



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

**OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
 REGULATIONS AND SYLLABUS
 (with effect from Academic Year 2020 - 2021)**

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 20 UG Programmes, 14 PG Programmes, 6 M.Phil. 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 and Computer Applications.
Commerce & Management	: Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration.

PG PROGRAMMES

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

* AICTE approved Programmes

PRE-DOCTORAL PROGRAMMES (M.Phil.)

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Biochemistry
Commerce & Management	:	Commerce

OUTLINE OF CHOICE BASED CREDIT SYSTEM - UG

1. Core Courses
2. Discipline Specific Elective Courses (DSEC)
3. Allied Courses
4. Skill Enhancement Courses (SEC)
5. Non Major Elective Courses (NMEC)
6. Ability Enhancement Compulsory Courses (AECC)
7. Generic Elective Courses (GEC)
8. Internship / Field Project
9. Self Study Courses
10. Extra Credit Courses (optional)

Non Major Elective Courses (NMEC) Offered**UG PROGRAMMES**

Name of the Course	Semester	Department
History of India upto A.D.1858	III	History(EM)
இந்திய வரலாறு கி.பி. 1858 வரை	III	History (TM)
Indian National Movement (A.D 1885-1947)	IV	History(EM)
இந்திய தேசிய இயக்கம் (கி.பி. 1885 – 1947)	IV	History(TM)
English for Professions I	III	English
English for Professions II	IV	
இக்கால நீதி இலக்கியம்	III	Tamil
உரைநடை இலக்கியம்	IV	
Basic Hindi – I	III	Hindi
Basic Hindi – II	IV	
Practical Banking	III	Commerce
Basic Accounting Principles	IV	
Business Management	III	Business Administration
Entrepreneurship	IV	
Quantitative Aptitude	III	Mathematics
Statistics and Operation Research	IV	
Physics in Everyday life	III	Physics
Fundamentals of Electronics	IV	
Industrial Chemistry	III	Chemistry
Drugs and Natural Products	IV	
Applied Zoology	III	Zoology
Animal Science	IV	
Basic Food Science	III	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	IV	
Women and Health	III	Biochemistry
Lifestyle associated disorders	IV	
Medical Lab Technology	III	Microbiology
Applied Microbiology	IV	
Infectious Diseases	III	Biotechnology
Organic Farming	IV	
Basics of Fashion	III	Costume Design And Fashion
Interior Designing	IV	
Introduction to Computers and Office Automation	III	Computer Science
Introduction to Internet and HTML 5	IV	
MS Office	III	Information Technology
Introduction to HTML	IV	
Fundamentals of Computers	III	Computer Applications
Web Design with HTML	IV	
Horticulture – I	III	Botany
Horticulture – II	IV	
மருத்துவ தாவரவியல் - I	III	
மருத்துவ தாவரவியல் - II	IV	
Library and Information Science – I	III	Library Science
Library and Information Science – II	IV	

மேல்நிலை கல்வி வரை தமிழை முதன்மை பாடமாக எடுத்து படிக்காத மாணவிகள் கீழ்க்கண்ட பாடங்களை கட்டாயம் படிக்க வேண்டும்

1. அடிப்படைத் தமிழ் - எழுத்தறிதல்
2. அடிப்படைத் தமிழ் - மொழித்திறனறிதல்

List of Non Major Elective Courses (NMEC)
(2023-2024 onwards)

UG PROGRAMMES

Name of the Course	Semester	Department
History of India upto A.D.1858	III	History(EM)
இந்திய வரலாறு கி.பி. 1858 வரை	III	History (TM)
Indian National Movement (A.D 1885-1947)	IV	History(EM)
இந்திய தேசிய இயக்கம் (கி.பி. 1885 – 1947)	IV	History(TM)
English for Professions I	III	English
English for Professions II	IV	
இக்கால நீதி இலக்கியம்	III	Tamil
உரைநடை இலக்கியம்	IV	
Basic Hindi – I	III	Hindi
Basic Hindi – II	IV	
Fundamental Hindi – I	III	Hindi
Fundamental Hindi - II	IV	
Practical Banking	III	Commerce
Basic Accounting Principles	IV	
Financial Literacy I	III	
Financial Literacy II	IV	
Self-Employment And Start-Up Business	III	Commerce CA
Fundamentals Of Marketing	IV	
Women Protection Laws	III	Commerce (Professional Accounting)
Basic Labour Laws	IV	
Business Management	III	Business Administration
Entrepreneurship	IV	
Quantitative Aptitude I	III	Mathematics
Basic Statistics		
Quantitative Aptitude II		
Operations Research	IV	
Physics in Everyday life -I	III	Physics
Physics in Everyday life -II	IV	
Industrial Chemistry	III	Chemistry
Drugs and Natural Products	IV	
Applied Zoology	III	Zoology
Animal Science	IV	
Basic Food Science	III	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	IV	
Women and Health	III	Biochemistry
Lifestyle Associated Disorders	IV	

Medical Lab Technology	III	Microbiology
Applied Microbiology	IV	
Infectious Diseases	III	Biotechnology
Organic Farming	IV	
Basics of Fashion	III	Costume Design And Fashion
Interior Designing	IV	
Introduction to Computers and Office Automation	III	Computer Science
Introduction to Internet and HTML 5	IV	
MS Office	III	Information Technology
Introduction to HTML	IV	
Fundamentals of Computers	III	Computer Applications
Web Design with HTML	IV	
Horticulture – I	III	Botany
Horticulture – II	IV	
மருத்துவ தாவரவியல் - I	III	
மருத்துவ தாவரவியல் - II	IV	
Library and Information Science – I	III	Library Science
Library and Information Science - II	IV	
Cadet Corps for Career Development I	III	National Cadet Corps
Cadet Corps for Career Development II	IV	

மேல்நிலைக் கல்வி வரை தமிழை முதன்மைப் பாடமாக எடுத்துப் படிக்காத மாணவிகள் கீழ்க்கண்ட பாடங்களைக் கட்டாயம் படிக்க வேண்டும்

1. அடிப்படைத் தமிழ் - எழுத்தறிதல்
2. அடிப்படைத் தமிழ் - மொழித்ரதிறனறிதல்

**List of Ability Enhancement Compulsory Courses (AECC) &
Generic Elective Courses (GEC) Offered**

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

1. Value Education
2. Environmental Studies

GENERIC ELECTIVE COURSES 1

1. Human Rights
2. Women Studies

GENERIC ELECTIVE COURSES 2

1. Constitution of India
2. Modern Economics
3. Adolescent Psychology
4. Disaster Management

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 communicate proficiently and confidently with the ability to express original/complex ideas effectively in different situations. (*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 for the betterment of the society. (*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 exams 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.

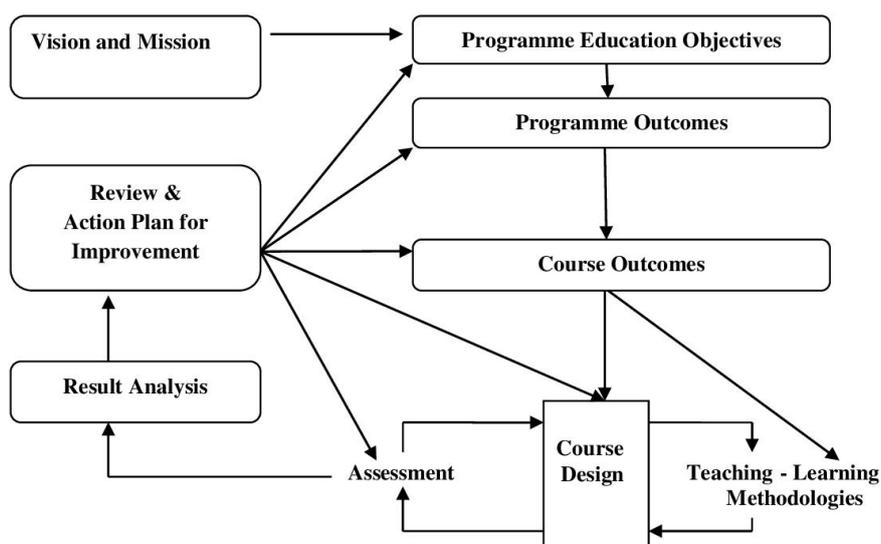
PO-PEO Mapping Matrix

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	✓	✓	✓
PO2/PSO2	✓	-	✓
PO3/PSO3	✓	✓	-
PO4/PSO4	✓	✓	✓
PO5/PSO5	✓	✓	-
PO6/PSO6	✓	✓	-
PO7/PSO7	✓	✓	✓

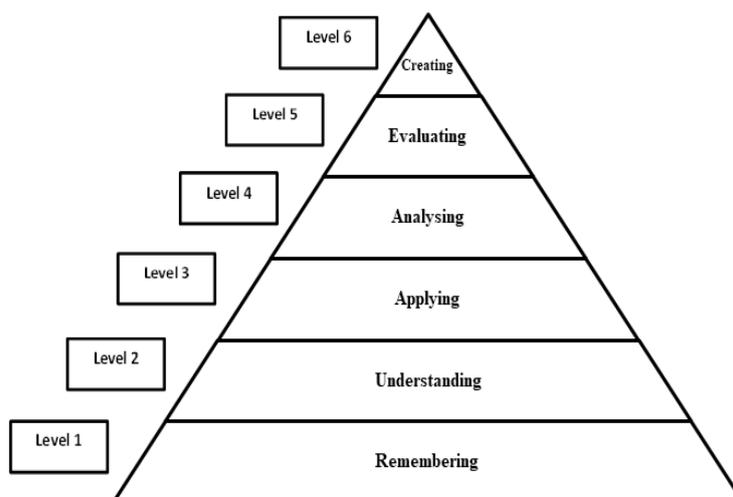
B.1.4 Course Outcomes (COs)

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, 2 and 1 respectively.

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

PO/PSOs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7
COs							
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/Alternate Course
Part II	:	English
Part III	:	Core Courses
	:	Allied Courses
	:	Elective Courses: Discipline Specific Elective Courses
	:	Self Study Course
Part IV	:	Skill Enhancement Courses (SEC)
	:	Field Project/Internship
	:	Non-Major Elective Courses (NMEC)
	:	Ability Enhancement Compulsory Courses (AECC)
	:	Generic Elective Courses (GEC)
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 and National Cadet Corps/ Rotaract Club

B.2. EVALUATION SCHEME

B.2.1. PART II

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	15	75	100
Practical	5+5	-	

INTERNAL ASSESSMENT

Distribution of Marks

Mode of Evaluation	Marks
Periodic Test	: 15
Practical	: 10
Total	: 25

Three Periodic Tests - Average of the best two will be considered**B.2.1.1 PART II (II UG – 2023-2024 onwards)**

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Test	15	60	100
Practical	10	15	

INTERNAL ASSESSMENT**Distribution of Marks**

Mode of Evaluation	Marks
Periodic Test	: 15
Practical	: 10
Total	: 25

Three Periodic Tests - Average of the best two will be considered**EXTERNAL ASSESSMENT****Distribution of Marks**

Mode of Evaluation	Marks
Theory	: 60
Practical	: 15
Total	: 75

B.2.1 Part I & ART III - Core Courses, Discipline Specific Elective Courses & Allied Courses

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	100
Practical	40	60	100
Project	100	-	100

INTERNAL ASSESSMENT**Distribution of Marks****Theory**

Mode of Evaluation			Marks
Periodic Test		:	15
Assignment	Core:I UG-K4 Level, II & III UG – K5 Level	:	5
	Part I & Allied: K4 Level		
	DSEC:K5 Level		
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

Practical

Mode of Evaluation			Marks
Test		:	15
Model Examination			15
Performance		:	10
Total		:	40

Test- Better of the two will be considered

Model Examination - Better of the two will be considered

Performance - Attendance and Record

Question Pattern for Periodic Tests**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- 4)	Multiple Choice	4	4	1	4
B Q.No.(5- 7)	Internal Choice - Either Or Type	3	3	7	21
C Q.No.(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

EXTERNAL EXAMINATION**Question Pattern****Duration: 3 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 10)	Multiple Choice	10	10	1	10
B Q. No.(11 -15)	Internal Choice – Either Or Type	5	5	7	35
C Q. No.(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. 2 Part III SELF STUDY COURSE

Core Courses Quiz- Online

Assessment by Internal Examiner only

- Question Bank is prepared by the Faculty Members of the Departments.
- 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	:	40
Model Examination	:	60
Total	:	100

Two Periodic Tests - Better of the two will be considered

B.2.3 PART IV - Skill Enhancement Courses & Non Major Elective Courses**INTERNAL ASSESSMENT****Distribution of Marks****Theory**

Mode of Evaluation			Marks
Periodic Test		:	25
Assignment	SEC:K4 Level	:	10
	NMEC:K3 Level		
Quiz	K2 Level	:	5
Total		:	40

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
Test		:	15
Model Examination			15
Performance		:	10
Total		:	40

Test- Average of the two will be considered

Model Examination - Better of the best two will be considered

Performance - Attendance and Record

Question Pattern**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	5	15
B Q. No.(4)	Internal Choice - Either Or Type	1	1	10	10
Total					25

EXTERNAL EXAMINATION**Question Pattern****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- 6)	Internal Choice - Either Or Type	6	6	5	30
B Q. No.(7- 9)	Internal Choice - Either Or Type	3	3	10	30
Total					60

B.2.4 PART IV- Ability Enhancement Compulsory Courses (AECC) & Generic Elective Courses (GEC)

Assessment by Internal Examiner only

- Model Examination is conducted after two periodic tests.
- Book and Study Material prepared by the Faculty Members of the respective departments will be prescribed.

Distribution of Marks

Mode of Evaluation			Marks
Periodic Test		:	30
Assignment	K2 Level	:	10
Model Examination		:	60
Total		:	100

Two Periodic tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Question Pattern for Periodic Test**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

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. 5 PART IV- Internship / Field Project

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

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

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

SELF STUDY COURSE

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	:	40
Model Examination	:	60
Total	:	100

Two Periodic Tests - Better of the two will be considered

B. 2.6 PART V - Extension Activities

Assessment by Internal Examiner only

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

*The marks obtained will be calculated for 100 marks

B. 2.7 EXTRA CREDIT COURSES (OPTIONAL):

Assessment by Internal Examiner only

Distribution of Marks**Question Pattern**

Duration: 3 Hours

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 10)	Multiple Choice	10	10	1	10
B Q. No.(11- 15)	Internal Choice (Either or Type)	5	5	9	45
C Q. No.(16- 20)	Open Choice	5	3	15	45
TOTAL					100

ELIGIBILITY FOR THE DEGREE

The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.

- No Pass minimum for Internal Assessment.
- Pass minimum for External Examination is 27 marks out of 75 for Core Courses, Discipline Specific Elective Courses and Allied Courses.
- Pass minimum for External Examination is 21 marks out of 60 for Skill Enhancement Courses and Non Major Elective Courses.
- The aggregate minimum pass percentage is 40.
- Pass minimum for External Practical Examination is 21 marks out of 60 marks.
- Pass minimum for Ability Enhancement Compulsory Course and Generic Elective Course is 40 marks.
- Pass minimum for Self Study Courses is 40 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.
 - These rules are applicable to UG, PG and M.Phil. Programmes and come into effect from 2020-2021 onwards.
 - For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

B.3 ASSESSMENT MANAGEMENT PLAN

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

B.3.1 Assessment Process for CO Attainment

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

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

Indirect Assessment – Done through Course Exit Survey.

CO Assessment Rubrics

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

CO Attainment

Direct CO Attainment

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

Attainment Levels of COs

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

	Level 3	60% of students scoring more than average marks or set target marks in End Semester Summative Examination
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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

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

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 attainment of 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 against 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
	Co-curricular / Extracurricular	For participation in Co-curricular / Extracurricular activities during the period of

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Average Direct PO Attainment									
Direct PO Attainment in percentage									

Indirect Attainment of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Graduate Exit Survey								
Indirect PO Attainment								

Attainments of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
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
Extracurricular Activities)]**

Expected Level of Attainment for each of the Programme Outcomes

POs	Level of Attainment
Value \geq 70%	Excellent
Value \geq 60 % and Value $<$ 70%	Very Good
Value \geq 50 % and Value $<$ 60%	Good
Value \geq 40% and Value $<$ 50%	Satisfactory
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	25% of the class strength	30% of the class strength
Progression to Higher Education	40% 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
Value \geq 70%	Excellent
Value \geq 60 % and Value $<$ 70%	Very Good
Value \geq 50 % and Value $<$ 60%	Good
Value \geq 40% and Value $<$ 50%	Satisfactory
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 PROGRAMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stake holders 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



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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 2020-2021

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, Discipline Specific Elective Courses, Allied Courses & Self Study Course							
Core Course	4 (4)	4 (4)	5 (5)	5 (5)	4 (4)	5 (4)	27 (26)
Core Course	4 (4)	4 (4)	-	-	4 (4)	5 (4)	17(16)
Core Course	-	-	-	-	4 (4)	5 (4)	9 (8)
Core Course Practical	2 (0)	2 (2)	2 (0)	2 (2)	3 (0)	3 (3)	14 (7)
					3 (0)	3 (3)	6 (3)
					2 (0)	2 (2)	4 (2)
DSEC	-	-	-	-	4 (4)	5 (4)	9 (8)
Project	-	-	-	-	0 (1)	-	0 (1)
Allied Course I	4 (4)	4 (4)	-	-	-	-	8 (8)
Allied Course I Practical	2(0)	2(2)	-	-	-	-	4(2)
Allied Course II	-	-	4 (4)	4 (4)	-	-	8 (8)
Allied Course II Practical	-	-	2 (0)	2 (2)	-	-	4 (2)
Self Study Course	-	-	-	-		0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Non Major Elective Courses, Ability Enhancement Compulsory Courses, Generic Elective Courses, Self Study Course & Internship/ Field Project							
SEC	-	2 (2)	2 (2)	2 (2)	2 (2)	2 (2)	10 (10)
SEC	-	-	-	-	2 (2)	-	2 (2)
Non Major Elective Course	-	-	2(2)	2(2)	-	-	4 (4)
AECC - Value Education	2 (2)	-	-	-	-	-	2 (2)
AECC - Environmental Studies	-	-	-	-	2 (1)	-	2 (1)
GEC -1	-	-	1 (1)	-	-	-	1 (1)
GEC -2	-	-	-	1 (1)	-	-	1 (1)
Self Study Course					0 (1)	-	0 (1)
Internship/ Field Project	-	-	-	0 (1)	-	-	0 (1)
Part V : Extension Activities	-	-	-	0 (1)	-	-	0 (1)
Total	30 (20)	30 (24)	30 (20)	30 (26)	30 (23)	30(27)	180 (140)
Extra Credit Course					0 (2)	0 (2)	0 (4)

DSEC: Discipline Specific Elective Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

GEC: Generic Elective Course



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PART I - TAMIL

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UTAG11	பொதுத்தமிழ் தாள் I	3	100
2.	II	20UTAG21	பொதுத்தமிழ் தாள் II	3	100
3.	III	20UTAG31	பொதுத்தமிழ் தாள் III	3	100
4.	IV	20UTAG41	பொதுத்தமிழ் தாள் IV	3	100
TOTAL				12	400

PART I – HINDI

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UHDG11 22UHDG11	Hindi - Paper I Prose – I & II, Ancient Stories - I, General Essays, Functional Hindi – I & Grammar General Hindi – I	3	100
2.	II	20UHDG21 22UHDG21	Hindi - Paper II Drama, One Act Play, Letter, Correspondence, Functional Hindi – II & Grammar General Hindi – II	3	100
3.	III	20UHDG31 22UHDG31	Hindi - Paper III Ancient Poetry, Drama, Indian History, Hindi Grammar & Functional Hindi III Advanced Hindi – I	3	100
4.	IV	20UHDG41 22UHDG41	Hindi - Paper IV Modern Poetry, Hindi Literary Essays, Letter Correspondence, Conversation & Functional Hindi IV Advanced Hindi - II	3	100
TOTAL				12	400

PART II - ENGLISH

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UENG11A 20UENG11B 20UENG11C	English – Paper I English for Advanced Learners I English for Career Guidance - I English for Communicative Competence-I	3	100
2.	II	20UENG21A 20UENG21B 20UENG21C	English – Paper II English for Advanced Learners II English for Career Guidance - II English for Communicative Competence - II	3	100

3.	III	20UENG31A 20UENG31B 20UENG31C 22UENG31	English – Paper III English for Advanced Learners III English for Career Guidance – III English for Communicative Competence – III Communicative English – I	3	100
4.	IV	20UENG41A 20UENG41B 20UENG41C 22UENG41	English – Paper IV English for Advanced Learners IV English for Career Guidance – IV English for Communicative Competence – IV Communicative English – II	3	100
TOTAL				12	400

PART III – CORE, DISCIPLINE SPECIFIC ELECTIVE COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1	I	20UZYC11	Invertebrata -I	4	100
2	I	20UZYC12	Invertebrata -II	4	100
3	II	20UZYC21/20UZYC21N	Chordata –I	4	100
4	II	20UZYC22/20UZYC22N	Chordata –II	4	100
5	II	20UZYC21P/ 20UZYC21PN	Core Practical- I Lab in Invertebrata and Chordata	2	100
6	III	20UZYC31	Cell and Molecular Biology	5	100
7	IV	20UZYC41/20UZYC41N	Developmental Biology	5	100
8	IV	20UZYC41P/ 20UZYC41PN	Core Practical –II Lab in Cell and Molecular Biology and Developmental Biology	2	100
9	V	20UZYC51	Biochemistry	4	100
10	V	20UZYC52	Animal Physiology	4	100
11	V	20UZYC53	Genetics and Biostatistics	4	100
12	V	20UZYE51/ 20UZYE52/ 20UZYE53	Discipline Specific Elective 1–(DSE 1) 1. Immunology/ 2. Environmental Biotechnology/ 3. Agricultural Microbiology	4	100
13	V	20UZYC5PR	Project	1	100
14	VI	20UZYC61	Microbiology	4	100
15	VI	20UZYC62	Biotechnology	4	100
16	VI	20UZYC63	Evolution	4	100
17	VI	20UZYE61/ 20UZYE62/ 20UZYE63	Discipline Specific Elective 2–(DSE 2) 1. Ecology/ 2. Entomology/ 3. Industrial Biotechnology	4	100
18	VI	20UZYQ61	Core Courses Quiz –Online	1	100
19	VI	20UZYC61P	Core Practical- III Lab in	3	100

			Biochemistry and Animal Physiology		
20	VI	20UZYC62P	Core Practical –IV Lab in Evolution, Genetics and Biostatistics	3	100
2100	VI	20UZYC63P	Core Practical- V Lab in Microbiology and Biotechnology	2	100
Total				72	2100

PART III – ALLIED COURSE I-CHEMISTRY

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UCHA11	Organic, Inorganic and Physical Chemistry – I	4	100
2.	II	20UCHA21	Organic, Inorganic and Physical Chemistry – I	4	100
		20UCHA21P	Volumetric Analysis	2	100
Total				10	300

PART III - ALLIED COURSE II - BOTANY

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	III	20UBTA31	Allied Botany –I Plant Ecology and Plant Physiology	4	100
2.	IV	20UBTA41	Allied Botany II Applied Botany	4 2	100 100
	IV	20UBTA41P	Allied Botany Practical –I Plant Ecology and Plant Physiology and Applied Botany		
Total				10	300

PART IV - SKILL ENHANCEMENT COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	II	20UZYS21/20UZYS21N	Vermiculture	2	100
2.	III	20UZYS31	Aquaculture	2	100
3.	IV	20UZYS41	Beekeeping	2	100
4.	V	20UZYS51	Sericulture	2	100
5.	V	20UZYS52	Fundamentals of Computer	2	100
6.	VI	20UZYS61	Poultry Science	2	100
Total				12	600

PART IV – NON MAJOR ELECTIVE COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	III	20UZYN31	Applied Zoology	2	100
2.	IV	20UZYN41	Animal Science	2	100
Total				4	200

PART IV- ABILITY ENHANCEMENT COMPULSORY COURSES, ENERIC ELECTIVE COURSES AND INTERNSHIP / FIELD

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UGVE11	Value Education	2	100
2.	V	20UGES51	Environmental Studies	1	100
3	III	20UGEH31 20UGEW32	Human Rights/ Women Studies	1	100
4.	IV	20UGEC41	Constitution of India/	1	100
		20UGEM42	Modern Economics/		
		20UGEA43	Adolescent Psychology/		
		20UGED44	Disaster Management		
		20UZVI41G	Internship/Field Project	1	100
5.	V	20UGCE51	Practice for Competitive Examinations -Online	1	100
Total				7	600

PART –V - EXTENSION ACTIVITIES

S. No.	Sem.	Code	Title of the Course	Credit
1	I, II, III & IV	20UVNS1, 20UVNS2	National Service Scheme	1
2		20UVPE1	Physical Education	
3		20UVYR1 20UVYR2	Youth Red Cross Society	
4		20UVRR1	Red Ribbon Club	
5		20UVSF1	Science Forum	
6		20UVEC1	Eco Club	
7		20UVLI1	Library and Information Science	
8		20UVCC1	Consumer Club	
9		20UVHF1	Health and Fitness Club	
10		20UVNC1 20UVNC2	National Cadet Corps	
11		20UVRO1	Rotaract Club	

PART III – ALLIED COURSE II FOR BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1	III	20UBIA31	Cell Biology	4	100
2	IV	20UBIA41	Applied Biology	4	100
3	III & IV	20UBIA41P	Practical – Cell Biology and Applied Biology	2	100

EXTRA CREDIT COURSES (Optional)

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	V	20UZY051	Dietetics for Women– (Internal Only)	2	100
2.	VI	20UZY061	Life style Diseases (Internal only)	2	100



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BACHELOR OF ZOOLOGY

Programme Code – 2018

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
I	Part I	20UTAG11	Tamil Paper I	6	3	3	25	75	100
		20UHDG11	Hindi Paper I						
	Part II	20UENG11A/ 20UENG11B/ 20UENG11C	English Paper I	6	3	3	25	75	100
	Part III	20UZYC11	Core Course -1 Invertebrata- I	4	4	3	25	75	100
		20UZYC12	Core Course - 2 Invertebrata -II	4	4	3	25	75	100
		20UZYC21P	Core Course Practical –I Lab in Invertebrata and Chordata	2	-	3	-	-	-
		20UCHA11 20UCHA21P	Allied Course –I Organic, Inorganic And Physical Chemistry – I Volumetric Analysis	4 2	4 -	3 3	25 -	75 -	100 -
	Part IV	20UGVE11	Value Education	2	2	-	100	-	100
			TOTAL	30	20				600

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
II	Part I	20UTAG21	Tamil Paper I	6	3	3	25	75	100
		20UHGD21	Hindi Paper I						
	Part II	20UENG21A/ 20UENG21B/ 20UENG21C	English Paper II	6	3	3	25	75	100
	Part III	20UZYC21	Core Course - 3 Chordata -I	4	4	3	25	75	100
		20UZYC22	Core Course - 4 Chordata -II	4	4	3	25	75	100
		20UZYC21P	Core Course Practical -I Lab in Invertebrata and Chordata	2	2	3	40	60	100
		20UCHA21 20UCHA21P	Allied Course –I Organic, Inorganic And Physical Chemistry – II Volumetric Analysis	4 2	4 2	3 3	25 40	75 60	100 100
	Part IV	20UZYS21	SEC -1 Vermiculture	2	2	2	40	60	100
	TOTAL			30	24				800

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
III	Part I	20UTAG31	Tamil Paper III	6	3	3	25	75	100
		20UHDG31	Hindi Paper III						
	Part II	20UENG31A/ 20UENG31B/ 20UENG31C	English Paper III	6	3	3	25	75	100
	Part III	20UZYC31	Core Course -5 Cell and Molecular Biology	5	5	3	25	75	100
		20UZYC41P	Core Course Practical – 2 Lab in Cell and Molecular Biology and Developmental Biology	2	-	3	-	-	100
		20UBTA31 20UBTA41P	Allied II -Course 1 Allied Botany - Plant Ecology and Plant Physiology Allied II Practical -1	4 2	4 -	3 3	25 -	75 -	100
	Part IV	20UZYS31	SEC -2 Aquaculture	2	2	2	40	60	100
		20UZYN31	NME-1 Applied Zoology	2	2	2	40	60	100
		20UGEH31 20UGEW32	Generic Elective -1 1.Human Rights/ 2. Women studies	1	1	2	100		100
			TOTAL	30	20				700

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
IV	Part I	20UTAG41	Tamil Paper IV	6	3	3	25	75	100
		20UH DG41	Hindi Paper IV						
	Part II	20UENG41A/ 20UENG41B/ 20UENG41C	English Paper IV	6	3	3	25	75	100
	Part III	20UZYC41	Core Course - 6 Developmental Biology	5	5	3	25	75	100
		20UZYC41P	Core Course Practical –2 Lab in Cell and Molecular Biology and Developmental Biology	2	2	3	40	60	100
		20UBTA41 20UBTA41P	Allied Course – II Allied Botany - Applied Botany Allied II Practical – 1 Plant Ecology and Plant Physiology and Applied Botany	4 2	4 2	3 3	25 40	75 60	100 100
	Part IV	20UZYS41	SEC -3 Beekeeping	2	2	2	40	60	100
		20UZYN41	NME -2 Animal Science	2	2	2	40	60	100
		20UZYI41G	Internship/Field Project	0	1	-	100	-	100
		20UGEC41/ 20UGEM42/ 20UGEA43/ 20UGED44	GEC 2 Constitution of India/ Modern Economics/ Adolescent Psychology/ Disaster Management	1	1	2	100		100
		Part V		Extension Activities	-	1	-	100	
		TOTAL		30	26				1100

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
V	Part III	20UZYC51	Core Course – 7 Biochemistry	4	4	3	25	75	100
		20UZYC52	Core Course - 8 Animal Physiology	4	4	3	25	75	100
		20UZYC53	Core Course – 9 Genetics and Biostatistics	4	4	3	25	75	100
		20UZYE51 20UZYE52 20UZYE53	DSEC -1 Immunology/ Environmental Biotechnology / Agricultural Microbiology	4	4	3	25	75	100
		20UZYC5PR	Core Course-10 Project	0	1	-	100		100
		20UZYC61P	Core Course Practical - 3 Lab in Biochemistry and Animal Physiology	3	-	3	-	-	-
		20UZYC62P	Core Course Practical - 4 - Lab in Evolution, Genetics and Biostatistics	3	-	3	-	-	-
		20UZYC63P	Core Course Practical -5 Lab in Microbiology and Biotechnology	2	-	3	-	-	-
	Part IV	20UZYS51	SEC -4 Sericulture	2	2	2	40	60	100
		20UZYS52	SEC -5 Fundamentals of Computer	2	2	2	40	60	100
		20UGCE51	Self Study Course Practice for Competitive Examinations – Online	-	1	-	100		100
		20UGES51	Environmental Studies	2	1	2	100		100
	TOTAL			30	23				800

Semester		Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks		
							Int	Ext	Total
VI	Part III	20UZYC61	Core Course -11 Microbiology	5	4	3	25	75	100
		20UZYC62	Core Course -12 Biotechnology	5	4	3	25	75	100
		20UZYC63	Core Course -13 Evolution	5	4	3	25	75	100
		20UZYE61/ 20UZYE62 / 20UZYE63	DSEC -2 Ecology/ Entomology/ Industrial Biotechnology	5	4	3	25	75	100
		20UZYC61P	Core Course Practical -3 Lab in Biochemistry and Animal Physiology	3	3	3	40	60	100
		20UZYC62P	Core Course Practical –4 Lab in Evolution, Genetics and Biostatistics	3	3	3	40	60	100
		20UZYC63P	Core Course Practical –5 Lab in Microbiology and Biotechnology	2	2	3	40	60	100
		20UZYQ61	Self Study Course Core Courses Quiz –Online	-	1	-	100		100
	Part IV	20UZYS61	SEC -6 Poultry Science	2	2	2	40	60	100
		TOTAL		30	27			900	



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VIRUDHUNAGAR - 626 001

BACHELOR OF ZOOLOGY

Programme Code – 2018

REVISED PROGRAMME CONTENT

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
I	Part I	20UTAG11	Tamil Paper I	6	3	3	25	75	100
		20UHDG11	Hindi Paper I						
	Part II	20UENG11A/ 20UENG11B/ 20UENG11C	English Paper I	6	3	3	25	75	100
	Part III	20UZYC11	Core Course -1 Invertebrata- I	4	4	3	25	75	100
		20UZYC12	Core Course - 2 Invertebrata -II	4	4	3	25	75	100
		20UZYC21PN	Core Course Practical –I Lab in Invertebrata and Chordata	2	-	3	-	-	-
		20UCHA11 20UCHA21P	Allied Course –I Organic, Inorganic And Physical Chemistry – I Volumetric Analysis	4 2	4 -	3 3	25 -	75 -	100 -
	Part IV	20UGVE11	Value Education	2	2	-	100	-	100
			TOTAL	30	20				600

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
II	Part I	20UTAG21	Tamil Paper I	6	3	3	25	75	100
		20UHDG21	Hindi Paper I						
	Part II	20UENG21A/ 20UENG21B/ 20UENG21C	English Paper II	6	3	3	25	75	100
	Part III	20UZYC21N	Core Course - 3 Chordata -I	4	4	3	25	75	100
		20UZYC22N	Core Course - 4 Chordata –II	4	4	3	25	75	100
		20UZYC21PN	Core Course Practical -I Lab in Invertebrata and Chordata	2	2	3	40	60	100
		20UCHA21 20UCHA21P	Allied Course –I Organic, Inorganic And Physical Chemistry – II Volumetric Analysis	4 2	4 2	3 3	25 40	75 60	100 100
	Part IV	20UZYS21N	SEC -1 Vermiculture	2	2	2	40	60	100
	TOTAL			30	24				800

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
III	Part I	20UTAG31	Tamil Paper III	6	3	3	25	75	100
		20UHDG31	Hindi Paper III						
	Part II	20UENG31A/ 20UENG31B/ 20UENG31C	English Paper III	6	3	3	25	75	100
	Part III	20UZYC31	Core Course -5 Cell and Molecular Biology	5	5	3	25	75	100
		20UZYC41PN	Core Course Practical – 2 Lab in Cell and Molecular Biology and Developmental Biology	2	-	3	-	-	100
		20UBTA31 20UBTA41P	Allied II -Course 1 Allied Botany - Plant Ecology and Plant Physiology Allied II Practical -1	4 2	4 -	3 3	25 -	75 -	100
	Part IV	20UZYS31	SEC -2 Aquaculture	2	2	2	40	60	100
		20UZYN31	NME-1 Applied Zoology	2	2	2	40	60	100
		20UGEH31 20UGEW32	Generic Elective -1 1.Human Rights/ 2. Women studies	1	1	2	100		100
			TOTAL	30	20				700

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
IV	Part I	20UTAG41	Tamil Paper IV	6	3	3	25	75	100
		20UHGD41	Hindi Paper IV						
	Part II	20UENG41A/ 20UENG41B/ 20UENG41C	English Paper IV	6	3	3	25	75	100
	Part III	20UZYC41N	Core Course - 6 Developmental Biology	5	5	3	25	75	100
		20UZYC41PN	Core Course Practical -2 Lab in Cell and Molecular Biology and Developmental Biology	2	2	3	40	60	100
		20UBTA41 20UBTA41P	Allied Course – II Alieed Botany - Applied Botany Allied II Practical – 1 Plant Ecology and Plant Physiology and Applied Botany	4 2	4 2	3 3	25 40	75 60	100 100
	Part IV	20UZYS41	SEC -3 Beekeeping	2	2	2	40	60	100
		20UZYN41N	NME -2 Animal Science	2	2	2	40	60	100
		20UZYI41G	Internship/Field Project	0	1	-	100	-	100
		20UGEC41/ 20UGEM42/ 20UGEA43/ 20UGED44	GEC 2 Constitution of India/ Modern Economics/ Adolescent Psychology/ Disaster Management	1	1	2	100		100
	Part V		Extension Activities	-	1	-	100		100
		TOTAL		30	26				1100

Semester	Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks			
						Int.	Ext.	Total	
V	Part III	20UZYC51	Core Course – 7 Biochemistry	4	4	3	25	75	100
		20UZYC52	Core Course - 8 Animal Physiology	4	4	3	25	75	100
		20UZYC53	Core Course – 9 Genetics and Biostatistics	4	4	3	25	75	100
		20UZYE51 20UZYE52 20UZYE53	DSEC -1 Immunology/ Environmental Biotechnology / Agricultural Microbiology	4	4	3	25	75	100
		20UZYC5PR	Core Course-10 Project	0	1	-	100		100
		20UZYC61P	Core Course Practical - 3 Lab in Biochemistry and Animal Physiology	3	-	3	-	-	-
		20UZYC62P	Core Course Practical - 4 - Lab in Evolution, Genetics and Biostatistics	3	-	3	-	-	-
		20UZYC63P	Core Course Practical -5 Lab in Microbiology and Biotechnology	2	-	3	-	-	-
	Part IV	20UZYS51	SEC -4 Sericulture	2	2	2	40	60	100
		20UZYS52	SEC -5 Fundamentals of Computer	2	2	2	40	60	100
		20UGCE51	Self Study Course Practice for Competitive Examinations – Online	-	1	-	100		100
		20UGES51	Environmental Studies	2	1	2	100		100
	TOTAL			30	23				800

Semester		Course Code	Courses	Hours per week	Credits	Exam. Hours	Marks		
							Int	Ext	Total
VI	Part III	20UZYC61	Core Course -11 Microbiology	5	4	3	25	75	100
		20UZYC62	Core Course -12 Biotechnology	5	4	3	25	75	100
		20UZYC63	Core Course -13 Evolution	5	4	3	25	75	100
		20UZYE61/ 20UZYE62 / 20UZYE63	DSEC -2 Ecology/ Entomology/ Industrial Biotechnology	5	4	3	25	75	100
		20UZYC61P	Core Course Practical -3 Lab in Biochemistry and Animal Physiology	3	3	3	40	60	100
		20UZYC62P	Core Course Practical –4 Lab in Evolution, Genetics and Biostatistics	3	3	3	40	60	100
		20UZYC63P	Core Course Practical –5 Lab in Microbiology and Biotechnology	2	2	3	40	60	100
		20UZYQ61	Self Study Course Core Courses Quiz –Online	-	1	-	100		100
	Part IV	20UZYS61	SEC -6 Poultry Science	2	2	2	40	60	100
		TOTAL		30	27			900	



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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester I	INVERTEBRATA-I	Hours/Week: 4	
Core Course-1		Credits: 4	
Course Code 20UZYC11		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts of taxonomy and organization of invertebrates. [K1]

CO2: understand the biology and special adaptations of invertebrates. [K2]

CO3: explain the specialized structures and its role in physiology of invertebrates. [K2]

CO4: apply their knowledge to identify the special features of invertebrates. [K3]

CO5: analyze the salient features in invertebrates. [K4]

UNIT I

Invertebrates- General characters and Classification of invertebrates upto Class level.

General characters and Classification of the following phyla up to Class level with examples

– Protozoa, Porifera, Coelenterata, Ctenophora and Platyhelminthes. (12 Hours)

UNIT II Protozoa

Type study: *Amoeba*- General organization, Locomotion, Nutrition and Reproduction.

Type study: *Paramecium* – General organization, Nutrition- Feeding mechanism - Cyclosis, Osmoregulation and Reproduction.

Life cycle and pathogenicity and control measures of parasites – *Plasmodium vivax* and *Entamoeba histolytica*.

General topics:

1. Locomotion in Protozoa.
2. Economic importance of Protozoa. (12 Hours)

UNIT III Porifera

Type study: *Olynthus*- General organization, Reproduction and Development - Parenchymula larva and Amphiblastula larva.

General topics:

1. Canal system in sponges- Ascon, Sycon and Rhagon type only.
2. Spicules. (12 Hours)

UNIT IV Coelenterata:

Type study: Hydra – General organization, Nematocysts, Locomotion, Reproduction and Regeneration.

Type study: Obelia colony – General organization, Polyp, Medusa and Life history.

Type Study: Ctenophore – Pleurobrachia- General organization and affinities of Ctenophora.

General topic: 1. Polymorphism in Coelenterata.

2. Coral reefs – Composition, Types, Formation and Significance. (12 Hours)

UNIT V Platyhelminthes:

Type study: *Fasciola* (Liver fluke) – General organization, Digestive system, Reproductive system and Life history.

Type study: Tapeworm – General organization, Excretory system, Reproductive system and Life cycle.

General topics: 1. Parasitic adaptations of Helminth parasites. (12 Hours)

TEXT BOOK

1. Nair, N.C., Leelavathy, S., Soundrapandian, N., Murugan, T., and Arumugam, N., (2014 Reprint). *A Text book of Invertebrates*. 4th edition. Nagarcoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Majupuria, T.C., (2001). *Invertebrate Zoology*, Jalandar: Pradeep Publications.
3. Jordan, E.J., and Verma, P.S., (2007 Reprint). *Invertebrate Zoology*. New Delhi: S. Chand and Company.
4. Kotpal, R.L., (2005 Reprint). *Invertebrate Zoology*. Third Edition. Meerat: Rakesh Rastogi for Rastogi Publications.
5. Dhama, P.S., and Dhama J.K., (2003). *Invertebrate Zoology*. New Delhi: Chand and Company.

Course Code 20UZYC11	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	H	H	H	M	H	H	H	-	M
CO2	H	M	H	M	H	H	H	L	M	H
CO3	H	M	M	M	H	H	L	M	M	M
CO4	H	M	H	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	L	H	M	H

Dr. J. Rani
Head of the Department

Dr. P. Veeramuthumari
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester I	INVERTEBRATA-II	Hours/Week: 4	
Core Course-2		Credits: 4	
Course Code 20UZYC12		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts of taxonomy and organization of invertebrates. [K1]

CO2: understand the biology and special adaptations of invertebrates. [K2]

CO3: explain the specialized structures and its role in physiology of invertebrates. [K2]

CO4: apply their knowledge to identify the special features of invertebrates. [K3]

CO5: analyze the salient features in invertebrates. [K4]

UNIT I

Invertebrates – Classification: General characters and Classification (upto Class level) of the following phyla with examples – Aschelminthes, Annelida, Arthropoda, Mollusca and Echinodermata.

Aschelminthes:

Type Study: Ascaris- General organization, Reproductive system and Life cycle.

General topics: 1. Life history, pathogenicity and control measures of *Wuchereria*

Bancrofti. (12 Hours)

UNIT II Annelida:

Type Study: Nereis – General organization, Nervous system and Trochophore larva.

Type Study: Earthworm- General organization, Nervous system, Excretory system, and Reproductive system.

General topics: 1. Metamerism in Annelids.

2. Biological significance of earthworm – bait, food, agriculture, medicine and research purpose. (12 Hours)

UNIT III Arthropoda

Type Study: *Penaeus* – General organization, Appendages, Green glands, Reproductive system and Development.

Type Study Cockroach- General organization, Mouth parts, Digestive system and Reproductive system.

General topics:

1. Peripatus as connecting link.
2. Harmful insects (Pest of coconut- *Oryctes rhinoceros* and Pest of paddy- *Tryporyza incertula*) & beneficial insects (honeybee and silk moth) (12 Hours)

UNIT IV Mollusca

Type Study: *Pila globosa* – General organization, Digestive system and Respiratory system.

Type Study: *Sepia* – General organization, Locomotion and Reproductive system.

General topics: 1. Cephalopods as advanced Molluscs.

2. Pearls - Types, Pearl producing animals and Pearl culture.

3. Economic importance of Molluscs. (12 Hours)

UNIT V Echinodermata:

Type study: Star fish – General organization, Pedicellaria, Water vascular system.

Type study: Sea cucumber – General organization, Skeleton, Digestive system and Mechanism of feeding.

General topic: 1. Larval forms of Echinoderms. (12 Hours)

TEXT BOOK

1. Nair, N.C., Leelavathy, S., Soundrapandian, N., Murugan, T., and Arumugam, N., A *Text book of Invertebrates*. (2015 Reprint), 2nd revised edition, Nagargoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Majupuria, T.C., (2001). *Invertebrate Zoology* Jalandar: Pradeep Publications,
3. Jordan, E.J., and Verma, P.S., (2007 Reprint). *Invertebrate Zoology*. New Delhi: S. Chand and Company.
4. Kotpal, R.L., (2005 Reprint). *Invertebrate Zoology*. Third Edition. Meerat: Rakesh Rastogi for Rastogi Publications.
5. Dhama, P.S., and Dhama, J.K., (2003). *Invertebrate Zoology*. New Delhi: Chand and Company.

Course Code 20UZYC12	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	H	H	H	M	H	H	H	-	M
CO2	H	M	H	M	H	H	H	L	M	H
CO3	H	M	M	M	H	H	L	M	M	M
CO4	H	M	H	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	L	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester II	CHORDATA- I	Hours/Week: 4	
Core Course-3		Credits: 4	
Course Code 20UZYC21		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts in taxonomy of chordates. [K1]

CO2: understand the biology of chordates. [K2]

CO3: explain the various physiological processes in chordates. [K2]

CO4: apply the knowledge to appreciate the adaptations of chordates. [K3]

CO5: analyze the unique features in chordates. [K4]

UNIT I

General characters of Chordates and Classification of Chordata upto Class level.

Prochordate: General characters and Classification upto class level.

Hemichordate:

Type study: Balanoglossus - Morphology, Respiratory system and Development - Tornaria larva. (12 Hours)

UNIT II

Urochordate:

Type study: Ascidian (*Herdmania*) - Morphology, Digestive system, Respiratory system, and Reproductive system.

Cephalochordate:

Type study: *Amphioxus*- Morphology, Digestive system, Circulatory system and Excretory system

General topic: 1. Retrogressive metamorphosis in Ascidian. (12 Hours)

UNIT III

Agnatha: General characters and Classification up to Class level.

Type study: Petromyzon - Morphology and Ammocoetes larva

Pisces: General Characters and Classification up to Class level.

Type study: Shark - Morphology, Digestive system, Respiratory system, Circulatory system - Venous system only. Sense organs – Lateral line sense organs only, Urinogenital system and Development. (12 Hours)

UNIT IV

Amphibia: General characters and Classification up to Order level.

Type study:

Rana hexadactyla - Morphology, Digestive system, Respiratory system(Bucco-pharyngeal, pulmonary and cutaneous system), and Urinogenital system. (12 Hours)

UNIT V

General Topics:

- Affinities of Prochordates.
- Migration of fishes.
- Parental care in fishes.
- Accessory respiratory organs in fishes.
- Economic importance of fishes.
- Parental care in Amphibia. (12 Hours)

TEXT BOOK

1. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). *A Textbook of Chordates*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology* . Volume II- *Chordata*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition. Meerut: Published by Rakesh Kumar Rastogi for Rastogi Publishers.
3. Jordon, E.L., and Verma, P.S., (2006 Reprint). *Chordate Zoology*. New Delhi: S. Chand and Co.
4. Dharni, P.S., and Dharni J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.

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

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Dr. M. Tamilselvi
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B.Sc. ZOOLOGY

(2022 -2023 onwards)

Semester II	CHORDATA- I	Hours/Week: 4	
Core Course-3		Credits: 4	
Course Code 20UZYC21N		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts in taxonomy of chordates. [K1]

CO2: understand the biology of chordates. [K2]

CO3: explain the various physiological processes in chordates. [K2]

CO4: apply the knowledge to appreciate the adaptations of chordates. [K3]

CO5: analyze the unique features in chordates. [K4]

UNIT I

General characters of Chordates and Classification of Chordata upto Class level.

Prochordate: General characters and Classification upto class level. **Hemichordate:**

Type study: Balanoglossus - Morphology, Respiratory system and Development - Tornaria larva. (12 Hours)

UNIT II

Urochordate: Type study: Ascidian (*Herdmania*) - Morphology, Digestive system, Respiratory system, and Reproductive system.

Cephalochordate: Type study: *Amphioxus*- Morphology, Digestive system, Circulatory system and Excretory system

General topic: 1. Retrogressive metamorphosis in Ascidian. (12 Hours)

UNIT III

Agnatha: General characters and Classification up to Class level.

Type study: Petromyzon - Morphology and Ammocoetes larva

Pisces: General Characters and Classification up to Class level.

Type study: Shark - Morphology, Digestive system, Respiratory system, Circulatory system - Venous system only. Sense organs – Lateral line sense organs only, Urinogenital system and Development. (12 Hours)

UNIT IV

Amphibia: General characters and Classification up to Order level.

Type study:

Rana hexadactyla - Morphology, Digestive system, Respiratory system (Bucco-pharyngeal, pulmonary and cutaneous system), Structure of Brain and Urinogenital system. Life cycle of frog. (12 Hours)

UNIT V

General Topics:

- Affinities of Prochordates.
- Migration of fishes.
- Parental care in fishes.
- Accessory respiratory organs in fishes.
- Economic importance of fishes.
- Adaptations of Deep sea fishes.
- Neoteny in Amphibia.
- Parental care in Amphibia. (12 Hours)

TEXT BOOK

1. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). *A Textbook of Chordates*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthkrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Volume II- *Chordata*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition. Meerut: Published by Rakesh Kumar Rastogi for Rastogi Publishers.
3. Jordon, E.L., and Verma, P.S., (2006 Reprint). *C* 17th Academic Council Meeting 31.01.2023 Chand and Co.
4. Dhama, P.S., and Dhama J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.

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

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B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester II	CHORDATA- II	Hours/Week: 4	
Core Course-4		Credits: 4	
Course Code 20UZYC22		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts in taxonomy and internal organization of chordates. [K1]

CO2: understand the biology and special adaptations of animals. [K2]

CO3: explain the various physiological processes in chordates. [K2]

CO4: apply their knowledge to identify the special features of chordates. [K3]

CO5: analyze the salient features and evolution of organs in chordates. [K4]

UNIT I

Reptilia: General characters and Classification upto Order level.

Type study: Calotes - Morphology, Circulatory system- Arterial system only. Sensory organs-Jacobson organs only, Reproductive system and Skeletal system – Pectoral and pelvic girdle only. (12 Hours)

UNIT II

Aves: General characters and Classification upto Order level.

Type study: Pigeon - Morphology, Digestive system, Respiratory system – mechanism of flight, Sense organs- Photoreceptor, Reproductive system, Skeletal System - Synsacrum, pectoral and Pelvic girdle only. (12 Hours)

UNIT III

Mammalia: General characters, Classification upto Order level.

Type study: Rabbit - Morphology, Digestive system, Respiratory system, Circulatory system - Structure and working of the heart, Sense organs – Photoreceptor and Phonoreceptor and Urinogenital system (12 Hours)

UNIT IV

General Topics:

- Identification of poisonous snakes – Poison apparatus and Biting mechanism.
- Poisonous snakes : Indian Cobra+, Bungarus and Viper
- Non poisonous snakes : Lycodon, Eryx johni and Ptyas
- Migration of Birds
- Flight adaptations in Birds
- Beaks and feet in Birds (12 Hours)

UNIT V

General Topics:

- Ratitae
- Archaeopteryx, the connecting link between Reptiles and Birds
- Adaptation of Aquatic Mammals
- Dentition in Mammals
- Evolution of Heart in Vertebrates
- Comparative study of Brain in Vertebrates (12 Hours)

TEXT BOOK

1. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). *A Textbook of Chordates*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology . Volume II- Chordata*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition. Meerut: Published by Rakesh Kumar Rastogi for Rastogi Publishers.
3. Jordon E.L., and Verma P.S., (2006 Reprint). *Chordate Zoology*. New Delhi: S. Chand and Co.
4. Dhama, P.S., and Dhama, J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.

Course Code 20UZYC22	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	H	H	H	M	H	H	L	L	M
CO2	H	H	L	H	M	M	L	L	M	L
CO3	H	M	L	H	H	H	L	L	M	H
CO4	M	M	M	H	H	M	L	L	M	H
CO5	H	H	M	H	H	M	M	H	M	H

Dr. J. Rani
Head of the Department

Dr. M. Tamilselvi
Course Designer



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2022 -2023 onwards)

Semester II	CHORDATA- II	Hours/Week: 4	
Core Course-4		Credits: 4	
Course Code 20UZYC22N		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: describe the basic concepts in taxonomy and internal organization of chordates. [K1]
- CO2: understand the biology and special adaptations of animals. [K2]
- CO3: explain the various physiological processes in chordates. [K2]
- CO4: apply their knowledge to identify the special features of chordates. [K3]
- CO5: analyze the salient features and evolution of organs in chordates. [K4]

UNIT I

Reptilia: General characters and Classification upto Order level. **Type study:** Calotes - Morphology, Circulatory system- Arterial system only. Sensory organs-Jacobson organs only, Reproductive system and Skeletal system – Pectoral and pelvic girdle only. (12 Hours)

UNIT II

Aves: General characters and Classification upto Order level.

Type study: Pigeon - Morphology, Digestive system, Respiratory system – mechanism of flight, Sense organs- Photoreceptor, Reproductive system, Skeletal System - Synsacrum, pectoral and Pelvic girdle only. (12 Hours)

UNIT III

Mammalia: General characters, Classification upto Order level.

Type study: Rabbit - Morphology, Digestive system, Respiratory system, Circulatory system - Structure and working of the heart, Sense organs – Photoreceptor and phonoreceptor and Urinogenital system. (12 Hours)

UNIT IV

General Topics:

- Identification of poisonous snakes – Poison apparatus and Biting mechanism.
- Poisonous snakes : Indian Cobra, Bungarus and Viper
- Non poisonous snakes : Lycodon, Eryx johni and Ptyas
- Golden age of Reptiles.
- Dinosaurs:- salient features, evolution and decline.
- Migration of Birds
- Flight adaptations in Birds
- Beaks and feet in Birds

17th Academic Council Meeting 31.01.2023

(12 Hours)

UNIT V

General Topics:

- Ratitae
- Archaeopteryx, the connecting link between Reptiles and Birds
- Adaptation of Aquatic Mammals
- Dentition in Mammals
- Stomach in mammals.
- Evolution of Heart in Vertebrates
- Comparative study of Brain in Vertebrates
- Integumentary derivatives in vertebrates.

(12 Hours)

TEXT BOOK

1. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). A *Textbook of Chordates*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Volume II- *Chordata*. Chennai: S.Visvanathan (Printers and Publishers) Pvt Ltd.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition. Meerut: Published by Rakesh Kumar Rastogi for Rastogi Publishers.
3. Jordon E.L., and Verma P.S., (2006 Reprint). *Chordate Zoology*. New Delhi: S. Chand and Co.
4. Dhama, P.S., and Dhama, J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.

17th Academic Council Meeting 31.01.2023

Course Code	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	H	H	H	M	H	H	L	L	M	H
CO2	H	H	L	H	M	M	L	L	M	L
CO3	H	M	L	H	H	H	L	L	M	H
CO4	M	M	M	H	H	M	L	L	M	H
CO5	H	H	M	H	H	M	M	H	M	H

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Dr. M. Tamilselvi
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester II	VERMICULTURE	Hours/Week: 2	
SEC -1		Credits: 2	
Course Code 20UZYS21		Internal 40	External 60

COURSE OUTCOMES

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

CO1: describe the basic concepts in vermiculture. [K1]

CO2: understand the culturable species of earthworm, techniques, methodology and management of pest in vermiculture. [K2]

CO3: explain the economic and ecological importance of vermiculture. [K2]

CO4: apply their knowledge and skills to set a vermiculture unit. [K3]

CO5: analyze the methods of vermiculture to carry out a successful culture unit for self employment. [K4]

UNIT I

Introduction, Culturable species of Earthworms, Two Exotic species only (*Lampito mauritii* and *Perionyx excavatus*), Life cycle of Earthworm – *Eisenia foetida* (manure worm). General importance of Earthworms. Earthworms as bioreactors. (6 Hours)

UNIT II

Vermiculture – Monoculture and Polyculture. Feed of earthworms, Suitable conditions required for culture of earthworm. (6 Hours)

UNIT III

Vermicomposting – methods – Preparation of worm bed - Bin and Windrow method, Harvesting and Advantages. Economic importance of vermicompost. (6 Hours)

UNIT IV

Vermicast- Shapes, Composition and importance. Vermiwash - Preparation, composition and applications. (6 Hours)

UNIT V**Pests of Earthworm:**

Predators – Ants, Birds and Mole.

Parasites - Centipedes and Mites.

Financial agencies to support Vermiculture – BERI (Bhawalkar Ecological Research Institute) & BAIF (Bhartiya Agro Industries Foundation). (6 Hours)

TEXT BOOKS

1. Seethalakshmi, M., and Santhi, R., (2012). *Vermiculture*. Nagercoil: Saras Publication.
2. Mary Violet Christy A. (2008). *Vermitechnology*. Chennai: MJP Publishers.

REFERENCE BOOKS

1. Prakash Malhotra., (2008). *Economic Zoology*. First edition. New Delhi: Adhyayan Publications and Distributers.
2. Renganthan, L.S., (2006). *Vermitechnology from soil health to human health*. First edition. India.
3. Agrobios Arumugam, N., Murugan, T., Johnson Rajeswar, J., and Ram Prabu, R., (2015). *Applied Zoology*. Fifth Edition, Nagercoil: Saras Publication.

WEBSITE REFERENCES:-

1. <https://www.google.co.in/bhalwalker+ecological+research+institute>.
2. www.baif.gov.in/www.baif.org.in

Course Code 20UZYS21	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	H	H	M	H	H	H	H	-	H	H
CO2	H	M	M	H	H	H	H	-	H	H
CO3	H	M	M	H	H	M	H	L	M	H
CO4	H	M	L	H	H	M	H	H	L	H
CO5	H	H	L	H	H	M	H	H	M	H

Dr. J. Rani
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Dr. P. Vijaya
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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2022 -2023 onwards)

Semester II	VERMICULTURE	Hours/Week: 2	
SEC -1		Credits: 2	
Course Code 20UZYS21N		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: describe the basic concepts in vermiculture. [K1]
- CO2: understand the culturable species of earthworm, techniques, methodology and management of pest in vermiculture. [K2]
- CO3: explain the economic and ecological importance of vermiculture. [K2]
- CO4: apply their knowledge and skills to set a vermiculture unit. [K3]
- CO5: analyze the methods of vermiculture to carry out a successful culture unit for self employment. [K4]

UNIT I

Introduction, scope of vermiculture, Culturable species of Earthworms, Two Exotic species only (*Lampito mauritii* and *Perionyx excavatus*), Life cycle of Earthworm – *Eisenia foetida* (manure worm). Collection of earthworms. General importance of Earthworms. Earthworms as bioreactors. (6 Hours)

UNIT II

Vermiculture –Steps involved in vermiculture, site selection, Vermibed, Feedstock, Inoculation, Feeding, Harvesting and Preservation of earthworms. Monoculture and Polyculture. Suitable conditions required for culture of earthworm. (6 Hours)

UNIT III

Vermicomposting – Requirements, steps and mechanism. Methods - Bin or tray and Windrow method. Maintenance and practical difficulties in vermicompost. Economic importance of vermicompost. (6 Hours)

UNIT IV

Vermicast- Shapes, Composition and importance. Vermiwash - Preparation, composition and applications. Role of earthworms in waste management and Soil fertility. (6 Hours)

UNIT V

Enemies of Earthworm: Predators – Ants, Birds and Mole. Parasites - Centipedes and Mites. Financial agencies to support Vermiculture – BERI (Bhawalkar Ecological Research Institute) & BAIF (Bhartiya Agro Industries Foundation). (6 Hours)

TEXT BOOK

1. Seethalakshmi, M., and Santhi, R., (2012). *Vermiculture*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Prakash Malhotra., (2008). *Economic Zoology*. First edition. New Delhi: Adhyayan Publications and Distributers.
2. Renganthan, L.S., (2006). *Vermitechnology from soil health to human health*. First edition. India.
3. Agrobios Arumugam, N., Murugan, T., Johnson Rajeswar, J., and Ram Prabu, R., (2015). *Applied Zoology*. Fifth Edition, Nagercoil: Saras Publication.
4. Mary Violet Christy A. (2008). *Vermitechnology*. Chennai: MJP Publishers.

WEBSITE REFERENCES:-

1. <https://www.google.co.in/bhawalkar+ecological+research+institute>.
2. www.baif.gov.in/www.baif.org.in

Course Code 20UZYS21N	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	H	H	M	H	H	H	H	-	H	H
CO2	H	M	M	H	H	H	H	-	H	H
CO3	H	M	M	H	H	M	H	L	M	H
CO4	H	M	L	H	H	M	H	H	L	H
CO5	H	H	L	H	H	M	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY
(2020 -2021 onwards)

Semester I/II	CORE PRACTICAL - I LAB IN INVERTEBRATA AND CHORDATA	Hours/Week: 2	
Core Course-3		Credits: 2	
Course Code 20UZYC21P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: apply the key concepts in biology to identify the invertebrates and chordates. [K3]

CO2: use the theoretical concepts to learn the various systems in animals. [K3]

CO3: make use of their knowledge and skills to observe the unique features of animals. [K3]

CO4: identify the features in the anatomical systems of invertebrates and chordates. [K3]

CO5: compare the ecological and economic importance of invertebrates and chordates. [K4]

SPOTTERS:

Phylum- Protozoa:

Paramecium, Amoeba, Euglena, Entamoeba and Plasmodium. Conjugation in Paramecium

Phylum-Porifera: Olynthus and Spicules of sponges

Phylum-Coelenterata:

Obelia colony, Obelia medusa, Aurelia, Physalia and Sea anemone.

Phylum-Platyhelminthes:

Planaria and Tape worm

Phylum- Aschelminthes:

Ascaris (Male and Female) and Branchionus.

Phylum-Annelida:

Earthworm, Chaetopterus and Leech.

Phylum-Arthropoda:

Limulus, Prawn, Spider, Scolopendra, Peripatus and Silkworm.

Adaptations of Planktons: Cypris

Phylum-Mollusca:

Pila, Pearl oyster, Chiton, Sepia and Solen.

Phylum-Echinodermata: Starfish, Sea-urchin, Sea-cucumber, Brittle Star and Bipinnaria larva of Starfish.

Sub Phylum- Prochordata:

Amphioxus, Balanoglossus, and Herdmania

Super Class - Agnatha:

Petromyzon.

Super Class - Pisces:

Shark, Catla, Salmon and Leptocephalus.

Class - Amphibia:

Ichthiophis, Bufo and Salamander

Class - Reptilia:

Poisonous Snakes: Cobra and Viper.

Non -Poisonous Snakes: Ptyas and Typhlops

Class - Aves:

Pigeon, Ostrich, and Archaeopteryx.

Class - Mammalia:

Pangolin, Kangaroo, Rabbit and Whale.

ANATOMICAL OBSERVATION:

Earthworm:

Nervous system, Body and Penial Setae.

Cockroach:

Digestive system, Nervous system and Trachea.

Pila:

Digestive system and Radula.

Frog:

Arterial System and Brain (Dorsal and Ventral view)

Mounting:

Body Setae in Earthworm.

Mouth parts in Ant, Cockroach and Honeybee.

Scales in fishes.

Collection:

1. Insects (any five)
2. Feathers of birds (any five).

Identification:

1. Any two freshwater planktons.
2. Commercially available fishes:
 - a) Catla b) Mrigal c) Rohu d) Gold fish e) Siamese fighter fish

REFERENCE BOOKS

1. Nair, N.C., Leelavathy, S., Soundrapandian, N., Murugan, T., and Arumugam, N., (2015 Reprint). *A Text book of Invertebrates*. 2nd revised edition. Nagarcoil: Saras Publication.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition, Meerut: Rakesh Kumar Rastogi for Rastogi Publishers.
3. Majupuria, T.C., (2001). *Invertebrate Zoology*. Jalandar: Pradeep Publications.
4. Jordan, E.I., and Verma P.S., (2007 Reprint). *Invertebrate Zoology*. New Delhi: S. Chand and Company.
5. Dhama, P.S., and Dhama, J.K., (2003). *Invertebrate Zoology*. New Delhi: R.Chand and Company.
6. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Volume II- Chordata. Chennai: S.Visvanathan (Printers and Publishers) Pvt. Ltd.
7. Jordon, E.L., and Verma P.S., (2006 Reprint). *Chordate Zoology*. New Delhi: Published by S. Chand and Co.
8. Dhama, P.S., and Dhama, J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.
9. Lal, S.S., (1996 Reprint). *A text book of Practical Zoology Invertebrate*. Meerut: Rastogi publications.
10. Lal, S.S., (1996 Reprint). *A text book of Practical Zoology Vertebrate* . Meerut: Rastogi publications.

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

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY
(2023 -2024 onwards)

Semester I/II	CORE PRACTICAL - I LAB IN INVERTEBRATA AND CHORDATA	Hours/Week: 2	
Core Course-3		Credits: 2	
Course Code 20UZYC21PN		Internal 40	External 60

COURSE OUTCOMES

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

CO1: apply the key concepts in biology to identify the invertebrates and chordates. [K3]

CO2: use the theoretical concepts to learn the various systems in animals. [K3]

CO3: make use of their knowledge and skills to observe the unique features of animals. [K3]

CO4: identify the features in the anatomical systems of invertebrates and chordates. [K3]

CO5: compare the ecological and economic importance of invertebrates and chordates. [K4]

SPOTTERS:

Phylum- Protozoa:

Paramecium, Amoeba, Euglena, Entamoeba and Plasmodium. Conjugation in Paramecium

Phylum-Porifera: Olynthus and Spicules of sponges

Phylum-Coelenterata:

Obelia colony, Obelia medusa, Aurelia, Physalia and Sea anemone.

Phylum-Platyhelminthes:

Tapeworm

Phylum- Aschelminthes:

Ascaris (Male and Female) and Brachionus.

Phylum-Annelida:

Earthworm

Phylum-Arthropoda:

Limulus, Prawn, Spider, Scolopendra, Peripatus and Silkworm.

Adaptations of Planktons: Cypris

Phylum-Mollusca:

Pila and Pearl oyster

Phylum-Echinodermata: Starfish and Bipinnaria larva of Starfish.

Sub Phylum- Prochordata:

Amphioxus, Balanoglossus, and Herdmania

Super Class - Agnatha:

Petromyzon.

Super Class - Pisces:

Shark, Catla, Salmon and Leptocephalus.

Class - Amphibia:

Ichthiophis, Bufo and Salamander

Class - Reptilia:

Poisonous Snakes: Cobra and Viper.

Non -Poisonous Snakes: Ptyas and Typhlops

Class - Aves:

Pigeon, Ostrich, and Archaeopteryx.

Class - Mammalia:

Pangolin, Kangaroo, Rabbit and Whale.

ANATOMICAL OBSERVATION:

Earthworm:

Nervous system, Body and Penial Setae.

Cockroach:

Digestive system, Nervous system and Trachea.

Pila:

Digestive system and Radula.

Frog:

Arterial System and Brain (Dorsal and Ventral view)

Mounting:

Body Setae in Earthworm.

Mouth parts in Ant, Cockroach and Honeybee.

Scales in fishes.

Scales in the wings of a butterfly.

Preparation of skeleton of a fish.

Appendages in Prawn.

Collection:

1. Insects (any five)
2. Feathers of birds (any five).

Identification:

1. Any two freshwater planktons.
2. Commercially available fishes:
 - a) Catla
 - b) Mrigal
 - c) Rohu
 - d) Gold fish
 - e) Siamese fighter fish
3. Differentiation of butterfly and moth.
4. Differentiation of Arachnid and an Insect.

REFERENCE BOOKS

1. Nair, N.C., Leelavathy, S., Soundrapandian, N., Murugan, T., and Arumugam, N., (2015 Reprint). *A Text book of Invertebrates*. 2nd revised edition. Nagargoil: Saras Publication.
2. Kotpal, R.L., (2005 Reprint). *Vertebrata*. Third Edition, Meerut: Rakesh Kumar Rastogi for Rastogi Publishers.
3. Majupuria, T.C., (2001). *Invertebrate Zoology*. Jalandar: Pradeep Publications.
4. Jordan, E.I., and Verma P.S., (2007 Reprint). *Invertebrate Zoology*. New Delhi: S. Chand and Company.
5. Dhama, P.S., and Dhama, J.K., (2003). *Invertebrate Zoology*. New Delhi: R.Chand and Company.
6. Ekambaranatha Ayyar, M., and Ananthakrishnan, T.N., (2005 Reprint). *A Manual of Zoology*. Volume II- Chordata. Chennai: S.Visvanathan (Printers and Publishers) Pvt. Ltd.
7. Jordon, E.L., and Verma P.S., (2006 Reprint). *Chordate Zoology*. New Delhi: Published by S. Chand and Co.
8. Dhama, P.S., and Dhama, J.K., (2006 Reprint). *Chordate Zoology*. New Delhi: Chand and Company.
9. Lal, S.S., (1996 Reprint). *A text book of Practical Zoology Invertebrate*. Meerut: Rastogi publications.
10. Lal, S.S., (1996 Reprint). *A text book of Practical Zoology Vertebrate* . Meerut: Rastogi publications.

Course Code 20UZYC21PN	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	H	H	M	H	H	H	H	L	H
CO2	H	H	M	M	H	H	M	L	H	H
CO3	H	M	M	M	H	H	H	L	H	H
CO4	H	H	M	M	H	H	H	L	H	H
CO5	H	H	M	L	H	H	H	H	M	H

Dr. J. Rani
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Dr. M. Tamilselvi
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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR ZOOLOGY

(2020 - 2021 onwards)

Semester I	ALLIED COURSE I- ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – I	Hours/Week: 4	
Allied Course -1		Credits: 4	
Course Code 20UCHA11		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic principles, statements, laws and theories in chemistry. [K1]

CO2: understand the fundamental concepts in organic, inorganic and physical chemistry.

[K2]

CO3: illustrate the preparations, uses and applications of polymers, hydrogen and water, various metallurgical process, bonding theories, colloids, sols, emulsion and gels

[K2]

CO4: predict the type of reactions involved in polymers preparation, utility of biomedical polymers, suitable process for metal extraction and water purification, shape of molecules using VSEPR, VB and MO theories, properties of gaseous and colloidal substances. [K3]

CO5: analyze different methodology of preparing polymers, separation of metals from their ores, water purification processes, various bonding theories, gas laws and properties various colloids, applications of colloids and biomedical polymers. [K4]

UNIT I Polymers

1. Polymers – Polymerization – Definition – Classification – examples –Preparation and uses of polythene, PVC, teflon, polystyrene, dacron, nylon- 6,6.
2. Natural and synthetic rubbers – examples – vulcanization of rubber- Preparation and uses of SBR, Buna – N and neoprene.
3. Biomedical polymers – characteristics – examples - Biomedical applications of polymer.

(12 Hours)

UNIT II Metallurgy, Hydrogen and Water

1. Metallurgy

Ores, minerals – various steps in the metallurgical processes – Froth floatation – calcination – roasting – leaching – smelting – Mond's process – Van Arkel –de-Boer process – Zone refining – Electrolytic refining – Extraction of titanium.

2. Hydrogen

Isotopes of hydrogen – Heavy water – uses- ortho and para hydrogen Interconversion. Occluded hydrogen – Nascent hydrogen – uses of hydrogen.

3. Water

Hardness of water – Types of hardness – Removal of hardness – sodalime, Permutit and Ion-exchange processes - Demineralisation process – purification of water using chlorine, Ozone and UV light. (12 Hours)

UNIT III Chemical Bonding

1. Bonding – Valence bond theory – postulates – Types of overlapping- σ & π bonds - Concept of hybridization – sp , sp^2 and sp^3 hybridisation – VSEPR Theory – NH_3 and H_2O molecules.

2. Molecular orbital theory – postulates – Application to the formation of H_2 , O_2 and He_2 molecules. Comparison of VBT and MOT. (12 Hours)

UNIT IV Gaseous State

1. Gas Laws - Boyle's law – Charles law – Gay Lussac's law – Ideal gas equation – Avogadro's law – molar gas volume – Dalton's law of partial pressure -Graham's law of diffusion.

2. Kinetic Theory of gases - Postulates – Kinetic gas equation (Derivation not required) – Deduction of gas laws from kinetic gas equation.

3. Different types of Velocities – Average velocity, RMS velocity, most probable velocity – relationship between them. (No derivation)

4. Ideal and real gases - Definition – Deviation of real gases from ideal behavior – reasons for deviation. (12 Hours)

UNIT V Colloids

1. Colloids – Definition and classification.
2. Sols – Different types – examples –Dialysis – electro osmosis – electrophoresis – stability of colloids- Gold number.
3. Emulsion – Types of emulsion – Emulsifier – Examples – Cleansing action of soap.
4. Gels – Types of gels – examples – Properties – Hydration – Swelling – syneresis – Thixotropy.
5. Applications of colloids. (12 Hours)

TEXT BOOKS

- 1.P.L.Soni, (2008) *Text book of Organic Chemistry*, Latest Edition.Sultan Chand & Sons.
2. P.L.Soni, (2008).*Text book of Inorganic Chemistry*,Latest Edition. Sultan Chand& Sons.
3. P.L.Soni, (2008).*Text book of Physical chemistry*Latest Edition.Sultan Chand & Sons.

REFERENCE BOOKS

1. Bahl and Arun Bahl,*Advanced Organic Chemistry*,22nd Edition.S.Chand&Company Ltd.
2. Puri, Sharma, Kalia, (2008).*Principles of Inorganic Chemistry*, 43rd Edition. Vishal Publishing Co.
3. Puri,Sharma,Patania,*Principles of Physical Chemistry*, 43rd Edition. Vishal Publishing Co.

Course Code 20UCHA11	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	H	L	L	H	L	L	L
CO2	L	L	-	-	L	-	-
CO3	-	H	-	M	L	-	M
CO4	H	L	-	L	M	L	L
CO5	H	H	M	M	L	L	-

Tmty.M.Dhanalakshmi
Head of the Department

Dr. M.Amutha
Course Designer



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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR ZOOLOGY (2020-2021 onwards)

Semester II	ALLIED COURSE I- ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – II	Hours/Week: 4	
Allied Course I		Credits: 4	
Course Code 20UCHA21		Internal 25	External 75

COURSE OUTCOMES

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

CO1: know about the basic concepts in organic, inorganic and physical chemistry. [K1]

CO2: understand the chemical constituent in oils, fats, soaps, detergents, biomolecules, fuels, fertilizers and pollutants. [K2]

CO3: identify the methods of preparation for organic and inorganic compounds, sources, effects and control measures of pollutions, methods for removal of salt from water. [K2]

CO4: comprehend the classification of biomolecules, fuels, fertilizers, catalyst, pollutions, application of adsorption and biomolecule. [K3]

CO5: analyze the oils, fats and biomolecules functions, sources of pollutions, characteristics of catalysts and the effects with control measures for various pollution. [K4]

UNIT I Oils and Fats, Soaps and Detergents

1. Oils and Fats – Definition – Properties - Distinction between them -Hydrogenation, Hydrogenolysis, Rancidification and Drying of oils – Preparation of Vanaspathi- Analysis of oils and Fats – Saponification and iodine number.

2. Soaps and Detergents

Soap – Definition – Different types – Manufacture of soap – Kettle process - Detergent – Definition – Synthetic detergents – examples – Distinction between soaps and detergents.

(12 Hours)

UNIT II Biomolecules

1. Carbohydrates – classification – Differences between glucose and fructose – Inter conversion of glucose and fructose – Haworth structure of glucose and fructose- Differences between starch and cellulose – Derivatives of cellulose and their uses.
2. Amino acids – classification – preparation of α -amino acids– properties – Zwitterion – isoelectric point .
3. Proteins – classification – Biological function – colour reaction of proteins.
4. Nucleic acids – RNA and DNA – Biological functions (Elementary idea only).

(12 Hours)

UNIT III Fuels and Fertilizers

1. Fuels – classification – Advantages of gaseous fuels – constituents and uses of water gas, producer gas, LPG, Gobar gas and natural gas.
2. Fertilizers – classification – Macro and micro nutrients – Functions of nutrients preparation and uses of urea, ammonium sulphate, superphosphate, triple superphosphate, potassium nitrate and NPK.

(12 Hours)

UNIT IV Pollution

1. Air pollution – Definition – sources of air pollution –classification and effects of air pollutants – Ozone layer- formation and depletion – Green house effect – Acid rain – Preventive measures of air pollution.
2. Water pollution –types and sources of water pollution –classification and effects of water pollutants-control of water pollution-Desalination of sea water by electro dialysis and reverse osmosis.
3. Radioactive pollution – sources – nuclear waste disposal – Effects of radiations.

(12 Hours)

UNIT V Surface Phenomena

1. Adsorption – Characteristics – Types of adsorption and comparison – Factors influencing adsorption – Langmuir and Freundlich adsorption isotherm (No derivation) – Applications of adsorption.
2. Catalysts – Characteristics- Different types with examples – Catalytic poisoning – promoters with examples.

(12 Hours)

TEXT BOOKS

1. Soni P.L.,(2008).*Text book of Organic Chemistry*, Latest Edition.Sultan Chand & Sons.
2. Soni P.L.,(2008).*Text book of Inorganic Chemistry*, Latest Edition. Sultan Chand & Sons.
3. Jayashree Ghosh, (2013). *Fundamental Concepts of Applied Chemistry*,S.Chand& Company Ltd.
4. Soni, P.L.(2008).*Text book of Physical chemistry*, Latest Edition,Sultan Chand & Sons.

REFERENCE BOOKS

1. Jain, M.K. & Sharma, S.C. (2016). *Modern Organic Chemistry*, 1st Edition. New Delhi: Vishal Publishing Co.
2. Sindhu P.S.,*Environmental Chemistry*.
3. Jain, P.C. & Monika Jain. (2013). *Engineering Chemistry*. 1stEdition.New Delhi: Dhanpat Rai Publishing CompanyPvt.Ltd.
4. Puri, Sharma, Pathania, (2008). *Elements of Physical Chemistry*, 4th Edition. Jalandhar Delhi: Vishal Publishing& Co.

Course Code 20UCHA21	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	M	-	H	-	-	-	L
CO2	H	H	M	M	M	-	L
CO3	H	H	M	M	L	H	-
CO4	H	H	H	M	M	H	M
CO5	H	H	L	-	H	-	L

Tmty.M.Dhanalakshmi
Head of the Department

Dr. M.Amutha
Course Designer



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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR ZOOLOGY
 (2020-2021 onwards)

Semester II	VOLUMETRIC ANALYSIS	Hours/Week: 2	
Allied Course I Practical		Credits: 2	
Course Code 20UCHA21P		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: apply the Principles involved in the Volumetric analysis. [K3]
- CO2: find out the strength of standard solutions. [K3]
- CO3: estimate the amount of the substance present in the given solution by volumetric analysis. [K3]
- CO4: determine the concentration of the unknown solutions. [K4]
- CO5: analyse and evaluate the accuracy of the results. [K4]

a. Acidimetry and Alkalimetry:

1. Titration between a strong acid and strong base
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base

b. Permanganimetry:

Titration between potassium permanganate and

- i) oxalic acid ii) ferrous sulphate and iii) ferrous ammonium sulphate (Mohr's salt)

c. Iodometry:

Titration between sodium thiosulphate and i) potassium permanganate and ii) potassium dichromate.

Course Code 20UCHA21P	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	H	-	M	M	M
CO2	H	H	H	M	H	-	M
CO3	H	H	H	L	-	-	L
CO4	H	H	H	M	L	M	M
CO5	H	H	M	L	L	M	L

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester III	CELL AND MOLECULAR BIOLOGY	Hours/Week: 5	
Core Course-5		Credits: 5	
Course Code 20UZYC31		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: describe the basic concepts about the different types of cells. [K1]
- CO2: understand the structure of cells and organelles. [K2]
- CO3: apply the knowledge about functions of cells and organelles in everyday life. [K3]
- CO4: analyze the significant role of cells in molecular level. [K4]
- CO5: assess the applications of various equipments and experiments in the study of cells. [K5]

UNIT I

Microscopy: Phase contrast microscope, Binocular microscope, Confocal and fluorescent microscope..

Cell structure: Prokaryotic and Eukaryotic cell

Protoplasm: Protoplasm as a colloidal system, different theories, Colloidal properties, Chemical nature and Biological properties. (15 Hours)

UNIT II

Ultra structure and functions of i) Plasma membrane ii) Mitochondria iii) Golgi apparatus iv) Endoplasmic reticulum and v) Ribosomes. (15 Hours)

UNIT III

Ultra structure and functions of i) Lysosomes ii) Centrioles iii) Nucleus iv) Nucleolus v) Chromosomes and vi) Giant chromosomes- Polytene and Lampbrush Chromosome. (15 Hours)

UNIT IV

- i) Cell division: Cell cycle, Amitosis, Mitosis, and Meiosis.
- ii) Comparison between Mitosis and Meiosis.
- iii) Mitotic apparatus.
- iv) Synaptonemal complex.

- v) Cancer: Characteristic features of Cancer cells – Oncogenes, Developmental stages of Cancer, Types, Symptoms and Treatment. (15 Hours)

UNIT V

Genetic code - Characteristics. Protein synthesis - Transcription and Translation
Prokaryotes. Wobble hypothesis for Genetic code. DNA as genetic material
(Griffith experiment). Gene regulation in Prokaryotes – Lac operon. (15 Hours)

TEXT BOOK

1. Arumugam, N. (2008). *A Text book of Cell Biology*. Kottar: Saras Publications.
2. Arumugam, N. (2004). *Molecular Biology and Genetic Engineering*, Kottar: Saras Publication.

REFERENCE BOOKS

1. Rastogi, S.C., (1990). *Cell Biology*. New Delhi: Tata McGraw Hill publishing Company Ltd.
2. Debnath, M., (2008). *Molecular Cell Biology*. India: Pointer Publishers.
3. De Robertis and De Robertis., (2004). *Cell and Molecular Biology*. Philadelphia: Reprint WB Saunders Co.

Course Code 20UZYC31	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	H	H	L	L	L	L	M	-	L	L
CO2	H	M	H	H	M	M	-	-	L	-
CO3	H	M	H	M	L	H	M	M	M	H
CO4	H	H	M	H	M	L	H	L	M	H
CO5	H	H	M	H	H	L	H	M	M	L

Dr. J. Rani
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Dr. R. Radhalakshmi
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

SEMESTER - III	AQUACULTURE	Hours/Week: 2	
SEC -2		Credits: 2	
Course Code 20UZYS31		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: define the basic concepts and importance of aquaculture through recognizing the fish farming technology and equipment. [K1]
- CO2: describe the knowledge necessary for professional or academic work in the field of aquaculture and fisheries. [K2]
- CO3: select the advanced techniques used in aquaculture and fisheries to increase the rate of production of the cultured as well as capture species according to the increasing demand of the market. [K2]
- CO4: develop the ability to guide layman individual in his/her difficulties during the construction as well as to run a fish farm successfully. [K3]
- CO5: analyze the basic technical skills to management of nursery, rearing and stocking ponds of commercially valuable and cultivable fishes to promote self employment. [K4]

UNIT I

Aquaculture- Introduction, scope, types - Freshwater, Coastal, Marine and Metahaline. Aquaculture organizations in India – CIFRI (Central Inland Fisheries Research Institute) and SOFIA (State of World Fisheries and Aquaculture) - Economic importance of common South Indian fishes. (6 Hours)

UNIT II

Culturable organisms – Desirable qualities of Culturable organisms, Types - Fin fishes and Shell fishes. Shrimp culture methods (Brief account only). Fish feed – Brief account on Artemia and its culture. Artificial feed - Composition. (6 Hours)

UNIT III

Fishery culture systems: Classification- Freshwater culture, Pond culture, Riverine culture, Pen culture, Monoculture, Monosex culture and Polyculture. Culture systems - Indian major carps – Catla and Rohu. Aquarium- Aim, Requirements and settings only. (6 Hours)

UNIT IV

Fish seed collection and transport. Hypophysation- Principle, Procedure and Advantages. Fish preservation methods.

Grafts- Coracle and Kattumaram, Gears - Gill nets. (6 Hours)

UNIT V

Fish diseases: Protozoan- White spot disease; Fungal – Gill rot; Bacterial- Vertical scale disease; Viral- Epizootic ulcerative syndrome (EUS). (6 Hours)

TEXT BOOKS

Arumugam, N. (2009). *Aquaculture*, Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Jhingran, V.G. (1983). *Fish and Fisheries of India*. Delhi: Hindustan Publishing Corp.
2. Pandey and Shukla. (2005). *Fish and Fisheries*. Rastogi Publications.
3. Pauly, D and Zeller, D. Comments on FAOs State of World Fisheries and Aquaculture (SOFIA 2016), *Marine Policy*, Volume 77, March 2017, pp: 176-181

WEBSITE REFERENCES

1. <http://www.fao.org/fishery/aquaculture/en>
2. <https://www.sciencedirect.com/science/article/pii/S0308597X16305516>

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

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester IV	DEVELOPMENTAL BIOLOGY	Hours/Week: 5	
Core Course-6		Credits: 5	
Course Code 20UZYC41		Internal 25	External 75

COURSE OUTCOMES

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

- CO1 : describe the fundamental principles in developmental biology. [K1]
 CO2 : understand the various stages in the development of an embryo. [K2]
 CO3 : apply the knowledge to appreciate the various interactive processes involved during the development of an organism. [K3]
 CO4 : analyze the factors responsible for important events in embryological studies. [K4]
 CO5 : assess the merits of advanced concepts in developmental biology. [K5]

UNIT I

1. Definition – Phases of embryonic and post embryonic Development.
2. Theories of development: Preformation, Epigenetic.
3. Gametogenesis: Spermatogenesis- Formation of spermatids, Spermiogenesis
 Types of Sperm, Oogenesis, Types of eggs and egg membranes.
 Structure of mammalian sperm and ovum. (15 Hours)

UNIT II

1. Fertilization: Types, Process of fertilization: Chemical factors- Chemotaxis and Fertilizin- Antifertilizin reaction; Cytological factors -Acrosomal reaction, cortical reaction and Amphimixis; Physiological factors – Fertilization cone, Rate of O₂ consumption, Protein synthesis and Initiation of mitosis.
 Significance of fertilization.
2. Parthenogenesis: Types and Significance.
3. Cleavage: Definition, Planes and Patterns of cleavage, types of blastula, factors controlling cleavage, Laws of Cleavage and Significance.
 Blastulation and gastrulation in Frog and Fate map in Frog. (15 Hours)

UNIT III

1. Organogenesis: Development of Eye and Heart in Frog.
2. Extra embryonic membranes in Chick.
3. Placentation in mammals: Definition, types and functions of Placenta. (15 Hours)

UNIT IV

1. Organizer: Properties, Structure and Mechanism of induction.
2. Gradients: Theories, Physico-chemical experiment of Horstadius, Factors affecting gradients.
3. Amphibian metamorphosis: Definition, Ecological, Morphological (Progressive and Retrogressive changes) and Physiological changes and Hormonal control.
4. Regeneration: Definition, Types, Regeneration in Salamander limbs, Factors affecting regeneration. (15 Hours)

UNIT V

1. Human Reproduction – Menstrual cycle, Pregnancy and Birth.
2. Twins, Amniocentosis.
3. Congenital anomalies – Phenyl ketonuria, Alkaptonuria, Milroy's disease and Dystonia.
4. Aging and Senescence. (15 Hours)

TEXT BOOKS

1. Arumugam, N. (2008). *Text Book of Embryology*. Kottar, Nagarcoil: Saras Publication.
2. Verma, P.S. and Agarwal V.K. (2000). *Chordate Embryolog.*, New Delhi: S.Chand & Co.

REFERENCE BOOKS

1. Balinsky. (1981). *An Introduction to Embryology*. Philadelphia : W.B. Saunders Company.
2. Berill, N.J.(1986). *Developmental Biology*. New Delhi: MC Graw Hill.
3. Patten, B.M.(1958). *Foundations of Embryology*. NewYork: Mc Graw Hill,
4. Saunder.J.W.(1982). *Developmental Biology Patterns and Principles*. New York: Macmillan.
5. Browder, L.W.Erickson, C.A. and Williams. (1992). *Developmental Biology*. London: R.J.Saunders College Publications.

Course Code	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	H	M	L	M	-	M	M	L	M	L
CO2	H	H	L	M	L	H	H	L	M	M
CO3	H	H	L	H	L	M	M	L	M	L
CO4	H	M	L	M	M	M	M	L	M	L
CO5	H	M	M	H	H	M	H	H	M	M

Dr. J. Rani
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B.Sc. ZOOLOGY (2022 -2023 onwards)

Semester IV	DEVELOPMENTAL BIOLOGY	Hours/Week: 5	
Core Course-6		Credits: 5	
Course Code 20UZYC41N		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: describe the fundamental principles in developmental biology. [K1]
- CO2: understand the various stages in the development of an embryo. [K2]
- CO3: apply the knowledge to appreciate the various interactive processes involved during the development of an organism. [K3]
- CO4: analyze the factors responsible for important events in embryological studies. [K4]
- CO5: assess the merits of advanced concepts in developmental biology. [K5]

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1. Definition – Phases of embryonic and post embryonic Development.
2. Theories of development: Preformation, Epigenetic.
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Types of Sperm, Oogenesis, Types of eggs and egg membranes.
Structure of mammalian sperm and ovum. (15 Hours)

UNIT II

1. Fertilization: Types, Process of fertilization: Chemical factors- Chemotaxis and Fertilizin- Antifertilizin reaction; Cytological factors -Acrosomal reaction, cortical reaction and Amphimixis; Physiological factors – Fertilization cone, Rate of O₂ consumption, Protein synthesis and Initiation of mitosis.
Significance of fertilization.
2. Parthenogenesis: Types and Significance.
3. Cleavage: Definition, Planes and Patterns of cleavage, types of blastula, factors controlling cleavage, Laws of Cleavage and Significance.
Blastulation and gastrulation in Frog and Fate map in Frog. (15 Hours)

UNIT III

1. Developmental pattern: Development of coelom and water vascular system in Star fish. Development of Eye and Heart in Frog.
2. Environmental influences on Development of embryo in frog-Polyphenism. Extra embryonic membranes in Chick.
3. Placentation in mammals: Definition, types and functions of Placenta. (15 Hours)

UNIT IV

1. Organizer: Properties, Structure and Mechanism of induction.
2. Gradients: Theories, Physico-chemical experiment of Horstadius, Factors affecting gradients.
3. Amphibian metamorphosis: Definition, Ecological, Morphological (Progressive and Retrogressive changes) and Physiological changes and Hormonal control.
4. Regeneration: Definition, Types, Regeneration in Salamander limbs, Factors affecting regeneration. (15 Hours)

UNIT V

1. Human Reproduction – Menstrual cycle, Pregnancy, Birth and Lactation.
2. Twins, Amniocentosis.
3. Congenital anomalies – Phenyl ketonuria, Alkaptonuria, Milroy's disease and Dystonia.
4. Aging and Senescence. (15 Hours)

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1. Arumugam, N. (2008). *Text Book of Embryology*. Kottar, Nagarcoil: Saras Publication.
2. Verma, P.S. and Agarwal V.K. (2000). *Chordate Embryolog.*, New Delhi: S.Chand & Co.

REFERENCE BOOKS

1. Subramoniam T. (2013). *Molecular Developmental Biology*. New Delhi: Narosa Publishing House.
2. Subramanian M.A. (2012). *Developmental Biology*. Chennai: MJP Publishers.
3. Balinsky. (1981). *An Introduction to Embryology*. Philadelphia : W.B. Saunders Company.
4. Berill, N.J.(1986). *Developmental Biology*. New Delhi: MC Graw Hill.
5. Patten, B.M.(1958). *Foundations of Embryology*. NewYork: Mc Graw Hill,
6. Saunder.J.W.(1982). *Developmental Biology Patterns and Principles*. New York: Macmillan.
7. Browder, L.W.Erickson, C.A. and Williams. (1992). *Developmental Biology*. London: R.J.Saunders College Publications.

Course Code	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	H	M	L	M	-	M	M	L	M	L
CO2	H	H	L	M	L	H	H	L	M	M
CO3	H	H	L	H	L	M	M	L	M	L
CO4	H	M	L	M	M	M	M	L	M	L
CO5	H	M	M	H	H	M	H	H	M	M

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B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester IV	BEEKEEPING	Hours/Week: 2	
SEC -3		Credits: 2	
Course Code 20UZYS41		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: describe the basic concepts of beekeeping and the role of bees in the improvement of ecosystem. [K1]
- CO2: understand the qualities of culturable species of honeybees and their behavior. [K2]
- CO3: explain the efficient handling of bees in the maintenance of a successful culture unit. [K2]
- CO4: apply the culture techniques of honeybees to promote self employment. [K3]
- CO5: analyze the role of government as well as non government organizations to improve beekeeping industry in our country. [K4]

UNIT I

Introduction - History of Beekeeping in India- Scope and importance of Beekeeping. Honeybee species - *Apis dorsata*, *A.florea*, *A.cerena*, *A.mellifera* and *A.meliphona* species. Candidate Species for Commercial Beekeeping. Funding agencies for Apiary – KVIC AND NBB. (6 Hours)

UNIT II

Bee colony – Queen bee, Drone bee and Worker bee. Life cycle of honeybee. Morphology of Honeybee. Food of Honeybee- Nectar, honey, pollen, royal jelly and bee bread. (6 Hours)

UNIT III

Behaviour of Honeybee-Bee dance, Swarming, Robbing, Absconding, Marriage flight/Nuptial flight and Supersedure. Methods of beekeeping - Modern method – Newton's Bee hive model- Advantages. (6 Hours)

UNIT IV

Appliances Used In Beekeeping Industry: Tool for culturing bees - Hive body and Comb Frame. Equipment for Handling the Bees- Queen excluder, Feeder, Smoker, Hive tool, Bee brush, Pollen trap and Comb foundation sheet. Equipment for protection – Bee veil and Gloves Equipment for extraction – Uncapping knife, Honey extractor and Storage container. (6 Hours)

UNIT V

Enemies of honeybees- Mites- Ectoparasitic mite-Varroa mite and Endoparasitic mite-Acarine mite. Bacterial Disease- American Foul Brood disease, Viral disease- Sac Brood disease. Products from beekeeping industry – Uses of Primary products- Honey, Bee pollen and Propolis. Uses of Secondary products - Bee wax, Royal jelly and bee venom. (6 Hours)

TEXT BOOKS

Tamilselvi,M., and Abdul Jaffar Ali, H., (2016). A Textbook on Apiculture. Vijay Nicole Pvt.Ltd., Chennai.

REFERENCE BOOKS

1. Johnson, J., and Jeya Chandra, I., (2001). *Apiculture*. Marthandam: Olympic Grafix.
2. Nair,N.C., Leelavathy,S., Soundara Pandian, N., and T. Murugan., (2014). *A Text book of Invertebrates*. Nagercoil: Saras Publication.
3. Mishra,R.C., (1998). *Perspectives in Indian Apiculture*. 1st Edition. Agro Botanica, Bikaner.
4. Mishra, R.C., (1995). *Honey bees and their Management*. ICAR, New Delhi: India.
5. Shends ,S.G. and Phadke, R.P. 1993. *History of beekeeping in India. Present status and future: In First National Conference on beekeeping*. Chandigarh:
6. Fenmore, P.G., and AlkaPrakash., (1992). *Applied Entomology*. New Delhi: Wiley Eastern Limited.
7. Mohammed Sulaiman., (1992). *Text book of Entomology*. Bombay: Himalaya Publishing House.

WEBSITE REFERENCES

1. <http://www.kvic.org.in/kvicres/training.html>
2. <http://nbb.gov.in/contactus.htm>
3. http://www.kvic.org.in/update/FBI/Beekeeping_SBC_List.pdf
4. <http://www.nhm.nic.in/>

Course Code 20UZYS41	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	H	H	M	H	H	M	M	L	M	M
CO2	H	H	M	M	M	M	M	L	M	M
CO3	H	M	M	H	M	H	H	L	M	H
CO4	H	H	-	H	H	M	M	-	M	H
CO5	H	M	M	H	M	H	H	H	M	H

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Dr. M. Tamilselvi
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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester III/IV	CORE PRACTICAL II CELL AND MOLECULAR BIOLOGY AND DEVELOPMENTAL BIOLOGY	Hours/Week: 2	
Core Course-3		Credits: 2	
Course Code 20UZYC41P		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: describe the basic principles for the handling of equipments. [K1]
- CO2: understand the practical applications of methods in cell and molecular biology and developmental biology. [K2]
- CO3: apply the knowledge and practical skills in completing their projects. [K3]
- CO4: compare the functional significance of different types of cells. [K4]
- CO5: evaluate the effectiveness of novel scientific techniques with that of conventional ones. [K5]

CELL AND MOLECULAR BIOLOGY

1. Microscopy – Stereomicroscope and Trinocular microscope (Demonstration)
2. Mounting – Buccal epithelium.
3. Mitosis in onion root tip.
4. Preparation of human blood smear and identification of blood cells.
5. Observation of Frog blood smear (Slide)
6. Histochemical Staining methods:-
 - Proteins – Pea seeds (Mercuric Bromophenol Blue method)
 - Lipids – Coconut (Sudan Black B method), Starch grains –Potato.
7. Charts
 - Charts on Mitochondria, Golgi apparatus, Endoplasmic Reticulum, Chromosomes – Lampbrush Chromosome and Giant Chromosomes.
 - Structure –DNA and RNA (mRNA and tRNA)
8. Observation of Slides
 - Prokaryotic Cell (*E.coli*)

- Eukaryotic Cell (Plant and animal cell)
- Muscle cell (Striated, Unstriated and Smooth muscles)
- Stem cells (Diagram only)

9. Equipment (Demonstration)

- Principle and Applications of (a). Microcentrifuge
(b). Agarose gel electrophoresis.

DEVELOPMENTAL BIOLOGY

1. Slides on the Observation of mammalian egg and sperm.
2. T.S.of mammalian testis and ovary showing maturation Stages.
3. Placenta of Sheep and man.
4. Early developmental stages of frog – cleavage, Blastula and Gastrula.
5. Mounting of different stages of chick blastoderm (24 hrs, 48hrs, 72 hrs and 96 hrs).
6. Collection of eggs of different birds (any2)
7. Observation of Regeneration in Lizard (Virtual Video)
8. Observation of metamorphosis in frog (Virtual Video).
9. Types of eggs (Pictures)
 - a) Microlecithal egg - eg: Amphioxus
 - b) Megalecithal egg - eg: Hen
 - c) Centrolecithal egg - eg: Cockroach
 - d) Cleidoic egg - eg: Hen
 - e) Non –Cleidoic egg - eg: Frog

REFERENCE BOOKS

1. Arumugam,N., (2008). *A Text book of cell biology*. Kottar: Saras Publications.
2. Arumugam, N., (2004). *Molecular Biology and Genetic Engineerin*. Kottar: Saras Publication.
3. Rastogi, S.C., (1990). *Cell biology*. New Delhi: Tata Mc Graw Hill Publishing Company Ltd.
4. Debnath, M., (2008). *Molecular Cell Biology*. India: Pointer Publishers.
5. De Robertis and De Robertis., (2004). *Cell and Molecular Biology*. Philadelphia: Reprint WB Saunders Co.
6. Verma, P.S. and Agarwal, V.K., (2000). *Chordate Embryology*. New Delhi: S.Chand & Co.
7. Arumugam, N., (2008). *Text Book of Embryology*. Kottar: Saras Publication.

8. Balinsky., (1981). *An Introduction to Embryology*. Philadelphia: W.B. Saunders Company.
9. Berill, N.J., (1986). *Developmental Biology*. New Delhi: MC Graw Hill.
10. Patten, B.M., (1958). *Foundations of Embryology*. New York: Mc Graw Hill.
11. Saunder.J.W., (1982). *Developmental Biology*. New York: Patterns and Principles, Macmillan.
12. Browder, L.W., Erickson, C.A., and Williams., (1992). *Developmental Biology*. London: R.J.Saunders College Publications.

Course Code 20UZYC41P	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	H	M	M	L	L	H	H	L	H	M
CO2	H	H	M	L	M	H	H	M	H	M
CO3	H	M	M	M	M	H	H	M	H	M
CO4	M	M	M	M	M	M	M	M	H	M
CO5	H	H	M	H	L	M	H	H	H	M

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2022 -2023 onwards)

Semester III/IV	CORE PRACTICAL II CELL AND MOLECULAR BIOLOGY AND DEVELOPMENTAL BIOLOGY	Hours/Week: 2	
Core Course-3		Credits: 2	
Course Code 20UZYC41PN		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: apply the basic principles for the handling of equipments. [K3]
- CO2: identify the practical applications of methods in cell and molecular biology and developmental biology. [K3]
- CO3: make use of their theoretical knowledge and practical skills in completing their projects. [K3]
- CO4: compare the functional significance of different types of cells. [K4]
- CO5: evaluate the effectiveness of novel scientific techniques with that of conventional ones. [K5]

CELL AND MOLECULAR BIOLOGY

1. Microscopy – Stereomicroscope and Trinocular microscope (Demonstration)
2. Mounting – Buccal epithelium.
3. Mitosis in onion root tip.
4. Preparation of human blood smear and identification of blood cells.
5. Observation of Frog blood smear (Slide)
6. Histochemical Staining methods:-
 - Proteins – Pea seeds (Mercuric Bromophenol Blue method)
 - Lipids – Coconut (Sudan Black B method), Starch grains –Potato.
7. Isolation of genomic DNA from Liver/Spleen of Goat or Chick.
8. Confirmation of genomic DNA using Agarose gel electrophoresis
9. Charts
 - Charts on Mitochondria and Lampbrush Chromosome.
 - Structure –DNA and RNA (mRNA and tRNA)

10. Observation of Slides

- Prokaryotic Cell (*E.coli*)
- Eukaryotic Cell (Plant and animal cell)
- Muscle cell (Striated, Unstriated and Smooth muscles)
- Stem cells (Diagram only)

11. Equipment (Demonstration)- Principle and Applications of Microcentrifuge

DEVELOPMENTAL BIOLOGY

1. Observation of Courtship behavior in ornamental fishes.
2. Identification of developmental stages in fishes.
3. Observation of Sperm motility in Bull.
4. Slides on the Observation of mammalian egg and sperm.
5. T.S. of mammalian testis and ovary showing maturation Stages.
6. Placenta of Sheep and man.
7. Early developmental stages of frog – cleavage, Blastula and Gastrula.
8. Mounting of different stages of chick blastoderm (24 hrs, 48hrs, 72 hrs and 96 hrs).
9. Collection of eggs of different birds (any2)
10. Observation of Regeneration in Lizard (Virtual Video)
11. Observation of metamorphosis in frog (Virtual Video).
12. Types of eggs (Pictures)
 - a) Microlecithal egg - eg: Amphioxus
 - b) Megalecithal egg - eg: Hen
 - c) Centrolecithal egg - eg: Cockroach
 - d) Cleidoic egg - eg: Hen
 - e) Non –Cleidoic egg - eg: Frog

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1. Arumugam, N., (2008). *A Text book of cell biology*. Kottar: Saras Publications.
2. Arumugam, N., (2004). *Molecular Biology and Genetic Engineerin*. Kottar: Saras Publication.
3. Rastogi, S.C., (1990). *Cell biology*. New Delhi: Tata Mc Graw Hill Publishing Company Ltd.
4. Debnath, M., (2008). *Molecular Cell Biology*. India: Pointer Publishers.
5. De Robertis and De Robertis., (2004). *Cell and Molecular Biology*. Philadelphia: Reprint WB Saunders Co.

6. Verma, P.S. and Agarwal, V.K., (2000). *Chordate Embryology*. New Delhi: S.Chand & Co.
7. Arumugam, N., (2008). *Text Book of Embryology*. Kottar: Saras Publication.
8. Balinsky., (1981). *An Introduction to Embryology*. Philadelphia: W.B. Saunders Company.
9. Berill, N.J., (1986). *Developmental Biology*. New Delhi: MC Graw Hill.
10. Patten, B.M., (1958). *Foundations of Embryology*. New York: Mc Graw Hill.
11. Saunder.J.W., (1982). *Developmental Biology*. New York: Patterns and Principles, Macmillan.
12. Browder, L.W., Erickson, C.A., and Williams., (1992). *Developmental Biology*. London: R.J.Saunders College Publications.

Course Code 20UZYC41PN	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	H	M	M	L	L	H	H	L	H	M
CO2	H	H	M	L	M	H	H	M	H	M
CO3	H	M	M	M	M	H	H	M	H	M
CO4	M	M	M	M	M	M	M	M	H	M
CO5	H	H	M	H	L	M	H	H	H	M

Dr. J. Rani
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VIRUDHUNAGAR - 626 001

ALLIED BOTANY

(2020 -2021 onwards)

Semester III	PLANT ECOLOGY AND PLANT PHYSIOLOGY	Hours/Week: 4	
Allied Course		Credits: 4	
Course Code 20UBTA31		Internal 25	External 75

COURSE OUTCOMES

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

CO1: find the relationship between the plants with the environment. [K1]

CO2: compare the adaptations of plant groups in response to the environment. [K2]

CO3: interpret the structural and functional aspects of plant tissue system in relation to water. [K2]

CO4: identify aerobic and anaerobic respiration in higher plants and solve natural growth Hormonal issues in plants. [K3]

CO5: distinguish plant response and movements with the environment. [K4]

PLANT ECOLOGY

UNIT I

Historical account, Concepts and Principles of Ecology. Biotic and abiotic components. Ecosystems – Structure, components and functions and pond ecosystem. Energy and its flow in ecosystem, food chain, food web and ecological pyramids. Components and Functions of Soil. Biogeochemical cycles – water cycle, nitrogen cycle, carbon cycle and phosphorus cycle.

(12 Hours)

UNIT II

Plant adaptations – Ecological classification of plants: morphological, anatomical and physiological adaptations of hydrophytes, xerophytes and halophytes. Methods of studying vegetation: quadrat and transect methods – Line and Belt.

(12 Hours)

PLANT PHYSIOLOGY

UNIT III

Plant water relation - Absorption of water - mechanism of active and passive absorption of water. Ascent of sap – path and mechanism - Dixon's cohesion theory. Photosynthesis – photosynthetic apparatus, pigments and units. Mechanism of photosynthesis – light reaction: cyclic and non- cyclic photo phosphorylation and dark reaction: calvin Cycle.

(12 Hours)

UNIT IV

Respiration – Aerobic and anaerobic respiration, respiratory substrates, respiratory apparatus, mechanism of respiration - glycolysis, kreb's cycle and electron transport chain, factors affecting respiration. Physiological role of natural growth hormones in plants: auxins, gibberellins and cytokinins.

(12 Hours)

UNIT V

Physiology of flowering – photoperiodism- long day, short day, day neutral plant. Phytohormone, concept of florigen. Vernalization and its significance. Physiology of seed germination - water uptake, respiration and mobilization and reserve materials. Dormancy and methods to overcome seed dormancy. Plant movements – tropic movements – geotropic, phototropic and hydrotropic, Nastic – seismonastic.

(12 Hours)

TEXT BOOKS

1. Shukla, R.S. and Chandel, P.S. (2007). *Plant Ecology and Soil Science*, New Delhi: S. Chand & Company Ltd.
2. Kochhar P. L. (1981). *A Text Book of Plant Physiology*, Delhi, Lucknow: Atmaram and Sons.

REFERENCE BOOKS

1. Bidwell, R.G.S. (1979). *Plant Physiology*, London: Collier MacMillan Publishers, 2nd Edition.
2. Salisbury, F.B. & Ross C.W. (2004). *Plant Physiology*, New Delhi: CBS Publishers & Distributors.

Course Code 20UBTA31	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	M	M	L	L	-
CO2	H	M	M	M	L	L	-
CO3	H	M	M	M	L	L	-
CO4	H	M	M	M	L	L	-
CO5	H	M	M	M	M	L	-

Dr.B. Karunai Selvi
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VIRUDHUNAGAR - 626 001

ALLIED BOTANY

(2020 -2021 onwards)

Semester IV	APPLIED BOTANY	Hours/Week: 4	
Allied Course		Credits: 4	
Course Code 20UBTA41		Internal 25	External 75

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: find the applied areas of Botany. [K1]

CO2; learnt skills related to laboratory as well as industries based work. [K2]

CO3: explain the applications of plants in various industries and how to become an entrepreneur. [K2]

CO4: solve the issues related to the applied areas of Botany. [K3]

CO5: analyze the applied potential areas/branches of Botany. [K4]

APPLIED BOTANY

UNIT I

Plant tissue culture: History of plant tissue culture, biosafety guidelines and regulations,

Good Laboratory Practices in plant tissue culture: Basic Requirements - Equipments, Media:

MS medium composition and preparation and Maintenance of aseptic condition, General

Techniques: tissue culture protocol, cellular totipotency, Types of culture of plant materials – shoot culture, meristem and anther cultures, applications of plant tissue culture. (12 Hours)

UNIT II

Mushroom cultivation : Historical background, nutritional value, morphology and reproduction of mushroom, cultivation methods: Pure culture, spawn preparation, preparation of compost, and spawning, cultivation of oyster mushroom and button mushroom, post harvesting techniques of mushrooms: Long term and short term storage methods, recipes of edible mushrooms and importance of mushrooms. Keys to differentiate edible from poisonous mushrooms. (12 Hours)

UNIT III**Biofertilizers**

Introduction, Isolation, Identification, mass cultivation and production of biofertilizers: Bacterial inoculants – *Rhizobium*, Cyanobacterial inoculants – *Anabaena*, Fungal inoculants - AM fungi, methods of seed inoculation. Field applications of biofertilizers and advantages of biofertilizers. Good laboratory practices in biofertilizer technology. Intellectual Property Right (IPR) - forms of protections and patenting of Biological materials. (12 Hours)

UNIT IV**Composting and Bioenergy**

Composting methods: backyard, indoor and bangalore method of composting, benefits of composting, biodiesel production from algal source (*Chlorella* and *Ulva lactuca*). Biogas: characteristics features of biogas, production of biogas (Indian biogas plant), biogas form different feedstocks, factors affecting methane formation and uses of biogas. (12 Hours)

UNIT V**Horticulture**

Introduction, tools of horticulture techniques, methods of vegetative propagation – cuttage – stem and leaf, layerage – simple, compound and air layering, graftage – whip and cleft. Indoor gardening - Hanging pots, Planning and layout of kitchen garden and orchards. (12 Hours)

TEXT BOOKS

1. Dubey, R. C. (2006). *A Text book of Biotechnology*, New Delhi: S. Chand & company Ltd.,
2. Albert, F. Hill. (1974). Rao, K.M. *Text Book of Horticulture*, New Delhi: Mac Millan India Ltd.

REFERENCE BOOKS

1. Gupta, P.K.(1994). *Elements of Biotechnology*, Meerut: Rastogi & company.
2. Suman, B.C. and Sharma, V.P. (2005). *Mushroom Cultivation and uses*, Jodhpur: Agrobios (India)
3. Kumar, N. (1999). *Introduction to Horticulture*, Nagercoil: Rajalakshmi Publications.

Course Code 20UBTA41	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	M	M	L	L	L
CO2	H	M	M	M	L	L	L
CO3	H	M	M	M	L	L	L
CO4	H	M	M	M	L	L	L
CO5	H	M	M	M	M	L	L

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ALLIED BOTANY

(2020 -2021 onwards)

Semester IV	PLANT ECOLOGY, PLANT PHYSIOLOGY AND APPLIED BOTANY	Hours/Week: 2	
Allied Practical		Credits: 2	
Course Code 20UBTA41P		Internal 40	External 60

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: apply the basic concepts learn in Botany for the identification of Plant Physiology experiments. [K3]

CO2: identify and dissect the ecologically important plant materials and draw the anatomical features. [K3]

CO3: identify, draw the diagrams and comment on the applied botany specimens.[K3]

CO4: infer about the Horticulture technique and completion the record work. [K3]

CO5: analyze and categorize the horticulture techniques and in the related areas. [K4]

- Anatomical studies - T.S of plant materials of ecological importance [*Hydrilla* stem and *Nerium* leaf]
- Plant physiology Experiments – Mohl’s half leaf experiment, Ganong’s Light screen experiment and Ganong’s respirometer
- Soil Analysis – Qualitative Analysis of N, P and K
- Spotters from Applied Botany – Callus, Oyster and Button Mushroom, T.S. of *Agaricus* Slide, *Azolla*, Biogas Plant and Horticultural Tools
- Oyster and Button mushroom – spawn preparation
- Biofertilizer preparation.
- Demonstration of techniques of Horticulture - Whip and cleft grafting demonstration
- Field visits can be arranged for applied botany programme

Course Code 20UBTA41P	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	H	M	L	L	L
CO2	H	M	H	M	L	L	L
CO3	H	M	H	M	L	L	L
CO4	H	M	H	M	L	L	L
CO5	H	M	H	M	L	L	L

Dr.B. Karunai Selvi
Head of the Department

Dr.B. Karunai Selvi
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VIRUDHUNAGAR - 626 001

Semester IV	Internship / Field Project (2020 -21 onwards)	Hours/Week: 0
PART IV		Credit: 1
Course Code 20UZYI41G		Internal 100

COURSE OUTCOMES

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

- CO1: relate their theoretical insights with hands-on experience. [K3]
- 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]

GENERAL INSTRUCTIONS:

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

Course Code 20UZYI41G	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	M	M	M	H	-
CO2	H	M	M	M	M	H	
CO3	H	M	-	-	-	H	
CO4	H	H	M	M	-	M	H
CO5	H	M	H	H	M	-	

Dr.J.Rani

Head of the Department



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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY
(2020 -2021 onwards)

Semester V	BIOCHEMISTRY	Hours/Week: 4	
Core Course- 7		Credits: 4	
Course Code 20UZYC51		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic concepts of Biochemistry. [K1]

CO2: describe the chemistry and biological importance of nutrients. [K2]

CO3: apply the molecular techniques to gain knowledge on the biochemical processes.
[K3]

CO4: analyze various metabolic pathways and metabolic disorders in organisms. [K4]

CO5: recommend the appropriate techniques for studying biomolecules. [K5]

UNIT I

Introduction: Scope of Biochemistry, pH- Definition and importance of pH, Buffer- Definition and Importance. **Enzymes:** Classification, Mechanism of Enzyme action, Factors affecting enzyme action. **Vitamins:** Classification and biological significance of Fat soluble and Water soluble vitamins. (12 Hours)

UNIT II

Carbohydrate: Classification, Structure of Monosaccharide (Glucose), Disaccharide (Sucrose), Polysaccharide (Starch) and biological significance. Metabolism – Glycolysis, Citric acid cycle and Glycogenesis. Metabolic disorder-Diabetes mellitus. (12 Hours)

UNIT III

Protein: Classification, Structure and Biological significance. Metabolism- Transamination, Deamination, Transmethylation and Decarboxylation. Inborn errors of metabolism – Phenylketonuria and Alkaptonuria. Metabolic disorder –MSUD (Maple syrup urine disease). (12 Hours)

UNIT IV

Lipid: Classification, Structure of Cholesterol and Biological significance. Salient features of steroids and steroid hormones. Metabolism- β - Oxidation of fatty acids, Metabolic disorder - Hypercholesterolemia. (12 Hours)

UNIT V

Principle, working mechanism and applications: Colorimeter, pH meter, Spectrophotometer, Flame Photometer, TLC and Column Chromatography. (12 Hours)

TEXT BOOK

1. Fatima, D., Meyyan Pillai R.P., Prasannakumar, S., Narayanan, L.M., Nallasingam, K., and Arumugam, N. (2019). *Biochemistry*. 19th Edition. Saras Publication, Nagercoil.

REFERENCE BOOKS

1. Lehninger, AL, (2001). *Principles of Biochemistry*. Nelson & CO Publishers and Distributors. Delhi.
2. Ambika Shanmugam N, (2007). *Biochemistry*. Williams & Wilkins, Chennai.

Website references

1. http://en.wikipedia.org/wiki/Maple_syrup_urine_disease
2. http://en.wikipedia.org/wiki/Inborn-error_of_metabolism
3. http://www.khanacademy.org/pHand_buffer
4. http://chem.libretexts.org/Bookshelves/Introductory_chemistry/Book

Course Code 20UZYC51	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	H	M	M	H	H	H	M	L	H	H
CO2	H	H	M	M	H	H	M	L	L	H
CO3	H	M	H	M	M	H	L	M	L	H
CO4	H	L	M	M	L	H	M	M	M	M
CO5	H	M	M	L	M	H	L	H	M	M

Dr. J. Rani
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Dr. P. Vijaya
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B.Sc. ZOOLOGY
(2020 -2021 onwards)

Semester V	ANIMAL PHYSIOLOGY	Hours/Week: 4	
Core Course-8		Credits: 4	
Course Code 20UZYC52		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: apply their knowledge to find out the various diseases in our body. [K3]

CO4: analyze the causes for various diseases and disorders in man. [K4]

CO5: recommend the methods of diagnosis and treatment. [K5]

UNIT I

Digestion -Structure of human alimentary canal, Digestion and absorption of carbohydrates, proteins and lipids. Role of enzymes in digestion. Hormonal control of digestion.

Respiration –Definition, Types, Respiratory pigments, Mechanism of Respiration in man. Transport of Gases – Oxygen, Carbon dioxide, Chloride shift and Respiratory quotient.

(12 Hours)

UNIT II

Circulation – Blood-composition and functions, Mechanism of clotting- Enzyme cascade theory and Best and Taylor's theory. Structure of human heart, Typical pattern of circulation, Cardiac cycle, Pulse and blood pressure. **Muscles**-Types, Ultra structure of striated muscle, Muscle contraction- Types and Theories.

(12 Hours)

UNIT III

Nerve Physiology Neurons – types, structure, Impulse propagation, synaptic transmission, and neuro transmitters. Reflex action. **Sense Organs**- types- Structure and functions of human eye and ear. Gustatory- Taste buds in man.

(12 Hours)

UNIT IV

Endocrine glands- Structure and functions of Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhans. **Reproduction-** Male and Female reproductive system and Hormonal control in female reproductive cycle. (12 Hours)

UNIT V

Diseases - Peptic Ulcer Disease (PUD), Asthma, Cardiac arrest, Myopia, Tinnitus, Epilepsy, Fatigue and Polycystic Ovary Disease (PCOD). **Diagnosis-** Applications of Endoscope, Oximeter, ECG, Glucometer, CT and MRI scanning. (12 Hours)

TEXT BOOK

1. Arumugam, N. & Mariyakuttikan, A. (2019). *Animal Physiology*. Nagarcoil: Saras Publication.

REFERENCE BOOKS

1. William, H.S. (2004). *General and Comparative Physiology*. New Delhi: Prentice Hall of Indian Pvt. Ltd.
2. Verma, P.S. Tyagi, B.S. & Agarwal, V.K. (1994). *Animal Physiology*. New Delhi: S.Chand & Company Ltd.
3. Nagabhusanam, R., Kodarkar, M.S., Sarojini, R. (1983). *Animal Physiology*. New Delhi, Bombay and Calcutta: Oxford and IBH Publishing Co.

Course Code 20UZYC52	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	M	M	L	L	L	L	H
CO2	H	H	H	L	M	L	L	L	L	H
CO3	H	H	H	L	L	L	L	L	M	H
CO4	H	H	H	L	L	L	M	L	M	H
CO5	H	H	H	L	L	H	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester V	GENETICS AND BIOSTATISTICS	Hours/Week: 4	
Core Course-9		Credits: 4	
Course Code 20UZYC53		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic concepts of genetics and biostatistics. [K1]

CO2: explain the scope of genetics and biostatistics in the field of research. [K2]

CO3: apply their knowledge to analyze the data in genetics using statistical methods. [K3]

CO4: analyze the causes of genetic diseases using statistics. [K4]

CO5: assess the prevalence of genetic disorders using statistical analysis and to minimize the risk. [K5]

UNIT I

Mendelian Inheritance: Introduction-Contribution made by Har Gobind Khorana and M.W.Nirenberg in Genetics. Mendelian Principle: Mendel and his experiments, laws of inheritance: Monohybrid and Dihybrid cross in pea plants, back cross and test cross. Simple problems relating to Mendel's Laws. Epistasis –types and Biochemical basis of epistasis, multiple alleles – ABO Blood group and Rh factor in human beings – Multiple genes – Skin colour in man, Problems on Multiple alleles. (12 Hours)

UNIT II

Linkage and Crossing over: Linkage: Introduction, types of Linkage, arrangement of genes, Coupling and repulsion, linkage groups, theories and factors affecting linkage. Crossing over - mechanism, salient features - Theories, factors affecting crossing over, tetrad analysis and significance of crossing over. (12 Hours)

UNIT III

Sex determination and chromosomal variation: Sex determination in man- Chromosomes, barr body and hormones. Genic balance theory of Bridges in *Drosophila*, Environmental determination of sex and Free martin. Extra Chromosomal Inheritance: Kappa particles in *Paramecium*. Sex linked inheritance –Colour blindness and Haemophilia in man. Chromosomal disorders in man Allosomal (Klinefelter's syndrome and Turner's syndrome) and Autosomal (Down syndrome) disorder. Eugenics, Euthenics and Genetic Counseling.

(12 Hours)

UNIT IV

Data collection and measures of central tendency and dispersion: Collection of data – Primary and Secondary data, Classification and Tabulation of Data, Diagrammatic and Graphic representations of Data. Measures of central tendency - brief account on Mean, Median and Mode. Measures of dispersion - Standard deviation, Standard error and variance.

(12 Hours)

UNIT V**Statistical analysis:**

Probability –Addition Theorem and Multiplication theorem- Simple Problems. Chi-square test, Correlation - Types and Co-efficient, Rank correlation and Students t-test- Paired and unpaired.

(12 Hours)

TEXT BOOKS

1. Meyyan, R.P., (2011). *Genetics*. Nagarcoil: Saras Publications.
2. Arumugam, N., (2005). *Biostatistics and Computer Application*. Nagarcoil: Saras Publications.

REFERENCE BOOKS

1. Sambamurthy AVSS. (2012) *Genetics*. Narosa Publishing House, New Delhi, India.
2. Meyyan, R.P., (2011). *Genetics*. Nagarcoil: Saras Publications.
3. Verma, P.S., & Agarwal, V.K., (2005). *Genetics*. New Delhi: S.Chand & Co.
4. Arora, M.P., & Sandhu, G.S., (2000). *Genetics*. Mumbai: Himalaya Publishing House.
5. Arumugam, N., (2004) *Molecular Biology and Genetic Engineering*. Nagarcoil: Saras Publications.
6. Gupta, S.P., (2006). *Statistical Methods*. New Delhi: Sulthan chand and Sins Educational Publishers.
7. Khan, S.,& Khanum, A., (2004). *Fundamental of Biostatistics*. Hyderabad: Ukaas Publishers.

Course Code 20UZYC53	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	H	H	H	M	H	H	H	L	L
CO2	H	H	H	M	H	H	M	L	L	M
CO3	H	H	H	H	H	H	L	M	M	M
CO4	H	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	H	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (2020 -2021 onwards)

Semester V	IMMUNOLOGY	Hours/Week: 4	
DSE Course:1		Credits: 4	
Course Code 20UZYE51		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Define the essential immunological principles and concepts. [K1]

CO2: explain the fundamental concepts of immunity and role of immune cells and organs involved in immunological process at a cellular and molecular level. [K2]

CO3: identify the roles of the immune system in both maintaining health and contributing to disease. [K3]

CO4: analyze how cell mediated and antibody mediated immunity work to protect a host from pathogenic organisms and harmful substances. [K4]

CO5: appraise a comprehensive and practical understanding of basic immunological principles involved in research and clinical/applied science. [K5]

UNIT I

Introduction, Contribution of Edward Jenner and Louis Pasteur in the field of Immunology, types of Immunity: Innate and acquired immunity. Innate immunity – Acquired immunity – Active and Passive immunity. Lymphoid organs: Primary Lymphoid organs –Thymus and Bone marrow in mammals, Secondary Lymphoid organs- Lymph nodes and spleen. Immune cells: Lymphocytes- T cells and B cells-Types. (12 Hours)

UNIT II

Antigens- Structure,Types,and functions . Antibodies (immunoglobulins)- Structure, Types and functions. Immune response – Types: Humoral Immune Response (Antibody Mediated Immune Response)-mechanism, types and functions, Cell mediated immune response – mechanism and functions. Antigen-Antibody reactions- Salient features, Detection of Antigen and Antibody reaction – Precipitation and Agglutination. (12 Hours)

UNIT III

Major histocompatibility complex (MHC)- Structure of Class I, Class II MHC molecule and HLA. Hypersensitivity: Types – Based on the time taken for reactions and different mechanisms of pathogenesis- Type I (Anaphylaxis) ,Type II – Isoimmune reaction- Erythroblastosis foetalis, Autoimmune reactions- Haemolytic anaemia and Myasthenia gravis, Type III- Arthus reaction, Type IV-Mantoux reaction , Type V- Thyrotoxicosis or Grave's disease. (12 Hours)

UNIT IV

Vaccines – Importance and Types of vaccines- Attenuated, Inactivated vaccines and Recombinant Vaccine. Transplantation Immunology- Types of graft, Graft acceptance and rejection, Host versus graft rejection, Graft versus host reaction and Prevention of graft rejection Immuno deficiency diseases-AIDS. (12 Hours)

UNIT V

Immunological techniques – Principle and applications- Radial immune diffusion, Ouchterlony double diffusion, Immunoblotting, Immunoelectrophoresis, ELISA and Radioimmunoassay (RIA). (12 Hours)

TEXT BOOK

1. Fatima, D. & Arumugam, N. (2014). *Immunology*. Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Rao, C.V., (2006). *Immunology*. New Delhi: Narosa Publishing House.
2. Donald, M.W. & Stewart. J., (1993). *Immunology*. Singapore: London Singapore Publishers.
3. Kannan, I., (2007). *Immunology*. Chennai: MJP Publishers.
4. Roitt, I.M., (2000). *Essential Immunology*. London: Blackwell Scientific Publishers.

Course Code 20UZYE51	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	H	H	H	M	H	H	H	L	L
CO2	H	H	H	M	H	H	M	L	L	M
CO3	H	M	M	H	H	H	L	M	M	M
CO4	H	M	M	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester V	ENVIRONMENTAL BIOTECHNOLOGY	Hours/Week: 4	
DSE Course: 1		Credits: 4	
Course Code 20UZYE52		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the basic concepts in environmental biotechnology. [K1]

CO2: explain the scope of environmental biotechnology. [K2]

CO3: apply the methods to improve the quality of environment. [K3]

CO4: analyze the factors that contaminate various ecosystems. [K4]

CO5: assess the impacts of recent methods in controlling pollution. [K5]

UNIT I

Environment – Introduction, Environmental pollutants - Chemical, Physical and Biological.

Criteria for pollution monitoring – Visual rating, Genotoxicity rating and metabolic rating.

Role of biotechnology in Pollution control and Environmental monitoring, Bioassays- Role of

Algae and Fishes. Biosensors and DNA probes. Environmental Impact Assessment - Methods

to detect pollutants.

(12 Hours)

UNIT II

Biological Waste Treatment- Introduction, Sewage treatment- Primary, Secondary and

Tertiary. Reuse of sewage and wastes as raw materials. Conversion of wastes into useful

product- Biogas. Compost making – Indore method and Bangalore method and

Vermicomposting.

(12Hours)

UNIT III

Biological monitoring of hazardous wastes- Biodegradation of Xenobiotics- Hydrocarbons,

Pesticides and PCB and Significance. Biodegrading agent- Super bug- Construction and

applications. Modification and strain development using Bacteria. Treatment of toxic

pollutants. Bioremediation- Methods. Phytoremediation.

(12 Hours)

UNIT IV

Biomining- Introduction, Bioleaching- Microorganisms involving in bioleaching. Methods- Direct, indirect leaching, Heaps and *In situ* methods. Bioreactors. Advantages of Biomining. Removal of metals from water and Microbial Enhancement of Oil Recovery (MEOR).

(12 Hours)

UNIT V

Bioproducts for environmental health: Biofuels –Bioethanol and Biobutanol- Production and uses. Biodiesel- properties, manufacture and uses. Biogas and Biohydrogen - Production and uses.

(12 Hours)

TEXT BOOK

1. Kumaresan , V., (2015). *Text book of Biotechnology*. Nagercoil and Kottar: Saras Publication.

REFERENCE BOOKS

1. Kumar, H.D., (1999). *Biodiversity and Sustainable Conservation*. New Delhi: Oxford and IBH Publication Co. Pvt. Ltd.
2. Kumaresan, N., (2005). *Biotechnology*. Nagercoil: Saras Publications.
3. Dubey, R.C., (2006). *A Text Book of Biotechnology*. New Delhi: S.Chand & Company Ltd.
4. Yadav Rajiv Tyagi, P. R., (2006). *Environmental Biotechnology*. New Delhi: Discovery Publishing House.
5. Satyanrayana, U., (2010). *Biotechnology*. Calcutta: Books and Allied Private Ltd.
6. Singh, S., (2012). *Applied Biotechnology*. Jaipur: RBSA Publishers.

Course Code 20UZYE52	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	H	H	H	H	H	H	H	L	L
CO2	H	H	H	H	H	H	M	L	L	H
CO3	H	H	M	H	H	H	L	L	M	H
CO4	H	H	H	H	H	H	M	L	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester V	AGRICULTURAL MICROBIOLOGY	Hours/Week: 4	
DSE Course:1		Credits: 4	
Course Code		Internal	External
20UZYE53		25	75

COURSE OUTCOMES

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

CO1: Relate the relationship between the plant and microorganisms with Soil factors. [K1]

CO2: Explain the biofertilizer preparation process. [K2]

CO3: Identify the importance of microbial inoculants. [K3]

CO4: Analyze the importance and application of biofertilizers. [K4]

CO5: Interpret the importance biofertilizers preparation technique. [K5]

UNIT I

Soil :Edaphic factors , Composition of soil, Effect of edaphic factors on plants.Soil microflora- Bacteria, fungi, Actinomycetes, Algae, Phosphate solubilizing bacteria and Plant Growth Promoting Bacteria.Rhizosphere and non rhizosphere concept.Role of Rhizosphere microorganisms in soil fertility.Interrelationship between plants and microorganisms.

(12 Hours)

UNIT II

Nitrogen fixation:Nitrogen cycle,Biological Nitrogen fixation-Symbiotic Nitrogen fixation and Mechanism of Nitrogen fixation. Bacterial inoculants – *Rhizobium* and *Azotobacter*- Characteristics of *Rhizobium* and *Azotobacter*, Isolation, Identification, mass cultivation and carrier based inoculants preparation, quality control for bacterial inoculants, methods of seed inoculation, field applications of bacterial inoculants - *Rhizobium* and *Azotobacter*.Advantages and disadvantages of using biofertilizers.

(12 Hours)

UNIT III

Bacterial inoculants – *Azospirillum*, Characteristics of *Azospirillum*, Isolation, mass cultivation and carrier based inoculants preparation, methods of seed inoculation and field applications of biofertilizers. Cyanobacterial inoculants, Mass production of Cyanobacterial

inoculants. Blue green algae - *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth. (12 Hours)

UNIT IV

Phosphorus cycle, Phosphate solubilizing Microorganisms - Isolation, Identification, mass cultivation and carrier based inoculants preparation, methods of seed inoculation and field applications of biofertilizers. Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth, yield and colonization of AM. Fungal Inoculants – AM fungi – isolation, identification, mass cultivation and Inoculum preparation of AM fungi, and its influence on growth and yield of crop plants.

(12 Hours)

UNIT V

Basic requirements – soil manures, organic manures, inorganic fertilizers and biofertilizers. Organic farming- Need, advantages and benefits of organic farming and green manuring. Recycling of biodegradable municipal, agricultural and industrial wastes- Biocompost making methods – Indoor method, Bangalore method and trench method, Vermicomposting types and method of and field application. (12 Hours)

TEXT BOOKS

1. Dubey, R. C. ,(2006). *A Text book of Biotechnology*. New Delhi: S. Chand and Company Ltd.
2. John JothiPrakash, E., (2004) .*Outlines of Plant Biotechnology*. New Delhi: Emkay Publication.

REFERENCE BOOKS

1. Gupta, P.K., (1994). *Elements of Biotechnology*. Meerut: Rastogi Publications.
2. SubhaRao, N.S., (2000). *Soil Microbiology*. New Delhi: Oxford & IBH Publishers

Course Code 20UZYE53	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	M	M	L	L	L	L	M
CO2	H	H	H	M	M	M	M	L	L	M
CO3	H	H	M	H	H	H	L	L	M	H
CO4	H	H	H	H	H	H	M	L	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester V	PROJECT	Hours/Week: 0	
Core Course: 10		Credits: 1	
Course Code 20UZYC5PR		Internal	External 100

COURSE OUTCOMES

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

CO1: apply the learned concepts to select projects in Zoology and related

interdisciplinary fields. [K3]

CO2: apply the theoretical knowledge to design experimental set up for their projects. [K3]

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. [K4]

CO5: plan to meet out the challenges in regional and state level to solve the existing

problems. [K5]

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 20UZYC5PR	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	M
CO3	H	H	H	H	H	H	H	M	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester V	SERICULTURE	Hours/Week: 2	
SEC -4		Credits: 2	
Course Code		Internal	External
20UZYS51		40	60

COURSE OUTCOME

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

CO1: define the basic science in culture of silkworms. [K1]

CO2: explain the methods involved in sericulture industry. [K2]

CO3: apply their knowledge to set up a sericulture unit to promote self employment opportunity. [K3]

CO4: identify and solve the problems encountered in sericulture unit. [K3]

CO5: get support from various funding agencies to promote entrepreneurship. [K4]

UNIT I

Sericulture – History and Scope. Four species of silkworm -*Bombyx mori*, *Antheraea paphia*, *Attacus ricini* and *Antheraea assama*, Morphology, digestive system and life cycle of *Bombyx mori*. (6 Hours)

UNIT II

Moriculture –Introduction, Propagation methods- Stem cutting, Root grafting, Simple layering (a brief account only). Management techniques-Pruning and Mulching. Harvesting methods – Leaf picking and Branch cutting. Preservation of leaves. Nutritional and medicinal uses of mulberry plant. (6 Hours)

UNIT III

Silkworm Rearing– Rearing Appliances, Rearing methods - Disinfection, hatching of Egg card, Brushing, Feeding, Mounting, Bed cleaning, Harvesting and Reeling. Silk Reeling – Methods of reeling operation. A brief account on Reeling end formation, Twisting, drying, reeling, re-reeling and finishing. (6 Hours)

UNIT IV

Diseases of silkworm: Protozoan disease – Pebrine, bacterial disease – Flacherie, Viral disease – Grasserie, Fungal disease – Muscardine, Pest of Silkworm – Uzifyly. (6 Hours)

UNIT V

Byproducts of sericulture, Types of silk and its Economic importance. Funding agencies - Central Silk Board (CSB) and The Central Silk Technology Research Institute (CSTRI). (6 Hours)

TEXT BOOK

1. Ganga, G. and Sulochana Chetty, J. (2006). *An Introduction to sericulture*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

REFERENCE BOOKS

1. Ganga, G., & Sulochana Chetty, J., (1998). *An Introduction to Sericulture*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
2. Arumugam, N., (2010). *A Text Book of invertebrates*. Nagarkoel: Saras Publication.
3. John M and Kesary M (2019). *Sericulture*, Nagarkoel: Saras Publication.

WEBSITE REFERENCES

1. https://www.business-standard.com/article/government-press-release/schemes-implemented-by-the-government-to-promote-the-sericulture-sector-117031600651_1.html.

Course Code 20UZYS51	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	H	H	H	H	M	M	M
CO2	H	H	H	H	H	H	H	M	H	H
CO3	H	H	H	H	H	H	H	M	M	H
CO4	H	H	H	H	H	H	H	M	H	H
CO5	H	H	H	H	H	H	H	H	H	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester V	FUNDAMENTALS OF COMPUTER	Hours/Week: 2	
SEC:5		Credits: 2	
Course Code 20UZYS52		Internal 40	External 60

COURSE OUTCOMES

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

CO1: understand the basic concepts, components and applications of a computer. [K1]

CO2: explain the various operating methods in computer. [K2]

CO3: describe the importance of Computer in day to day life. [K2]

CO4: apply their knowledge and skills to get employment in various fields. [K3]

CO5: analyze the applications of computer in the field of research. [K4]

UNIT I

Knowing Computer: Computer–Introduction–Block diagram. Basic Applications, Characteristic and Generation of Computer, Components of Computer System, Computer Memory- RAM & ROM; Storage devices- Hard Drive, CD , USB Flash Drive and Memory Card. Concepts of Hardware and Software. Operating Systems-Mouse operation and Keyboard operation – Short- cut keys. (6 Hours)

UNIT II

MS Office: MS Word - Parts of word window, Opening and saving of documents – Creation and Formatting of Text and Table. MS – Excel-Spread sheet – features, advantages of electric spread sheet-Data entry, Preparation of graphs & Calculation of mean, Median, Mode & Standard deviation. MS Power Point -Parts of Power Pointwindow, Preparation of power point presentation and its uses in various fields. (7 Hours)

UNIT III

Introduction to Internet: Introduction, Basic of Computer networks- LAN and WAN. Concept & Applications of Internet- World Wide Web (WWW), Web Browsing software, Understanding URL, Domain name, Internet Protocol Address and e-governance website. Internet usage in Medical transcription. (6 Hours)

UNITIV

Communications and Collaboration With computer: Basics of electronic mail- Creation of an email account, Sending and receiving emails, Accessing sent emails. Document collaboration tools, Instant Messaging Technology and Netiquettes. (5 Hours)

UNIT V

Role of Computer in Biology: Bioinformatics: Origin of bioinformatics, Biological databases- objectives, properties, classification and types – generalized and specialized, DNA, RNA and protein databases, applications of Bioinformatics. (6 Hours)

TEXT BOOK

1. Arumugam, N., (2007). *Computer applications and Information technology*.Nagarcoil: Saras Publications.
2. Jean Michel.C.andN.Cedric.(2010).Bioinformatics - A Beginner's Guide. 2nd edition. Wiley.India.

REFERENCE BOOKS

1. Krishnamoorthy, R., (2009). *Computer programming and Applications*. Madurai: J.J. Publications,
2. Shanmughavel, P., (2006). *Trends in Bioinformatics*. Jaipur: Avishkar publishers.

WEBSITE REFERENCES

1. https://www.google.com/search?ei=5tAUXfeyOdL-rQGq6lvGdQ&q=document+collaboration+tools&oq=Document+collaboration&gs_l=psy-ab.1.1.0l10.30920.30920..36786...0.0..0.144.144.0j1.....0....2j1..gws-wiz.....0i71.deLa7oZsul8
2. <https://www.computerhope.com/jargon/j/jumpdriv.htm>
3. https://en.wikipedia.org/wiki/Hard_disk_drive
4. https://en.wikipedia.org/wiki/Compact_disc

5. https://en.wikipedia.org/wiki/Memory_card
6. <https://integralmemory.com/faq/cards-what-difference-between-sdhc-and-sd-cards>
7. https://www.google.com/search?source=hp&ei=kJRNxbSZC4j1vgTG_ZaIDg&q=Concept+%26+Applications+of+Internet-+World+Wide+Web+%28WWW%29%2C+&oq=Concept+%26+Applications+of+Intern+et-+World+Wide+Web+%28WWW%29%2C+&gs_l=psy-ab.12...1725.1725..3351...1.0..0.234.453.2-2.....0....2j1..gws-wiz.....10..35i39.sORmy9u22io&ved=0ahUKEwi0oZTBkPbjAhWluo8KHca-BeEQ4dUDCAk

Course Code 20UZYS52	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	H	H	L	M	M	H	H	H	H	M
CO2	H	H	M	L	M	H	H	H	M	L
CO3	H	H	M	L	M	H	H	H	M	L
CO4	H	H	M	M	L	M	H	H	M	L
CO5	H	H	H	M	H	H	H	H	H	L

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V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY (SEMESTER)

(2020 -2021 onwards)

Semester VI	MICROBIOLOGY	Hours/Week: 5	
Core Course-11		Credits: 4	
Course Code 20UZYC61		Internal 25	External 75

COURSE OUTCOME

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

CO1: understand the basic concepts of microbial studies. [K1]

CO2: explain the importance of microbes in various fields. [K2]

CO3: apply their knowledge in differentiating the beneficial and harmful microorganisms. [K3]

CO4: analyze the role of microorganism for the healthy lifestyle of mankind. [K4]

CO5: assess the applications of microbes for the betterment of ecosystem. [K5]

UNIT I

Basic concepts of Microbiology: Scope of microbiology, Contributions of Louis Pasteur and Edward Jenner. Classification of micro organisms – Five Kingdom concept only. Nutritional types of microorganisms – Autotrophs, Heterotrophs, Phototrophs, Lithotrophs and Organotrophs. Structure of bacteria – *E. coli*, Structure of Bacteriophage- T₄ phage. Bacterial Growth Curve. Role of beneficial and harmful microbes. (15 Hours)

UNIT II

Culture of Microbes: Types of Culture medium - Nutrient agar, and Broth. Culturing bacteria – Broth culture, agar plate culture, Agar slant and Agar Stab. culture. Sterilization – Dry heat, Moist heat, Filtration and Radiation. Pure culture techniques- Serial dilution, Spread plate, Pour plate and Streak plate methods. Biosafety measures during the culture. Preservation of Microorganisms. (15 Hours)

UNIT III**Food Microbiology**

Microorganisms and food spoilage, Food poisoning –Botulism- Symptoms and Prevention. Food borne infections– Amoebiasis, Salmonellosis and Diahorrea- symptoms and Prevention. Food Preservation methods –Pickling, Canning, Pasteurization, Smoking, Drying and Dehydration, Refrigeration, Sterilization, Radiation and Chemical additives. (15 Hours)

UNIT IV**Medical Microbiology**

Causative agent, symptoms , treatment and prevention: Bacterial diseases – Tuberculosis and Gonorrhoea. Viral diseases – AIDS and COVID-19. Fungal diseases –Candidiasis and Mycotoxicosis. Hospital-acquired infection– Sources and Control measures. (15 Hours)

UNIT V

Agricultural microbiology: Role of microbes in soil fertility- Symbiotic nitrogen fixation: Rhizobium-Host specificity, root nodulation and mechanism. Non-Symbiotic nitrogen fixation: Azotobacter, *Biofertilizer* - Blue green algae-Preparation of inoculums, field application and crop response. *Bio manure: Azolla-Mass cultivation*, field application and crop response. *Biopesticides- Bacillus thuringiensis*. (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.
17th Academic Council Meeting 31.01.2023
7. Rajan, S., & Selvi Christy, R., (2016). *Essentials of Microbiology*. Chennai: Anjan Book House.

Course Code 20UZYC61	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	H	H	H	H	L	L	H
CO2	H	H	H	H	H	H	M	L	L	H
CO3	H	H	H	H	H	H	L	L	M	H
CO4	H	H	H	H	H	H	M	L	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	BIOTECHNOLOGY	Hours/Week: 5	
Core Course-12		Credits: 4	
Course Code		Internal	External
20UZYC62		25	75

COURSE OUTCOMES

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

CO1: understand the basic concepts of biotechnology. [K1]

CO2: explain the techniques of biotechnology in various fields. [K2]

CO3: apply their knowledge in using the techniques of biotechnology in the field of research. [K3]

CO4: analyze the merits of techniques for the betterment of man and environment. [K4]

CO5: recommend the suitable techniques for the production of novel products. [K5]

UNIT I

Recombinant DNA technology: Introduction, Scope of Biotechnology, DNA manipulative enzymes - Restriction enzymes and DNA ligases. Gene Cloning vectors –pBR322 and M13. Gene transfer techniques - Microinjection, Electroporation and Liposome fusion. Screening of rDNA- Colony hybridization, Southern and Northern blotting techniques. (15 Hours)

UNIT II

Application of rDNA in Human health: Recombinant DNA Proteins and their Uses - Interferons and Cytokines. Recombinant vaccines: Hepatitis-B and FMD Vaccine. Commercial production of insulin. Human Genome Project and Gene therapy. (15 Hours)

UNIT III

Animal tissue culture & Molecular Techniques: Transgenic animal – Dolly; Steps involved in mammalian cell culture- HeLa and WI38 cell lines. Methods to amplify DNA – PCR- Types, Principle and applications. Agarose gel Electrophoresis –Principle and method. DNA finger printing methods and its applications. Molecular markers - RAPD and RFLP. Bioethics. (15 Hours)

UNIT IV

Industrial Biotechnology: Microbial production of enzymes – Methods and Industrial applications. Biosensors: Principle and Applications of Glucose Biosensor only. Biochips- Principle and uses. Microbial production of antibiotics - Penicillin only. SCP- Spirulina- Mass culture and uses. IPR and Patenting of Biotechnological products. Bioentrepreneurship.
(15 Hours)

UNIT V

Nanobiotechnology : Drug delivery technologies- Releasing, Targeting and Membrane transport. Adopted technologies for drug delivery- Prostheses and implants. Diagnosis and Screening of genetic disorders: DNA and Protein Micro array- Preparation, targeting, Hybridization, Scanning and applications. Gene chip. Applications of Nanotechnology.
(15 Hours)

TEXT BOOK

1. Kumaresan, V., (2019). *Biotechnology*. Kottar and Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Kumaresan, V., (2008). *Text book of Biotechnology*. Kottar and Nagercoil: Saras Publication.
2. Dubey, R.C., (1995). *Text book of Biotechnology*. New Delhi: S.Chand and Co.
3. Swarnalatha, C.D., & Digumarti. (2007). *Microbial Biotechnology*. New Delhi: Bhasare Rao, Discovery Publishing House.
4. Jogdand, S.N., (2005). *Medical Biotechnology*. Mumbai: Himalaya Publishing House.
5. Eugenie J., Olguin *et al.* (2005). *Environmental Biotechnology and Cleaner Bioprocesses*. London: Taylor and Francis New fetter Lane Publishers.
6. Pelczar MJ., Chan, ECS., Noel R. Krieg. (2018) *Microbiology*. McGraw Hill Education, Chennai.

WEBSITE REFERENCES

1. <https://www.nap.edu/read/24605/chapter/4;>
<https://www.nap.edu/read/24605/chapter/1#xiii>
2. <https://mangalmay.org/blog/current-trends-in-the-biotechnology-industry-in-india/>
3. www.understandingnano.com

Course Code 20UZYC62	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	H	H	H	M	H	H	H	L	L
CO2	H	H	H	M	H	H	M	L	L	M
CO3	H	H	M	H	H	H	L	M	M	M
CO4	H	H	M	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	EVOLUTION	Hours/Week: 5	
Core Course- 13		Credits: 4	
Course Code 20UZYC63		Internal 25	External 75

COURSE OUTCOMES

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

CO1: learn essential concepts about the evolution of life on earth. [K1]

CO2: acquire the knowledge about the evidences of evolution which explains ancestry of animals. [K2]

CO3: apply the knowledge on variations that leads to speciation. [K3]

CO4: analyze the importance of causative factors on variations in evolution of species. [K4]

CO5: assess the evolutionary trends in the life history of animals. [K5]

UNIT I

Origin of life and evidences of Evolution: Biogenesis - Louis Pasteur's experiment, Biochemical origin of life - Urey - Miller experiment- Morphological evidences - Atavism, Connecting link - Lung fish. Embryological evidences- Similarity of embryos and Teeth in bird's embryos Biochemical evidences DNA and Precipitin Test. (15 Hours)

UNIT II

Theories of Evolution: Lamarckism and Neo - Lamarckism. Darwinism and Neo - Darwinism. Supplementary theories of Darwin - Sexual selection theory only. HMS Beagle, Galapagos island. Mutation theory of De Vries. Modern mutation theory and Modern synthetic theory. (15 Hours)

UNIT III

Elemental forces of Evolution: Mutation, Recombination, Migration, Hybridization, Isolation- Isolating mechanism- Allopatric and Sympatric speciation and role of isolation in Speciation, Natural selection, Founders principle, Genetic drift, Neoteny, Adaptive colouration, Mimicry - Batesian and Mullerian mimicry and their significances in evolution. Hardy-Weinberg law and its significance in evolution. Animal dispersal - Barriers to dispersal. (16 Hours)

UNIT IV

Patterns of Evolution: Sequential evolution, Divergent evolution, Convergent and Parallel evolution, Micro and Macro evolution, Mega evolution, Quantum evolution and Co-evolution. Adaptive radiation. (14 Hours)

UNIT V

Extinction and Fossils: Extinction – Types, causes and significance. Fossils: Types, Methods of Fossilization, Methods of dating fossils. Geological Time Scale. Indian Fossils –Trilobite and Nautilus. Living fossils –Salient features – Latimeria and Platypus. Human evolution. Phylogenetic tree-Structure, types and significance. Molecular phylogenetics - DNA Barcoding. (15 Hours)

TEXT BOOK

1. Arumugam, N. (2019). Organic Evolution. 11th Edition. Nagarcovil: Saras Publication.

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.

WEBSITE REFERENCES

1. http://byjus.com/biology/evidence_of_evolution
2. http://www.britannia.com/science/mutation_theory
3. <http://www.biorxiv.org/content/10.1101/685>
4. <http://link.springer.com/referenceworkentry/10.0117>
5. http://biologywise.com/batesian_mimicrysmullerian_mimicry
6. [http://en.wikipedia.org/wiki/Lucy\(Austrlopithecus\)](http://en.wikipedia.org/wiki/Lucy(Austrlopithecus))

Course Code 20UZYC63	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	M	H	M	M	L	L	H
CO2	H	H	H	M	H	M	M	L	L	H
CO3	H	M	M	H	H	H	L	M	L	H
CO4	H	M	M	H	H	H	M	M	M	H
CO5	H	H	M	H	H	M	M	H	M	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	ECOLOGY	Hours/Week: 5	
DSE Course: 2		Credits: 4	
Course Code 20UZYE61		Internal 25	External 75

COURSE OUTCOMES

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

CO1: understand the basic concepts of environmental science. [K1]

CO2: explain the interactions of living organisms in various ecosystems. [K2]

CO3: apply the knowledge to find out the causes of ecological problems. [K3]

CO4: plan for solving the existing problems for restoration of environment. [K4]

CO5: assess the methods to promote sustainable management of healthy environment.

[K5]

UNIT I

Ecological concepts and factors:

Ecology- Introduction, Autecology, Synecology – definition. Medium: Water – Forms and types – Hydrological Cycle – Properties of water – thermal Stratification, Ecological Significance. Light – Light on water, Biological effects of light - Photomorphogenesis, Locomotion and Movement, Photoperiodism, Diurnal migration, Circadian and Lunar Rhythm. Temperature – Eurythermal and Stenothermal organisms. Biological effects of temperature on Metabolism and reaction rate, Development, Morphology and Cyclomorphosis. (15 Hours)

UNIT II

Nutrient cycles & Interactions

Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous. Food Chain, Food Web, Pyramids and Trophic levels -Energy flow. Animal relationships: Mutualism, Commensalism, Parasitism, Competition and Predation. (15 Hours)

UNIT III

Habitat Ecology

Characteristic features, types and faunal adaptations in Freshwater (Lotic), Marine, Estuarine, Mangrove, Cave, Forest and Desert ecosystems. Population ecology – Characteristics of a population, Factors affecting population density. Community Ecology – Characteristics- Diversity, Dominance, Periodicity, Inter dependence, Ecotone and Edge effect, Ecological Niche and Ecological Succession. (15 Hours)

UNIT IV

Pollution

Pollution- Types. Causes, Effects (with examples) and control measures of Noise, Water, Air pollution, Nuclear Hazards and Plastic pollution. Disaster management- Landslides and Flood. Sustainable management of natural resources. (15 Hours)

UNIT V

biodiversity and Conservation

Biodiversity – Definition, Types, values and Reasons for the Loss of Biodiversity. Biodiversity hot spots in India. Endangered species in India: Lion-tailed Macaque, Eagle, Green turtle and Indian salamander. Methods of Conservation – Afforestation. Sanctuaries, National parks and Tiger reserves in Tamilnadu. Human and Animal conflicts. Red Data Book. Role of IUCN, CITES, WWF and Indian Board for Wildlife (15 Hours)

TEXT BOOK

1. Arumugam, N. (2016). *Concepts of Ecology*. Nagarcoil: Saras Publication.

REFERENCE BOOKS

1. Odum. E.P. (1985). *Fundamentals of Ecology*. Philadelphia: W.B. Saunders Publishers.
2. Dash M.C. (1996). *Fundamentals of Ecology*. New Delhi: Tatamc Graw Hill Publishing Co, Ltd.
3. Sharma P.D. (2006). *Environmental Biology*. Meerut: Rastogi Publication.

WEBSITE REFERENCES

1. <https://fwee.org/environment/how-a-hydroelectric-project-can-affect-a-river/how-a-hydro-project-affects-a-river-print/>
2. https://en.wikipedia.org/wiki/Lion-tailed_macaque
3. https://en.wikipedia.org/wiki/Himalayan_newt
4. https://en.wikipedia.org/wiki/Green_sea_turtle
5. <https://en.wikipedia.org/wiki/Eagle>

Course Code 20UZYE61	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	H	H	H	M	H	H	M	M	M
CO2	H	M	M	H	H	M	M	M	M	H
CO3	H	H	M	H	H	H	L	M	M	H
CO4	H	M	M	H	H	H	M	M	M	H
CO5	H	M	M	H	H	H	L	H	H	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	ENTOMOLOGY	Hours/Week: 5	
DSE Course		Credits: 4	
Course Code		Internal	External
20UZYE62		25	75

COURSE OUTCOMES

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

CO1: remember the basic concepts in entomology. [K1]

CO2: explain the kinds of insects and its role in various fields. [K2]

CO3: apply their knowledge in grouping the insects based on their impact on man and Environment. [K3]

CO4: analyze the functional status of insects in various ecosystems. [K4]

CO5: assess the methods of control of pests and vectors. [K5]

UNIT I

Introduction

Outline classification of Insect upto orders with examples. Development of Insect- Moulting and metamorphosis- Types of metamorphosis, Larva and Pupa - types. Morphology and Life cycle of Butter fly and Dragon fly. Importance of insects. (15 Hours)

UNIT II

Kinds of insects

Productive insect –Lac insect: Biology, production of Lac and uses. Harmful insect: Biology and uses - Rhinoceros Beetle and Wasps. Scavengers- Flesh flies. Predators - Lady beetles and Reduviid bug. Parasites – Flea, Lice and Bed bugs. Aesthetic and Scientific value of Insects. (16 Hours)

UNIT III

Medical Entomology

Disease transmitted and control measures- Mosquito – Chikungunya and Dengue. Fleas- Plague; and Ticks- Haemorrhagic fever. (14 Hours)

UNIT – IV

Agriculture Pests and Control measures

Biology, Pathology and Control measure: Cotton pest – *Earias fabia*; Sugarcane pest- *Pyrrilla perpusilla*; Paddy pest- *Leptocorisa varicornis* and Coconut pest- *Oryctes rhinoceros*.
(15 Hours)

UNIT V

Methods of Pest control

Natural and Artificial – Physical – Cooling, Heating and Radiation; Mechanical – Hand picking and Trapping; Chemical – Insecticides & Pesticides – Types. Biological- Predatory, Bacterial pesticide & Plant pesticide (Neem) and Integrated pest management (IPM).

(15 Hours)

REFERENCE BOOKS:

1. Nalina Sundari, M. S. (2016). *Entomology*. Chennai: MJP Publishers.
2. Donald, J. B. Triplehorn, C.A. and Johnson, N.F. (1989). *An Introduction to the Study of Insects*. Philadelphia: Saunders College Publication.
3. Vasantha Raj Devid, B and Kumaraswami, T. (1982). *Elements of economic entomology*. Madras : Popular Book Depot.
4. Fenemore, P. G and Prakash, A. (1992). *Applied entomology*. New Delhi: Wiley Eastern Ltd.
5. Chapman, R.F. (2000). *The Insect: Structure and function*. UK ; New York: Cambridge University Press.
6. David, B. and Ananthkrishnan, T. (2004). *General and Applied Entomology*. India: McGraw Hill Education Private Limited.
7. Ravindran, K.R. (2003). *Economic Zoology*. New Delhi: Dominant Publishers and Distributors.

WEBSITE REFERENCES:

1. <https://sciencing.com/list-insects-eat-dead-flesh-8596530.html>
2. <https://www.sare.org/Learning-Center/Books/Manage-Insects-on-Your-Farm/Text-Version/Beneficial-Agents-on-the-Farm/Principal-Insect-Predators>
3. <https://en.wikipedia.org/wiki/Flea>

Course Code 20UZYE62	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	H	H	H	M	H	H	H	L	L
CO2	H	H	H	M	H	H	M	L	L	H
CO3	H	H	H	H	H	H	L	M	M	H
CO4	H	H	H	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	INDUSTRIAL BIOTECHNOLOGY	Hours/Week: 5	
DSE Course		Credits: 4	
Course Code		Internal	External
20UZYE63		25	75

COURSE OUTCOMES

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

CO1: find the basic principles of biotechnological processes. [K1]

CO2: explain the industrial biotechnological innovations. [K2]

CO3: identify the industrial biotechnological techniques. [K3]

CO4: analyze microbial fermentation products. [K4]

CO5: interpret industrial applications of biotechnology. [K5]

UNIT I

Historical developments in Fermentation - Definition and scope of industrial biotechnology, Outline of upstream processing, Screening of industrially important microbes- primary and secondary screening, Strain improvement, Inoculum development and Preservation of strains. (15 Hours)

UNIT II

Fermentation- Media formulation, Sterilization, solid state fermentation and submerged state fermentation, Types of fermentation –Batch, fed batch and continuous culture systems, Method of immobilization. . (15 Hours)

UNIT III

Bioreactor- Design, parts and their function. Types of bioreactors- CSTR, Air lift, Bubble column, Packed bed, Tower. Monitoring and control of process variables (Temperature, pH and DO). (15 Hours)

UNIT IV

Production of microbial products

Enzymes- Amylase, Organic acid- Citric acid, Amino acid- Glutamic acid, Antibiotics- Penicillin, Solvent- Ethanol, Vitamins- Riboflavin and SCP (*Spirulina*). (15 Hours)

UNIT V**Downstream processing**

Solid –liquid separation - Flootation, flocculation, filtration, centrifugation, Cell disruption, Concentration – evaporation, liquid-liquid extraction, membrane, filtration, precipitation, adsorption, purification - chromatography, Formulation -drying, crystallization. (15 Hours)

TEXT BOOKS

1. Patel,A.H. (2005). *Industrial Microbiology*. New Delhi:MacMillan Publishers.
2. Satyanarayana, U. (2008). *Biotechnology*. New Delhi: Books and Allied (P) Ltd.

REFERENCE BOOKS

1. Stanbury, P.F. and Whitaker, A. (1984). *Principles of Fermentation Technology*.
New York: Pergamon Press.

Course Code 20UZYE63	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	H	H	H	M	M	L	L	L	L
CO2	H	H	H	M	M	M	M	L	L	M
CO3	H	H	M	H	H	H	L	M	M	M
CO4	H	H	M	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	POULTRY SCIENCE	Hours/Week: 2	
SEC-6		Credits: 2	
Course Code 20UZYS61		Internal 40	External 60

COURSE OUTCOME (CO)

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

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

CO2: explain the scope and importance of poultry farming. [K2]

CO3: apply their knowledge to set up a poultry farm to promote self employment opportunity. [K3]

CO4: identify and solve the problems encountered in poultry farm. [K3]

CO5: assess the rearing methods to bring out more productivity. [K4]

UNIT I

Introduction

Scope of poultry science, Desirable qualities of commercial layers and broilers. Nutritive value of egg and meat. Sexing-Vent Sexing, Colour Sexing and Feather sexing and its Advantages. (6 Hours)

UNIT II

Poultry House- Construction and principles. Deep litter system and Cage rearing- Advantages and disadvantages. Management of layers- three stages- Rearing of chick, growers and layers. Management of broilers and their merits. (7 Hours)

UNIT III

Management Techniques - Summer management and winter management- the precautionary measures and their importance. Debeaking, Lighting and its significance. (6 Hours)

UNIT IV

Poultry nutrition – Feed formulation. Feed stuff for poultry. Non-nutritive feed additives used in poultry feeds. Nutrient deficiency disease- Perosis and Goitre. (5 Hours)

UNIT V

Diseases: Ranikhet disease (viral). Salmonellosis (Bacterial), Aspergillosis (Fungal). Coccidiosis(Parasitic)- causative agent, symptoms and control measures. Vaccination programme. (6 Hours)

REFERENCE BOOK

1. Gnanamani, M.R. (1992). *Modern aspects of commercial poultry keeping*. Madurai: Giri Publication.
2. Singh, R.A. (1992). *Poultry production*. New Delhi: Kalyani Publishers.
3. Scott, M.L. (1982). *Nutrition of the Chicken*. New York: M.L.Scott and Associates.
4. Sharma, P.L. (1974;1995). *Bee keeping in India*. New Delhi: ICAR Publications.

Course Code 20UZYS61	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	H	H	H	M	H	H	H	L	L
CO2	H	H	H	M	H	H	H	L	L	H
CO3	H	H	H	H	H	H	H	M	M	H
CO4	H	H	H	H	H	H	H	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

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VIRUDHUNAGAR - 626 001

B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	LAB IN BIOCHEMISTRY AND ANIMAL PHYSIOLOGY	Hours/Week: 3	
Core Practical-3		Credits: 3	
Course Code 20UZYC61P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: apply theoretical knowledge in carrying out the laboratory experiments and field work. [K3]

CO2: develop skills in handling of equipments. [K3]

CO3: work independently using lab procedures in biochemistry and physiology. [K3]

CO4: apply their practical skills in designing the projects. [K3]

CO5: analyze and solve the problems using scientific techniques. [K4]

Biochemistry:

1. Preparation of buffer in pH meter.
2. Qualitative analysis of carbohydrates, proteins and lipids.
3. Preparation of standard graph using standard glucose solution.
4. Quantitative estimation of carbohydrates, protein and lipids.
5. Separation of amino acids by paper chromatography technique.
6. Analysis of pH, turbidity and salinity of different water samples.
7. Verification of Beer –Lambert's Law using different concentrations of $K_2Cr_2O_7$
- Principles and applications of
8. Centrifuge
9. SDS-PAGE
10. Estimation of moisture content, sodium, calcium and potassium in food samples.

Animal Physiology:

1. Sphygmomanometer.
2. Bleeding Time
3. Clotting Time
4. RBC Counting.
5. WBC Counting.

6. Estimation of Haemoglobin.
7. Estimation of urease in horse gram.
8. Action of Salivary amylase in man.
9. Analysis of nitrogenous waste products- Ammonia, Urea and Uric acid.
10. Oxygen consumption in fishes.

Course Code 20UZY61P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	H	M	H	H	M	H	H
CO2	H	H	H	H	M	H	M	H	H	H
CO3	H	H	H	H	M	H	H	H	H	H
CO4	H	H	H	H	H	H	M	H	H	H
CO5	H	H	M	H	H	H	H	H	H	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	LAB IN EVOLUTION, GENETICS AND BIOSTATISTICS	Hours/Week: 3	
Core Practical-4		Credits: 3	
Course Code 20UZYC62P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: apply their theoretical knowledge in carrying out the laboratory experiments and field work. [K3]

CO2: develop problem solving skills in Evolution, Genetics and Biostatistics. [K3]

CO3: design experiments and conduct survey in evolution, genetics and biostatistics. [K3]

CO4: examine the causative factors of recent issues that affect human mankind. [K4]

CO5: analyze and interpret the data in genetics and evolution using statistical methods. [K4]

EVOLUTION:

1. Action of Natural selection in a large and small population.
2. Variation in finger print.
3. Fossils –Archaeopteryx.
4. Living fossil – Peripatus and Evolutionary importance.
5. Mimicry –Stick insect, Lycodon and Krait.
6. Homologous, Analogous and Vestigial organs.

GENETICS

1. Simple Mendelian traits in Man
2. Analysis of blood group in Man and its genetics
3. Pedigree Analysis –Colour blindness.
4. Abnormal Karyotype in man – Klinefelter's syndrome, Down's syndrome and Turner's syndrome
5. Amniocentesis and
6. Erythroblastosis foetalis

BIOSTATISTICS:

1. Statistical analysis - Survey of data and measures of central tendency and dispersion using
 - a). Neem leaf serrations and length of leaves.
 - b). Age, Height and Weight of students.
2. Analysis of correlation between height and weight of students in the class.
3. Probability of single coin toss.
4. Drawing of bar Diagram, line diagram and Pie diagram using the data.

Course Code 20UZY62P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	H	M	H	L	H	H	H
CO2	H	H	H	H	M	H	M	H	H	H
CO3	H	H	H	H	H	H	M	H	H	H
CO4	H	H	H	H	H	H	M	H	H	H
CO5	H	H	M	H	H	H	L	H	H	H

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	LAB IN MICROBIOLOGY AND BIOTECHNOLOGY	Hours/Week: 2	
Core Practical-5		Credits: 2	
Course Code 20UZYC63P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: design new experiments in microbiology and biotechnology. [K3]

CO2: identify, classify and screen the microbes. [K3]

CO3: apply their knowledge to isolate the economically important microbial strains and nucleic acids. [K3]

CO4: analyze the usage of microbes in the field of research in biotechnology. [K4]

CO5: analyze the biotechnological methods in the production of novel products. [K4]

Microbiology:

1. Bacterial Growth curve.
2. Gram staining technique for identification of bacteria.
3. MS medium Preparation.
4. Pure culture techniques (a) Serial dilution method
(b) Pour plate method
(c) Spread plate method
(d) Streak plate method
5. Biochemical tests for bacterial identification.
(a) Methyl red test
(b) Voges –Proskauer test
(c) Catalase test
(d) Oxidase test
(e) Acid and gas production test
6. Instrument –Autoclave and Laminar Air flow chamber
7. Microbial taxonomy – Observation of permanent slides:
 - Bacteria - *E. coli*, *Vibrio cholera*
 - Fungi - *Penicillium*, *Agaricus*
 - Virus - TMV, HIV
 - Protozoa - *Euglena*, *Chlamydomonas*

Biotechnology:

1. Isolation of Chromosomal DNA from microbes.
2. Isolation of RNA from spleen.
3. Separation of DNA by agarose gel electrophoresis.
4. Polymerase chain reactions- Demonstration.
5. Synthetic seed preparation (Group)

Course Code 20UZYC63P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO									
	1.a	1.b	2	3.a	3.b	4.a	4.b	5	6	7
CO1	H	H	H	M	H	H	H	L	H	H
CO2	H	H	H	M	H	H	M	L	H	H
CO3	H	H	H	H	H	H	L	M	H	H
CO4	H	H	H	H	H	H	M	M	H	H
CO5	H	H	H	H	H	H	H	H	H	H

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Semester V	DIETETICS FOR WOMEN	Hours/Week: -
EXTRA CREDIT COURSE: 1 - Departmental		Credits: 2
Course Code 20UZY051		Internal 100

COURSE OUTCOMES

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

CO1: understand the concept of an adequate 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.

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 stress.

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 and Adolescent 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.

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B.Sc. ZOOLOGY

(2020 -2021 onwards)

Semester VI	LIFE STYLE DISEASES	Hours/Week:-
EXTRA CREDIT Course		Credits: 2
- Departmental		
Course Code		Internal
20UZY061		100

COURSE OUTCOMES

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

CO1: know about the causes, symptoms and dietary management of life style diseases.

CO2: plan therapeutic diets for life style diseases.

CO3: gain knowledge about diet counseling to patients and family.

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.

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