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 2023 - 2024)

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

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

A. CHOICE BASED CREDIT SYSTEM (CBCS)

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

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

---

UG PROGRAMMES

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

PG PROGRAMMES

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

OUTLINE OF CHOICE BASED CREDIT SYSTEM – 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)
(2023-2024 onwards)

UG PROGRAMMES

Name of the Course	Course Code	Semester	Department
Introduction to Tourism	23UHIN11	I	History(EM)
Indian Constitution	23UHIN21	II	History(EM)
சுற்றுலா ஓர் அறிமுகம்	23UHIN11	I	History (TM)
இந்திய அரசியலமைப்பு	23UHIN21	II	History(TM)
Popular Literature and Culture	23UENN11	I	English
English for Professions	23UENN21	II	
பேச்சுக்கலைத்திறன்	23UTAN11	I	Tamil
பயன்முறைத் தமிழ்	23UTAN21	II	
Practical Banking Basic Accounting Principles	23UCON11 23UCON22	I II	Commerce (Aided)
Financial Literacy-I Financial Literacy -II	23UCON12 23UCON21	I II	Commerce (SF)
Self-Employment and Startup Business	23UCCN11	I	Commerce CA (SF)

Fundamentals of Marketing	23UCCN21	II	
Women Protection Laws	23UCPN11	I	Commerce (Professional Accounting)
Basic Labour Laws	23UCPN21	II	
Basics of Event Management	23UBAN11	I	Business Administration
Business Management	23UBAN21	II	
Quantitative Aptitude I	23UMTN11	I	Mathematics
Quantitative Aptitude II	23UMTN21	II	
Physics for Everyday life -I	23UPHN11	I	Physics
Physics for Everyday life -II	23UPHN21	II	
Food Chemistry	23UCHN11	I	Chemistry
Drugs and Natural Products	23UCHN21	II	
Ornamental fish farming and Management	23UZYN11	I	Zoology
Biocomposting for Entrepreneurship	23UZYN21	II	
Foundations of Baking and Confectionery	23UHSN11	I	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	23UHSN21	II	
Nutrition and Health	23UBCN11	I	Biochemistry
Life Style Diseases	23UBCN21	II	
Social and Preventive Medicine	23UMBN11	I	Microbiology
Nutrition & Health Hygiene	23UMBN21	II	
Herbal Medicine	23UBON11	I	Biotechnology
Organic farming and Health Management	23UBON21	II	
Basics of Fashion	23UCFN11	I	Costume Design And Fashion
Interior Designing	23UCFN21	II	
Office Automation	23UCSN11	I	Computer Science
Introduction to Internet and HTML 5	23UCSN21	II	
Office Automation	23UITN11	I	Information Technology
Introduction to HTML	23UITN21	II	
Introduction to HTML	23UCAN11	I	Computer Applications
Fundamentals of Computers	23UCAN21	II	
Introduction to HTML	23UGDN11	I	Computer Applications - Graphic Design
Fundamentals of Computers	23UGDN21	II	
Organic Farming	23UBYN11	I	Botany
Nursery and Landscaping	23UBYN12		
Mushroom Cultivation	23UBYN21	II	
Medicinal Botany	23UBYN22		
Cadet Corps for Career Development I	23UNCN11	I	National Cadet Corps
Cadet Corps for Career Development II	23UNCN21	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 B.Sc. Biotechnology Programme

The students will be able to

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

Key Components of 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 B.Sc. Biotechnology 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.

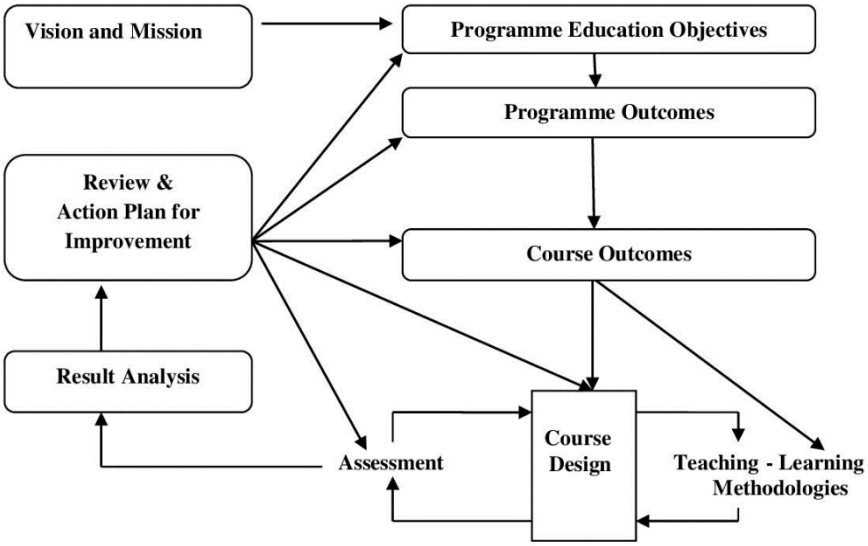
PO-PEO Mapping Matrix

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	-	-	✓

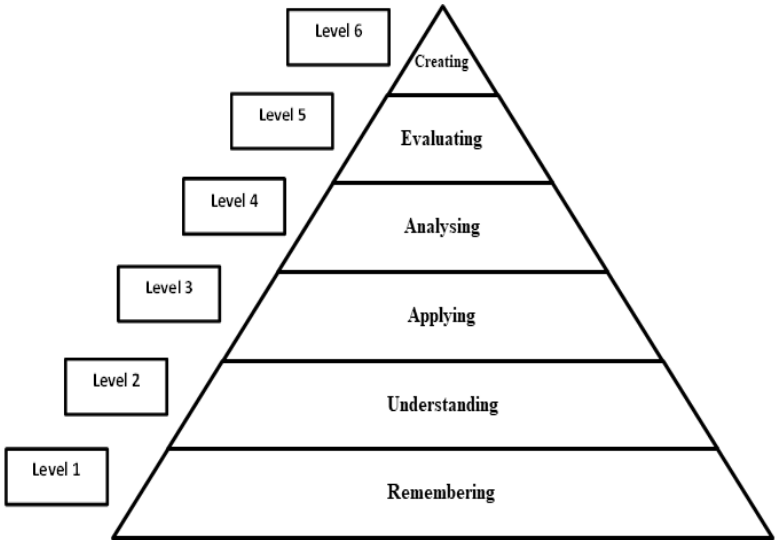
B.1.4 Course Outcomes (COs)

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
		Field Project/Internship
		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**

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 (Based on the listed activities) - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10
Report on student's Awareness creation on Environmental Protection /Ethical Values - 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/ Field Project

Internship / Field Project is compulsory for II year UG Science Students

- **Internship:** A designated activity that carries one credit involving not less than 15 days of working in an organization under the guidance of an identified mentor
- **Field Project:** Students comprising of maximum 5 members in a team need to undertake project that involve conducting surveys inside/outside the college premises and collection of data from designated communities or natural places.
- Assessment by Internal Examiner only

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

B.2.6 SELF STUDY COURSE

B.2.6 .1 PART III - Core & Elective Courses 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.2.6 .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.2.7. 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.2.8 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.
  - Pass minimum for External Practical Examination is 21 marks out of 60 marks.
  - Pass minimum for Ability Enhancement Compulsory Courses and Generic Elective Courses is 40 marks.
  - Pass minimum for Self Study Courses is 40 marks.

- Attendance
  - For UG, PG Programmes,

a) The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.

b) 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 condition according to the respective cases.

c) The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.

d) 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.

These rules come into effect from 2023-2024 onwards.

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 B.Sc. Biotechnology Programme.

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

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 2023-2024

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 & Self Study Course							
Core Course	5 (5)	5 (5)	5 (5)	4 (4)	6 (5)	6 (5)	31 (29)
Core Course	-	-	-	-	5 (4)	6(5)	11 (9)
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 (3)	-	1 (3)
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 &Internship/ Field Project							
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/ Field Project	-	-	-	-	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

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

B.Sc., BIOTECHNOLOGY– 2026
PROGRAMME CONTENT
SEMESTER I
2023-2024 onwards

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	23UTAG11/ 23UHDG11	6	3	3	25	75	100
2.	**Part II**		English	23UENG11	6	3	3	25	75	100
3.	**Part III**	Core Course -1	Cell and Molecular Developmental Biology	23UBOC11	5	5	3	25	75	100
4.		Core Course -2 Practical-I	Cell and Molecular Developmental Biology Practical	23UBOC11P	3	2	3	40	60	100
5.		Elective Course -1	Biological Chemistry	23UBOA11	4	3	3	25	75	100
6		Elective Course -1 Practical I	Biological Chemistry Practical	23UBOA11P	2	1	3	40	60	100
7	**Part IV**	NME-1	Herbal Medicine	23UBON11	2	2	2	25	75	100
8		SEC- 1 Foundation Course	Basics of Biotechnology	23UBOF11	2	2	2	25	75	100
				Total	**30**	**21**				**800**

B.Sc., BIOTECHNOLOGY - SEMESTER II

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	23UTAG21/ 23UHDG21	6	3	3	25	75	100
2.	**Part II**		English	23UENG21	6	3	3	25	75	100
3.	**Part III**	Core Course -3	Genetics	23UBOC21	5	5	3	25	75	100
4.		Core Course -4 Practical-II	Genetics Practical	23UBOC21P	3	2	3	40	60	100
5.		Elective Course -2	Fundamentals of Microbiology	23UBOA21	4	3	3	25	75	100
6		Elective Course -2 Practical-II	Fundamentals of Microbiology Practical	23UBOA21P	2	1	3	40	60	100
7.	**Part IV**	NME-2	Organic Farming and Health Management	23UBON21	2	2	2	25	75	100
8		SEC – 2	Food Chemistry	23UBOS21	2	2	2	25	75	100
				Total	**30**	**21**				**800**

B.Sc., BIOTECHNOLOGY– 2026
PROGRAMME CONTENT
SEMESTER III
2023-2024 onwards

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/Hindi	23UTAG31 / 23UHDG31	6	3	3	25	75	100
2.	**Part II**		English	23UENG31	6	3	3	25	75	100
3.	**Part III**	Core Course -5	Immunology and Immunotechnology	23UBOC31	5	5	3	25	75	100
4.		Core Course -6 Practical-III	Immunology and Immunotechnology Practical	23UBOC31P	3	2	3	40	60	100
5.		Elective Course -3	Bioinstrumentation	23UBOA31	4	3	3	25	75	100
6		Elective Course–3 Practical III	Bioinstrumentation Practical	23UBOA31P	2	1	3	40	60	100
7	**Part IV**	SEC-3	Mushroom cultivation	23UBOS31	1	1	2	100	-	100
8		SEC- 4	Food and Bioprocess Technology	23UBOS32	2	2	2	25	75	100
9			Environmental studies	23UGES41	1	-	-	-	-	-
				Total	**30**	**20**				**800**

B.Sc. BIOTECHNOLOGY - SEMESTER IV

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	23UTAG41/ 23UHDG41	6	3	3	25	75	100
2.	**Part II**		English	23UENG41	6	3	3	25	75	100
3.	**Part III**	Core Course -4	Genetic Engineering and rDNA Technology	23UBOC41	4	4	3	25	75	100
4.		Core Course -4 Practical-I	Genetic Engineering and rDNA Technology Practical	23UBOC41P	3	2	3	40	60	100
5.		Elective Course-4	Bioinformatics and Biostatistics	23UBOA41	4	3	3	25	75	100
6		Elective Course -4 Practical-II	Bioinformatics and Biostatistics Practical	23UBOA41P	2	1	3	40	60	100
7.	**Part IV**	SEC – 5	Aquaculture	23UBOS41	2	2	2	25	75	100
8.		SEC – 6	Poultry science and Management	23UBOS42	2	2	2	25	75	100
9.			Environmental Studies	23UGES41	1	2	2	100	-	100
				Total	**30**	**22**				**900**

B.Sc. BIOTECHNOLOGY - SEMESTER V

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course -4	Plant Biotechnology	23UBOC51	6	5	3	25	75	100
2		Core Course -5	Animal Biotechnology	23UBOC52	5	4	3	25	75	100
3		Core Course -6	Pharmaceutical Biotechnology	23UBOC53	5	4	3	25	75	100
		Core Course -1 - Practical-II	Plant Biotechnology and Animal Biotechnology	23UBOC51P	3	2	3	40	60	100
		Core Course Project	Project	23UBOC54PR	1	3	-	100	-	100
4		Elective Course DSEC-1	Bioethics and Biosafety	23UBOE51	4	3	3	25	75	100
5		Elective Course DSEC-2	Nano Biotechnology	23UBOE52	4	3	3	25	75	100
7	**Part -IV**		Value Education	23UGVE51	2	2	2	100	-	100
8		Self study course	Practice for Competitive Examinations - Online	23UGCE51	-	1	-	100	-	100
9.		Internship/ Field Project	Internship	23UBOI51G	-	1	-	100	-	100
				Total	**30**	**28**				**900**
	Extra Credit Course (Self-Study Course)		Enzymology	23UBOO51	-	2	3	100	-	100

B.Sc. BIOTECHNOLOGY - 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 -4	Bioentrepreneurship	23UBOC51	6	5	3	25	75	100
2		Core Course -5	Environmental and Industrial Biotechnology	23UBOC52	6	5	3	25	75	100
		Core Course -6 Practical-VI	Environmental and Industrial Biotechnology Practical	23UBOC61P	6	5	3	40	60	100
4		Elective Course DSEC-3	Marine Biotechnology	23UBOE61	5	5	3	25	75	100
		Elective Course DSEC-4	Good Laboratory Practices	23UBOE62	5	4	3	25	75	100
6		Self study course	Core Courses Quiz - online	23UBOQ61	-	1	-	100	-	100
7	**Part-IV**	SEC -7	Vermitechnology	23UBOS61	2	2	2	25	75	100
8	**Part-V**	Extension Activities	Extension Activities		-	1	-	100	-	100
				Total	**30**	**28**				**800**

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology
(2023-2024 onwards)

Semester I	**CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY**	Hours/Week: 5	
Core Course -1		Credits: 5	
Course Code **23UBOC11**		Internal 25	External 75

Course Outcomes:

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

CO1: Recall the cell structure, organelles, central dogma, cell division and development. (K1)

CO2: Understand the cell types, function, genetic material, signal transduction and organogenesis. (K2)

CO3: Summarize the structure and function of cells & nucleic acids, the molecular mechanism of replication, transcription, translation, signalling pathway, morphogenesis & growth (K2)

CO4: Illustrate the cell structure, cell organelles, response of cells to the intra and extracellular environment, and cellular differentiation. (K3)

CO5: Distinguish the structure, function of cells, replication, transcription, translation of prokaryotic & eukaryotic cells, cell signalling and morphogenesis. (K3)

UNIT I

Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells). (10 Hours)

UNIT II

Biomacromolecules and Biomicromolecules (Primary functions in the cell). Structure and Functions of Cell Organelles: Cell wall - Cell membrane - Cytoplasm - Nucleus - chromosomes -Endoplasmic reticulum - Ribosomes - Golgi bodies - Plastids - Vacuoles - Lysosomes - Mitochondria - Microbodies - Flagella - Cilia - Centrosome and Centrioles - Cytoskeleton. (17 Hours)

UNIT III

Structure and functions of DNA and RNA -Central Dogma of the cell. DNA -Replication in prokaryotes - Transcription in Prokaryotes and Eukaryotes - RNA Processing - Genetic code- Translation - Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications - Protein Sorting - Protein degradation. (16 Hours)

UNIT IV

Cell cycle - Cell cycle check points - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell Adhesion - Extra Cellular Matrix - Cell to cell communications - Signal transduction - G - Protein Coupled Receptors Signal transduction pathways. (16 Hours)

UNIT V

Gametogenesis - Spermatogenesis and Oogenesis in mammals. Fertilization- Types of cleavage, blastula formation, embryonic fields, gastrulation, and formation of germ layers in animals- Organogenesis. (16 Hours)

TEXTBOOKS

1. Devasena T. (2012) Cell Biology, Oxford University Press.
2. Gupta R, Makhija S, and Toteja R. (2018) Cell Biology: Practical Manual.
3. Gilbert S.F. (2023) Developmental Biology, 13th Edition. Sinauer Associates Inc. Publishers, MA. USA.
4. Bruce Alberts, (2022) Molecular Biology of the cell, 7th Edition W. W. Norton & Company.
5. James D. Watson (2010) The Double Helix: A personal account of the Discovery of the Structure of DNA, Touchstone Publishers.

Reference Books

1. James D. Watson, (2014) Molecular Biology of the Gene, 7th Edition, Pearson Publications
2. Gerald Karp, Janet Iwasa, Wallace Marshall (2019) Karp's Cell and Molecular Biology: Concepts and Experiments. 9th Edition, Wiley Publications.
3. Geoffrey M. Cooper, (2015). The Cell: A Molecular Approach, 7th Edition, Sinauer Associates, Oxford University Press.
4. Lodish Harwey, (2021) Molecular Cell Biology, 9th Edition W. H. Freeman Publications.
5. Wolpert L, Tickle C, (2015) Principles of Development, 5th Edition, Oxford University Press.

Web Resources

http://www.cellbiol.com/education.php

https://global.oup.com/uk/orc/biosciences/cellbiology/wang/student/weblinks/ch16/

https://www.cellsignal.com/contents/science/cst-pathways/science-pathways

https://nptel.ac.in/courses/102/106/102106025/11.

Course Code 23UBOC11	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	3	3	2	2	3	2
CO2	3	2	2	2	3	3	2	3	2	2
CO3	3	2	3	-	1	1	2	2	1	-
CO4	3	2	1	-	1	2	2	3	2	-
CO5	2	2	1	2	-	1	2	2	3	-

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

Dr.V.Jeyasimga
Head of the Department

C.Girija
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology
(2023-2024 onwards)

Semester I	**Cell and Molecular Developmental Biology Practical**	Hours/Week: 3	
Core Course – 2 Practical I		Credits: 2	
Course Code **23UBOC11P**		Internal 40	External 60

Course Outcomes

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

CO1: Use microscopy and micrometry in biotechnological applications. K2

CO2: Know and perform cell counting techniques and be able to prepare the Blood smear and Buccal smear.K2

CO3: identify and explain the salient features of the given spotters.K3

CO4: Infer the result and complete the record work. K3

CO5: Demonstrate the basic principles of Cell fractionation and Identification of cell organelles.K3

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

Recommended Text - K.V. Chaitanya, (2013), Cell and molecular biology: Lab manual, PHI publishers, ISBN 978-81-203-800-4.

Course Code **23UBOC11P**	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	3	3	2	2	3	2
CO2	3	2	2	2	3	3	2	3	2	3
CO3	3	2	3	-	1	1	2	2	1	3
CO4	3	2	1	-	1	2	2	3	2	2
CO5	2	2	1	2	-	1	2	2	3	1

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

Dr.V.Jeyasimga
Heads of the Department

Dr.Sinthia Ganeshan
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology
(2023-2024 onwards)

Semester I	**BIOLOGICAL CHEMISTRY**	Hours/Week: 4	
Elective Course-I		Credits: 3	
Course Code **23UBOA11**		Internal 25	External 75

Course Outcomes:

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

CO1: Recall the basic concepts in Chemistry and Biochemistry. (K1)

CO2: Understand the acid-base concept, buffer, classification, structure, chemistry, properties, and metabolism of biomolecules. (K2)

CO3: Summarize the types of chemical bonds, types of organic reactions and significance of buffer, and metabolic pathways of biomolecules. (K2)

CO4: Illustrate the configuration of atoms, types of chemical bonds, types of organic reactions, concentration of solution and structure of biomolecules (K3)

CO5: Explain the periodic table, organic compounds, significance of pH, pH in living systems and metabolic pathway of biomolecules. (K3)

UNIT I

Atomic theory, formation of molecules, electronic configuration of atoms- s & p shapes of atomic orbitals. Periodic table, periodic classification, valency. Types of chemical bonds - Hybridization in methane, ethane, acetylene and benzene. Definition with examples- electrophiles, nucleophiles and free radicals. Types of reactions with an example: addition, substitution, elimination, condensation and polymerization. Electrophilic substitution reaction in benzene, nitration and sulphonation. (12 Hours)

UNIT II

Acids & Bases properties and differences, Concepts of acids and bases- Arrhenius, Lowry-Bronsted and Lewis. Concentration of solution, ways of expressing concentrations of solutions – per cent by weight, normality, molarity, molality, mole fraction. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson-Hasselbalch equation, mechanism of buffer action of acidic buffer and basic buffer. (12 Hours)

UNIT III

Importance to Biochemistry-the chemical foundation of life. Water: its unique properties, and characteristics of water. Classification of carbohydrates. Properties of carbohydrates. The ring structure of sugars and conformations of sugars. Metabolism of Carbohydrates –Glycolysis, TCA cycle, bioenergetics of carbohydrate metabolism.

(12 Hours)

UNIT IV

Classification of Lipids. Characteristics, Properties and Biological importance of lipids. Metabolism of Fatty acids - β-oxidation of fatty acids. Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA and RNA. Metabolism of Nucleic acids, Salvage pathway.

(12 Hours)

UNIT V

Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. Degradation of Amino acids and Urea Cycle. ATP production. Oxidative phosphorylation, Electron transport chain and Photophosphorylation. (12 Hours)

TEXTBOOKS

1. P.L. Soni, (2013) A Textbook of Inorganic Chemistry, 11th Edition, S. Chand & Sons publications
2. Abhilasha Shourie, Shilpa S, Chapadgoankar and Anamika Singh (2020) Textbook of Biochemistry 1st Edition, I K International Publishing House Pvt. Ltd,
3. J.L. Jain, (2016) Fundamentals of Biochemistry, 7th Edition. S. Chand publication,
4. A.C. Deb, (2016) Fundamentals of Biochemistry, 7th Edition. New central book agencies.
5. Satyanarayana. U, (2022) Biochemistry, 7th edition. MJ publishers.

Reference Books

1. Leininger (2021) Principles of Biochemistry 8th Edition WH Freeman and Company NY.
2. Murray *et al.,* (2022) Harper's biochemistry 32nd Edition Appleton and Lange Publishers Florida USA.
3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, (1995) Principles of Biochemistry, 3rd Edition. W.C. Brown Publishers.

4. Lubert Stryer (2019) Biochemistry –Stanford University 9th Edition, W H Freeman company, Francisco.
5. Bahl Arun, Bahl B. S. (2019), A Textbook of Organic Chemistry, 22nd 'e' Edition, S. Chand & Sons publications

Web Resources

http/dwb4.unl.edu/chem869p/chem869plinks/s

www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp

https://www.britannica.com › science › biochemistry

Course Code **23UBOA11**	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	3	3	2	2	3	2
CO2	3	2	2	2	3	3	2	3	2	2
CO3	3	2	3	-	1	1	2	2	1	2
CO4	3	2	1	-	1	2	2	3	2	3
CO5	2	2	1	2	-	1	2	2	3	3

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

Dr.V.Jeyasimga
Dr.M.Dhanalakshmi
Heads of the Departments

Dr.Sinthia Ganeshan
Dr.M.Vairalakshmi
Course Designers

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology
(2023-2024 onwards)

Semester II	**BIOLOGICAL CHEMISTRY PRACTICAL**	Hours/Week: 2	
Elective Course– I Practical I		Credits: 1	
Course Code **23UBOA11P**		Internal 40	External 60

Course Outcome

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

CO1: Perform and estimate the amount of chemical substance present in a solution qualitatively. To analyze and detect the nature of various organic class of compounds qualitatively.K2

CO2: Qualitatively analyze the carbohydrates and amino acids and report the type of carbohydrate based on specific tests. K2

CO3: make use of formula, tables and graphs for the quantitative estimation, K3

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

CO5: distinguish different group of compounds.K3

Systematic analysis of Organic compounds

1. Functional group tests (Carboxylic acid (Benzoic acid, phthalic acid), Phenol, Urea, Benzaldehyde, Aniline (Aniline not to be given for exam)
2. Detection of elements (N, Halogens)
3. Distinguish between aliphatic and aromatic compounds.
4. Distinguish between Saturated and unsaturated compounds.

Qualitative Analysis

1. Qualitative analysis of carbohydrates - Glucose, Fructose, Lactose, maltose, sucrose, starch and glycogen.
2. Qualitative analysis of amino acids - Tyrosine, Tryptophan, Arginine, Proline and Cysteine.

Volumetric Analysis

1. Estimation of Glycine- Formal Titration.
2. Determination of Ascorbic acid – DCPIP method.
3. Estimation of Ferrous sulphate using standard Mohr's salt

Colorimetric Analysis

1. Estimation of glucose
2. Estimation of Cholesterol- Zak's method
3. Estimation of proteins – Bradford's method

Recommended Text

1. J. Jayaraman, (2011) Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers.
2. S. K. Sawhney Randhir, Singh, (2005) Introductory Practical Biochemistry, 2nd Edition Alpha Science International Ltd.
3. Irwin H. Segel, (1991) Biochemical calculations, Liss, New York.

Reference Books

1. Dr. O P Panday, D N Bajpai, Dr. S Giri, (2016) PRACTICAL CHEMISTRY, Revised edition, S Chand.
2. Hands Thacher Clarke, (2007) A handbook of Organic: Qualitative and Quantitative Analysis.
3. N.S. Gnanapragasam and G. Ramamurthy, (1998) Organic chemistry Lab manual, S.Viswanathan Co. Pvt. Ltd.

Course Code **23UBOA11P**	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	3	3	2	2	3	2
CO2	3	2	2	2	3	3	2	3	2	2
CO3	3	2	3	-	1	1	2	2	1	2
CO4	3	2	1	-	1	2	2	3	2	3
CO5	2	2	1	2	-	1	2	2	3	3-

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

Dr.V.Jeyasimga
Head of the Department

Dr.Sinthia Ganeshan
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc. Biotechnology

(2023-2024 onwards)

Semester I	**HERBAL MEDICINE**	Hours/Week: 2	
NME - 1		Credits: 2	
Course Code **23UBON11**		Internal 25	External 75

Course Outcomes:

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

CO1: Appreciate the concepts of Ethnomedicine (K1)

CO2: Learn the role of herbal medicines in health (K2)

CO3: Understand the importance of Tribal medicine (K2)

CO4: Explain about the role of traditional medicine for today's health (K3)

CO5: Apply the concepts of medicinal herbs to improve health (K3)

UNIT I (6 Hours)

Ethnomedicine – definition, history, and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

UNIT II (6 Hours)

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids, and vitamins).

UNIT III (6 Hours)

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos*, *Ficus benghalensis*, *Curcuma domestica*, *Cynodon dactylon* and Sesamum indicum.

UNIT IV (6 Hours)

Traditional knowledge and utility of some medicinal plants in Tamil Nadu – *Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica* and *Phyllanthus fraternus*.

UNIT V (6 Hours)

Plants in day today life – *Ocimum sanctum, Centella asiatica, Cassia auriculata, Aloe vera*. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and Vegetables - Greens (Moringa, *Solanum nigrum* Cabbage).

TEXTBOOKS

1. R. K. Sinha and Shweta Sinha (2001) Ethnobiology. Surabhe Publications – Jaipur.
2. D.C. Pal & S.K. Jain Naya Prakash, (1998) Tribal medicine, Bidhan Sarani, Calcutta.
3. S.K. Jain (2001) Contribution to Indian Ethnobotany 3rd edition, scientific publishers, B.No.91, Jodhpur, India.
4. Andrew Chevallie, (2000) Encyclopaedia of Herbal Medicine
5. James Green (2000) The Herbal Medicine-Maker's Handbook: A Home Manual

REFERENCE BOOKS

1. M.C. Joshi (2007) Handbook of Indian Medicinal Plants Hardcover.
2. Neelesh Malviya and Sapna Malviya (2019) Herbal Drug Technology, 1st Edition, CBS Publishers, and Distributors.
3. Rageeb Md. Usman, Vaibhav M. Darvhekar, Vijay Kumar D, and Akhila S.A, (2019) Practical Book of Herbal Drug Technology, 1st Edition, Nirali Prakashan Publishers.
4. Pragi and Varun Arora (2019) Herbal Drug Technology, 1st Edition, S.Vikas and Company Publisher.

Course Code **23UBON11**	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr. V. Jeyasimga
Head of the Department

Dr. Sinthia Ganeshan
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester I	**BASICS OF BIOTECHNOLOGY**	Hours/Week: 2	
SEC - 1 Foundation course		Credits: 2	
Course Code 23UBOF11		Internal 25	External 75

Course Outcomes:

CO1: Know the basics of Biotechnology (K1)

CO2: Elaborate the applications of Biotechnology in various fields such as healthcare, Agriculture, Bioprocess and Environment (K1)

CO3: Understand the history scope and various avenues of Biotechnology (K2)

CO4: Illustrate the Historical developments in Biotechnology, industrially important microbes, environmental application, and food processing technology (K2)

CO5: Explain the genetic engineering, Agricultural and forestry applications, genetically. Modified plants. (K2)

UNIT I

Origin and development of Biotechnology

Introduction and definitions, Historic perspectives- Biotechnology in prehistoric times, microorganisms and fermentation, Origin of genetics, Classical and modern genetics, DNA-structure, types, genetic Engineering, Beginning of modern Biotechnology. (6 hours)

UNIT II

Scope of Biotechnology- Commercial potential, Biotechnology in India and its global trends, Major Biotechnology institutes and companies in India, Application of Biotechnology.

(6 hours)

UNIT III

Applied Biotechnology - I: Industrial Biotechnology- Bioprocess and Fermentation Technology, Bioreactors, Environmental Biotechnology- Biofuels, Single cell protein, sewage and Effluent treatment; Medical Biotechnology- safer and cheaper medicines by biotechnology, new medicines through genetic engineering, Biopharming. **(**6 hours)

UNIT IV

Applied Biotechnology - II: Agriculture and Forest Biotechnology- Traditional methods of Crop improvement, Crop improvement through Biotechnology, Genetically Modified crops- benefits,- Herbicide tolerance, Insect resistance, genetically modified Livestock. -, application of Biotechnology in food processing. **(**6 hours)

UNIT V

Safety and Ethics in Biotechnology - Good Laboratory Practices (GLP), Good Laboratory Practices for Students, Good Manufacturing Practices (GMP), Marketing of Biotechnology Products. Bioethics (6 hours)

Reference Books

1. H.K. Das (2017) Textbook of Biotechnology, 5th Edition, Wiley India.
2. Daniel Callahan President (1998) Biotechnology and Ethics: A Blueprint for the Future, Hastings Centre, Centre for Biotechnology, Northwestern University.
3. Collins H. and T. Pinch, (2012) The Golem: What everyone should know about science, 2nd Edition, Cambridge University Press.

Course Code 23UBOF11	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester II	**GENETICS**	Hours/Week: 5	
Core Course -3		Credits: 5	
Course Code **23UBOC21**		Internal 25	External 75

Course Outcomes

CO1: Recall the key concepts of Genetics. (K1)

CO2: Understand the inheritance, variation, sex determination, chromosomal mapping, mutation, and evolution. (K2)

CO3: Outline the Mendelian and non-Mendelian inheritance, allelic interaction, linkage and population genetics. (K2)

CO4: Illustrate the concepts of genetics using specific examples or by solving simple genetic problems. (K3)

CO5: Analyze the Mendelian laws, allelic interaction, sex linkage, chromosomal mapping, mutation, and evolution. (K3)

UNIT I

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

(15 Hours)

UNIT II

Linkage - linkage in *Drosophila*- Morgan's experiments, factors affecting linkage. Crossing over- types, mechanism, significance of crossing over. Mapping of Chromosomes, interference, and coincidence. Cytoplasmic inheritance -Carbon dioxide sensitivity in *Drosophila* and milk factor in mice. Sex –Linked Inheritance and Sex-Determination in Man. (15 Hours)

UNIT III

Fine structure of the gene and gene concept, Operon Concept. Identification of the DNA as the genetic material- Griffith experiments, Avery, McLeod, McCarty, and Hershey Chase experiment. Microbial Genetics- bacterial recombination, Conjugation, Transformation, Transduction and sexduction (15Hours)

UNIT IV

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

(15 Hours)

UNIT V

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

(15 Hours)

TEXTBOOKS

1. Dr. Veer Bala Rastogi, (2020) Elements of Genetics, 11th Revised & Enlarged Edition, Kedar Nath Ram Nath Publications, Meerut.
2. Verma, P.S. and Agarwal, V.K., (2009) Genetics, 9th Edition, S. Chand & Co., New Delhi – 110055.

REFERENCE BOOKS

1. Gardener E.J. Simmons M.J. Slustad D. P. (2006) Principles of Genetics 8th Edition.
2. Lewis, R. (2018) Human Genetics- Concepts and application. 12th Edition. McGraw Hill.
3. Griffiths, Miller, J.H., (2020) An Introduction to Genetic Analysis, 12th Edition. W.H. Freeman. New York.
4. Winter, P.C., Hickey, G.J. and Fletcher, H. L., (2012) Instant notes in Genetics. 4th Edition Viva books, Ltd.
5. Good enough U. (1985) Genetics. Hold Saunders International.

Web resources

https://nptel.ac.in/courses/102/106/102106025/

http://www.ocw.mit.edu

http://enjoy.m.wikipedia.org

https://www.acpsd.net

Course Code 23UBOC21	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	2	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester II	**GENETICS PRACTICAL**	Hours/Week: 3	
Core Course -4 practical-II		Credits: 2	
Course Code **23UBOC21P**		Internal 40	External 60

Course Outcomes:

CO1: Demonstrate the basic principles of Genetics.[K2]

CO2: Analyze the Polytene chromosome of the organisms.[K2]

CO3: Identify Barr bodies from Buccal smear.[K3]

CO4: Infer the result and complete the record work [K3]

CO5: identify and explain the salient features of the given spotters.[K3]**.**

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

TEXTBOOKS

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

Course Code 23UBOC21P	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	2	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester II	**FUNDAMENTALS OF MICROBIOLOGY**	Hours/Week: 4	
Elective Course-1		Credits: 3	
Course Code **23UBOA21**		Internal 25	External 75

Course Outcomes:

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

CO1: Recall the fundamental concepts in Microbiology. (K1)

CO2: Describe the history of Microbiology, microscopy, classification, cultivation, nutritional requirements of microorganisms, microbial disease, and role of microbes in Biotechnology. (K2)

CO3: Understand the contributions of microbiologists, working of microscopy, identification of microbes, sterilization techniques and interaction of microbes. (K2)

CO4: Apply basic concepts of Microbiology for identification, utilisation of beneficial microbes and diagnosis of pathogens . (K3)

CO5: Illustrate the interaction and relationship of microbes, host and the factors affecting growth of microorganisms. (K3)

UNIT I

History of Microbiology, Classification of bacteria, fungi, virus, protozoa, and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology. (12 Hours)

UNIT II

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

(12 Hours)

UNIT III

Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL. (12 Hours)

UNIT IV

Bioinsecticides - *Bacillus thuringiensis*, Baculoviruses- Biofertilizers -*Azospirillum* and blue green algae - single cell protein – prebiotics and probiotics - Dairy products (Cheese and Yoghurt). (12 Hours)

UNIT V Microbial

Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria). (12 Hours)

TEXTBOOKS

1. Pelczar. M. J., Chan E.C.S. and Noel. R.K. (2023) Microbiology. 5th Edition, East West Press Private Limited, New Delhi, (Indian Edition)
2. Ananthanarayanan, Paniker and Kapil. (2022) Textbook book of Microbiology, 12th edition, Orient Black Swan,
3. Dubey R.C. and Maheswari, S. (2022). A textbook of Microbiology, 5th Edition. New Delhi: S. Chand & Co.
4. Prescott, Harley, Klein, (2022) Microbiology, 12th Edition, McGraw – Hill.
5. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC.Web Resources

Horst W. Doelle (2004). Microbial Metabolism and Biotechnology. Proceedings of an E-seminar organized by the International organization for Biotechnology and Bioengineering (IOBB)

http://www ejb.org/content.

www. Biotech.kth.se Electronic Journal of biotechnology

https://www.cliffsnotes.com/study guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology

https://bio.libretexts.org/@go/page/9188

REFERENCE BOOKS

1. Madigan, Martinko, Bender, Buckley, and Stahl, (2021) Brock Biology of Microorganisms, 10th edition.
2. Gillespie, Bamford, (2022) Medical Microbiology and Infection at a Glance, 5th edition.
3. Boyd, R.F. (2016) General Microbiology, 2nd Edition., Times Mirror, Mosby College Publishing, St Louis.
4. Tortora, G.J., Funke, B.R., Case, C.L. (2018) Microbiology. An Introduction 13th Edition., A La Carte Pearson.
5. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw Hill Inc. New York.
6.. C.A. Reedy., T.J. Beveridge., J.A.Breznak. G.A., Maerzluf, T.M. Schmidt., and L.R. Snyder. (2007). Methods for general and molecular Microbiology 3rd Edition, Wiley. ASM press.

Course Code 23UBOA21	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	2	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.D. Karthiyaini
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester II	**FUNDAMENTALS OF MICROBIOLOGY PRACTICAL**	Hours/Week: 2	
Elective Course -1 practical - II		Credits: 1	
Course Code **23UBOA21P**		Internal 40	External 60

Course Outcomes

On completion of the course the students will be able to

CO1: Develop Skills in Media Preparation, Isolation & Serial Dilution Techniques, and Pure Culture Techniques general Laboratory safety & Sterilization Techniques.[K2]

CO2: Microscopically analyze the morphological features of Bacteria and fungi and define various Staining Techniques.[K2]

CO3: Perform the Motility of organisms and identify bacteria using Biochemical tests.[K3]

CO4: Infer the result and complete the record work [K3]

CO5: identify and explain the salient features of the given spotters.[K3]**.**

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

Recommended Text

1. James G Cappucino and Chad T. Welsh (2023) Microbiology: A Laboratory Manual, 11th Edition. Pearson, New York.
2. Kannan. N (2002) Laboratory manual in General Microbiology. Panima Publications.
3. Sundararaj T (2005) Microbiology Lab Manual 1st Edition publications.

4. Gunasekaran, P. (2018) Laboratory manual in Microbiology. 2nd Edition. New Age International Ld., Publishers, New Delhi.
5. R C Dubey and D K Maheswari (2023). Practical Microbiology. 4th Edition. S. Chand Publishing.

Reference Books

1. Atlas.R (2014) Principles of Microbiology, 2nd Edition. McGraw Hill.
2. Amita J, Jyotsna A and Vimala V (2018) Microbiology Practical Manual. 1st Edition, Elsevier India.
3. Talib VH (2019) Handbook Medical Laboratory Technology. 2nd Edition. CBS.
4. Wheelis M, (2008) Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.
5. Lim D. (1998) Microbiology, 2nd Edition, WCB McGraw Hill Publications.

Course Code 23UBOA21P	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	2	-	3	1	2	2	1	-	2	-
CO2	1	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	3
CO5	3	1	2	3	2	3	2	2	3	3

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

Dr.V.Jeyasimga
Head of the Department

Dr.D. Karthiyaini
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc. Biotechnology

(2023-2024 onwards)

Semester II	**ORGANIC FARMING AND HEALTH MANAGEMENT**	Hours/Week: 2	
NME – 2		Credits: 2	
Course Code **23UBON21**		Internal 25	External 75

Course Outcomes:

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

CO1: Learn the concepts of ecology, organic farming, Health and fitness (K1)

CO2: Know the techniques of Vermicomposting and learn the organic certification , maintenance of good health (K1)

CO3: Describe the Principles and Policies in Organic farming , Role of physical activity in health (K2)

CO4: Explain the Concept of composting and organic cultivation, Health and importance of wellbeing (K2)

CO5: Examine the significance of organic manures, Role of exercise and nutrition in Health-related fitness (K3)

UNIT I

Ecology and Environment – Principles of ecology – Ecosystem - Biotic and abiotic components and interaction – Farming, organic farming - concept, Principles, Types of organic farming, Benefits of organic farming. (6 Hours)

UNIT II

Composting – Microbial Compost – Vermicompost Types, Methods and Advantages Setup for vermicompost unit - Nutrition Garden – Ring garde n – Double digging – Cultivating vegetables – Common medicinal herbs – Identification and Cultivation.

(6 Hours)

UNIT III

Organic farming – Certification agencies – AGMARK, FSSAI, Halal certification – Participatory grading system (PGS) – Storage – Packing – Transportation – Marketing. Micro-enterprises – Self Help Groups – Economics of cultivation– Sustainability. **(**6 Hours)

UNIT IV

Health: Concept of Health, changing concepts definitions of health, dimensions of health, concept of wellbeing, spectrum of health, determinants of health, ecology of health, right to health, responsibility for health, indicators of health. (6 Hours)

UNIT V

Exercise and Health related fitness: Health related fitness, health promotion, physical activity for health benefits. Sports related fitness: Role of nutrition in sports, nutrition to athletic performance. (6 Hours)

TEXTBOOKS

1. G.K. Veeresh, (2006) Organic farming, First edition, New Delhi, India Foundation Books in association with Centre for Environment Education.
2. Mangala rai, (2012) Handbook of Agriculture, Sixth Edition, ICAR New Delhi.
3. B.B. Sharma (2007) A Guide to Home Gardening, Second Edition, MIB India, New Delhi
4. Adrianne E. Hardman, 2009. Physical Activity and Health – The evidence explained, Second edition, Taylor, and Francis Group.

REFERENCE BOOKS

1. F. H. King, Farmers of Forty Centuries: Permanent Organic Farming in China, Korea, and Japan (2011) Hardcover.
2. Gehlot D, Organic Farming: Components and Management 1st Edition, Publisher: M/s AGROBIOS (INDIA).

Course Code **23UBON21**	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	1	-	2	1	2	2	1	-	2	2
CO2	2	3	2	2	2	2	2	-	2	2
CO3	1	-	2	1	2	1	2	-	3	2
CO4	2	-	3	2	2	1	2	-	1	1
CO5	1	-	2	2	3	2	2	1	2	1

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

Dr. V. Jeyasimga
Head of the Department

Dr. Sinthia Ganeshan
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc., Biotechnology

(2023-2024 onwards)

Semester II	**FOOD CHEMISTRY**	Hours/Week: 2	
SEC -2		Credits: 2	
Course Code **23UBOS21**		Internal 25	External 75

Course outcome:

On completion of the course the students will be able to

CO1: Know the basic concepts in Food chemistry. [K1]

CO2: Explain the food types, food additives, toxins and poisons in food. [K1]

CO3: Understand the food components, analytical techniques and the impact of natural poisons, toxins and fat on human health.[K2]

CO4: Describe the adulterants, toxins, poisons, pesticide residues, and to do first aid. [K2]

CO5: Apply the concepts of Food Chemistry to detect adulterants, toxins and analyse the food quality. [K3]

Unit – I

Sources of food, food groups. Functions of food, food adulteration - contamination of Wheat, Rice, Milk, Butter etc. with clay stones, water, and toxic chemicals - Common adulterants. Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques. (6 Hours)

Unit – II

Food Poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion)- Chemical poisons - First aid for Poison consumed victims. (6 Hours)

Unit – III

Food additives - artificial sweeteners- Saccharin - Cyclamate and aspartame. Food flavours - esters, aldehydes, and heterocyclic compound. Food colours - Emulsifying agents-preservatives - leavening agents. Baking powder - yeast - taste makers - MSG and vinegar.

(6 Hours)

Unit – IV

Beverages - soft drinks - soda - fruit juices - alcoholic beverages. Carbonation - addiction to alcohol - diseases of liver and social problems. (6 Hours)

Unit – V

Fats, Oils - Sources of oils - Production of refined vegetable oils - Preservation. Saturated and unsaturated fats - role of MUFA and PUFA in preventing heart diseases - determination of iodine value, RM value, saponification values and their significance.

(6 Hours)

References

1. Swaminathan M., (1979) Food Science and Experimental foods, Ganesh, and Company.
2. Jayashree Ghosh, (2006) Fundamental concepts of Applied chemistry, S. Chand & Co. Publishers.
3. Thangamma Jacob, (1997) Textbooks of applied chemistry for Home Science and Allied Sciences, Macmillan.
4. Mohini Sethi. E.S. Rao., (2019) Food Science Experiment and Applications. 2nd Edition, CBS Publications and Distribution.

Course Code 23UBOS21	PO1		PO2		PO 3	PO4		PO 5	PO 6	PO 7
	PSO 1. a	PSO 1. b	PSO 2. a	PSO 2. b	PSO 3	PSO 4. a	PSO 4. b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	1	2	2	1	2	2	-
CO2	3	-	2	1	3	2	2	-	2	-
CO3	3	2	2	2	2	2	2	-	2	2
CO4	2	1	2	3	2	2	2	1	2	2
CO5	3	1	2	3	2	1	1	1	3	1

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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

B.Sc. BIOTECHNOLOGY

(For those who join in 2023-2024)

Semester: III	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	Hours/Week: 5	
Core course III		Credits: 5	
Course code- **23UBOC31**		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 techniquess. [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)

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 23UBOC31	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
(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

B.Sc. BIOTECHNOLOGY

(For those who join in 2023-2024)

Semester III	**IMMUNOLOGY AND IMMUNOTECHNOLOGY PRACTICAL**	Hours/Week: 3	
Core Practical – 3		Credits: 2	
Course Code **23UBOC31P**		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 23UBOC31P	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
Head of the Department

Dr.V.Jeyasimga
Course Designer

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

Semester: III	**BIOINSTRUMENTATION**	Hours/Week: 4	
Elective Paper III		Credits: 3	
Course Code - **23UBOA31**		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 23UBOA31	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
Head of the Department

Dr.S.Gurupavithra
Course Designer

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

Semester: III	**BIOINSTRUMENTATION PRACTICAL**	Hours/Week: 2	
Elective Course Practical II		Credits: 1	
Course code-23UBOA31P		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: Understand 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:

1.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 23UBOC31P	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**

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

B.Sc. BIOTECHNOLOGY
(for those who join in 2023-2024)

Semester III	**MUSHROOM CULTIVATION**	Hours/Week: 1
Skill Enhancement Course		Credits: 1
Course Code **23UBOS31**		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 23UBOS31	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
Course Designe

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

Semester III	**FOOD AND BIOPROCESS TECHNOLOGY**	Hours/Week: 2	
Skill Enhancement Course		Credits: 2	
Course Code **23UBOS32**		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)

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.

Textbooks

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

Course Code 20UBOS32	**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
Course Designer

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

SEMESTER –IV	**GENETIC ENGINEERING AND RDNA TECHNOLOGY**	Hours/Week: 4	
Core Paper IV		Credits: 4	
Course code **23UBOC41**		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.

References

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 23UBOC41	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 33.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
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

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

Semester IV	**Genetic Engineering and rDNA Technology Practical**	Hours/week-3	
Core-Practical -IV		Credits-2	
Course Code- **23UBOC41P**		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 Books:

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

Course Code 23UBOC41P	**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	-

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

Dr.V.Jeyasimga
Head of the Department

Dr.V.Jeyasimga
Course Designer

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

SEMESTER –IV	**BIOINFORMATICS AND BIOSTATISTICS**	Hours/Week: 4	
Elective Paper IV		Credits: 3	
Course code-**23UBOA41**		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 23UBOA41	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	-

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

Dr.V.Jeyasimga
Head of the Department

Dr.Karthiyaini D
Course Designer

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

B.Sc., BIOTECHNOLOGY

(For those who join in 2023-2024)

SEMESTER –IV	**BIOINFORMATICS AND BIOSTATISTICS PRACTICAL**	Hours/Week: 2	
Elective Course Practical IV		Credits: 1	
Course code- **23UBOA41P**		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

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

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

Reference Books

1.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 23UBOC41P	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	-

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

Dr.V.Jeyasimga
Head of the Department

Dr.D.Karthiyaini
Course Designer

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

B.Sc., BIOTECHNOLOGY

(for those who join in 2023-2024)

SEMESTER –IV	**AQUACULTURE**	Hours/Week: 2	
SEC - 5		Credits: 2	
Course code- **23UBOS41**		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, Sources of pollution, 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, adaptive management; Seaweeds- types and their culture practices. (6 Hours)

Unit – III:

Live feed organisms – Artemia and rotifers culture; Fish feed - types, formulation and preparation, techniques, Consequences of artificial feeding; Natural, supplementary and artificial breeding; Breeding – Bundh breeding and induced breeding; rearing of hatchlings, fry and fingerlings. (6 Hours)

Unit – IV:

Fungus infections. Protozoan diseases. Worm diseases. Non parasitic diseases. Transport of fish seed and Brood fish. Causes of mortality in transport. Methods for packaging and transport. Use of chemicals in live fish transport. Anesthetic drugs. Antiseptics and Antibiotics. (6 Hours)

Unit – V:

Applied aquaculture: Identification of cultivable fish species; Hypophysation- Principle, Procedure and Advantages. 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

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.

4.Jameson, J.D. and Santhanam. R. (1996), Manual of ornamental fishes and farming, Technologies Peejay, Thoothukkudi.

Textbook

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.

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 23UBOS41	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
(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

B.Sc., BIOTECHNOLOGY

(For those who join in 2023-2024)

SEMESTER –IV	**POULTRY SCIENCE AND MANAGEMENT**	Hours/Week: 2	
SEC- 6		Credits: 2	
Course Code- **23UBOS42**		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)

References:

1.Banerjee G.C., (2018) Poultry, Oxford and IBH, New Delhi

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

3. Chauhan H.V.S. and S.Roy (2024), Poultry diseases, diagnosis and treatment, New Age International private limited.

4. John William S. (Ed) 2003. Poultry for sustainable Food Production and livelihood. Loyola Publication, Chennai.

Course Code 23UBOS42	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	1

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

Dr.V.Jeyasimga Dr.S.Jeyaruby

Head of the Department **Course Designer**