (1998). New Developments in Marine Biotechnology. Springer.
3. David H. Attaway, (2001). Marine Biotechnology, Volume 1, Pharmaceutical and Bioactive Natural Products
4. Rita R. Colwell. (1984). Biotechnology in the Marine Sciences (Advances in Marine Science & Biotechnology) Wiley Interscience.

REFERENCE BOOKS

1. Scheupr, P.J. (Ed.), (1984). Chemistry of Marine Natural Products ,Chemical and Biological Perspectives. Vol. I III, Academic Press, New York.
2. Marine Biology- Lalli C.M. and T.R. Parsons., (1997). Biological Oceanography - An Introduction, Elsevier.
3. Marine Pollution- Clark, R. B. (2001). Marine pollution, 5th edition. Oxford University press, New York Inc.
4. Gloria Sanchez, Elizabeth Hernandez. (2019), Environmental Biotechnology and cleaner Bioprocess, 1st Edition, CRC Press.
5. Kirchman, D.L.Gasol, J.M. (2018), Microbial ecology of the oceans, 3rdEdition, Wiley –Blackwell.

Web Sources

- http://coe.genomics.org.cn/
- http://www.bcb.iastate.edu/
- http://www.nwfsc.noaa.gov/protocols/bioinformatics.html
- http://www.ebi.ac.uk/ ExPASy.org/
- http://www.expasy.org/

Course Code 24UBOE61	PO1		PO2	PO3		PO4		PO5	PO 6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	1	1	1	2	1	2	2	1
CO2	1	2	1	3	3	3	3	2	3	3
CO3	3	3	2	3	3	2	3	3	3	3
CO4	3	3	2	3	3	3	3	1	3	3
CO5	3	3	2	2	3	3	3	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Ms.K.Srinithi
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B.Sc. BIOTECHNOLOGY
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Semester: VI	**MEDICAL BIOTECHNOLOGY**	**Hours/Week: 5**	
Elective Course 4 DSEC 4		**Credits: 5**	
Course code- **24UBOE62**		**Internal** 25	**External** 75

COURSE OUTCOMES

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

CO1: obtain knowledge on molecular basis of diseases, Vaccines, Antibody therapy and diagnostics. **[K1]**

CO2: understand the metabolic disorders, diagnosis, infectious diseases, production of therapeutic agents and ethical issues in clinical trials. **[K2]**

CO3: explain the disease types and therapeutic agents. **[K2]**

CO4: illustrate the antibody production, diagnostics and clinical trials. **[K3]**

CO5: discuss the types of vaccines, in born errors of metabolism, diagnostics techniques and ethical issues in clinical trials. **[K3]**

UNIT I

Antibodies and vaccines - Therapeutic production of antibodies, antibody mediated drug delivery of vaccines, different kinds of vaccines and applications of recombinant vaccines. Diagnosis - Biochemical diagnostics, inborn errors of metabolism, haemoglobinopathies**.** (15 Hours)

UNIT II

Molecular basis of disease, Recombinant DNA Technology in medicine, gene probes as molecular diagnostic reagents. Polymerase Chain Reaction in clinical diagnostics, DNA sequencing of representative clones to detect mutations. (15 Hours)

UNIT III

Diagnosis of infectious diseases, Viral diseases – HIV, influenza; bacterial diseases - enteric diseases, mycobacterium diseases; immune arrays. FACs immunocytochemical staining, ELISA, FISH techniques. (15 Hours)

UNIT IV

Immunoblot analysis of antigens and allergens. Production of therapeutic agents – Productions and application of therapeutic agents, Production of cytokines and interferons. (15 Hours)

UNIT V

Principles of project management in Clinical trials and its application. Principles of research ethics; Ethical issues in clinical trials; Animal rights and use of animals in the advancement of medical technology. Use of humans in Scientific Experiments; Introduction to ethical codes and conduct.

(15 Hours)

TEXT BOOKS

1. Roli, M. (2017). National Ethical Guidelines for Biomedical and Health Research Involving Human Participants.

2. Lela, B. and Maribeth, L. F. (2011). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. 1st Edition. Philadelphia, USA. F A Davis Company.

REFERENCE BOOKS

1. Bernard, R. G. Terry, L.D. and Cherryl, L.P. (2014). Medical Biotechnology, 2nd Edition. Amer Society for Microbiology.

2. Patrick, R.M. Kenneth, S.R. and Michael, A.P. (2016). Medical Microbiology, 8th Edition. USA. Elsevier Publishers.

3. Pamela, G. Michelle, M, (2009). Molecular Therapeutics: 21st century medicine, 1st Edition. Hoboken, New Jersey. Wiley Publishers.

Web Resources:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2881260/

https://www.nature.com/articles/s41577-021-00542-x

https://www.ncbi.nlm.nih.gov/books/NBK26837/

https://www.sciencedirect.com/topics/medicine-and-dentistry/dna-sequencing

http://aquafind.com/articles/Elisa.php

Course Code 24UBOE62	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO 6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	1	1	1	2	1	2	2	1
CO2	1	2	1	3	3	3	3	2	3	3
CO3	3	3	2	3	3	2	3	3	3	3
CO4	3	3	2	3	3	3	3	1	3	3
CO5	3	3	2	2	3	3	3	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Gurupavithra
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B.Sc. BIOTECHNOLOGY
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Semester: VI	**GOOD LABORATORY PRACTICES (GLP)**	Hours/Week: 5	
Elective Course 4 DSEC 4		Credits: 4	
Course code- **24UBOE63**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: obtain adequate knowledge on Biotechnology Laboratory [K1]

CO2: define the preparation and nature of chemicals, principles of instruments, calibration, quality control and waste disposal. [K2]

CO3: understand the working of lab equipments hazards, lab ethics, maintenance of equipments and types of waste. [K2]

CO4: illustrate the general laboratory organisation, health hazards, methods of documentation.[K3]

CO5: gain knowledge about Safety measures. [K3]

UNIT I

Biotechnology lab organization - Types of labs associated with Biotechnology (General lab, microbial culture lab, plant tissue culture lab, Fermentation lab, computational simulation lab), Types of Chemical (Analytical grade, molecular grade) and its various arrangement (Arrangement of basic chemicals, solvent, acid and base, fine chemicals like dyes, protein and enzyme storage units), Physical chemical characteristics: hygroscopic, corrosive, volatile properties; Fire and explosion hazard data, Health hazards (how to use UV-illuminator), Fumigation technique. (15 Hours)

UNIT II

Lab ethics - Regulatory affairs: Methods and types of documentation (pre-lab writes, result recording and post lab report: interpretation of result), Dilution factor calculation, Molarity, percentage, dilution of concentrated solution, metric units (kg to gms and vice -versa). (15 Hours)

UNIT III

Instrument calibration and importance - Principles, use and maintenance of laboratory instruments like Autoclave, hot air oven, Incubators, Water bath, Refrigerator, Centrifuge, Calorimeter, pH meter, Haemocytometer, Microtome, Electronic balances, Bio safety cabinets. SOP preparation for instrumentation. (15 Hours)

UNIT IV

GLP & Biotechnology Industry standards - Good Laboratory guidelines, Elements of GLP, Standard Operating Procedures and its importance, Quality Assurance & Quality control, Internal audit basics, ISO, BIS and HACCP standards. (15 Hours)

UNIT V

Types of wastes and safe disposal methods - Definition of waste, types of waste: Biological and chemical waste, methods of Safe Disposal of biological and chemical waste: treatment methods of Ethidium Bromide solutions, Electrophoresis Gels, Contaminated Gloves, debris, Wastes containing sodium azide, Silver staining solutions, Perchloric acid, Nanoparticle wastes, Spill management, Awareness and training for personnel. (15 Hours)

TEXT BOOKS

1. Milton A. Anderson. (2002). GLP Essentials: A Concise Guide to Good Laboratory Practice, 2nd Edition, Published by CRC press.
2. Pradeep Deshmukh. (2020). Principles of Good Laboratory Practice. Adhyyan Books.

REFERENCE BOOKS

1. Mindy J Allport-Settle. (2010). Good Laboratory Practice: Nonclinical Laboratory Studies Concise. Pharmalogika.
2. Willa Y. Garner, Maureen S. Barge, James P. Ussary. (1992). Good Laboratory Practice Standards: Applications for Field and Laboratory Studies 1st Edition. ACS Professional.

Web Resources

1. https://www.oecd.org/chemicalsafety/testing/overview-of-good-laboratory-practice.htm
2. https://www.intechopen.com/chapters/22127

Course Code 24UBOE63	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	3	1	3	3	3	1	2	3	1
CO2	2	3	2	3	2	3	1	3	3	1
CO3	1	3	3	3	2	1	1	3	3	1
CO4	1	3	3	3	1	1	1	3	2	1
CO5	1	3	2	3	1	1	1	3	2	1

Dr.V.Jeyasimga
Head of the Department

Dr.D.Karthiyaini
Course Designer

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B.Sc. BIOTECHNOLOGY
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Semester: VI	**FORENSIC BIOTECHNOLOGY**	Hours/Week: 5	
Elective Course 4 DSEC 4		Credits: 4	
Course code- **24UBOE64**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic principles and scope of Forensic Biotechnology. **[K1]**

CO2: understand the techniques used in crime scene investigation. **[K2]**

CO3: describe the sample collection Forensic analysis techniques for identification of signature,body fluids, and DNA profiling. **[K2]**

CO4: explain the different types of Microscopy and molecular techniques used in case studies. **[K3]**

CO5: examine the DNA testing methods in identifying paternity and maternity. **[K3]**

UNIT I

Definition and scope of Forensic Biotechnology, History and development, Forensic genetics, Forensic agriculture. (15 Hours)

UNIT II

Crime scene investigation; collection, preservation, packing and forwarding of physical and trace evidence. Questioned documents – identification of handwriting, signature and detection of forgery. (15 Hours)

UNIT III

Serology - Fresh blood grouping and typing, stains of bloods. Identification of blood stains, collection and storage of allied body fluids (semen, saliva and blood). Case studies. (15 Hours)

UNIT IV

PCR, RFLP, AFLP, Microscopy (Electron, Fluorescent) and Chromatography (Paper, TLC & HPLC) in forensic investigation. (15 Hours)

UNIT V

DNA Profiling, Isolation of DNA from blood samples, DNA testing in cases of disputed paternity and maternity**.** (15 hours)

TEXT BOOKS

1. Nageshkumar G Rao, (2013) Textbook of Forensic Medicine & Toxicology, Jaypee, 2013.

2. K.S. Narayan reddy and O.P. Murty,(2017) The Essentials of Forensic Medicine & Toxicology, 35th Edition, Jaypee, Nanda, B.B. and Tiwari R. K. (2014). Forensic Science in India: A Vision for the Twenty First Century, (2nd edition), Select Publishers, New Delhi, ISBN: 9788190113526.

3. Barbara H. Stuart (2013). Forensic Analytical Techniques (Analytical Techniques in the Sciences (AnTs), (1st edition), UK, Wiley, ISBN: 978-0-470-68727-7.

4. C. Champod, C. Lennard, C. Margot, P. and Stoilovic (2015). Fingerprints and otherRidge Skin Impressions, (7th edition), Boca Raton, CRC Press, ISBN: 9781498728959.

REFERENCE BOOKS

1. Jim Fraser, (2010). Forensic Science: A very short introduction, Oxford university press,.

2.. William Goodwin, Adrian Linacre, SibteHadi, (2007). An introduction to Forensic Genetics. John Wiley & Sons Ltd.

3. Harralson H. and Miller S. (2017). Huber and Headrick's Handwriting Identification: Facts and Fundamentals, 2nd Edition. Boca Raton, CRC Press.

4. Ghosal S. and Avasthi A.S. (2018). Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Edition. Delhi.

Web Resources

- http://www.forensicsciencesimplified.org
- www.nfstc.org
- https://archive.org/details/FBI_Handbook_of_ForensicScienc
- https://www.soinc.org/forensics-notes

Course Code 24UBOE64	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	2	2	1	2	3	2	2	2
CO2	2	2	2	3	2	3	2	3	2	2
CO3	3	3	2	3	2	3	2	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2
CO5	2	3	3	3	2	3	3	3	1	2

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

Dr.V.Jeyasimga
Head of the Department

Ms.K.Srinithi
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Semester: VI	**VERMITECHNOLOGY**	Hours/Week:2	
SEC -7		Credits:2	
Course code-**24UBOS61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic characteristics of earthworms in the field of vermitechnology to identify their beneficial aspects in agriculture. [K1]

CO2: explain the selection of earthworm species, different methods of vermicompost and its parameters for crop improvement. [K2]

CO3: describe the small and large scale techniques of producing vermicompost in a successful way [K2]

CO4: make use of all the prospects of vermiculture in order to produce vermiwash and vermicompost [K3]

CO5: apply their theoretical knowledge to become a successful entrepreneur [K3]

UNIT I

Earthworms – Introduction, Types, Collection and Preservation of earthworms - Types and basic characteristics of species suitable for vermicomposting; Role of earth worms in soil fertility, Biology of *Lampito maruitti*. (6 Hours)

UNIT II

Culturing techniques of earthworms and composting materials; Pot method; Wooden box method; Propagation; Factor affecting culturing of earthworm; Vermicomposting materials; Harvest and Storage of vermicompost – Characterization and Uses. (6 Hours)

UNIT III

Small scale techniques of Vermicomposting - Indoor dual bin method; Bed method; Pit method; Heap method; Expandable worm tower assembly method; Hanging basket method; Physical, chemical and biological properties of vermicompost. (6 Hours)

UNIT IV

Large scale techniques of Vermicomposting Outdoor dual bin; Raised cage; Dual pit; Commercial model; Trickling filter vermicomposting; Keep it simple and save plan. Flow sheet for vermi technology

(6 Hours)

UNIT V

Vermiwash and Economics - Chemical composition of vermiwash; Techniques of vermiwash production: Advantages of Vermicomposting; Prospects of vermi-culture as self-employment venture. (6 Hours)

TEXTBOOK

Mary violet Christy, A. (2014).*Vermitechnology*,1st Edition. New Delhi: MJP Publishers.

REFERENCES BOOKS

1. Sultan Ahmed Ismail, (2009), The earthworm book, Other India Press edition
2. Somani, L.L. (2008). Vermicomposting and vermiwash. Agrotech Publishing Academy, Udaipur.
3. Talashilkar and Dosani, (2005). Earthworm in Agriculture. Agrobios (India), Jodhpur.
4. Ranganathan, L.S. (2006). Vermibiotechnology from soil health to human health – Agrobios, India.

Course Code 24UBOS61	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO 6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	1	3	3	3	3	3	2	3	2
CO2	2	1	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	3	2
CO4	2	1	2	3	3	3	3	1	3	1
CO5	3	3	1	3	3	3	3	1	3	2

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

Dr.V.Jeyasimga
Head of the Department

Dr.S.Jeyaruby
Course Designer