V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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

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

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

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

A. CHOICE BASED CREDIT SYSTEM (CBCS)

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

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

UG PROGRAMMES

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

PG PROGRAMMES

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

* AICTE approved Programmes

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

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

List of Non Major Elective Courses (NME)

(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 Zoology

- To cater the students to be competent in the field of life science and responsible for the betterment of society.

Mission of the Department of Zoology

- To impart the quality education to meet out the needs of rural women folk.
- To motivate them to apply the academic skills for the improvement of society.
- To mould the students to be responsible and successful citizens.

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. Zoology Programme

The students will be able to

- To mould the students into efficient professionals in educational Institutions, Research centres, Medical laboratory, Zoos, Museums etc.
- To empower the learners with skills to promote self-employment opportunities.
- To uphold the moral standards of students to enable them to face challenges in life and to be better citizens.

Key components of mission statement	PEO1	PEO2	PEO3
To impart quality education to meet out the needs of rural women folk.	√	√	-
To mould the students to be responsible and successful citizens.		√	√
To motivate them to apply the academic skills for the improvement of society.	√	√	√

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. Zoology Programme, the students will be able to

PO1- *Disciplinary Knowledge*

PSO 1.a: Apply their knowledge of fundamental principles in biological sciences to pursue higher studies in interdisciplinary subjects and compete in their profession.

PSO 1.b: Use their practical skills gained in various branches of Biology to promote their career, entrepreneurial skills and research activities.

PO2-*Communication Skills*

PSO 2: Communicate the biological concepts confidently in interviews and career for their personal betterment and extension programmes to create awareness among the villagers.

PO3- *Scientific Reasoning and Problem Solving*

PSO 3.a: Identify the causes for the environmental and health issues by the application of biological principles.

PSO 3.b: Solve the problems in the management of quality of environmental resources and culture units of economically valuable animals by adapting the scientific methods.

PO4 - *Critical thinking and Analytical Reasoning*

PSO 4.a: Design innovative projects for the betterment of their research endeavors in the various branches of animal sciences.

PSO 4.b: Design self employment units with the knowledge gained in applied biology to promote self employment and entrepreneurship in the society.

PSO5- *Digital Literacy, Self - directed and Lifelong Learning*

PSO 5: Use their computer skills in M.S Office to compete in their higher education, competitive examinations and career.

PO6 - *Cooperation/Team Work and Multi-Cultural Competence*

PSO 6: Work efficiently with team spirit in a team for its success by the skills acquired through internship programmes and group practicals and assignments.

PO7 –*Moral and Ethical Awareness*

PSO 7: Could develop scientific responsibilities regarding the disposal of wastes, usage of natural products instead of chemicals in day today life and preservation of fauna in their locality.

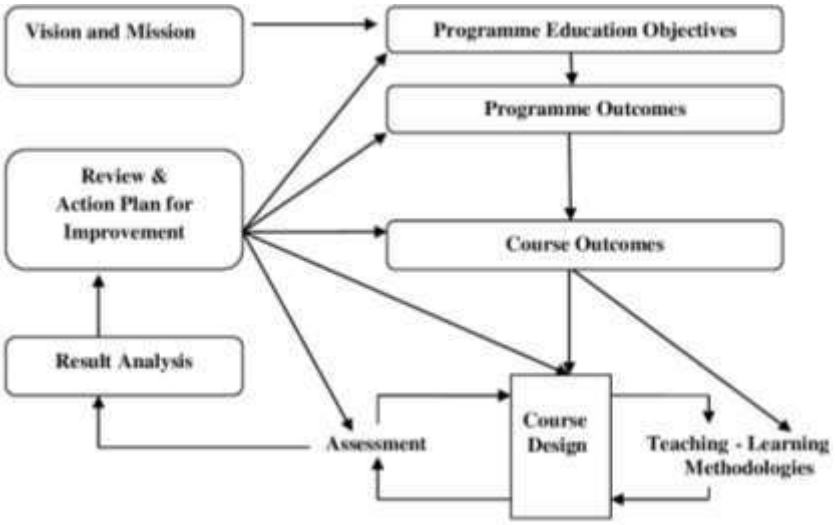
PO-PEO Mapping Matrix

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	-	-	✓

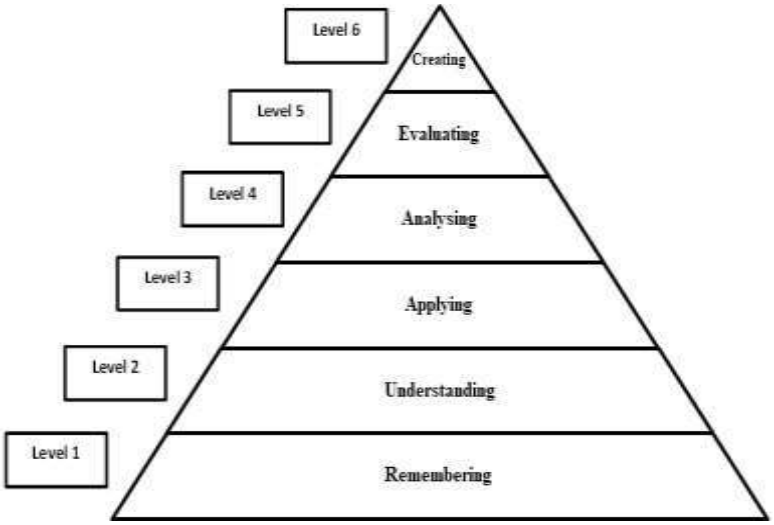
B.1.4 Course Outcomes (COs)

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 or Zoology and Botany 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 Course (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 ExaminationMarks	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	Q. 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	
B	4	Internal Choice – Either …or Type	1	1	10	
	Total					**25***

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

SUMMATIVE EXAMINATION

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

Question Pattern **Duration: 2 Hours**

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

B.2.3.2 Skill Enhancement Course - Entrepreneurial skills

INTERNAL ASSESSMENT ONLY
Distribution of Marks

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

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

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

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

Two Periodic Tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Two Quiz Tests - Better of the two will be considered

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

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

B.2.3.3 Skill Enhancement Courses/ Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

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

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

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

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

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

SUMMATIVE EXAMINATION

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

Question Pattern **Duration: 2 Hours**

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

B.2.4 PART IV- ENVIRONMENTAL STUDIES / VALUE EDUCATION

INTERNAL ASSESSMENT ONLY

Evaluation Pattern

Mode of Evaluation		**Marks**
Periodic Test	:	15
Assignment - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10
Report - K3 Level		10
Model Examination	:	30
Total	**:**	**100**

Three Assignment - Best of the three will be considered

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

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

Two Periodic tests - Better of the two will be considered

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

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

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

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

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

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

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

B.2.6 SELF STUDY COURSE

B.2.6.1 PART III - Discipline Specific Quiz – Online

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

Distribution of Marks

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

Two Periodic Tests - Better of the two will be considered

B.2.6 .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 for all the Courses.
  - 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.
- **Attendance**

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 conditions 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? (Yes/No)

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the Courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 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. Zoology 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 ZOOLOGY (2018)

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 (6)	5 (5)	30 (30)
Core Course	-	-	-	-	5 (5)	5(5)	10(10)
Core Course	-	-	-	-	5 (4)	5(4)	10(8)
Core Course Practical	3(2)	3 (2)	3 (2)	3 (2)	3 (2)	3 (2)	18(12)
Core Course Project	-	-	-	-	1 (1)	-	1 (1)
Elective Course (DSEC)	-	-	-	-	5(4)	5 (4)	10 (8)
Elective Course (DSEC Practical)	-	-	-	-	3(2)	5(4)	8(6)
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/ Industrial Training							
SEC	2 (2)	-	1 (1)	2 (2)	-	-	5(5)
SEC	-	2 (2)	2 (2)	2 (2)	-	2 (2)	8 (8)
Elective Course(NME)	2 (2)	2 (2)	-	-	-	-	4 (4)
Value Education	-	-	-	-	2 (2)	-	2 (2)
Environmental Studies	-	-	1 (0)	1 (2)	-	-	2 (2)
Self Study Course	-	-	-	-	0 (1)	-	0 (1)
Internship/ Industrial Training	-	-	-	-	0 (1)	-	0 (1)
Part V : Extension Activities	-	-	-	-	-	0 (1)	0 (1)
Total	**30 (21)**	**30 (21)**	**30 (20)**	**30 (22)**	**30 (28)**	**30 (28)**	**180 (140)**
Extra Credit Course (Self Study Course)	-	-	-	-	0(2)	0(2)	0(4)

DSEC: Discipline Specific Elective Course SEC: Skill Enhancement Course

NMEC: Non Major Elective Course

BACHELOR OF ZOOLOGY -2018

PROGRAMME CONTENT - 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 -9	Evolutionary Biology	23UZYC51	6	6	3	25	75	100
2		Core Course -10	Animal Physiology	23UZYC52	5	5	3	25	75	100
3		Core Course -11	Environmental Biology	23UZYC53	5	4	3	25	75	100
4		Core Course -13 Practical-VI	Eco Physiology Practical	23UZYC51P	3	2	3	40	60	100
5		Core Course -14 Project	Project	23UZYC54PR	1	1	-	100	-	100
6		DSEC-1	Animal Behaviour/ Bioinstrumentation	23UZYE51/ 23UZYE52	5	4	3	25	75	100
7		DSEC-2 Practical-I	Environmental Toxicology Practical/Bioinstrumentation Practical	23UZYE53P/ 23UZYE54P	3	2	3	40	60	100
8	**Part IV**		Value Education	23UUGVE51	2	2	2	100	-	100
9		Self-study	Practice for Competitive Examinations Online	23UGCE51	-	1	-	100	-	100
10		Internship/ Industrial Training	Internship	23UZYI51	-	1	-	100	-	100
				Total	**30**	**28**				**1000**

11.	Extra Credit Course - Self-Study Course)	Dietetics for Women	23UZYO51	**-**	**2**	**3**	**100**	**-**	**100**

BACHELOR OF ZOOLOGY -2018

PROGRAMME CONTENT - SEMESTER VI

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course -14	Animal Biotechnology	23UZYC61	5	5	3	25	75	100
2		Core Course -15	Microbiology	23UZYC62	5	5	3	25	75	100
3		Core Course -16	Immunology	23UZYC63	5	4	3	25	75	100
4		Core Course -17 Practical-VII	Biotechnology Practical	23UZYC61P	3	2	3	40	60	100
5		DSEC-3	Medical Laboratory Techniques/ Human Reproductive Biology	23UZYE61/ 23UZYE62	5	4	3	25	75	100
6		DSEC –4	Radiation Biology/ Basics of Marine Biology	23UZYE63/ 23UZYE64	5	4	3	25	75	100
7		Self-study	Discipline Specific Quiz - Online	23UZYQ61	-	1	-	100	-	100
8	**Part IV**	SEC-7	Nanobiology	23UZYS61	2	2	2	25	75	100
9	**Part V**	Extension Activities	Extension Activities		-	1	-	100	-	100
Total					**30**	**28**				**900**

10.	Extra Credit Course - Self-Study Course)	Life Style Diseases	23UZYO61	**-**	**2**	**3**	**-**	**-**	**100**

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. Zoology

(for those who join in 2023-2024)

Semester V	**EVOLUTIONARY BIOLOGY**	Hours/Week: 6	
Core Course - 9		Credits: 6	
Course Code **23UZYC51**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: understand the Primordial earth and theories on origin of life. [K1]

CO2: integrate and assess Lamarckism - Neo Lamarckism – Darwinism. [K2]

CO3: analyse various fossil records of man and fossil records of horse, various types of rocks - Geological time scale. [K2]

CO4: explain the Nature of fossils- Dating of fossils, evidences of evolution, Adaptive radiation in reptiles and mammals. [K3]

CO5: construct and compile the role of Human Genome Project, Evolution in the diagnosis, and treatment of diseases. [K3]

Unit I

Inorganic and organic evolution-History of evolutionary thought, Primordial earth and primeval atmosphere, Chemical origin of life: Synthesis of organic molecules, Urey-Miller experiment, Origin of prokaryotes and eukaryotes. **(18 Hours)**

Unit II

Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and Modern synthetic theory - DeVrie's Mutation theory – Modern concepts of Mutation - Mutation and their role in evolution - Animal colouration and Mimicry. **(18 Hours)**

Unit III

Isolating mechanisms - Modes of speciation-Hybridization is an evolutionary catalyst-Law of Adaptive Radiation- Adaptive radiation in reptiles and mammals - Convergence and Parallelism - Evolutionary constancy. **(18 Hours)**

Unit IV

Morphological, physiological, biochemical, embryological, taxonomical and geographical evidences -Palaeontological evidences – Evolutionary genomics. Types of rocks - Geological time scale – Nature of fossils- Dating of fossils - Fossil records of Man and Horse.

(18 Hours)

Unit V

Natural selection in action in man- level of selection- Eugenics, Euphenics and Euthenics- Adaptation- Human Genome Project – Evolution and Ethics.

(18 Hours)

Text Book:

1. Arumugam, N(2019). Organic evolution, 11th Edition, Nagercoil, Saras Publication.
2. Ridley, M., 2004. Evolution. III Edition. Blackwell Publishing.

Reference Books

1. Rastogi, VB. (2007). Organic Evolution. Uttar Pradesh: Kedarnath Ramnath Publishers.

2. Ledyard Stebbins, G. (1970). Process of Organic Evolution. New Delhi: Prentice-Hall, Inc., Englewood Cliffs.

3. ***Kavitha, K. (2017). Organic Evolution. India : A17BS Publication.***
4. Lull, R.S. 2010. Organic evolution, The Macmillan, New York.
5. Minkoff, E. C. (1983). Evolutionary biology. Reading, MA: Addison-Wesley Publishing Company
6. Sober, E. (1994). Conceptual issues in evolutionary biology. Cambridge, MA: MIT Press.
7. Dr. Kishore R. Pawar, Dr. Ashok E. Desai, 2019. A text book of Organic Evolution, Nirali Prakashan,
8. Rastogi VB. 1991. Organic Evolution. Kedar Nath Ram Nath Publications, Meerut,Uttar Pradesh, India.
9. Stricberger, M.W., 1996. Evolution. Jones& Bartlett, USA
10. Colbert, E.H. Morales, M. and Minkoff, E.C. 2011. Colbert's Evolution of The Vertebrates: A History of the Backboned Animals Through Time, Wiley, India.
11. Burns GW. 1972. The Science of Genetics. An Introduction to Heredity. Mac Millan Publ. Co.Inc.
12. Gardner EF. 1975. Principles of Genetics. John Wiley & Sons, Inc. New York.
13. Harth and Jones EW. 1998. Genetics – Principles and Analysis. Jones and BarHett Publ. Boston.
14. Levine L. 1969. Biology of the Gene. Toppan.
15. Pedder IJ. 1972. Genetics as a Basic Guide. W. Norton & Company, Inc.
16. Rastogi VB. 1991. A Text Book of Genetics. Kedar Nath Ram Nath Publications, Meerut, Uttar Pradesh, India.
17. White MJD. 1973. Animal Cytology and Evolution. Cambridge Univ.Press.

Course Code **23UZYC51**	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	3	3	2	2	1	1	3
CO2	3	3	3	2	1	2	2	1	1	3
CO3	3	2	2	3	3	3	1	2	1	3
CO4	3	2	2	3	3	3	2	2	2	3
CO5	3	3	2	3	3	2	2	3	2	3

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

Dr. J. Rani

Head of the Department

Dr. M.Tamilselvi

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. Zoology

(for those who join in 2023-2024)

Semester V	**ANIMAL PHYSIOLOGY**	Hours/Week: 5	
Core Course - 10		Credits: 5	
Course Code **23UZYC52**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic concepts of biological processes in Animals. [K1]

CO2: explain the structure and physiology of various organs and systems in our body. [K2]

CO3: summarize various diseases in our body with reference to vitamin and hormonal deficiency. [K2]

CO4: analyze the causes for various diseases and disorders in man. [K3]

CO5: apply their knowledge to lead a healthy life. [K3]

UNIT –I

Nutrition&Respiration

Nutrition:Digestion and absorption of carbohydrates proteins and lipids and Hormonal control of digestion. Sources and deficiency diseases of Vitamins A,B,C,D,E,and K . Types of Respiration, Respiratory pigments-structure of Haemoglobin, Transportation of gases-Bohr effect-Regulation of respiration-bronchitis, asthma –Physiological effects of smoking. (15 hours)

UNIT –II

Circulation & Excretion

Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat and its regulation -pace maker – Cardiac cycle – ECG - Pulse and blood pressure. Nephron structure &mechanismof urine formation, Regulation of acid base balance, Excretory products, Osmoregulation infishes. (15 hours)

UNIT –III

Muscle & Nerve Physiology

Types of muscles – Ultrastructure of striated muscle, Muscle contraction & properties, Neurons– structure & types-Impulse propagation, synaptic transmission, neurotransmitters - Reflex action,

Nerve disorders – epilepsy, Alzheimer's disease, Parkinson'sdisease. (15 hours)

UNIT –IV

SenseOrgans

Structure of eye, physiology of vision, visual elements and pigments, photo chemistry ofvision - Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract - Structure of ear and mechanism of hearing - Hearing impairments – deafness, labyrinthine disease - Olfactory,gustatory and tactile sense organs. (15 hours)

UNIT –V

Reproductive Physiology

Endocrine glands in man Hormones, and disorders of Pituitary,Thyroid,Pancreas,Adrenal and sex glands.Outlines of mechanism of hormonal activity during Puberty, adolescence, pregnancy, parturition, lactation and birth control. (15 hours)

Text Books

1. Agarwal R A., Anil K Srivastava., Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 pp
2. Arumugam N. & Mariyakuttikan, A. (2019). Animal Physiology, Nagarcoil, Saras Publication.

References Books

1Ambika Shanmugam, 2001. Fundamentals of Biochemistry for Medical students, Karthik Offset Printers, Chennai, 590pp

1. Berry A.K.1998. A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi, 320 pp.
2. Parameswaran, Ananta krishnan and Ananta Subramanian, 1975. Outlines of Animal Physiology, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.
3. 5.Verma P.S., Tyagi B.S & Agarwal V.K., 2010. Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp
4. Sarada Subrahmanyam, Madhavan Kutty, K., & Singh H.D., 2018. Text Book of Human Physiology, S. Chand & Co, New Delhi.
5. Singh, H.R and Kumar, N. 2017. Animal physiology and biochemistry, Vishal publishing company, Jalandhar, 864 pp
6. Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi.210 pp

Web Resources

- https://microbenotes.com/category/biochemistry/
- https://www.stem.org.uk/resources/collection/3931/animal-physiology
- https://animalphys4e.sinauer.com
- https://nptel.ac.in/courses/102/104/102104042/
- https://biochem.oregonstate.edu

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYC52	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	1	1	1	1	2	-	1	1
CO2	3	2	3	3	2	2	-	-	1	-
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani
Head of the Department

Dr. J.Rani
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. Zoology

(for those who join in 2023-2024)

Semester V	**ENVIRONMENTAL BIOLOGY**	Hours/Week: 5	
Core Course - 11		Credits: 4	
Course Code **23UZYC53**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: understand the properties of toxicants, effects, origin and occurrence in the environment.[K1]

CO2: To explain the relationship between biotic and abiotic factors in an ecosystem.[K2]

CO3: describe the toxic chemicals in the environment. [K2]

CO4: identify the role of the elements in environmental pollution and the effects on organisms. .[K3]

CO5: discuss the applicability of chemical analysis and toxicity data.[K3]

UNIT - I

Ecosystem : Concept of an ecosystem-Structure and function of an ecosystem- Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem : Forest ecosystem-Grassland ecosystem-Desert ecosystem-Aquatic ecosystems (ponds, oceans and estuaries). **(15 hours)**

UNIT - II

Population and Biological Cycles : Structure and distribution – Growth curves - Groups, natality, Mortality -Density indices, Life study tables - factors affecting population growth - Carrying capacity. Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle.

(15 hours)

UNIT –III

Environmental Stresses and Management: Global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition. biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation, Pesticides and other chemical in agriculture and industry their disposal. Bio indicator and biomarkers of environmental health. Bioremediation of chemicals.

(15 hours)

UNIT –IV

Environmental Pollution: Definition- cause, effects and control measures of: -Air pollution - Water pollution -Soil pollution -Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards. **(15 hours)**

UNIT – V

Biodiversity Conservation: Biodiversity crisis – habitat degradation, poaching of wild life. In situ and ex situ conservation of biodiversity. Hot spots of Biodiversity. Green peace movement and Chipko Movement. **Role of government agencies:** Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Natural Disaster Management, Bio villages – sustainable utilization and development. Environmental ethics. **(15 hours)**

Text Books

1. Matthew R. Fisher, 2018. Environmental Biology.Open Oregon Educational Resources. James Madison University.
2. Arumugam N. 2025. Environmental studies. Saras Publication, Nagercoil.

References Books

1. Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand, New Delhi.
2. Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.
3. Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.
4. Odum E.P.1983. Basic Ecology, Saunders, New York
5. Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYC53	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	1	1	1	1	2	-	1	1
CO2	3	2	3	3	2	2	-	-	1	-
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani

Head of the Department

Dr. J.Rani

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. Zoology

(for those who join in 2023-2024)

Semester V	**ECO PHYSIOLOGY PRACTICAL**	Hours/Week: 3	
Core Course 12 Practical - V		Credits: 2	
Course Code **23UZYC51P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: understand the qualitative analysis and quantitative determination of biomolecules.[K2]

CO2: explain the principle of bioinstruments.[K2]

CO3: analyse Physio - chemical parameters that regulate metabolism.[K3]

CO4: Evaluate and Examine the various parameters of biochemistry. [K3]

CO5: Summarise the effect of various physical and chemical factors. [K3]

Practicals

1. Estimation of dissolved Oxygen in different water sample.
2. Determination of salinity of water samples in different water sample.
3. Ptyalin activity in relation to temperature and pH in human saliva.
4. Estimation of oxygen consumption in an aquatic animal.
5. Estimation of pH in water and soil samples using pH meter.
6. Collection, isolation, identification and mounting of marine and freshwater planktons.
7. Qualitative tests for identification of carbohydrates, proteins and lipids.
8. Estimation of Haemoglobin.
9. Total erythrocyte count by haemocytometer.

Field Work:

1. Visit to a local polluted site- Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

2. Study of fauna in sandy shore /rocky shore.

Reference Books:

1. Widmaier, E.P., Raff, H. and Strang, K.T. 2008. Vander's Human Physiology, XI Edition., McGraw Hill., 770 PP.
2. Bishop, ML.,Fody, E.P., Schoeff, LE. 2010. Clinical Chemistry: Principles, Procedure, correlations. Wolters Kluwer, Inida, 298 PP.
3. Burtis, C.A. and Ashwood, E.R. 2008. Tietztext book of Fundamentals of clinical chemistry and molecular diagnostics, Elsevier, Philadelphia.
4. Tortora G.J.&Derrickson B.., 2016. Principles of Anatomy and Physiology, John Wiley and Sons, Inc. 1232 PP.
5. Agarwal R A., Anil K Srivastava.,Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 PP.
6. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
7. Michael, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
8. APHA, 1992. Standard Methods for the examination of water and waste water, American Public Health association, Washington D.C.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYC51P	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr.M. Tamilselvi
Dr. J. Rani Dr.J.Rani

Head of the Department **Course Designers**

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. Zoology

(for those who join in 2023-2024)

Semester V	**PROJECT**	Hours/Week: 1	
Core Course: 12		Credits: 1	
Course Code **23UZYC54PR**		Internal 100	External -

Course Outcomes

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

CO1: explain the learned concepts to select projects in Zoology and related interdisciplinary fields. [K2]

CO2: describe the theoretical knowledge to design experimental set up for their projects. [K2]

CO3: execute the technical skills in handling the equipment, and observe the results and exhibit the written communication skill acquired in related project. [K3]

CO4: analyze the experimental/ survey outcomes and present their project results effectively. [K3]

CO5: plan to meet out the challenges in regional and state level to solve the existing problems. [K3]

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

Project Work and Report: 60

marks Presentation and Viva-Voce- 40 marks

Course Code 23UZYC54PR	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani
Head of the Department

Dr. J. Rani
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. Zoology

(for those who join in 2023-2024)

Semester V	**ANIMAL BEHAVIOUR**	Hours/Week: 5	
DSEC - I		Credits: 4	
Course Code **23UZYE51**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the genetic basis and evolutionary history of animal behavior. [K1]

CO2: understand the environmental influence of movement and migration in animals.[K2]

CO3: explain the differences between innate, learned and cognitive behavior. [K2]

CO4: discuss the role of hormones in behavior and reproduction of animals. [K3]

CO5: identify the rhythmicity of behaviour in animals. [K3]

Unit I: Genetics and Behaviour :Single and Polygenic inheritance of behaviour, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness, Evolution of adaptive strategies. **(15 hours)**

Unit II: Evolution and Social Behaviour: Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour, Sensory processes and perception, Visual adaptations to unfavourable environments. **(15 hours)**

Unit III: Animal and the Environment: Coordination and Orientation, Homeostasis and Behaviour, Physiology and Behaviour in changing environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning.

(15 hours)

Unit IV: Understanding Complex Behaviour : Instinct and learning, Displacement activities, Ritualization and Communication, Decision making behaviour in Animals, Complex behaviour of honey bees, Mechanism of Decision making. The mentality of Animals : Languages and mental representation, non-verbal communication in human, Intelligence, tool use and culture, Animal awareness and Emotion. **(15 hours)**

Unit V: Chronobiology : Circadian system in multicellular animals; central and peripheral clock system; Circadian pacemaker system in Drosophila; Photoreception and photo- transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The biological clocks for human welfare - Clock function Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy. **(15 hours)**

Text Books

1. David McFarland, 1985.Animal Behaviour, Longman Scientific & Technical, UK.576pp.

Reference Books

1. Michael D. Breed and Janice Moore, 2012. Animal Behaviour, Academic Press, USA, 359pp.
2. Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to Animal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp.
3. Davis E.Davis, 1970. Integral Animal Behaviour, Mac Millan Company,London, 118pp.
4. Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.
5. HarjindraSingh,1990.ATextBookofAnimalBehaviour,AnomolPublication,293pp.
6. HoshangS.GundeviaandHareGovingSingh,1996.AnimalBehaviour,S.Chand&Co, 280pp.
7. Shukla, J. P 2010, Fundamentals of Animal Behaviour, Atlantic, 587pp.
8. Vinod Kumar, 2002. BiologicalRhythms. NarosaPublishingHouse, Delhi.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYE51	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani — **Head of the Department**

Dr.R.Radhalakshmi — **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. Zoology

(for those who join in 2023-2024)

Semester V	**BIOINSTRUMENTATION**	Hours/Week: 5	
DSEC Course - I		Credits: 4	
Course Code **23UZYE52**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the principle and working mechanism biological instruments.[K1]

CO2: explain the applications of biological techniques. .[K2]

CO3: infer the results of experiments using biological instruments. .[K2]

CO4: design experiments in accordance with the available bioinstruments. .[K3]

CO5: justify the results with the principles of bioinstrumentation. .[K3]

Unit I

Good Laboratory Practices : Guide lines, Laboratory symbols, Laminar flow hood: types and use; Concepts of molecular weight and atomic weight, preparation of solutions of a particular molarity and percentage; Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings**.** **(15 hours)**

Unit II

Microscopy - Light microscope, SEM, TEM, Atomic force microscope; Cryopreservation - principle and procedure; Fluorescence activated cell sorting; X-ray crystallography. **(15 hours)**

Unit III

Centrifugation- working principle and types of centrifugation- Tabletop and Ultra centrifugation; Spectrophotometry; Mass spectrometry; Chromatography - principle and types of chromatography- Paper Chromatography, Thin Layer Chromatography and Column Chromatography. **(15 hours)**

Unit IV

Biomedical Instrumentation: ESR measurement, haemoglobin measurement, blood pressure, ECG, cardiac pacemakers; X- ray imaging, CT scan and NMR imaging; Ultrasound imaging; medical applications of laser; Biosensors - glucose biosensor, artificial retina, environmental biosensors and DNA biosensor. **(15 hours)**

Unit V

Molecular Techniques : Isolation of DNA, RNA and proteins; Electrophoresis of DNA and proteins; Polymerase Chain Reaction (PCR); ELISA; Immunofluorescence; Fluorescent in-situ hybridization; Southern and Western blotting. **(15 hours)**

Text Books

1. Sabari Ghosal and Anupama Sharma Avasthi, 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., Phi Learning Pvt. Ltd., New Delhi, India.
2. Veerakumari L., 2015. Bioinstrumentation, MJP Publishers, Chennai, India.

Reference Books

1. Prakash Singh Bisen, Anjana Sharma, 2012. Introduction to Instrumentation in Life Sciences, CRC Press, Taylor & Francis Group, New York, USA.
2. Gupta P.C., 2010. Biological Instrumentation and Methodology (Tools & Techniques), S. Chand & Company Limited, New Delhi, India.
3. Ghatak K. L., 2010. Techniques and Methods in Biology, Phi Learning Pvt. Ltd., New Delhi, India.
4. Sue Carson, Heather Miller, Melissa Srougi and Scott Witherow, 2019. Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA.
5. Aysha Divan, Janice Royds, 2013. Tools and Techniques in Biomolecular Science, Oxford Univeristy Press, UK.
6. Gordon M.H., Macrae R., 2012. Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK
7. Leonard Davis, Mark Dibner and James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Publishing Co., New York, USA.
8. Wilson, K.M. and Walker, J.M., 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.

Web Resources

1. https://www.nature.com/subjects/biological-techniques
2. https://www.ibiology.org

Course Code 23UZYE52	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani — **Head of the Department**

Dr. P. Veeramuthumari — **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. Zoology

(for those who join in 2023-2024)

Semester V	**ENVIRONMENTAL TOXICOLOGY PRACTICAL**	Hours/Week: 3	
DSEC Practical -I		Credits: 2	
Course Code **23UZYE53P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: explain the main mechanisms of environmental toxic response in living organisms.[K2]

CO2: describe the optimal use of natural resources.[K2]

CO3: provide practical knowledge and hands on tools and techniques.[K3]

CO4: discuss the remediation of contaminated environments.[K3]

CO5: develop data that can ensure appropriate protection of public health.[K3]

Practicals:

1. Estimation of Ammonia and alkalinity in soil
2. Estimation of chlorine water
3. Determination of hardness of water.
4. Estimation of BOD/ Estimation of COD
5. Toxicity Testing- Use of LC50 values – sub lethal effects of critical pollutants on fish.
6. Settling rate of bacteria from air. Bacterial Gram staining. Identification of bacteria from air up to colony characteristics.
7. Enumeration of bacteria from air.
8. Study of collection, concentration and preservation techniques of algae.
9. Identification techniques of algae (Study of morphological characteristics of algae).
10. Determination of phosphate levels in clean and polluted waters.

Spotters:

Spectrophotometer, Colorimeter, Atomic absorption spectroscopy, Ultracentrifuge, Incubator,

Mini Project:

Visit to a vermicompost plant/Visit to waste water and Drinking water plant.

Reference Books

1. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
2. DAS H.K.,2005. Text Book of Biotechnology. Wiley Dreamtech Pvt Ltd, New Delhi.
3. Rastogi, S.C., 2005. Experimental physiology, New age International publishers, New Delhi.
4. Ramesh, R and M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.
5. Micheal, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
6. Agarwal, A. State of India's Environment: A Citizens Report, Centre for Science and Environment, New Delhi.
7. Goel, P.K. Water Pollution: Causes, Effects and Control. New Age International, Publishers, New Delhi (2006).

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYE53P	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr. J. Rani

Head of the Department

Dr.J.Rani
Dr.R.Radhalaksmi

Course Designers

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. Zoology

(for those who join in 2023-2024)

Semester V	**BIOINSTRUMENTATION PRACTICAL**	Hours/Week: 3	
DSEC-2 Practical - I		Credits: 2	
Course Code **23UZYE54P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: describe the principle and working mechanism biological instruments.[K2]

CO2: explain the applications of biological techniques. [K2]

CO3: infer the results of experiments using biological instruments. .[K3]

CO4: design experiments in accordance with the available bioinstruments. .[K3]

CO5: justify the results with the principles of bioinstrumentation. [K3]

Practicals:

1. Laboratory Practices – Lab safety practices-Dos and Don'ts- Waste Disposal
2. Principles and Applications of
   a) Laminar Air Flow Chamber
   b) pH Meter
   c) Ultra-Centrifuge
   d) AGE
   e) ELISA
3. Preparation of buffer (Acetate Buffer)
4. Isolation of Bioactive compounds using Column Chromatography technique.
5. Separation of Protein by SDS PAGE.
6. Measurement of ESR in human blood.
7. Comparative study on normal and abnormal blood pressure using ECG.

Text Books

1. Sabari Ghosal and Anupama Sharma Avasthi, 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., Phi Learning Pvt. Ltd., New Delhi, India.
2. Veerakumari L., 2015. Bioinstrumentation, MJP Publishers, Chennai, India.

Reference Books

1. Prakash Singh Bisen, Anjana Sharma, 2012. Introduction to Instrumentation in Life Sciences, CRC Press, Taylor & Francis Group, New York, USA.
2. Gupta P.C., 2010. Biological Instrumentation and Methodology (Tools & Techniques), S. Chand & Company Limited, New Delhi, India.
3. Ghatak K. L., 2010. Techniques and Methods in Biology, Phi Learning Pvt. Ltd., New Delhi, India.
4. Sue Carson, Heather Miller, Melissa Srougi and Scott Witherow, 2019. Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA.
5. Aysha Divan, Janice Royds, 2013. Tools and Techniques in Biomolecular Science, Oxford Univeristy Press, UK.
6. Gordon M.H., Macrae R., 2012. Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK
7. Leonard Davis, Mark Dibner and James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Publishing Co., New York, USA.
8. Wilson, K.M. and Walker, J.M., 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.

Web Resources

1. https://www.nature.com/subjects/biological-techniques
2. https://www.ibiology.org

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYE54P	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

Dr. J. Rani

Head of the Department

Dr.M.Tamilselvi

Dr.P. Veeramuthumari

Course Designers

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. Zoology

(for those who join in 2023-2024)

Semester: V	**Internship**	Hours/Week: -
PART IV		Credit: 1
Course Code 23UZYI51		Internal: 100

COURSE OUTCOMES

On completion of the Internship/Field Project, students will be able to

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

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

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

CO4: exhibit the written communication skills acquired through internship/field project. [K3]

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

Guidelines/ Regulations:

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

Course Code 23UZYI51	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	2	1	1	3	3
CO2	3	3	2	1	2	3	3
CO3	3	2	2	2	2	3	3
CO4	2	2	2	2	2	2	2
CO5	3	3	2	3	1	2	3

Dr. J. Rani — **Head of the Department**

Dr. J. Rani — **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

(for those who join in 2023-2024)

Semester V	**DIETETICS FOR WOMEN**	Hours/Week: -
Extra Credit Course:		Credits: 2
Course Code 23UZYO51		Internal **100**

COURSE OUTCOMES

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

CO1: understand the concept of an diet and the importance of meal planning.

CO2: know the factors affecting the nutrient needs during the life cycle for women.

CO3: gain knowledge about dietary management in common ailment.

CO4: assess the nutritional needs, develop dietary plans.

CO5: provide the counseling and awareness related to nutrition.

UNIT I

Meal Planning

Definition of dietetics Meal Planning- Basic principles and factors influencing of meal planning, Basic meal pattern and its modification to suit different income levels, age and physiological stres

UNIT II

Nutrition for Infants and Preschool Girls

Nutrition during Infancy - Advantages of Breast feeding – Weaning and supplementary food, Nutrient requirements. Nutrition during preschool - Nutrient Requirements, inculcation of good food habits, feeding programmes – school lunch programme.

UNIT III

Nutrition for School going dnd Adolescenct Girls

Nutrition during school going period, Nutrient Requirements. Nutrition during adolescence - Growth and development Eating disorder, nutritional requirements.

UNIT IV

Nutrition for Pregnant and Lactating Women

Nutrition during pregnancy –Nutrient requirements during pregnancy. Nutrition during lactation – Nutrient requirement during lactation.

UNIT V

Nutrition for Adult and Old Aged Women

Adulthood - Nutritional problems and nutritional requirements. Nutrition during old age - Nutritional problems and nutritional requirements.

REFERENCES

1. Srilakshmi, B. (2000). *Dietetics.* Chennai: New Age International (P) Ltd.
2. Robinson, C.H. (1977). *Normal and the Therapeutic Nutrition.* New Delhi: The oxford and IBH Publishing Co.
3. Guthrie, A.H. (1986). *Introductory Nutrition.* St. Louis: The C.V. Mosby Company.
5. Swaminathan, M. (1985). *Essentials of Food and Nutrition.* Madras: Ganesh & Co.
6. Williams, S.R. (2001). *Basic Nutrition and Diet Therapy*. St. Louis: Mosby Inc.
7. Brown, J.E.(2002). *Nutrition Now*. Canada: Wordsworth Thomson Learning, Inc.

Dr. J. Rani
Head of the Department

Dr. R.Radhalakshmi
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. Zoology

(for those who join in 2023-2024)

Semester VI	**ANIMAL BIOTECHNOLOGY**	Hours/Week: 5	
Core Course - 14		Credits: 5	
Course Code **23UZYC61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: understand the culture techniques of animal cells. [K1]

CO2: explain the protocols for genetically manipulating cells and produce transgenic animals.[K2]

CO3: select the apt molecular techniques to evaluate and analyze animal traits and diseases.[K2]

CO4: apply the biotechnology tools to improve the Animal husbandry.[K3]

CO5: produce bioactive compounds through animal cell culture.[K3]

UNIT-I

Fundamentals of Biotechnology: Animal cell culture: Basic requirements and techniques of cell culture, natural and synthetic culture media, primary and secondary culture- cell lines; Stem cells: types, culture and applications; r-DNA technology: Enzymes; Vectors – pBR322, Phage lambda, Cosmid, BAC, YAC; Host cells; Gene cloning: steps in cloning, selection of clones –Blue white screening and Nucleic acid hybridization.

(15 hours)

UNIT-II

Techniques in Animal Biotechnology : Isolation and purification: DNA and mRNA; DNA sequencing: Maxam Gilbert and Sanger method, DNA chips, microarray, Gene library. Screening with probes- Gene transfer in animal cells- Microinjection, Electroporation, Liposome fusion: transfection, viral mediated, biolistic, direct DNA injection.

(15 hours)

UNIT-III

Transgenic Animal Technology : Transgenesis: Concept, transgenes, transgenic animal models - knock out mice, sheep; Applications of transgenesis : Molecular farming, Transgenic fishes, transgenic live stocks, and animals as bioreactors **(15 hours)**

UNIT-IV

Animal Biotech and Health Care : Medical biotechnology: Monoclonal antibodies, recombinant vaccines –hepatitis B, hormones – insulin. DNA diagnostic systems: tuberculosis, AIDS, genetic diseases; Gene therapy: Ex vivo and in vivo, role in cancer treatment; CRISPR gene editing. Molecular markers: RFLP, RAPD, DNA fingerprinting and application**.**

(15 hours)

UNIT-V

Applications and Ethics : Human genome project: Mapping of human genome, applications, ethics; Industrial biotechnology: Bioreactors - Basic concepts of fermentation, bioreactor design, production of ethanol and streptomycin; Ethics: Socio ethical problem, recent trends in animal biotechnology, ethical implications. **(15 hours)**

Text Books:

1. Dubey R. C., 2014. A text Book of Biotechnology, S. Chand & Co Ltd, Ram Nagar, New Delhi.

Reference Books:

1. Singh B. D., 2015. Biotechnology: Expanding horizon, Kalyani publishers.
2. Sasidhara, R., 2015. Animal biotechnology, MJP publishers.
3. Dubey S. K., Bandana Ghosh, 2012. Fish biotechnology, Wisdom Press.
4. Dubey R.C., 2014. Advanced Biotechnology, S. Chand Publication.
5. Ruby, R.C., 2012. A text book of biotechnology, S. Chand Company, New Delhi.
6. Sambamurthy K., Ashutosh Kar., 2009. Pharmaceutical Biotechnology, New Age International (P) Ltd.
7. Ramdoss P.,2009. AnimalBiotechnology- Recent concepts and developments, MJP publishers.
8. Sathyanarayran U., 2008. Biotechnology, Books and Allied, Kolkata.
9. Ignacimuthu, S., 2008. Basic Biotechnology, Tata McGraw hill, New Delhi.
10. Rastogi S. C., 2007. Biotechnology: Principles and applications, Alpha Science publishers.

Ranga, M.M., 2003. Animal biotechnology, Agrobios, New Delhi.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYC61	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	1	1	1	1	2	-	1	1
CO2	3	2	3	3	2	2	-	-	1	-
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani
Head of the Department

Dr. R. Radhalakshmi
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. Zoology

(for those who join in 2023-2024)

Semester VI	**MICROBIOLOGY**	Hours/Week: 5	
Core Course - 15		Credits: 5	
Course Code **23UZYC62**		Internal 25	External 75

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

CO1: understand the classification of bacteria. [K1]

CO2: explain the working principles and applications of types of microscopes.[K2]

CO3: describe the structure of microbial cells, its organelles, physiology and behaviour. [K2]

CO4: classify the microbial organisms based on its characteristic features. [K3]

CO5: use the beneficial microbes for nurturing the environment and Man's health. [K3]

Unit I

Introduction to microbiology: History, scope, branches of microbiology. Contribution of Leeuwenhoek, Jenner, Pasteur, Koch, Flemming, Iwanowsky, Waksman, Luria, M. J. Thirumalachar, Subba Rao, Sambhu Nath De. Evolution of Microbial diversity. Systematic position: 5 kingdom classification of Whittaker and 3 kingdom classification. Comparison of Bacteria, Archaea, Eukarya (tabular and diagrammatic).

(15 Hours)

Unit II

Microscopy: Principles of microscopy ii. Compound microscope (Monocular and Binocular microscopes) – construction and function of parts, ray diagram of path of light, objectives, oculars, condensers, sources of illumination and uses iii. Dark field, Phase contrast and Fluorescence microscopes, Confocal microscopes, Atomic Force Microscope - principle, construction, ray diagram and applications iv. Electron microscopy – TEM and SEM – principle, construction, ray diagram and uses.

(15 Hours)

Unit III

Introductory Mycology: General characteristics and outline classification of fungi, Morphology of some common fungi – Mucor, Rhizopus, Aspergillus, Penicillium and Fusarium. Yeasts: General characteristics and outline classification of yeasts. General characteristics of Lichens and Mycorrhiza. **(15 Hours)**

UNIT IV

Introductory Bacteriology: Classification of bacteria. Anoxygenic photosynthetic bacteria: general characteristics of purple bacteria and green bacteria. Oxygenic photosynthetic bacteria: General characteristics of Cyanobacteria – external and internal features, physiology and ecology. Magnetotactic bacteria- General characteristics, Magnetosomes, Enrichment and isolation of Magnetotactic bacteria. Types of staining- Simple and Differential Staining.

(15 Hours)

Unit V:

Introductory Virology: Virus Structure and Classification. Virus Entry and Viral Pathogenesis. Positive-strand RNA viruses: Picornaviruses, Flaviviruses, Togaviruses, Coronaviruses. Negative-strand and double-strand RNA viruses: Paramyxoviruses, Rhabdoviruses, Filoviruses, Bunyaviruses, Orthomyxoviruses and Reoviruses. DNA viruses: Parvoviruses, Polyomaviruses, Papillomaviruses, Adenoviruses and Baculoviruses, Herpes viruses and Poxviruses.

(15 Hours)

Text Book:

1. Arumugam, N., (2007). Microbiology. Nagercoil: Saras Publication.

Reference Books

1. Aneja, K.R., & Jain, P., Aneja, R., (2009). A Text Book of Basic and Applied Microbiology. New Delhi: New age International Publications.
2. Black, J., (1999). Microbiology. Principle and Explorations. New Jersey: Prentice Hall International Inc.
3. Madigan, M., Martinko, J., & Parker, J., (2005). Biology of Microorganisms. New Jersey: Prentice Hall International INC.
4. Prescott, L., Harley, J.P., & Klein, D.N., (2004). Microbiology. New York: WMC Brown MC Graw Hill Publications.
5. Adams, M.R., & Moss, M.D., (1995). Food Microbiology. New Delhi: New Age International Ltd.
6. Chakkraborty, B., (1998). A Text Book of Microbiology. Calcutta: New Central Book Agency Pvt Ltd.
7. Rajan, S., & Selvi Christy, R., (2016). Essentials of Microbiology. Chennai: Anjan Book House.

Course Code 23UZYC62	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	3	3	3	3	1	1	3
CO2	3	3	3	3	3	3	2	1	1	3
CO3	3	3	3	3	3	3	1	1	2	3
CO4	3	3	3	3	3	3	2	1	2	3
CO5	3	3	3	3	3	3	3	3	2	3

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

Dr. J. Rani
Head of the Department

Dr. M. Tamilselvi
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. Zoology

(for those who join in 2023-2024)

Semester VI	**IMMUNOLOGY**	Hours/Week: 5	
Core Course - 16		Credits: 4	
Course Code **23UZYC63**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: understand the basic structural and functional components of the immune system.[K1]

CO2: classify the types of immunity, Antibody and Antigen. .[K2]

CO3: describe the biological characteristics of antibodies and Antigen. .[K2]

CO4: explain the mechanism of various types of hypersensitivity reactions and different types of autoimmune diseases. .[K3]

CO5: summarize immune responses against pathogens.[K3]

Unit I

Immune Cells and Organs: Overview of Immune System - General concepts and Haematopoiesis. Cells of the immune system - T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils -Mast cells and dendritic cells. Organs of the Immune system: Primary lymphoid organs - Thymus and bone marrow; Secondary Lymphoid organs - Lymph nodes and spleen; Lymphatic tissues - Peyer's patches and Kupffer cells and MALT.

(15 hours)

UNIT II

Innate and Adaptive Immunity: Innate and Adaptive Immunity; Cells and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral). Receptors and Signaling: Cytokines and Chemokines - General Properties of Cytokines and Chemokines. Major Histocompatibility Complex (MHC): Classes, Structure and functions. Structure and cellular distribution of HLA antigens. **(15 hours)**

Unit III

Antigen and Antibodies: Antigens- Antigenicity and immunogenicity: Properties -foreignness, molecular size, heterogeneity. B & T epitopes, T-dependent and T- independent B cell responses. Antibodies: Structure, function and properties of the Immunoglobulins, Different classes of Immunoglobulins; antigenic determinants on antibodies (isotype, allotype and idiotype). Hybridoma technology - production of monoclonal antibodies. **(15 hours)**

Unit IV

Hypersensitivity and Autoimmune Diseases: Hypersensitivity: classification and brief description of various types of hypersensitivities. Autoimmunity: cause of autoimmune diseases - classification of autoimmune diseases. Transplantation immunology: Types of grafts, immunosuppressive therapy and clinical transplantation. **(15 hours)**

Unit V

Clinical Immunology: Immunity and tumors- tumor antigens (TSTA and TAA), immune response to tumors. Tumor evasion of the immune system, Immunotherapy for tumors. Immunity against - viral, bacterial and parasitic infections. Vaccines: Types and uses - Immunization schedule for children. **(15 hours)**

Text Book

1. Kuby, J, Punt, J, Stranford, S, Jones,Pand Owen, J, 2018. Immunology, 8th Edition, W.H.Freeman Publishing, New York, 944 pp.

References

1. Roitt, M, Peter J. Delves, Seamus J. Martin and Dennis R. Burton, 2017. Essential Immunology, 13th Edition, Wiley-Blackwell Publishing,USA, 576 pp.
2. Coleman,R.M., 2014. Fundamental Immunology, 2nd Edition, Published by Mc Graw Hill Education India, 357 pp.
3. Raj Khanna, 2011. Immunology, Oxford University press, New Delhi. 428 pp.
4. Rao.C.V. 2011. Immunology, Narosa Publishing House, New Dehli, 426 pp.
5. Abul A. Andrew, Lichtman. H, Shiv. P, 2014. Cellular and Molecular Immunology, 8th Edition, Published by W.B. Saunders, 544 PP.
6. Chapel. H, Haeney. M, Misbah. S, and Snowden. N, 2006. Essentials of Clinical Immunology, 5th Edition. Blackwell Publishing, 368 PP.
7. William R. Clark, 1985. The Experimental Foundations of Modern Immunology, Published by Johns Hopkins University Press, New York. 326 PP.
8. Kenneth Murphy & Casey Weaver, 2016. Janeway's Immunology, Garland Science publishers, 924 pp.

Website References

https://www.immunology.org/

https://microbenotes.com/category/immunology/

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYC63	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani

Head of the Department

Dr. P. Veeramuthumari

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. Zoology

(for those who join in 2023-2024)

Semester VI	**BIOTECHNOLGY PRACTICAL**	Hours/Week: 3	
Core Course – 17 Practical-VII		Credits: 2	
Course Code **23UZYC61P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1**:** describe the organization of genomic material.[K2]

CO2: isolate the genetic molecules. .[K2]

CO3: distinguish genetic material in different organisms. .[K3]

CO4: identify the changes in genetic material. .[K3]

CO5: justify the results of molecular and genetic experiment. .[K3]

Practicals

1. Isolation of RNA from spleen.
2. Isolation of DNA from plant.
3. Determination of the purity of isolated DNA samples by UV spectrophotometry.
4. Agarose gel electrophoresis of DNA.
5. Radial Immunodiffusion test.
6. Double Immunodiffusion test.
7. Restriction Digestion of plasmid DNA

Virtual lab activity:

8. Trypsinization of liver cells.
9. Determination of the viability of trypsinized cells by Trypan Blue method.
10. Creation of transgenic flies.
11. Polymerase Chain Reaction (PCR)
12. Enzyme Linked Immunosorbent Assay (ELISA)

Reference Books

1. Surya Nandan Meena, Milind Naik, 2019. Advances in Biological Science Research: A Practical Approach, Academic Press, New York, USA.
2. Michael Perlin, William Beckerson, Adarsh Gopinath, 2017. Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.
3. Saxena J., Baunthiyal M., Ravi I., 2015. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology, Scientific Publishers, India.
4. Bansal M.P., 2013. Molecular Biology and Biotechnology: basic experimental protocols, The Energy and Resources Institute (TERI), New Delhi, India.
5. Chaitanya K.V., 2013. Cell and molecular biology: A Lab Manual, Phi Learning Pvt. Ltd., New Delhi, India.
6. Andreas Hofmann, Samuel Clokie, 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.
7. Sarah Stauffer, Aaron Gardner, Wilko Duprez, Dewi Ayu Kencana Ungu, Philip Wismer, 2018. Labster Virtual Lab Experiments: Basic Genetics, Springer Publishers, NY, USA.
8. Leonard Davis, Mark Dibner, James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Pubilshing Co., NY, USA.
9. Robert F. Schleif, Pieter C. Wensink, 2012. Practical Methods in Molecular Biology, Springer-Verlag, NY, USA.
10. Ian Freshney R., 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, John Wiley & Sons, USA.

Website references

- (https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/ind ex.ht ml)
- https://www.ibiology.org/biology-techniques/

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYC61P	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr. J. Rani

Head of the Department

Dr.P. Veeramuthumari
Dr.P. Vijaya

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. Zoology

(for those who join in 2023-2024)

Semester VI	**MEDICAL LABORATORY TECHNIQUES**	Hours/Week: 5	
DSEC Course -III		Credits: 4	
Course Code **23UZYE61**		Internal 25	External 75

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

CO1: describe the different protocols and procedures to collect clinical samples.[K1]

CO2: explain the characteristics of clinical samples. [K2]

CO3: demonstrate skill in handling clinical equipment. [K2]

CO4:. evaluate the safety precautions while handling clinical samples. [K3]

CO5: analyse the control measures to avoid contamination of clinical samples.[K3]

Unit I: Laboratory Safety and Human Health and Hygiene : Laboratory safety –toxic chemicals and biohazards waste- biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol, tobacco, smoking & junk food & its treatment - biomedical waste management. **(15 hours)**

Unit II: Haematology : Composition of blood and their function- collection of blood & lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation- bleeding time-clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing-haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count. **(15 hours)**

Unit III: Medical Microbiology and Instrumentation Techniques : Definition and scope of microbiology- structure and function of cells - parasites - Entamoeba- Plasmodium-Leishmania and Trypanosome- Computer tomography (CT scan) – Magnetic Resonance imaging – flowcytometry – treadmill test – PET. **(15 hours)**

Unit IV: Medical Physiology : Cardiovascular system- Blood pressure - Pulse – regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) – significance – ultra sonography- Electroencephalography (EEG).

(15 hours)

Unit V: Diagnostic Pathology : Handling and labelling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome- sectioning, staining –staining methods- vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

(15 hours)

Text Books

1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.

Reference Books

1. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elseiner, New Delhi.
2. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.
3. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.
4. Manoharan,A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee brothers, New Delhi.
5. Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia.Published by Tata McGraw-Hill Education Pvt. Ltd.,
6. Ochei. J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYE61	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani — **Head of the Department**

Dr. R.Radhalakshmi — **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. Zoology

(for those who join in 2023-2024)

Semester VI	**HUMAN REPRODUCTIVE BIOLOGY**	Hours/Week: 5	
Elective Course - IV		Credits: 4	
Course Code **23UZYE62**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Recall the structure and functioning of the male and female reproductive system. [K1]

CO2: understand the role of accessory glands. [K2]

CO3: Explain the mechanism of sex determination. [K2]

CO4: Discuss the physiological changes during pregnancy. [K3]

CO5: analyze the different techniques related to reproductive technology. [K3]

Unit I

Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, regulation of gonadotrophin secretion in male and female; Reproductive System: Development of gonads, genital ducts, mechanism of sex differentiation; Puberty.

(15 Hours)

Unit II

Outline and histoarchitecture of male reproductive system; Testis: Cellular functions; Spermatogenesis and its hormonal regulation; Androgen synthesis and metabolism; Accessory glands functions; Sperm transportation in male tract; Andropause. (15 Hours)

Unit III

Outline and histoarchitecture of female reproductive system; Ovary: oogenesis and its hormonal regulation; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation, Menopause. (15 Hours)

Unit IV

Ovum transport in the fallopian tubes; Sperm transport in the female tract, Fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, Mechanism of parturition and its hormonal regulation; Lactation and its regulation.

(15 Hours)

Unit V

Infertility in male and female: causes, diagnosis and management; Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, Stem Cell banks, *in vitro* fertilization, IUT, ZIFT, GIFT; ethical issues related to ART; Surrogate motherhood; ethical issues; Consanguinity; Fetal Loss and Birth Defects.

(15 Hours)

Text Book:

1. Cassan, A. (2005). *Human reproduction and Development (Inside the Human Body).* NewYork: Chelsea Clubhouse.
2. Gardner, D. K.(2001). *Textbook of Assisted Reproductive Techniques: Laboratory andClinicalPerspectives.*London: MartinDunitz.

Reference Books:

1. Field,M.A.(1990).*SurrogateMotherhood*.Massachusetts:Harvard University.
2. Gardner, D. K.(2001). *Textbook of Assisted Reproductive Techniques: Laboratory andClinicalPerspectives.*London: MartinDunitz.
3. Gardner, D. K.(2006). In vitro Fertilization: A Practical Approach. CRC Press.
4. Johnson, M. H. (2018). *Essential Reproduction*. New Jersey: Wiley-Blackwell.
5. Jones,R.E.(2013).*HumanReproductiveBiology*.Amsterdam:Elsevier.
6. Neill, Jimmy D. ed (2006). Knobil and Neill's Physiology of Reproduction.Volume I. Third edn. Elsevier Academic Press.
7. Pinon, R. (2003).*Biology of Human Reproduction*. California: University Science Books.

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYE62	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani — **Head of the Department**

Dr. J. Rani — **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. Zoology

(for those who join in 2023-2024)

Semester VI	**RADIATION BIOLOGY**	Hours/Week: 5	
DSEC Course - V		Credits: 4	
Course Code **23UZYE63**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: find out the basic concepts in radiation biology .(K1)

CO2: classify the types and sources of radiation. (K2)

CO3: explain the biological impact of radiation on living cells and tissues(K2)

CO4: discuss the causes for radiation effects in different levels.(K3)

CO5: apply their knowledge to handle radioactive isotopes safely.(K3)

UNIT-I

Scope of Radiation Biology – Sources of Natural Radiation: Terrestrial and cosmic sources - Man made radiations - Medical (occupational and diagnostic). Types of radiation – Ionizing and non-ionizing radiation. **(15 hours)**

UNIT-II

Properties of Radiation – Radiation Units (Becquerel, RAD, Gray& Curie, Sievert). Measurement of Radiation in the Environment - Alpha and Beta counters and Scintillometer.

(15 hours)

UNIT-III

Biological effects of Radiation - Cellular level – Organ and system level – Genetic effects (chromosomal aberrations), radiation induced mutations – Radiation sickness – Syndromes – Cancer induction – Dosimetry. **(15 hours)**

UNIT-IV

Radiation safety measures - Safety standards disposal of radioactive waste management, administrative & legislative aspect of radiation protection.Nuclear reactors – Nuclear energy programme in India. Regulatory authorities– AERB, BARC, & ICRP.

(15 hours)

UNIT-V

Applications of Radioisotopes in biology- Auto radiography, Radioimmunoassay; Agriculture - insect, pest and disease management- Sterile Insect Technology (SIT); Medicine - (Therapy & diagnosis); Food preservation.

(15 hours)

REFERENCES

1. Rao, B.M. (2002), Radioactive Materials, Himalayas publishing House.
2. Sood, D.D. Reddy, A.V.R. and Ramamoorthy, N. (2000) Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, Radiochemistry Division, Mumbai.
3. Sharma, B.K., (1990) Environmental Chemistry, Goel Publishing House, Meerut.
4. Kiefer, J. (1990) Biological Radiation Effects, Springer-verlag.
5. Radiation Biology: A Handbook for Teachers and Students International Atomic Agency (IAEA), 2010 - Training Course Series42.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYCE63	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr. J. Rani

Head of the Department

Dr, J. Rani

Course Designers

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. Zoology

(for those who join in 2023-2024)

Semester VI	**BASICS OF MARINE BIOLOGY**	Hours/Week: 5	
DSEC Course - VI		Credits: 4	
Course Code **23UZYE64**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the physical, chemical and biological aspects of marine environment. [K1]

CO2: gain knowledge about the significance of marine organisms. [K2]

CO3: explain the adaptations of marine animals. [K2]

CO4: identify and classify marine plants and animals [K3]

CO5: develop an awareness of the career possibilities available in the coastal area. [K3]

Unit I: Marine Ecology : Marine environment- ecological factors- light, temperature, salinity, pressure; Classification of marine environment; Pelagic environment – Planktonic and Nektonic adaptations; Distribution and ecological role of other coastal environments - coral reefs, estuaries, mangroves. (15 Hours)

Unit II: Physical Oceanography : Physical Properties of Seawater- density, viscosity, surface tension, conductivity and their relationship; temperature distribution in the sea - heat budget, UV radiation; El Nino/La Nina – global impact; Dynamics of the ocean-general surface circulation, Waves, Currents and Tides, Tsunami. (15 Hours)

Unit III: Chemical Oceanography : Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements- their importance, distribution. Chemistry of seawater constituents- concept of chlorinity and salinity - methods of measurements, nutrients - biogeochemical cycles. (15 Hours)

Unit IV: Biological Oceanography : Sea as a biological environment- Plankton- classification based on size, mode of life and habitat. Phytoplankton and Zooplankton - methods of collection. Primary productivity – estimation and factors affecting primary productivity. (15 Hours)

Unit V: Marine Pollution and Ocean Management : Ocean pollution- kinds and quantities of pollutants, toxic effects and control measures – oil spills and plastics in marine environment, Eutrophication. Role of National and international agencies and organizations in ocean management-FAO, UNEP, DOD, WOCE, WHOI, IOI Malta, IMO INMARSA, Marpol, Traffic. Ocean policy (India) - research and management. (15 Hours)

Text Books

1. Thurman, Harold., 2001 Introduction to Oceanography, Prentice Hall Inc. New Jersey. 506 pp.
2. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.

Suggested Readings

1. Barbara E. Curry, 2016. Advances in Marine Biology, Volume 74, Ist Edition. Academic Press ISBN: 9780128036075
2. Peter Castro, Michael E. Huber, 2015. Marine Biology; Series Botany, Zoology, Ecology and Evolution.McGraw-Hill Education.
3. Philip V. Mladenov, 2013 Marine Biology: A very short introduction, Ist Edition. Oxford University Press.
4. Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj C. R, 2012. Marine diversity in India.Zoological Survey of India, Kolkata.178 pp.
5. Amy Hill. 2002. Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Ser) Walch publishing.
6. Pickard, G.L. and W.J. Emery 1995. Descriptive Physical Oceanography. PergamonPress,London.
7. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press,Cambridge
8. Raymont J. E. G., 1980. Plankton and Productivity in the oceans: Volume 1: Phytoplankton, Pergamon Press.
9. Van Der Spoel, S. and PierrotBults, A. C (Eds) 1979.Zoogeography and diversity of plankton.Bungs Scientific Publishers Utrecht, 410pp.
10. Riley, J.P. and Skirrow, 1975-1984. Chemical Oceanography Vols. 1 to 8. Academic Press,London
11. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
12. Fincham A. A, 1984.Basic Marine Biology. Cambridge University Press, England. 157 pp.5. John Resech Jr.1979, Marine Biology. Reston Publishing Company, Virginia. 257 pp.

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYE64	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	1	1	1	1	2	1	1	1
CO2	3	2	3	3	2	2	1	1	1	1
CO3	3	2	3	2	1	3	2	2	2	3
CO4	3	3	2	3	2	1	3	1	2	3
CO5	3	3	2	3	3	1	3	2	2	1

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

Dr. J. Rani
Head of the Department

Dr.P. Vijaya
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. Zoology

(for those who join in 2023-2024)

Semester VI	**NANOBIOLOGY**	Hours/Week: 2	
SEC- 7		Credits: 2	
Course Code		Internal	External
23UZYS61		25	75

COURSE OUTCOMES

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

CO1: understand basics of Nano-science and Nano-biology.[K1]

CO2: explain the different types of nanomaterials and nanoparticles. [K1]

CO3: describe the biological applications of nanomaterials and nanoparticles. [K2]

CO4: apply their knowledge in their career development in higher education, research and development. [K2]

CO5: synthesis different types of nanomaterials and nanoparticles. [K3]

Unit I

Nanobiology- Definition-concepts and scope. History of nanotechnology and nanoscience in Nature; Structure and Properties ofnanomaterials: size, surface charge, conductivity, optical properties and biocompatibility. **(6 hours)**

Unit II

Synthesis and characterization of nanomaterials, Fabrication of nanostructures, Metallic nanoparticles, semiconductor, biopolymericnano-structures and nanoparticles. **(6 hours)**

Unit III

Composition and functional properties of nanostructures: Protein and peptide-based nanostructures, carbohydrate and nucleic acid based nanomaterials; Use of gold, silver and other metallic nanoparticles. **(6 hours)**

Unit IV

Strategies to design biologically active nanostructure-based biomaterials. Interaction of nanoparticles with biomolecules to study their conformational and functional properties.

(6 hours)

Unit V

Biological Applications of Nanomaterials and nanoparticles – therapeutics – biomaterials - Immobilized enzymes - drug delivery systems – Biosensors - Cellular imaging tools and diagnostics. **(6 hours)**

Reference Books

1. Pradeep, T. (2017) The Essentials: Understanding Nanoscience and Nanotechnology: McGraw-Hill Education.
2. Phoenix, D.A. and Ahmad, W (2014) Nanobiotechnology. One Central Press Ltd.

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UZYCS61	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	1	1	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr. J. Rani — **Head of the Department**

Dr, P. Vijaya — **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. Zoology

(for those who join in 2023-2024)

Semester VI	**LIFE STYLE DISEASES**	Hours/Week:-
Extra Credit Course		Credits: 2
Course Code **23UZYO61**		Internal 100

COURSE OUTCOMES

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

CO1: understand the impact of life style on health.

CO2: gain knowledge about diet counseling to patients and family

CO3: explain the causes, symptoms and dietary management of life style diseases

CO4: identify the modifiable and non-modifiable risk factors of life style diseases.

CO5: plan therapeutic diets for life style diseases.

UNIT I

Definition of dietetics and Diet therapy for life style diseases, Purpose and principles of therapeutic diets, factors considered in planning therapeutic diets.

UNIT II

Causes, symptoms and dietary management of: 1. Obesity and Under weight.

Febrile diseases – Typhoid and Tuberculosis. 3. Deficiency disease- Anaemia.

UNIT III

Causes, symptoms and dietary management of: 1. Gastrointestinal Disorders- Diarrhea, and Peptic Ulcer 2. Diet in Allergy

UNIT IV

Causes, symptoms and dietary treatment for 1. Diabetes mellitus 2. Cardio Vascular diseases- Hypertension and Atherosclerosis.

UNIT V

Causes, symptoms and dietary treatment for

1. Disease of liver-Hepatitis and Cirrhosis
2. Disease of the urinary tract- Urinary calculi and Renal failure- Acute and Chronic.

REFERENCES

1. Srilakshmi, B. (2000). *Dietetics*. Chennai: New Age International (P) Ltd.
2. Robinson, C.H. (1977). *Normal and the Therapeutic Nutrition*. London: The Oxford and IBH Publishing Co.
3. Gopalan, C. and Balasubramanian, S.C. Ramasastri, B.V. and Viswesvera, R (1970). Diet Atlas of India. New Delhi: ICMR.

Dr. J. Rani
Head of the Department

Dr. R.Radhalakshmi
Course Designer