

# **FATIMA COLLEGE (AUTONOMOUS)**



**Re-Accredited with A<sup>++</sup>(NAAC IV Cycle)**  
**Maryland, Madurai- 625 018, Tamil Nadu, India**

**NAME OF THE DEPARTMENT: ZOOLOGY**

**NAME OF THE PROGRAMME : B.Sc**

**PROGRAMME CODE : UAZO**

**ACADEMIC YEAR : 2023 - 2024**

## VISION OF THE DEPARTMENT

Women Empowerment through Biological Education for the Betterment of Environment and Mankind

## MISSION OF THE DEPARTMENT

- To ensure quality education offering skill based program
- To render entrepreneurial training to make students employable
- To create awareness on the conservation of Biodiversity
- To give ultimate insight into the correlation of various branches of biology that has overwhelming applications
- To facilitate Higher education & research (for the advanced learners)

## PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

<b>PEO 1</b>	Our graduates will be academic, digital and information literates; creative, inquisitive, innovative and desirous for the “more” in all aspects
<b>PEO 2</b>	They will be efficient individual and team performers, exhibiting progress, flexibility, transparency and accountability in their professional work
<b>PEO 3</b>	The graduates will be effective managers of all sorts of real – life and professional circumstances, making ethical decisions, pursuing excellence within the time framework and demonstrating apt leadership skills
<b>PEO 4</b>	They will engage locally and globally ,evincing social and environmental stewardship demonstrating civic responsibilities and employing right skills at the right moment.

## GRADUATE ATTRIBUTES (GA)

Fatima College empowers her women graduates holistically. A Fatimite achieves all-round empowerment by acquiring Social,

Professional and Ethical competencies. A graduate would sustain and nurture the following attributes:

<b>I. SOCIAL COMPETENCE</b>	
<b>GA 1</b>	Deep disciplinary expertise with a wide range of academic and digital literacy
<b>GA 2</b>	Hone creativity, passion for innovation and aspire excellence
<b>GA 3</b>	Enthusiasm towards emancipation and empowerment of humanity
<b>GA 4</b>	Potentials of being independent
<b>GA 5</b>	Intellectual competence and inquisitiveness with problem solving abilities befitting the field of research
<b>GA 6</b>	Effectiveness in different forms of communications to be employed in personal and professional environments through varied platforms
<b>GA 7</b>	Communicative competence with civic, professional and cyber dignity and decorum
<b>GA 8</b>	Integrity respecting the diversity and pluralism in societies, cultures and religions
<b>GA 9</b>	All – inclusive skill - sets to interpret, analyse and solve social and environmental issues in diverse environments
<b>GA 10</b>	Self-awareness that would enable them to recognise their uniqueness through continuous self-assessment in order to face and make changes building their strengths and improving on their weaknesses
<b>GA 11</b>	Finesse to co-operate exhibiting team-spirit while working in groups to achieve goals
<b>GA 12</b>	Dexterity in self-management to control their selves in attaining the kind of life that they dream for

<b>GA 13</b>	Resilience to rise up instantly from their intimidating setbacks
<b>GA 14</b>	Virtuosity to use their personal and intellectual autonomy in being life-long learners
<b>GA 15</b>	Digital learning and research attributes
<b>GA 16</b>	Cyber security competence reflecting compassion, care and concern towards the marginalised
<b>GA 17</b>	Rectitude to use digital technology reflecting civic and social responsibilities in local, national and global scenario
<b>II. PROFESSIONAL COMPETENCE</b>	
<b>GA 18</b>	Optimism, flexibility and diligence that would make them professionally competent
<b>GA 19</b>	Prowess to be successful entrepreneurs and employees of trans-national societies
<b>GA 20</b>	Excellence in Local and Global Job Markets
<b>GA 21</b>	Effectiveness in Time Management
<b>GA 22</b>	Efficiency in taking up Initiatives
<b>GA 23</b>	Eagerness to deliver excellent service
<b>GA 24</b>	Managerial Skills to Identify, Commend and tap Potentials
<b>III. ETHICAL COMPETENCE</b>	
<b>GA 25</b>	Integrity and discipline in bringing stability leading a systematic life promoting good human behaviour to build better society
<b>GA 26</b>	Honesty in words and deeds
<b>GA 27</b>	Transparency revealing one's own character as well as self-esteem to lead a genuine and authentic life

<b>GA 28</b>	Social and Environmental Stewardship
<b>GA 29</b>	Readiness to make ethical decisions consistently from the galore of conflicting choices paying heed to their conscience
<b>GA 30</b>	Right life skills at the right moment

### PROGRAMME OUTCOMES (PO)

On completion of B.Sc. ZOOLOGY programme, the graduates would be able to

<b>PO 1</b>	Apply acquired scientific knowledge to solve complex issues.
<b>PO 2</b>	Attain Analytical skills to solve complex cultural, societal and environmental issues.
<b>PO 3</b>	Employ latest and updated tools and technologies to analyse complex issue.
<b>PO 4</b>	Demonstrated Professional Ethics that foster community, Nation and Environment Building Initiatives.
<b>PO 5</b>	Apply the knowledge and skill to take up higher education, entrepreneurship and employment in government and private sectors.

### PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of B.Sc. ZOOLOGY programme, the graduates would be able to

<b>PSO 1</b>	Gain comprehensive knowledge in different branches of Zoology–Invertebrata, Chordata, Cell biology, Physiology, Environmental Biology, Biochemistry, Microbiology, Immunology, Embryology, Entomology,
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	Genetics, Molecular Biology, Biotechnology, Biostatistics, Bioinformatics and Evolution.
<b>PSO 2</b>	Acquire technical skills in performing experiments in the field of Microbiology, Cell Biology, Biochemistry, Plant Physiology, Human Physiology, Molecular Biology, Environmental Biology, Developmental Biology, Biostatistics, Immunology, Evolution, Genetics, Clinical Laboratory Techniques, Biotechnology and Bioinformatics.
<b>PSO 3</b>	Develop empathy and instil love towards conserving plants and animals.
<b>PSO 4</b>	Express ideas and concept through seminar and assignments.
<b>PSO 5</b>	Solve the environmental problems by applying the biological principles for minimizing pollutants in air, water and land.
<b>PSO 6</b>	Develop environmental concern towards value of economically important plants, Biodiversity promote Bioremediation, Bio fertilizer and vegetative propagation.
<b>PSO 7</b>	Adopt Good Laboratory Practice, bioethics and biosafety guidelines to ensure minimal use of animals during experiments.
<b>PSO 8</b>	Exhibit the holistic growth by developing subject proficiency, interpersonal skills, and show vertical mobility in taking up PG courses and horizontal mobility by enrolling in B.Ed institution, clinical

	laboratory course and seek employment in schools, Medical coding and IT companies.
<b>PSO 9</b>	Make them self employed/ Entrepreneur in the field of Sericulture, Vermitechnology, Ornamental fish culture, Dairy farming, Apiculture, Mushroom cultivation and Horticulture.
<b>PSO 10</b>	Use of computers for Power point presentation, Virtual Dissection, analysis of bio- molecules using bioinformatics tools and computing biological data.
<b>PSO 11</b>	Healthy diet pattern for combat life style disorder.

**FATIMA COLLEGE (AUTONOMOUS), MADURAI-18****DEPARTMENT OF ZOOLOGY***For those who joined in June 2019 onwards***PROGRAMME CODE: UAZO****PART – I – TAMIL / FRENCH / HINDI- 12 CREDITS****PART – I – TAMIL****Offered by The Research Centre of Tamil**

S. NO	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TOT. MKs
1.	I	23TL1C1	Pothu Tamil – I	5	3	40	60	100
2.	II	23TL2C2	Pothu Tamil – II	5	3	40	60	100
3.	III	19TL3C3	General Tamil – Kaapiya Illakiyam	5	3	40	60	100
4.	IV	19TL4C4	General Tamil - Sangam Illakiyam	5	3	40	60	100
<b>Total</b>				<b>20</b>	<b>12</b>			

**PART – I –FRENCH****Offered by TheDepartment of French**

S. NO	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TOT. MKs
1.	I	23RL1C 1	PART 1 LANGUAGE INTRODUCTORY FRENCH - I	5	3	40	60	100
2.	II	23RL2C 2	PART 1 LANGUAGE INTRODUCTORY	5	3	40	60	100



S. NO	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TOT. MKs
			FRENCH – II					
3.	III	19RL3C 3	PART 1 LANGUAGE FRENCH - LE NIVEAU INTERMEDIAIRE	5	3	40	60	100
4.	IV	19RL4C 4	PART 1 LANGUAGE FRENCH - LE NIVEAU DE SUIVRE	5	3	40	60	100
<b>Total</b>				<b>20</b>	<b>12</b>			

### PART – I – HINDI

Offered by TheDepartment of Hindi

S. NO	SE M.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TOT. MKs
1.	I	23DL1C1	PART 1 LANGUAGE GENERAL HINDI – I	5	3	40	60	100
2.	II	23DL2C2	PART 1 LANGUAGE GENERAL HINDI – II	5	3	40	60	100
3.	III	19DL3C3	PART 1 LANGUAGE HINDI –Hindi Sahithya Ka Aadhikaal aur Bhakthikaal	5	3	40	60	100
4.	IV	19DL4C4	PART 1 LANGUAGE HINDI –Reetikaleen Hindi Sahithya aur Aadhunik	5	3	40	60	100

S. NO	SE M.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TOT. MKs
			Kaal					
<b>Total</b>				<b>20</b>	<b>12</b>			

**PART – II -ENGLISH – 12 CREDITS**

**Offered by The Research Centre of English**

S. NO	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TO T. MK s
1.	<b>I</b>	23EL1LB	BASIC COMMUNICATIVE ENGLISH	5	3	40	60	100
2.		23EL1LI	INTERMEDIATE COMMUNICATIVE ENGLISH					
3.		23EL1LA	ADVANCED COMMUNICATIVE ENGLISH					
4.	<b>II</b>	23EL2LB	ENGLISH FOR EFFECTIVE COMMUNICATION (BASIC)	5	3	40	60	100
5.		23EL2LI	ENGLISH FOR EMPOWERMENT (INTERMEDIATE)					
6.		23EL2LA	ENGLISH FOR CREATIVE WRITING (ADVANCED)					
7.	<b>III</b>	19EL3LN	ENGLISH FOR THE DIGITAL ERA	5	3	40	60	100
8.	<b>IV</b>	19EL4LN	ENGLISH FOR INTEGRATED	5	3	40	60	100

S. NO	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ESE Mks	TO T. MK S
			DEVELOPMENT					
<b>Total</b>				<b>20</b>	<b>12</b>			

**PART – III -MAJOR, ALLIED & ELECTIVES – 95 CREDITS**

**MAJOR CORE COURSES INCLUDING PRACTICALS : 60 CREDITS**

S.N O	SEM.	COURSE CODE	COURSE TITLE	HRS	CRE DITS	CIA Mks	ES E Mks	TOT . Mks
1.	I	23Z1CC1	INVERTEBRATA	5	4	40	60	100
2.		23Z1CC2	INVERTEBRATE LAB COURSE	4	4	40	60	100
3.	II	23Z2CC3	CHORDATA	5	3	40	60	100
4.		23Z2CC4	CHORDATA LAB COURSE	4	3	40	60	100
5.	III	19Z3CC7	HUMAN PHYSIOLOGY	5	4	40	60	100
6.		19Z3CC8	ENVIRONMENTAL BIOLOGY	4	3	40	60	100
7.		19Z3CC9	LAB - HUMAN PHYSIOLOGY & ENVIRONMENTAL BIOLOGY	3	2	40	60	100
8.	IV	19Z4CC10	MICROBIOLOGY	5	4	40	60	100
9.		19Z4CC11	EVOLUTION	4	3	40	60	100
10.		19Z4CC12	LAB - MICROBIOLOGY & EVOLUTION	3	2	40	60	100
11.	V	19Z5CC13	FUNDAMENTALS OF BIOCHEMISTRY	6	4	40	60	100
12.		19Z5CC14	MOLECULAR BIOLOGY	6	4	40	60	100

S.N O	SEM.	COURSE CODE	COURSE TITLE	HR S	CRE DITS	CIA Mks	ES E Mk s	TOT · Mks
13.		19Z5CC15	LAB - BIOCHEMICAL ANALYSIS	4	2	40	60	100
14.		19Z5CC16	LAB - MOLECULAR BIOLOGY	4	2	40	60	100
15.	VI	19Z6CC17	BASIC IMMUNOLOGY	5	4	40	60	100
16.		19Z6CC18	PRINCIPLES OF BIOTECHNOLOGY	5	4	40	60	100
17.		19Z6CC19	LAB - IMMUNOLOGY	3	2	40	60	100
18.		19Z6CC20	LAB - BIOTECHNOLOGY	3	2	40	60	100
Total				84	60			

**ALLIED COURSES- 20 CREDITS**

S.N O	SE M.	COURSE CODE	COURSE TITLE	HR S	CREDI T	CIA Mk s	ES E Mk s	TOT · MK s
1.	III	21Q3ACZ1	PLANT DIVERSITY &PATHOLOGY	3	3	40	60	100
2.		21Q3ACZ2	LAB - PLANT DIVERSITY &PATHOLOGY	2	2	40	60	100
3.	IV	21Q4ACZ3	DEVELOPMENTS IN BOTANY & PLANT BREEDING	3	3	40	60	100
4.		21Q4ACZ4	LAB -DEVELOPMENTS IN BOTANY & PLANT BREEDING	2	2	40	60	100
Total				20	20			

**ELECTIVES-15 CREDITS**

S.No	SEM.	COURSE CODE	COURSE TITLE	HRS	CREDIT	CIA Mks	ES E Mks	TOT. Mks
1.	V	19Z5ME1 / 19Z5ME2	BIOSTATISTICS / ANIMAL BEHAVIOUR	5	5	40	60	100
2.	VI	19Z6ME3 / 19Z6ME4	EMBRYOLOGY / CLINICAL LABORATORY TECHNIQUES	5	5	40	60	100
3.		19Z6ME5 / 19Z6ME6	BIOINFORMATICS / ENTOMOLOGY	5	5	40	60	100
Total				15	15			

**PART – IV – 20 CREDITS**

- VALUE EDUCATION
- ENVIRONMENTAL AWARENESS
- NON MAJOR ELECTIVE
- SKILL BASED COURSES

S.No	SEM.	COURSE CODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. Mks
1.	I	21G1VE1	Personal Values	1	1	40	60	100
2.		23Z1FC	Fundamentals of Biology	2	2	40	60	100
3.		23Z1SE1	Non-Major Elective – Ornamental Fish Farming and Management Health (Offered to other major Students)	2	2	40	60	100
4.	H	21G2VE2	Values for Life	1	1	40	60	100

S. No	SEM.	COURSE CODE	COURSE TITLE	H RS	CRE DITS	CIA Mks	ESE Mks	TOT. Mks
5.		23Z2SE2	Non-Major Elective – Biocomposting for Entreoreneurship (Offered to other major Students)	2	2	40	60	100
6.		23Z2SE3	AQUARIUM KEEPING	2	2	40	60	100
7.	III	19G3EE1	Environmental Education	1	1	40	60	100
8.		19Z3SB1	Vermitechnology	2	2	40	60	100
9.	IV	19G4EE2	Gender Studies	1	1	40	60	100
10.		19Z4SB2	MUSHROOM CULTIVATION	2	2	40	60	100
11.	V	19Z5SB3	ORNAMENTAL FISH CULTURE	2	2	40	60	100
12.		19Z5SB4	SERICULTURE	2	2	40	60	100
13.	VI	19Z6SB5	API CULTURE	2	2	40	60	100
14.		19Z6SB6	DAIRY FARMING	2	2	40	60	100
TOTAL				20	20			

**PART – V – 1 CREDIT**

**OFF-CLASS PROGRAMMES - ALL PART-V**

**SHIFT - I**

S. No	SEM.	COURSE CODE	COURSE TITLE	HRS	CREDIT	TOT. Mks
1.	I - IV	21A4PED	Physical Education	30/ SEM	1	100
2.		21A4NSS	NSS			
3.		21A4NCC	NCC			

4.		21A4WEC	Women Empowerment Cell			
5.		21A4ACUF	AICUF			

**OFF-CLASS PROGRAMMES****ADD-ON COURSES**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>HR S.</b>	<b>CRE DITS</b>	<b>SEMESTER IN WHICH THE COURSE IS OFFERED</b>	<b>CIA Mks</b>	<b>ESE Mks</b>	<b>TOTAL Mks</b>
21UAD1CA	<b>COMPUTER APPLICATIONS</b> (offered by the department of PGDCA for Shift I)	40	2	I&II	40	60	100
21UADFCS	<b>ONLINE SELF LEARNING COURSE</b> -Foundation Course for Science	40	2	II	40	60	100
23UAD1CA	<b>COMPUTER APPLICATIONS</b> (offered by the department of PGDCA for Shift I)	40	2	I&II	40	60	100
23Z1FC	<b>ONLINE SELF LEARNING COURSE</b> -Fundamentals of Biology	40	2	I	40	60	100
23UAD3ES	Professional Ethics	15	1	III	40	60	100
21UAD4ES	Personality Development	15	1	IV	40	60	100
21UAD5ES	Family Life Education	15	1	V	40	60	100

COURSE CODE	COURSE TITLE	HR S.	CRE DITS	SEMES TER IN WHICH THE COURSE IS OFFER ED	CIA Mks	ESE Mks	TOT AL Mks
21UAD6ES	Life Skills	15	1	VI	40	60	100
19UAD5HR	<b>HUMAN RIGHTS</b>	15	2	V	100	-	100
21UAD6RS	<b>OUTREACH PROGRAMME-</b> Reach Out to Society through Action <b>ROSA</b>	100	3	V & VI	100	-	100
21UAD6PR	<b>PROJECT</b>	30	4	VI	40	60	100
21UAD6RC	<b>READING CULTURE</b>	10/ Sem este r	1	II-VI	-	-	-
<b>TOTAL</b>			<b>20</b>				

**EXTRA CREDIT COURSES**

COURSE CODE	COURSE	HR S.	CREDIT S	SEMES TER IN WHICH THE COURSE IS OFFER ED	CIA MK S	ESE MK S	TOTA L MARK S
21UG2SL Z	<b>SELF LEARNING COURSES for ADVANCED LEARNERS</b> <b>SingleCell</b> <b>ProteinCulture</b>	-	2	II	40	60	100



<b>21UG4SL Z</b>	<b>Public Health &amp; Hygiene</b>	-	2	IV	40	60	100
<b>23UG6SL ZC</b>	<b>HerbalCosmetics</b>	-	2	VI	40	60	100
	<b>MOOC COURSES / International Certified online Courses</b> (Department Specific Courses/any other courses) * Students can opt other than the listed course from UGC-SWAYAM UGC / CEC	-	Minimu m 2 Credits	I – VI	-	-	

**OFF CLASS PROGRAMMES****19UGVACZ1 - Value Added Certificate Course (Herbalism in Health Care)****21UGVACZ1 – Skill – Embedded Value Added Certificate Course  
(Livestock Farming)****I B.Sc. Zoology****SEMESTER – I***For those who joined in 2023 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z1CC1</b>	<b>Invertebrata</b>	<b>Theory</b>	<b>5</b>	<b>4</b>

**COURSE DESCRIPTION**

This course provides an overview of the Invertebrate animals by focussing on the General characters, Classification, Special features and Biology of some selected Invertebrates.

**COURSE OBJECTIVES**

- To understand the basic concepts of lower animals and observe their structure and functions.
- To illustrate and examine the systemic and functional morphology of various groups of invertebrates.
- To differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.
- To compare and distinguish the general and specific characteristics of reproduction in lower animals.
- To infer and integrate the parasitic and economic importance of invertebrate animals

**UNITS****UNIT- I PROTOZOA & PORIFERA****(15 HRS.)****Protozoa:** Introduction to Classification, taxonomy and nomenclature.

**General characters and classification of Phylum Protozoa up to classes.** Type study - Paramecium - Parasitic protozoans (Entamoeba, Trypanosoma & Leishmania) - Nutrition in protozoa.

**Porifera:** **General characters and classification up to Classes.** Type study - Ascon- Canal system in - Reproduction in sponges.

**Self-study –General characters of Protozoa & Porifera****UNIT- II COELENTERATA, PLATYHELMINTHES & ASCHELMINTHES (15 HRS.)**

**Coelenterata:** General characters and classification up to classes – Type study - *Obelia* - Corals and coral reefs - Polymorphism in Hydrozoa.

**Platyhelminthes:** General characters and classification up to classes. Type study – *Fasciola hepatica*. Nematode Parasites - *Wuchereria bancrofti*, *Ancylostoma duodenale*.

**Aschelminthes:** General characters and classification up to classes - Type study - *Ascaris lumbricoide*.

**Self-study –General characters of Coelenterates, Platyhelminthes and Aschelminthes****UNIT- III ANNELIDA & ARTHROPODA****(15 HRS.)**

**Annelida:** General characters and classification up to Classes. Type study – *Nereis*. Metamerism, Nephridium and coelomoducts.

**Arthropoda:** General characters and classification of Phylum Arthropoda up

to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus*.

### **Self-study –General characters of Annelids and Arthropods**

#### **UNIT- IV MOLLUSCA&ECHINODERMATA (15 HRS.)**

**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot in Mollusca – Cephalopoda as the most advanced invertebrate.

**Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias*. Water vascular system in Echinodermata – Larval forms of Echinoderms.

### **Self-study –General characters of Molluscs & Echinoderms**

#### **UNIT- V INSECTS ASSOCIATED WITH HUMAN DISEASES & INSECT PEST (15 HRS.)**

Insects associated with human diseases: Mosquitoes, housefly; Insects associated with household materials: Termites; Insect pests: Insect pests, life cycle and types of damage to plants. Pest of rice: Rice stem borer (*Scirpophagaintertulas*) – Pest of Sugarcane: The shoot borer (*Chilo infuscatellus*) – Pest of coconut: The rhinoceros beetle (*Oryctes rhinoceros*) Pest of cotton: The spotted bollworm (*Eariasinsulana*) –Principles of Integrated Pest Management.

### **Self-study –Insect associated with human diseases**

## **REFERENCES:**

### **Text Books**

EkambaranathaIyer, 2000. A Manual of Zoology, 10<sup>th</sup> edition, Viswanathan, S., Printers & Publishers Pvt Ltd

Jordan, E.L. and Verma P.S, 1995.Invertebrate Zoology, 12<sup>th</sup> edn. S. Chand& Co.

Kotpal, R.L, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda.

Ekambaranatha Ayyar, and T. N. Ananthakrishnan, 2000.A Manual of Zoology.Vol 1 (Invertebrata). Part II – Viswanathan Pvt. Ltd, 842pp

Jordan, E.L. and Verma P.S, 1995.Invertebrate Zoology, 12th edn. S. Chand& Co.

Kotpal R.L. 2019. Modern Text Book of Zoology, Invertebrates 9th Ed., Rastogi Publications, Gangotri, Shivaji Road, Meerut, 1004 pp.

Vasantharaj David, B. 2001. Elements of Economic Entomology, Popular Book Depot, Chennai. 400pp.

Ruppert and Barnes, R.D. 2006. Invertebrate Zoology, VIII Edition. Holt Saunders International Edition, Belmont, CA : Thomson-Brooks/Cole,

928pp.

### References Books

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Hyman L.H, 1955. The invertebrates - Vol.I to Vol. VII – Mc Graw Hill Book Co.
5. Parker, J. and Haswell , 1978. A text book of Zoology Vol.I - Williams and Williams.
6. Barrington, E.J.W., 2012, Invertebrate structure and function. Boston – Houghton. Mifflin and ELBS, London.
7. Bhamrah, H.S. and Kavitha Juneja, 2002. A text book of Invertebrates. Alilnol Publications Private Limited, 4374/4B. Ansari Road, Dayaganj, New Delhi.
8. Hyman L.H, 1955. The invertebrates – Vol. I to Vol. VII – McGraw Hill Book Co.
9. Kotpal, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata, R.L- Rastogi Publication.
10. Parker, J. and Haswell , 1978. A text book of Zoology Vol. I - Williams and Williams.
11. Srivastava, M.D.L and Srivastava, 1969. A text book of Invertebrate Zoology, U.S- Central Book Depot, Allahabad.
12. Verma, A. Invertebrates: Protozoa to Echinodermata. Narosa Publishing House Private Limited. 35-36 Greams Road, Thousand Lights, Chennai.

### Web Resources

#### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.nationalgeographic.com/animals/invertebrates/>
2. <https://bit.ly/3kABzKa>
3. <https://www.nio.org/>
4. <https://greatbarrierreef.org/>
5. <https://bit.ly/3lJdUXO>

### COURSE CONTENTS & LECTURE SCHEDULE:

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 PROTOZOA&amp;PORIFERA</b>				
1.1	Introduction to Classification, taxonomy and nomenclature.	1	Chalk & Talk	Black Board
1.2	General characters and classification of Phylum Protozoa up to classes.	2	Chalk & Talk	LCD
1.3	Type study - Paramecium	2	Lecture	PPT
1.4	Parasitic protozoans (Entamoeba, Trypanasoma&Leishmania)	2	Lecture	Smart Board
1.5	Nutrition in protozoa	1	Lecture	Black Board
1.6	General characters and classification up to Classes	1	Chalk & Talk	Black Board
1.7	Type study - Ascon	3	Chalk & Talk	Black Board
1.8	Canal system in sponges	1	Lecture	PPT
1.9	Reproduction in sponges.	1	Lecture	PPT
1.10	<b>Self-study –General characters of Protozoa &amp; Porifera</b>	-	Discussion	-
<b>UNIT -ICOELENTERATA, PLATYHELMINTHES&amp; ASCHELMINTHES</b>				
2.1	<b>Coelenterata:</b> General characters and classification up to classes	2	Chalk & Talk	Black Board
2.2	Type study - <i>Obelia</i>	2	Chalk & Talk	LCD
2.3	Polymorphism in Hydrozoa.	1	Chalk & Talk	Black Board
2.4	<b>Platyhelminthes:</b> General characters and classification of up to classes..	2	Chalk & Talk	LCD
2.5	Type study – <i>Fasciola hepatica</i>	2	Chalk & Talk	Black Board
2.6	Nematode Parasites - <i>Wuchereriabancrofti</i> , <i>Ancylostomeduodenale</i> .	2	Chalk & Talk	LCD

2.7	<b>Aschelminthes:</b> General characters and classification of up to classes -	2	Chalk & Talk	Black Board
2.8	Type study - <i>Ascaris lumbricoid</i> .	2	Chalk & Talk	Black Board
2.9	<b>Self-study – General characters of Coelenterates, Platyhelminthes and Aschelminthes</b>	-	Discussion	-
<b>UNIT -III ANNELIDA&amp; ARTHROPODA</b>				
3.1	General characters and classification up to Classes.,	2	Lecture	PPT
3.2	Type study – <i>Nereis</i> .	3	Lecture	PPT
3.3	Metamerism	2	Lecture	PPT & Videos
3.4	Nephridium and coelomoducts	2	Lecture	PPT & Videos
3.5	<b>Arthropoda:</b> General characters and classification of Phylum Arthropoda up to Classes.	2	Lecture	PPT
3.6	Detailed study: <i>Penaeus indicus</i> .	3	Chalk & Talk	Black Board
3.7	Affinities of <i>Peripatus</i> .	1	Chalk & Talk	Black Board
3.8	<b>Self-study - General characters of Annelids and Arthropods</b>	-	Discussion	-
<b>UNIT -IV MOLLUSCA &amp;ECHINODERMATA</b>				
4.1	<b>Mollusca:</b> General characters and classification of Phylum Mollusca up to Classes.	2	Lecture	PPT & Videos
4.2	Detailed study: <i>Pila globosa</i> .	3	Lecture	PPT & Videos
4.3	Foot in Mollusca	1	Lecture	PPT & Videos
4.4	Cephalopoda as the most advanced invertebrate.	2	Lecture	PPT & Videos
4.5	<b>Echinodermata:</b> General characters and classification of Phylum Echinodermata up to Classes.	2	Lecture	PPT & Videos

4.6	Detailed study: <i>Asterias</i> .	3	Lecture	PPT & Videos
4.7	Water vascular system in Echinodermata	1	Chalk & Talk	Black Board
4.8	Larval forms of Echinoderms.	1	Chalk & Talk	Black Board
4.9	<b>Self-study –General characters of Molluscs &amp; Echinoderms</b>	-	Discussion	-
<b>UNIT -V INSECTS ASSOCIATED WITH HUMAN DISEASES &amp; INSECT PEST</b>				
5.1	Insects associated with human diseases: Mosquitoes, housefly.	2	Chalk & Talk	Black Board
5.2	Insects associated with household materials: Termites	2	Chalk & Talk	LCD
5.3	Pest of rice: Rice stem borer ( <i>Scirpophagaincertulas</i> ) —	2	Lecture	PPT
5.4	Pest of Sugarcane: The shoot borer ( <i>Chilo infuscatellus</i> )	2	Chalk & Talk	LCD
5.5	Pest of coconut: The rhinoceros beetle ( <i>Oryctes rhinoceros</i> )	2	Lecture	PPT
5.5	Pest of cotton: The spotted bollworm ( <i>Eariasinsulana</i> )	2	Chalk & Talk	LCD
5.6	Principles of Integrated Pest Management.	3	Lecture	PPT
5.7	<b>Self-study – Insect associated with human diseases</b>	-	Discussion	-

Components	Marks	Converted Marks
<b>T1</b>	<b>30</b>	<b>15</b>
<b>T2</b>	<b>30</b>	
<b>Assignment</b>		<b>3</b>

<b>Quiz / Seminar</b>		<b>5</b>
<b>Attendance</b>		<b>2</b>
<b>Total</b>		<b>25 Marks</b>

### EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand the basic concepts of invertebrate animals and recall its structure and functions.	K2	PO1
CO 2	Illustrate and examine the systemic and functional morphology of various groups of invertebrata.	K2	PO1, PO2
CO 3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	K1 & K3	PO4, PO6
CO 4	To compare and distinguish the various physiological processes and organ systems in lower animals.	K2 & K3	PO4, PO5, PO6
CO 5	Infer and integrate the parasitic and economic importance of invertebrate animals.	K3	PO3, PO8



**Mapping COs Consistency with PSOs**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

**Mapping of COs with POs**

CO/PSO	PO1	PO2	PO3	PO4
CO1	3	2	1	1
CO2	3	2	1	1
CO3	3	2	1	1
CO4	3	2	1	1
CO5	3	2	1	1

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:****Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology****SEMESTER – I***For those who joined in 2023 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	23Z1CC1	INVERTEBRATA LAB COURSE	Practical	4	4

**COURSE DESCRIPTION**

This course provides an overview of Invertebrate animals by focussing on the General characters, Classification, Special features and Biology of some selected Invertebrates.

**COURSE OBJECTIVES**

CO1	To identify the different groups of invertebrate animals by observing their external characteristics.
CO2	To understand the organs, organ system and their functions in lower animals.
CO3	To get knowledge about the different modes of life and their adaptation based on the environment.
CO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.

**MAJOR DISSECTION (Virtual/Demo)**

Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Reproductive system

Earthworm: Nervous System, Reproductive system.

*Pila globosa*: Nervous system. Prawn: Nervous system (including appendages).

**MINOR DISSECTION (Virtual/Demo)**

Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.

*Pila globosa*: Digestive system (Including radula).

Freshwater Mussel: Digestive system.

**MOUNTING**

Mounting: Earthworm: Body setae; Pineal setae.

Cockroach: Salivary apparatus

Mouth parts - Honey Bee, House fly and Mosquito

**SPOTTERS**

**Spotters :**

**(i) Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation.

**(ii) Porifera:** Ascon, Spicules, Gemmule

**(iii) Coelenterata:** Obelia – Colony & Medusa, Physalia, Velella

**(iv) Platyhelminthes:** Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, *Taenia solium*

**(v) Nematelminthes:** Ascaris (Male & Female), Ancylostoma, Wuchereria

**(vi) Annelida:** Nereis, Chaetopterus, Hirudinaria, Trochophore larva

**(vii) Arthropoda:** Palaemon, Scorpion, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouthparts of Housefly and Butterfly.

**(viii) Mollusca:** Pila, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

**(ix) Echinodermata:** Asterias, Bipinnaria larva

**REFERENCES:****Text Books**

1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai
2. Ganguly, Sinha and Adhikari, 2011. Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2014. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1070 pp.
4. Lal, S. S., 2016. Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebrates, S Chand, 497pp.

**References Books**

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

**Web Resources****DIGITAL OPEN EDUCATIONAL RESOURCES**

<https://nbb.gov.in/>  
<http://www.agshoney.com/training.htm>  
<https://icar.org.in/>  
<http://www.csrtimys.res.in/>  
<http://csb.gov.in/>  
<https://iinrg.icar.gov.in/>  
<https://www.nationalgeographic.com/animals/invertebrates/>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 MAJOR DISSECTION</b>				
1.1	Cockroach: Circulatory system, Nervous system, Reproductive system	3	Demonstration	Virtual software
1.2	Leech : Nervous System, Reproductive system	3	Demonstration	Virtual software
1.3	Earthworm: Nervous System, Reproductive system.	3	Demonstration	Virtual software
1.4	<i>Pila globosa</i> : Nervous system. Prawn: Nervous system (including Appendages).	3	Demonstration	Virtual software
<b>UNIT -II MINOR DISSECTION</b>				
2.1	Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.	6	Demonstration	Virtual software
2.2	<i>Pila globosa</i> : Digestive system (Including radula).	3	Demonstration	Virtual software
2.3	Freshwater Mussel: Digestive system.	3	Demonstration	Virtual software
<b>UNIT -III MOUNTING</b>				
3.1	Earthworm: Body setae; Pineal setae.	3	Demonstration and Hands on training	Earthworm
3.2	Cockroach: Salivary apparatus	3	Demonstration and Hands on	Cockroach

			training	
3.3	Mouth parts - Honey Bee	2	Demonstration and Hands on training	Honey bee
3.4	Mouth parts - House fly	2	Demonstration and Hands on training	House fly
3.5	Mouth parts - Mosquito	2	Demonstration and Hands on training	Mosquito
<b>SPOTTERS</b>				
5.1	<b>Protozoa:</b> Amoeba, Paramecium, Paramecium Binary fission and Conjugation.	2	Explanation	Spotters
5.2	<b>Porifera:</b> Ascon, Spicules, Gemmule	1	Explanation	Spotters
5.3	<b>Coelenterata:</b> Obelia – Colony & Medusa, Physalia, Velella	1	Explanation	Spotters
5.4	<b>Platyhelminthes:</b> Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, <i>Taenia solium</i>	2	Explanation	Spotters
5.5	<b>Nemathelminthes:</b> Ascaris (Male & Female), Ancylostoma, Wuchereria	1	Explanation	Spotters
5.5	<b>Annelida:</b> Nereis, Chaetopterus, Hirudinaria, Trochophore larva	1	Explanation	Spotters
5.6	<b>Arthropoda:</b> Palaemon, Scorpion, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouthparts of Housefly and Butterfly.	2	Explanation	Spotters
5.7	<b>Mollusca:</b> Pila, Sepia, Loligo,	1	Explanation	Spotters

	Octopus, Nautilus, Glochidium larva		ion	
5.8	<b>Echinodermata:</b> Asterias, Bipinnaria larva	1	Explanation	Spotters

Components	Marks	Converted Marks
T1	30	15
T2	30	
Assignment		3
Quiz / Seminar		5
Attendance		2
Total		25 Marks

**EVALUATION PATTERN**

MARKS		
CIA	ESE	Total
40	60	100

**COURSE OUTCOMES**

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify and label the external features of different groups of invertebrate animals.	K2	PO1

<b>CO 2</b>	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.	<b>K2</b>	PO1, PO2
<b>CO 3</b>	Differentiate and compare the structure, function and mode of life of various groups of animals.	<b>K1 &amp; K3</b>	PO4, PO6
<b>CO 4</b>	To compare and distinguish the dissected internal organs of lower animals.	<b>K2 &amp; K3</b>	PO4, PO5, PO6
<b>CO 5</b>	Prepare and develop the mounting procedure of economically important invertebrates.	<b>K3</b>	PO3, PO8

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO1</b>	<b>S</b>							
<b>CO2</b>	<b>M</b>	<b>S</b>						
<b>CO3</b>				<b>S</b>		<b>S</b>		
<b>CO4</b>				<b>S</b>	<b>S</b>	<b>M</b>		
<b>CO5</b>			<b>S</b>					<b>S</b>

**S-Strong(3) M-Medium (2) L-Low (1) B N**

### Mapping of COs with POs

CO/PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>

**Note:** ♦ Strongly Correlated – **3**  
♦ Weakly Correlated -**1**

♦ Moderately Correlated – **2**

**COURSE DESIGNER:**

**Forwarded By****HOD'S Signature  
& Name****I B.Sc. Zoology****SEMESTER – I*****For those who joined in 2023 onwards******(Offered to I B. Sc Chemistry Students)***

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	23Z1EC1	Allied Zoology -I	Theory	3	2

**COURSE DESCRIPTION**

It emphasises the identification and taxonomy of animals, as well as the current diversity in animal form and function, within an evolutionary context.

- To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida
  - To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata
  - To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia
- To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia
  - To acquire detailed knowledge of select invertebrate and chordate forms

**COURSE OBJECTIVES****UNITS****UNIT-I :Diversity of Invertebrates–I (9 Hrs.)**

Principles of taxonomy. Criteria for classification–Symmetry and Coelom–Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

**UNIT-II :Diversity of Invertebrates–II (9 Hrs.)**

Classification of Arthropoda, Mollusca and Echinodermata upto class



level with examples.

**UNIT-III :Diversity of Chordates-I**

**(9 Hrs.)**

Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.

**UNIT-IV :Diversity of Chordates-II**

**(9 Hrs.)**

Classification of Reptilia, Aves and Mammalia upto orders giving two examples.

**UNIT- V :Animal organisation**

**(9 Hrs.)**

Structure and organization of (i).Earthworm  
(ii)Rabbit/Rat(iii)Prawn/Fish

**REFERENCES:**

**Text Books**

1. Ekambaranathalyer,- Outlines of Zoology, Viswanathan Publication

**References Books**

1. Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual of Zoology Invertebrata Vol I,ViswanathanPublishers.
- 2.Ekambaranatha Iyar and T.N.Ananthakrishnan,-A Manual of Zoology – Invertebrata Vol - II: ViswanathanPublishors.
3. Ekambaranatha Iyar and T.N.Ananthakrishnan, - A Manual of Zoology Chordata, Viswanathan Publishers.
4. JordanE.L .and P.S. Verma - Invertebrate Zoology, S.Chand& Co.

**Web Resources**

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. [www.sanctuaryasia.com](http://www.sanctuaryasia.com)
2. [www.iaszoology.com](http://www.iaszoology.com)

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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<b>UNIT -1</b> Diversity of Invertebrates–I				
1.1	Principles of taxonomy. Criteria for classification	3	Chalk & talk	Black board
1.2	Symmetry and Coelom–Binomial nomenclature.	2	Chalk & talk	Black board
1.3	Classification of Protozoa and Coelenterata, up to classes with two examples.	2	Lecture	LCD
1.4	Classification of Helminthes and Annelida up to classes with two examples.	2	Chalk & talk	Black board
<b>UNIT -2</b> Diversity of Invertebrates–II				
2.1	Classification of Arthropoda, up to class level with examples.	3	Chalk & talk	Black board
2.2	Classification of Mollusca up to class level with examples.	3	Lecture	PPT & White board
2.3	Classification of Echinodermata up to class level with examples.	3	Chalk & talk	Black board
<b>UNIT - 3</b> Diversity of Chordates–I				
3.1	Classification of Prochordata up to orders giving two examples.	3	Chalk & talk	Black board
3.2	Classification of Pisces up to orders giving two examples.	3	Lecture	PPT & White board
3.3	Classification of Amphibia up to orders giving two examples.	3	Chalk & talk	Black board
<b>UNIT - 4</b> Diversity of Chordates–II				
4.1	Classification of Reptilia up to orders giving two examples.	3	Chalk & talk	Black board
4.2	Classification of Aves up to orders giving two examples.	3	Lecture	PPT & White board

4.3	Classification of Mammalia up to order giving two examples.	3	Chalk & talk	Black board
<b>UNIT 5</b> Animal organization				
5.1	Structure and organization of (i). Earth worm	3	lecture	PPT & White board
5.2	Structure and organization of (ii) Rabbit/Rat	3	lecture	PPT & White board
5.3	Structure and organization of (iii) Prawn/Fish	3	lecture	PPT & White board

### EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Recall the characteristic features invertebrates and chordates.	<b>K1</b>	PO1
<b>CO 2</b>	Classify invertebrates up to class level and chordates up to order level	<b>K3</b>	PO1, PO2
<b>CO 3</b>	Explain and discuss the structural and functional organisation of some invertebrates and chordates	<b>K2</b>	PO4, PO6
<b>CO 4</b>	Relate the adaptations and habits of animals to their habitat	<b>K1</b>	PO4, PO5, PO6
<b>CO 5</b>	Analyse the taxonomic position of animals.	<b>K4</b>	PO3, PO8

**Mapping COs Consistency with PSOs**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

**Mapping of COs with POs**

CO/PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**

**Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology****SEMESTER –I**

*For I B.Sc Chemistry those who joined in 2023 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGO RY</b>	<b>HRS/ WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z1EC2</b>	<b>ALLIED ZOOLOGY LAB - 1</b>	<b>Practical</b>	<b>2</b>	<b>1</b>

**COURSE DESCRIPTION**

Students develop laboratory skills with identification of preserved specimen, manipulation of prepared slides, dissections and display under the microscope

**COURSE OBJECTIVES**

To study the diversity of animals and to understand the fundamental

organization of cells.

### **INVERTEBRATA**

1. Laboratory biosafety guidelines and Regulations of Animal Ethics
2. Examination of pond water for Protists.
3. Mounting of Body setae of Earthworm. (Collected from Vermiculture Centres)
4. Mounting of Mouth Parts of Honey Bee.

### **CHORDATA**

1. Mounting of Ctenoid or Placoid scale.
2. Dissection of Frog Viscera using Virtual or Online Software.
3. Visit to Coastal Area.
4. Study of different types of Feathers of Birds.

### **SPOTTERS:**

Preserved Museum Specimens

1. Invertebrata - *Amoeba*, Ascon Sponge. Obelia Colony, *Taenia solium*, *Ascaris* (Male & Female), Nereis, Peripatus, Limulus, Octopus, Starfish (Oral & Aboral view).
2. Chordata - *Anguilla* (Eel), Toad (*Bufo*), *Naja*, Viper, Chamaeleon, Pigeon, Manis

### **REFERENCES**

1. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008) *Techniques in Life Sciences*, 1<sup>st</sup> ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009) *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.

### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.uwlax.edu/biology/zoo-lab/>
2. <http://virtualbiologylab.org/>
3. <https://www.labster.com/simulations/animal-genetics/>
4. <https://libguides.mines.edu/oer/simulationslabs>
5. <https://www.biodiversitylibrary.org/item/29076#page/5/mode/1up>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>INVERTEBRATA</b>				
1.1	Laboratory biosafety guidelines and Regulations of Animal Ethics	2	Hands on Training	Specimen
1.2	Mounting of Mouth Partsof Honey Bee.	4	Hands on Training	Specimen
1.3	Mounting of Body setae of Earthworm. (Collected from Vermiculture Centres)	4	Hands on Training	Specimen
1.4	Examination of pond water for Protists.	2	Hands on Training	Specimen
<b>CHORDATA</b>				

2.1	Mounting of Ctenoid or Placoid scale.	4	Hands on Training	Specimen
2.2	Dissection of Frog Viscera using Virtual or Online Software.	4	Demo	Virtual Software/ Online
2.3	Study of different types of Feathers of Birds.	2		
<b>SPOTTERS</b>				
3.1	Invertebrata - <i>Amoeba</i> , Ascon Sponge. <i>Obelia</i> Colony, <i>Taenia solium</i> , <i>Ascaris</i> (Male & Female), <i>Nereis</i> , <i>Peripatus</i> , <i>Limulus</i> , <i>Octopus</i> , <i>Starfish</i> (Oral & Aboral view).	6	Hands on Training	Specimen
3.2	Chordata – <i>Anguilla</i> (Eel), Toad ( <i>Bufo</i> ), <i>Naja</i> , Viper, <i>Chamaeleon</i> ,	2	Hands on Training	Specimen



	Pigeon, Manis			
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CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the Laboratory biosafety guidelines and good laboratory practices.	K1	PSO1, PSO2 & PSO7
CO 2	Dissect and mount the Body setae of Earthworm	K4	PSO1, PSO2, PSO4 & PSO7
CO 3	List out the features of the Invertebrata specimens.	K1	PSO1, PSO7 & PSO8

<b>CO 4</b>	Identify and explain the features of vertebrate specimens.	<b>K3</b>	PSO2 & PSO4
<b>CO 5</b>	Explain the type of feathers.	<b>K2</b>	PSO1 & PSO4

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
<b>CO1</b>	3	3	2	2	2	2	3	2	2	2	2	2
<b>CO2</b>	3	3	2	2	2	2	2	2	2	2	2	2
<b>CO3</b>	3	3	2	2	2	2	3	2	2	2	2	2
<b>CO4</b>	3	2	2	3	2	2	3	2	2	2	2	2
<b>CO5</b>	2	3	2	3	2	2	2	2	2	2	2	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	2	2	1
<b>CO2</b>	3	2	2	1
<b>CO3</b>	3	2	2	1
<b>CO4</b>	3	2	2	1
<b>CO5</b>	3	2	2	1

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology**

**SEMESTER – I***For those who joined in 2023 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z1SE1</b>	<b>Ornamental Fish Farming &amp; Management</b>	<b>Theory</b>	<b>2</b>	<b>2</b>

**COURSE DESCRIPTION**

This course familiarizes basic principles, themes and steps needed to set-up and maintain an aquarium.

**COURSE OBJECTIVES**

- To understand the basic concepts, Scope and importance of ornamental fish culture
- The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.
- Explain the process of food preparation.
- Identify the symptoms of various diseases prevalent in aquarium fishes.
- To analyze the knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.

**UNITS****UNIT I****(6 Hrs)**

Introduction to ornamental fish keeping.

Scope and importance of ornamental fish culture.

Domestic and global scenario of ornamental fish trade and export potential.

Commercially important ornamental fishes - Indigenous and exotic varieties.

**UNIT II****(6 Hrs)**

Biology of egg layers and live bearers.

Food and feeding in ornamental fishes. Formulated feed and Live feed; Live

feed culture.

Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).

### **UNIT III**

**(6 Hrs)**

Aquarium design and construction; Accessories - aerators, filters and lighting.

Aquarium plants and their propagation.

Maintenance of aquarium and water quality management.

Ornamental fish diseases, their prevention, control and treatment methods.

### **UNIT IV**

**(6 Hrs)**

Conditioning, packing, transport and quarantine methods.

Economics, trade regulations, domestic and export marketing strategies.

### **Practical**

**(6 Hrs)**

1) Identification of locally available ornamental fishes - Egg layers and live bearers.

2) Identification of locally available live feed organisms.

### **REFERENCES:**

#### **Text Books**

1. Thara Devi, C.S and Jayashree, K.V., (2009) *Aquarium*. Saras Publication, Nagercoil,

#### **Reference Books**

1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.
2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.
3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.
4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquaculture. Daya Publishing House, New Delhi.

### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=297>
2. <https://www.ofish.org/>
3. <https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/>
4. <https://99businessideas.com/ornamental-fish-farming/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1</b>				
1.1	Introduction to ornamental fish keeping. Scope and importance of ornamental fish culture.	2	Chalk & Talk	Black Board
1.2	Domestic and global scenario of ornamental fish trade and export potential.	2	Chalk & Talk	LCD
1.3	Commercially important ornamental fishes - Indigenous and exotic varieties.	2	Lecture	PPT & White board
<b>UNIT -2</b>				
2.1	Biology of egg layers and live bearers.	2	Chalk & Talk	Black Board
2.2	Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture.	2	Chalk & Talk	Black Board

2.3	Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).	2	Chalk & Talk	Black Board
<b>UNIT -3</b>				
3.1	Aquarium design and construction; Accessories - aerators, filters and lighting.	2	Chalk & Talk	Black Board
3.2	Aquarium plants and their propagation. Maintenance of aquarium and water quality management.	2	Chalk & Talk	LCD
3.3	Ornamental fish diseases, their prevention, control and treatment methods.	2	Lecture	PPT & White board
<b>UNIT -4</b>				
4.1	Conditioning, packing, transport and quarantine methods.	3	Chalk & Talk	LCD
4.2	Economics, trade regulations, domestic and export marketing strategies.	3	Chalk & Talk	LCD
<b>Practical</b>				
1	Identification of locally available ornamental fishes - Egg layers and live bearers.	3	Hands on training	

2	Identification of locally available live feed organisms.	3	Hands on training	
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Components	Marks	Converted Marks
T1	30	15
T2	30	
Assignment		3
Quiz / Seminar		5
Attendance		2
Total		25 Marks

### EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To recall the basic concepts, Scope and importance of ornamental fish culture	K1	PSO1

<b>CO 2</b>	The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.	<b>K3</b>	PSO1, PSO2
<b>CO 3</b>	Explain the process of food preparation.	<b>K2</b>	PSO1, PSO2
<b>CO 4</b>	Identify the symptoms of various diseases prevalent in aquarium fishes.	<b>K1</b>	PSO2, PSO3
<b>CO 5</b>	To analyze the knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.	<b>K4</b>	PSO1, PSO4

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	S	S						
CO3				S				
CO4				S	S			
CO5			S					

S-Strong(3) M-Medium (2) L-Low (1) B N

### Mapping of COs with POs

CO/PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	S	M	M
CO3	S	S	M	M
CO4	M	S	S	M
CO5	S	M	M	S



**Note:** ♦ Strongly Correlated – **3**  
 ♦ Weakly Correlated – **1**

♦ Moderately Correlated – **2**

**Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology  
SEMESTER –II**

*For those who joined in 2023 onwards*

PROGRAMM E CODE	COURS E CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	23Z1FC	Fundamental s of Biology	Foundatio n Course	2	2

**COURSE DESCRIPTION**

This course aims to create interest for the subject and instill confidence among students.

**COURSE OBJECTIVES**

- To understand the biological significance of biomolecules
- To illustrate the structure and functions of cell and its organelles
- To determine the concept of molecular biology and heredity.
- To correlate various functions and activities of living things
- Infer the concepts of ecology and origin of new life

**Units**

**UNIT –I** **CHEMICAL COMPOSITION OF LIVING ORGANISM( 6 HRS.)**

The water and its properties. Biological molecules: proteins, nucleic acids, lipids, carbohydrates.

### **UNIT –II THE CELL (6 HRS.)**

Prokaryotic and eukaryotic cells. Cell membranes and organelles: structure and function.

### **UNIT –III MOLECULAR BIOLOGY & GENETICS (6 HRS.)**

DNA and genes - Central Dogma of Molecular Biology -DNA as the genetic material.Hereditry – Inherited traits - Mendelian Inheritance – sex determination.

### **UNIT –IV PHYSIOLOGY (6 HRS.)**

**Life Processes** – Nutrition: Autotrophic and Heterotrophic nutrition – Digestion – Respiration – Transportation – Excretion – Neuronal control & Coordination – Reproduction in animals.

### **UNIT –V ECOLOGY AND EVOLUTION (6 HRS.)**

Population interactions - Ecosystem–Structureand Function –Decomposition - Energy Flow– Origin of Life - Evolution of Life Forms – Evidences of Evolution.

#### **TEXT BOOKS:**

1. Biology Textbook for Class XII, Revised edition, 2022, National Council of Educational Research and Training, New Delhi, India.
2. Biology Textbook for Class XI, Revised edition, 2022, National Council of Educational Research and Training, New Delhi, India.

#### **REFERENCES:**

1. P. Raven and G. Johnson, “Biology,” 6th Edition, Mc-Graw-Hill Companies, New York, 2002.
2. Urry, Lisa A., et al. Campbell Biology. Eleventh edition. New York, NY, Pearson Education, Inc, 2017.
3. Taylor, O.J., Green, N.P.O. and Stout, G.W. (1997) Biological Science. Cambridge University Press, Cambridge, UK.

4. Biology, Coursebook. Cambridge IGCSE. Jones and Jones. Cambridge University press, Cambridge, UK.

### DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)

1. <https://ncert.nic.in/textbook.php>
2. <https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/>
3. [https://www.queensu.ca/artsci\\_online/courses/fundamentals-of-biology-molecular-and-cell-biology](https://www.queensu.ca/artsci_online/courses/fundamentals-of-biology-molecular-and-cell-biology)
4. <https://www.illuminalearning.org/register/general-sciences/fundamentals-of-biology>
5. <https://mitocw.ups.edu.ec/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 CHEMICAL COMPOSITION OF LIVING ORGANISM</b>				
1.1	The water and its properties	1	Chalk & Talk	Black Board
1.2	Biological molecules: proteins	2	Chalk & Talk	LCD
1.3	Biological molecules: Nucleic Acids	1		PPT & White board
1.4	Biological molecules: Lipids and Carbohydrates	2	Lecture	Black Board
<b>UNIT – 2THE CELL</b>				
2.1	Prokaryotic and eukaryotic cells.	1	Lecture	Black Board
2.2	Cell membranes	2	Chalk & Talk	Black Board
2.3	Organelles: structure and function.	3	Chalk & Talk	Black Board
<b>UNIT – 3 MOLECULAR BIOLOGY &amp; GENETICS</b>				
3.1	DNA and genes - Central Dogma of Molecular Biology	1	Chalk & Talk	Black Board
3.2	DNA as the genetic material	2	Lecture	PPT &

				White board
3.3	Heredity – Inherited traits – Mendelian Inheritance – sex determination.	3	Chalk & Talk	LCD
<b>UNIT – 4 PHYSIOLOGY</b>				
4.1	Nutrition: Autotrophic and Heterotrophic nutrition	1	Lecture	Black Board
4.2	Digestion – Respiration – Circulation	2	Chalk & Talk	Black Board
4.3	Excretion – Neuronal control & Coordination – Reproduction in animals.	3	Chalk & Talk	Black Board
<b>UNIT – 5 ECOLOGY AND EVOLUTION</b>				
5.1	Population interactions	1	Lecture	Black Board
5.2	Ecosystem–Structureand Function	2	Chalk & Talk	Black Board
5.3	Decomposition - Energy Flow	1	Chalk & Talk	Black Board
5.4	Origin of Life - Evolution of Life Forms – Evidences of Evolution.	2	Lecture	Black Board

**INTERNAL - UG**

<b>Components</b>	<b>Marks</b>	<b>Converted Marks</b>
<b>T1</b>	<b>30</b>	<b>15</b>
<b>T2</b>	<b>30</b>	
<b>Assignment</b>		<b>3</b>
<b>Quiz / Seminar</b>		<b>5</b>
<b>Attendance</b>		<b>2</b>
<b>Total</b>		<b>25 Marks</b>

**EVALUATION PATTERN**

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>

		<b>1</b>
40	60	<b>100</b>

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Recall the biological significance of biomolecules	<b>K1</b>	PSO1, PSO2, PSO4 & PSO8
<b>CO 2</b>	Illustrate the structure and functions of cell and its organelles	<b>K2</b>	PSO1, PSO2, PSO4 & PSO8
<b>CO 3</b>	Determine the concept of molecular biology and heredity.	<b>K3</b>	PSO1, PSO2, PSO4 & PSO8
<b>CO 4</b>	Correlate the different life processes of human	<b>K3</b>	PSO1, PSO2, PSO4 & PSO8
<b>CO 5</b>	Infer the concepts of ecology and evolution	<b>K2</b>	PSO1, PSO2, PSO4 & PSO8

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO1</b>	<b>S</b>							
<b>CO2</b>	<b>M</b>	<b>S</b>						
<b>CO3</b>				<b>S</b>		<b>S</b>		
<b>CO4</b>				<b>S</b>	<b>S</b>	<b>M</b>		
<b>CO5</b>			<b>S</b>					<b>S</b>

S-Strong(3) M-Medium (2) L-Low (1) B N

**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:****Forwarded By****HOD'S Signature  
& Name****I B.Sc. Zoology****SEMESTER – II***For those who joined in 2023 onwards*

PROGRA MME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	23Z2CC3	Chordata	Theory	5	5

**COURSE DESCRIPTION**

This course imparts knowledge on the salient features, classification and uniqueness of the Classes of Phylum Chordata.

**COURSE OBJECTIVES**

- To understand the structures and distinct features of Phylum Chordata.

- To understand and able to distinguish the characteristic features of each subphylum and class.
- To understand the economic importance of vertebrates
- To know about the adaptations of vertebrates
- To understand the evolutionary position of different groups of vertebrates

## UNITS

### UNIT I

(12 Hrs)

**General Characters and Classification of Phylum Chordata:** Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata (*Amphioxus*).

### UNIT II

(12 Hrs)

**Prochordates and Agnatha:** Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, Agnatha (*Petromyzon*), - Pisces (*Scoliodon sorra*) General characters and classification, Origin of fishes, Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.

### UNIT III

(12 Hrs)

**Amphibia :** General characters and classification - Origin of Amphibia - Type study - *Rana hexadactyla* - Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in Amphibia.

### UNIT IV

(12 Hrs)

**Reptilia :** General characters and classification - Type study - (*Calotes versicolor* (endoskeleton of *Varanus*) - Origin of reptiles and effects of terrestrialsation, Extinct reptiles. Snakes of India. Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification

### UNIT V

(12 Hrs)

**Aves and Mammalia :** Aves: General characters and classification - Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying

mammals, Aquatic mammals, Dentition in mammals.

## REFERENCES:

### Text Books

1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942.
4. Ganguly, Sinha, Bharati Goswami and Adhikari, 2004. Biology of animals Vol.II - New central book Agency (p) Ltd.
5. Kotpal. R.L.A, Modern text book of Zoology Vertebrates- Rastogi publications. 2009

### References Books

1. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
2. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
3. Hickman, C.P. Jr., F.M. Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp.
4. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp.
5. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp.
6. Pough H. Vertebrate life, VIII Edition, Pearson International.
7. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.
8. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

### Web Resources

### DIGITAL OPEN EDUCATIONAL RESOURCES

3. <http://tolweb.org/Chordata/2499https://bit.ly/3kABzKa>
4. <https://www.nhm.ac.uk/>
5. <https://bit.ly/3Av1Ejg>
6. <https://bit.ly/3kqTfYZ>
7. <https://biologyeducare.com/aves/>
8. <https://www.vedantu.com/biology/mammalia>

## COURSE CONTENTS & LECTURE SCHEDULE:



Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1</b>				
1.1	General Characters and Classification of Phylum Chordata: Origin of Chordata,	2	Chalk & Talk	PPT
1.2	Differences between non-chordates and chordates	2	Chalk & Talk	LCD
1.3	General characters, Affinities and Systematic position of Hemichordata ( <i>Balanoglossus</i> )	2	Lecture	PPT
1.4	Urochordata ( <i>Ascidia</i> )	3	Chalk & Talk	Black Board
1.5	Cephalochordata ( <i>Amphioxus</i> ).	3	Chalk & Talk	Black Board
<b>UNIT -2</b>				
2.1	Prochordates and Agnatha: Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level	3	Chalk & Talk	Black Board
2.2	Agnatha ( <i>Petromyzon</i> ), - Pisces ( <i>Scoliodon sorra</i> ) General characters and classification	2	Chalk & Talk	Black Board
2.3	Origin of fishes, Affinities of Dipnoi	2	Chalk & Talk	LCD

2.4	Types of scales and fins - Accessory respiratory organs - Air bladder	3	Lecture	PPT
2.5	Parental care - Migration - Economic importance.	2	Chalk & Talk	Black Board
<b>UNIT - 3</b>				
3.1	Amphibia : General characters and classification	3	Chalk & Talk	Black Board
3.2	Origin of Amphibia - Type study - <i>Rana hexadactyla</i>	3	Chalk & Talk	Black Board
3.3	Adaptive features of Anura, Urodela and Apoda	3	Chalk & Talk	LCD
3.4	Neoteny in Urodela - Parental care in Amphibia.	3	Lecture	PPT
<b>UNIT - 4</b>				
4.1	Reptilia : General characters and classification	2	Chalk & Talk	Black Board
4.2	Type study – ( <i>Calotes versicolor</i> (endoskeleton of <i>Varanus</i> ))	3	Chalk & Talk	Black Board
4.3	Origin of reptiles and effects of terrestriation, Extinct reptiles.	2	Chalk & Talk	LCD
4.4	Snakes of India. Poison apparatus and biting mechanism of poisonous snakes	3	Lecture	PPT
4.5	Skull in reptiles as basis of classification	2	Chalk & Talk	LCD
<b>UNIT - 5</b>				
5.1	Aves and Mammalia : Aves: General characters and classification	2	Chalk & Talk	Black Board

5.2	Type study - <i>Columba livia</i> - Origin of birds, Flight adaptations, Migration.	3	Chalk & Talk	Black Board
5.3	Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals	3	Chalk & Talk	LCD
5.4	Egg laying mammals, Marsupials, Flying mammals,	2	Lecture	PPT
5.5	Aquatic mammals, Dentition in mammals.	2	Chalk & Talk	LCD

Components	Marks	Converted Marks
T1	30	15
T2	30	
Assignment		3
Quiz / Seminar		5
Attendance		2
Total		25 Marks

### EVALUATION PATTERN

MARKS		
CIA	ESE	Total

40	60	<b>100</b>
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### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Classify, Identify and recall the name and distinct features of different subphylum belonging to phylum Chordata.	<b>K3</b>	PSO1
<b>CO 2</b>	Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates.	<b>K2</b>	PSO1, PSO2
<b>CO 3</b>	Analyze, compare and distinguish the developmental stages and describe the important biological process.	<b>K4</b>	PSO3, PSO4, PSO5
<b>CO 4</b>	Correlate the different modes of life and parental care among different vertebrates.	<b>K4</b>	PSO3, PSO5,
<b>CO 5</b>	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.	<b>K2</b>	PSO2, PSO3, PSO5

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
<b>CO1</b>	<b>S</b>							

CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	M	S	M	M
CO3	M	S	S	S
CO4	M	M	S	S
CO5	M	M	S	M

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:****Dr. S. Barathy****Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology****SEMESTER – II***For those who joined in 2023 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
UAZO	23Z2CC4	CHORDATA LAB COURSE	Practical	4	3

**COURSE DESCRIPTION**

This Course aims to develop the ability to Identify the salient features of Chordates.

**COURSE OBJECTIVES**

- To identify the different groups of Chordates by observing their external characteristics.
- To understand and compare the structure of various internal organs of Chordates
- To get knowledge about the different modes of life and their adaptation based on the environment.
- Able to mount and display the internal organs and scales of Chordates

**CHORDATA**

**Dissections** (Virtual/ Demo only): Frog  
(Virtual/Demo)/Fish: External features, Digestive system, Arterial system, Venous system, 5<sup>th</sup> Cranial nerve, 9<sup>th</sup> and 10<sup>th</sup> cranial nerves, Male and female urinogenital system.

**Mounting:** Fish: Placoid and Ctenoid scale

**Osteology:** Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hindlimb. Pigeon - synsacrum.

**Specimen and Slides:** (i) **Hemichordata:** Balanoglossus, Tornaria larva (ii). **Protochordata:** Amphioxus, (iii). **Cyclostomata:** Petromyzon, Ammocoetus larva (iv). **Pisces:** Hippocampus, Exocoetetus, Echieneis, Auguilla, Scales: Placoid, Cycloid, Ctenoid (v). **Amphibia:** Ichthyophis, Hyla, Bufo, Axolotal larva (vi). **Reptilia :** Draco, Chamaeleon, Vipera russelli, Naja, Enhydryna, (vii). **Aves:** Archaeopteryx, Passer, Columba,; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down (viii). **Mammalia:** Ornithorhynchus, Manis, Loris.

**Embryology:** Stages in the development of Frog and – Placenta in mammals.

**REFERENCES:**

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The

Invertebrates: A New Synthesis, III Edition, Blackwell Science

3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut
6. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
7. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp.
8. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T.B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp.
9. Pough H. Vertebrate life, VIII Edition, Pearson International.
10. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan &Co., New York, 587 pp.

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://bit.ly/3kABzKa>
2. <https://www.nio.org/>
3. <https://greatbarrierreef.org/>
4. <http://tolweb.org/Chordata/2499>
5. <https://www.nhm.ac.uk/>
6. <https://bit.ly/3Av1Ejg>
7. <https://bit.ly/3kqTfYz>
8. <https://biologyeducare.com/aves/>
9. <https://www.vedantu.com/biology/mammalia>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.1	<b>Dissections (Demo only):</b> Frog (Demo)/Fish: External features, Digestive system,	4	Demo/Virtual Dissection	specimen

1.2	Arterial system, Venous system, 5 <sup>th</sup> Cranial nerve, 9 <sup>th</sup> and 10 <sup>th</sup> cranial nerves, Male and female urinogenital system.	2	Demonstration	Specimens and Slides
1.3	<b>Mounting:</b> Fish: Placoid and Ctenoid scale	6	Demonstration	Specimens and Slides
<b>Osteology</b>				
2.1	<b>Osteology:</b> Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hindlimb. Pigeon - synsacrum. Manis, Loris.	3	Demonstration	Specimens and Slides
2.2	<b>Specimen and Slides:</b> (i) <b>Hemichordata:</b> Balanoglossus, Tornaria larva (ii). <b>Protochordata:</b> Amphioxus, (iii). <b>Cyclostomata:</b> Petromyzon, Ammocoetus larva (iv). <b>Pisces:</b> Hippocampus, Exocoetus, Echieneis, Auguilla, Scales: Placoid, Cycloid, Ctenoid (v). <b>Amphibia:</b> Ichthyophis, Hyla, Bufo, Axolotal larva (vi). <b>Reptilia :</b> Draco, Chamaeleon, Viperarusselli, Naja, Enhydrina , (vii). <b>Aves:</b> Archaeopteryx, Passer, Columba,; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down (viii). <b>Mammalia:</b> Ornithorhynchus,	6	Demonstration	Specimens and Slides
2.3	<b>Embryology:</b> Stages in the development of Frog and – Placenta	3	Demonstration	Specimens and Slides



	in mammals.			
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**COURSE OUTCOMES**

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Identify and label the external features of different groups Chordate animals.	<b>K3</b>	PO1
<b>CO 2</b>	Illustrate and examine the circulatory system, nervous system and reproductive system of Chordate animals.	<b>K2</b>	PO1, PO2
<b>CO 3</b>	Differentiate and compare the structure, function and mode of life of various groups of animals.	<b>K2</b>	PO4, PO6
<b>CO 4</b>	To compare and distinguish the dissected internal organs of lower animals.	<b>K2</b>	PO4, PO5, PO6
<b>CO 5</b>	Prepare and develop the mounting procedure of economically important Chordate	<b>K3</b>	PO3, PO8

**I B.Sc. Zoology****SEMESTER – II***For those who joined in 2023 onwards**(Offered to I B. Sc Chemistry Students)*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z2SE3</b>	<b>ALLIED ZOOLOGY -II</b>	<b>Theory</b>	<b>3</b>	<b>2</b>

**COURSE DESCRIPTION**

This course is designed for the chemistry student which discusses the branch of Zoology that deals with structure and function of various systems, development, inheritance in man and behaviour of animals.

**COURSE OBJECTIVES**

- To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology.
- To enable students to comprehend the processes involved during development.
- To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule.
- To enable students to comprehend the basic concepts of human genetics and patterns of inheritance.
- To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning.

## **UNITS**

### **UNIT I**

**(9 Hrs)**

Respiration - Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products – Ornithine cycle. Structure of neuron – Conduction of nerve impulse, Mechanism of vision and hearing.

### **UNIT II**

**(9 Hrs)**

Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals

### **UNIT III**

**(9 Hrs)**

Immunity Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs – responses in humans; Vaccination schedule

### **UNIT IV**

**(9 Hrs)**

Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked, Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counselling

### **UNIT V**

**(9 Hrs)**

Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour

## **REFERENCES:**

**Text Books**

1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

**References Books**

1. Owen, J. A., Punt, J. & Stranford, S. A. - Kuby Immunology. New York: W.H. Freeman & Company
2. Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education
3. Mathur, R.- Animal Behaviour. Meerut: Rastogi.
4. Verma P.S. & Agarwal Developmental Biology, Chordata embryology S. Chand & Co.

**Web Resources****DIGITAL OPEN EDUCATIONAL RESOURCES****COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 RESPIRATION</b>				
1.1	Respiration - Respiratory pigments	1	Chalk & Talk	Black Board
1.2	Transport of gases	1	Discussion	Google classroom
1.3	Mechanism of blood clotting	2	Lecture	PPT & White board
1.4	Types of excretory products – Ornithine cycle.	2	Lecture	Smart Board
1.5	Structure of neuron	1	Lecture	Black Board
1.6	Conduction of nerve	1	Lecture	Black Board

	impulse,			
1.7	Mechanism of vision	2	Lecture	LCD
1.8	Mechanism of hearing.	2	Discussion	Black Board
<b>UNIT -2 DEVELOPMENTAL BIOLOGY</b>				
2.1	Fertilization	2	Lecture	Green Board Charts
2.2	Cleavage	2	Chalk & Talk	Black Board
2.2	Gastrulation	3	Chalk & Talk	Green Board
2.3	Organogenesis of Frog	3	Lecture	LCD
2.4	Placentation in mammals	2	Chalk & Talk	Black Board
<b>UNIT – 3 IMMUNOLOGY</b>				
3.1	Immunity	1	Chalk & Talk	Black Board
3.3	Innate and Acquired	3	Chalk & Talk	Black Board
3.4	Active and Passive	1	Lecture	PPT/LCD
3.5	Antigens and Antibodies	3	Lecture	PPT/LCD
3.6	Immunological organs	2	Chalk & Talk	Black Board
3.7	Responses in humans	3	Lecture	PPT/LCD
3.8	Vaccination schedule	1	Chalk & Talk	Black Board
<b>UNIT – 4 HUMAN GENETICS</b>				

4.1	Human Genetics – Introduction	1	Lecture	PPT/LCD
4.2	Human Chromosomes	1	Group Discussion	Smart Board
4.3	Sex Determination in Humans	1	Group Discussion	Smart Board
4.4	Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive,	3	Lecture	LCD
4.5	X-linked, Y-linked, Mitochondrial,	2	Chalk & Talk	Black Board
4.6	Multiple Allelic and Polygenic Inheritance	3	Chalk & Talk	Black Board
4.7	Genetic Counselling	1		
<b>UNIT – 5ANIMAL BEHAVIOUR</b>				
5.1	Animal Behaviour	2	Chalk & Talk	Black Board
5.2	Foraging, Courtship Behaviour,	3	Chalk & Talk	Black Board
5.3	Shelter and Nest Construction,	2	Lecture	LCD
5.4	Parental Care	3	Chalk & Talk	Green Board
5.5	Learning Behaviour	2	Chalk & Talk	White board

CIA	
Scholastic	
Non Scholastic	

## 2. EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour	K1	PO1
CO2	Analyse the different developmental stages	K4	PO1, PO2
CO3	Analyse the working of body and immune systems	K4	PO4, PO6
CO4	Analyse the different patterns of inheritance	K4	PO4, PO5, PO6
CO5	Relate the behaviour of animals to physiology. Analyse the different types of behaviour	K2	PO3, PO8

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
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<b>CO1</b>	<b>S</b>	<b>S</b>						
<b>CO2</b>	<b>S</b>		<b>S</b>		<b>S</b>			
<b>CO3</b>	<b>S</b>						<b>S</b>	
<b>CO4</b>	<b>S</b>	<b>M</b>		<b>S</b>		<b>M</b>		
<b>CO5</b>	<b>S</b>							<b>S</b>

S-Strong(3) M-Medium (2) L-Low (1) B N

### Mapping of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	S							
<b>CO 2</b>	M	S						
<b>CO 3</b>				S		S		
<b>CO 4</b>				S	S	S		
<b>CO 5</b>			S					M

S-Strong (3) M-Medium (2) L-Low (1)

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc.**

**SEMESTER –I**

*For I B.Sc Chemistry those who joined in 2023 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGO RY</b>	<b>HRS/ WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z1EC4</b>	<b>ALLIED ZOOLOGY LAB – II</b>	<b>Practical</b>	<b>2</b>	<b>1</b>

### COURSE DESCRIPTION

Students develop laboratory skills with identification of preserved



specimen, manipulation of prepared slides, dissections and display under the microscope

### **COURSE OBJECTIVES**

To study the Physiology and Behaviour of animals.

1. Laboratory biosafety guidelines and Regulations of Animal Ethics.
2. Qualitative analysis of urea and ammonia
3. Qualitative analysis of Uric Acid
4. Identification of Barr Bodies from Cheek Cells.
5. Observation of Mendelian traits in Man.
6. Demonstration of ABO Blood grouping.
7. Observation and recording of behaviour in various animals.

### **SPOTTER**

Eye, Ear, Developmental stages of Frog, Ig A, Ig G, Ig M, Ig D, Placenta in Goat.

### **REFERENCES**

5. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
6. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
7. Tembhare D.B., (2008) *Techniques in Life Sciences*, 1<sup>st</sup> ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
8. Dutta A., (2009) *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.

### **DIGITAL OPEN EDUCATIONAL RESOURCES**

6. <https://www.uwlax.edu/biology/zoo-lab/>
7. <http://virtualbiologylab.org/>
8. <https://www.labster.com/simulations/animal-genetics/>
9. <https://libguides.mines.edu/oer/simulationslabs>

10. <https://www.biodiversitylibrary.org/item/29076#page/5/mode/1up>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>INVERTEBRATA</b>				
1.1	Laboratory biosafety guidelines and Regulations of Animal Ethics.	1	Hands on Training	Specimen
1.2	Qualitative analysis of urea and ammonia	2	Hands on Training	Specimen
1.3	Qualitative analysis of Uric Acid	2	Hands on Training	Specimen
1.4	Identification of Barr Bodies from Cheek Cells.	4	Hands on Training	Specimen
1.5	Observation of Mendelian traits in Man.	1	Hands on Training	Specimen

1.6	Demonstration of ABO Blood grouping.	4	Hands on Training	Specimen
1.7	Observation and recording of behaviour in various animals.	4	Hands on Training	Specimen
<b>SPOTTERS</b>				
2.1	Eye. Ear, Developmental stages of Frog, Ig A, Ig G, Ig M, Ig D, Placenta in Goat.	10	Specimen	Specimen/ Model

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Tota</b>

		<b>1</b>
<b>40</b>	<b>60</b>	<b>100</b>

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Outline the Laboratory biosafety guidelines and good laboratory practices.	<b>K1</b>	PSO1, PSO2 & PSO7
<b>CO 2</b>	Identification of Barr Bodies from Cheek Cells.	<b>K3</b>	PSO1, PSO2, PSO4 & PSO7
<b>CO 3</b>	Examine the presence of excretory products in the samples.	<b>K4</b>	PSO1, PSO7 & PSO8
<b>CO 4</b>	Identify and explain the features of Eye and Ear.	<b>K3</b>	PSO2 & PSO4
<b>CO 5</b>	Explain the type of Immunoglobulins.	<b>K2</b>	PSO1 & PSO4

### Mapping of COs with PSOs

/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	3	2	2	2	2	3	2	2	2	2	2
CO2	3	3	2	2	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	3	2	2	2	2	2
CO4	3	2	2	3	2	2	3	2	2	2	2	2
CO5	2	3	2	3	2	2	2	2	2	2	2	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	1
CO2	3	2	2	1
CO3	3	2	2	1
CO4	3	2	2	1
CO5	3	2	2	1

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Forwarded By**

**HOD'S Signature  
& Name**

**I B.Sc. Zoology  
SEMESTER – II**

*For those who joined in 2023 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	23Z2SE2	BIOCOMPOSTING FOR ENTREPRENEURSHIP	Theory	2	2

**COURSE DESCRIPTION**

This course imparts knowledge on biocomposting methods and hands on experience on the preparation of biocompost and its applications in solid waste management and motivate the learners to become an entrepreneur

**COURSE OBJECTIVES**

CO1	To understand the basic concepts and process of biocomposting
CO2	To analyze the various biocomposting methods
CO3	To foster the skills on the preparation of quality biocompost by recycling the waste
CO4	To infer and integrate the applications of biocompost
CO5	To design and estimate the economic cost of establishing small Biocompost units as a cottage industry.

**UNITS****UNIT - I INTRODUCTION TO BIOCOMPOSTING (6HRS.)**

Biocomposting – Definition, types and ecological importance.

**UNIT – II BIOCOMPOSTING TECHNOLOGY (6HRS.)**

Types of Biocomposting technology – Field pits/ground heaps/tank/large-scale/batch and continuous methods.

**UNIT – III PREPARATION OF BIOCOMPOST (6HRS.)**

Preparation of Biocompost pit and bed using different amendments.

**UNIT –IV APPLICATIONS OF BIOCOMPOST (6HRS.)**

Applications of Biocompost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction, etc.

**UNIT – V ESTABLISHMENT OF SMALL BIOCOMPOST UNIT (6HRS.)**

Economics of establishment of a small biocompost unit – project report

proposal for Self Help Group (Income and employment generation).

### **PRACTICAL**

- ☐ Preparation procedures for Biocompost pit.
- ☐ Selection of Biocompost material, separation of Compostable and Non-compostable materials.
- ☐ Packing and marketing of Biocompost.
- ☐ Field visit to Biocomposting unit.

### **REFERENCES:**

#### **Text Books**

1. Christy, A.M.V. *Vermitechnology*, MJP publishers, Chennai, 1976.

#### **References Books**

1. Bikas R. Pati & Santi M. Mandal (2016). *Recent trends in composting technology*, I K International Publishing House Pvt.Ltd India, 2019.
2. Van der Wurff, A.W.G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J. (Editors) 2016. *Handbook for Composting and Compost Use in Organic Horticulture*. BioGreenhouse COST Action FA 1105, [www.biogreenhouse.org](http://www.biogreenhouse.org).
3. Sultan A I. *The Earthworm Book*. Second Revised Edition .Other India Press, Mapusa - 403 507, Goa, 2005.
4. Bhatnagar R.K. & Palta R.K. “*Earthworm Vermiculture and Vermicomposting*”, Kalyani Publishers, Chennai
5. Gupta P.K. *Vermi Composting for Sustainable Agriculture*, AGROBIOS (India), Jodhpur.

#### **Web Resources**

#### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. [www.biogreenhouse.org](http://www.biogreenhouse.org).
2. <https://pubmed.ncbi.nlm.nih.gov/21628345/>
3. <https://pubmed.ncbi.nlm.nih.gov/18515003/>
4. [https://www.brainkart.com/article/Vermitechnology\\_39993/](https://www.brainkart.com/article/Vermitechnology_39993/)

5. <https://technology4agri.wordpress.com/2013/02/12/vermitechnology-an-introuction/>
6. [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_vermicompost.html](https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html)

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 INTRODUCTION TO BIOCOMPOSTING</b>				
1.1	Biocomposting – Definition	2	Chalk & Talk	Black Board
1.2	Types and	2	Chalk & Talk	Black Board
1.3	Ecological importance.	2	Lecture	PPT
<b>UNIT -2 BIOCOMPOSTING TECHNOLOGY</b>				
2.1	Types of Biocomposting technology	1	Chalk & Talk	Black Board
2.2	Field pits/ground heaps/tank	1	Chalk & Talk	Black Board
2.3	Large-scale/batch and continuous methods.	1	Chalk & Talk	Black Board
<b>UNIT - 3PREPARATION OF BIOCOMPOST</b>				
3.1	Preparation of Biocompost pit	3	Chalk & Talk	Black Board
3.2	Preparation of Biocompost bed using different amendments.	3	Lecture	PPT & White board
<b>UNIT - 4 PROPERTIES OF VERMICOMPOST</b>				
4.1	Applications of Biocompost in soil fertility maintenance	2	Chalk & Talk	Black Board
4.2	Applications of Biocompost	2	Lecture	LCD



	for the promotion of plant growth, value added products			
4.3	Applications of Biocompost in waste reduction, etc.	2	PPT	LCD & White Board
<b>UNIT - 5 ECONOMICS AND PROSPECTS</b>				
5.1	Economics of establishment of a small biocompost unit	3	Chalk & Talk	Black Board
5.2	Project report proposal for Self Help Group (Income and employment generation)	3	Chalk & Talk	Black Board

<b>Components</b>	<b>Marks</b>	<b>Converted Marks</b>
<b>T1</b>	<b>30</b>	<b>15</b>
<b>T2</b>	<b>30</b>	
<b>Assignment</b>		<b>3</b>
<b>Quiz / Seminar</b>		<b>5</b>
<b>Attendance</b>		<b>2</b>
<b>Total</b>		<b>25 Marks</b>

### EVALUATION PATTERN

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
40	60	<b>100</b>

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the basic concepts and process of biocomposting		PO1
CO 2	To demonstrate biocomposting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc..		PO1, PO2
CO 3	To foster the skills on the preparation of quality biocompost by recycling the waste		PO4, PO6
CO 4	To infer and integrate the applications of biocompost		PO4, PO5, PO6
CO 5	To design and estimate the economic cost of establishing small Biocompost units as a cottage industry.		PO3, PO8

### Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

### Mapping of COs with POs

CO/PSO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	2

<b>CO3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – **3**  
 ♦ Weakly Correlated – **1**

♦ Moderately Correlated – **2**

**Forwarded By**

**I B.Sc. Zoology**

**HOD'S Signature  
& Name**

**SEMESTER – II**

*For those who joined in 2023 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>23Z2SE3</b>	<b>Aquarium Keeping</b>	<b>Theory</b>	<b>2</b>	<b>3</b>

### **COURSE DESCRIPTION**

This course familiarizes the status and the importance of ornamental fish industry

### **COURSE OBJECTIVES**

- To create knowledge on self employment opportunity of ornamental fishes
- To provide the knowledge of ornamental fishes and their equipment
- To understand the different breeding techniques of ornamental fishes

### **UNITS**

#### **UNIT I**

**(6 Hrs)**

Introduction and scope - Aquarium fish keeping as hobby and cottage industry. Commercial aspects like national and international market. To create knowledge on self employment opportunity.

#### **UNIT II**

**(6 Hrs)**

External morphology of a typical fish. Exotic and endemic varieties of ornamental fishes.

**UNIT III****(6 Hrs)**

**Aquarium preparation and maintenance**- Kinds of tanks, tank setting, biological filter and aeration, water management, planting, lighting and feeds. Budget for setting up an Aquarium Fish Farm as a Cottage Industry

**UNIT IV****(6 Hrs)**

**Live fish transport- handling, feeding and forwarding techniques of fish**. Fish Diseases and their control.

**UNIT V****(6 Hrs)**

Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Guppies, Mollies, Sword tails, Platy, Siamese fighters and Gold fish, Butterfly fish, Blue morph and Anemone fish.

**REFERENCES:****Text Books**

K. V. Jayasree, C. S. Tharadevi and N. Arumugam (2015), Home Aquarium and Ornamental Fish Culture. Saras Publication

**References Books**

1. Santhanam, P., Sukumaran, N. & P. Natarajan, A manual of freshwater aquaculture (1987), Reprint 1999, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.
2. Cliff Harrison, A colour guide to Tropical Fish (1980), Chartwell Books, INC, Berkshire, printed in Hong Kong.
3. O'Connell, R. F., The freshwater aquarium (1977), Arco Publishing Company, INC New York.
4. Jhingran V.G., 1991: Fish and Fisheries in India – Hindustan Publ.co. New Delhi
5. Mill Dick, 1993: Aquarium Fish, Daya Pub.co., New Delhi

**Web Resources****DIGITAL OPEN EDUCATIONAL RESOURCES**

1. [https://mpeda.gov.in/?page\\_id=791](https://mpeda.gov.in/?page_id=791)
  2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4952235/>
  3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435374/>
  4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3648355/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4203283/>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION</b>				
1.1	Introduction and scope	1	Chalk & Talk	Black Board
1.2	Aquarium fish keeping as hobby and cottage industry.	1	Discussion	Google classroom
1.3	Commercial aspects like national and international market.	2	Lecture	PPT & White board
1.4	knowledge on self employment opportunity.	2	Lecture	Smart Board
<b>UNIT -2 DEVELOPMENTAL BIOLOGY</b>				
2.1	External morphology of a typical fish.	2	Lecture	Green Board Charts
2.2	Exotic varieties of ornamental fishes.	2	Chalk & Talk	Black Board
2.2	Endemic varieties of ornamental fishes.	2	Chalk & Talk	Green Board
<b>UNIT – 3 AQUARIUM MANAGEMENT</b>				
3.1	Aquarium preparation and maintenance	1	Chalk & Talk	Black Board
3.3	Kinds of tanks, tank setting, biological filter and aeration,	2	Chalk & Talk	Black Board
3.4	water management, planting, lighting and feeds.	2	Lecture	PPT/LCD
3.5	Budget for setting up an Aquarium Fish Farm as a Cottage Industry	1	Lecture	PPT/LCD
<b>UNIT – 4 TRANSPORT AND DISEASE</b>				

4.1	Live fish transport-handling, feeding	2	Lecture	PPT/LCD
4.2	forwarding techniques of fish.	2	Group Discussion	Smart Board
4.3	Fish Diseases and their control.	2	Lecture	LCD
<b>UNIT – 5 BREEDING</b>				
5.1	Breeding – Common characters and sexual dimorphism of Fresh water Guppies, Mollies, Sword tails, Platy, Siamese fighters and Gold fish,	3	Chalk & Talk	Black Board
5.2	Breeding – Common characters and sexual dimorphism of Marine aquarium ornamental fish		Chalk & Talk	Black Board
5.3	Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Butterfly fish, Blue morph and Anemone fish.		Lecture	LCD

CIA	
Scholastic	
Non Scholastic	

### 3. EVALUATION PATTERN

<b>MARKS</b>
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<b>CIA</b>	<b>ESE</b>	<b>Total</b>
40	60	100

### **COURSE OUTCOMES**

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	List the types of aquarium.	<b>K1</b>	
<b>CO 2</b>	Identify the exotic and endemic varieties of ornamental fishes.	<b>K3</b>	
<b>CO 3</b>	Outline the physico – chemical parameters in setting and management of aquarium Farm.	<b>K2</b>	
<b>CO 4</b>	Explain the techniques followed in feeding, handling and transport of ornamental fish.	<b>K2</b>	
<b>CO 5</b>	Identify the common freshwater and marine ornamental fishes based on common characters and sexual dimorphism.	<b>K3</b>	

### **Mapping COs Consistency with PSOs**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>		<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>
<b>CO1</b>	<b>S</b>								

CO2	S			S			M	M	
CO3	S				M				
CO4	S			S					
CO5	S								

S-Strong (3) M-Medium (2) L-Low (1) B N

**Mapping of COs with POs**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3							
CO 2	2	3						
CO 3				3		3		
CO 4				3	3	2		
CO 5			3					2

S-Strong (3) M-Medium (2) L-Low (1)

**Note:** ♦ Strongly Correlated – 3 ♦ Moderately Correlated – 2

♦ Weakly Correlated -1

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& Name****II B.Sc.Zoology****SEMESTER –III***For those who joined in 2019 onwards*

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDITS
UAZO	19Z3CC 7	Human Physiology	Lecture	5	4

**COURSE DESCRIPTION**

The course focuses on the complex organization of different organ systems and their functions.



**COURSE OBJECTIVES**

- To understand the structure and functions of digestive, respiratory, circulatory, urinogenital, neuromuscular system and sense organs.
- To introduce the physiological concepts of Homeostasis and control mechanisms.
- Learning in depth about the structure and functions of various Endocrine glands

**UNITS****UNIT – I DIGESTIVE SYSTEM****(15 HRS.)**

Structure and Functions of digestive system - Buccal glands, Gastric, Intestinal glands, Liver and their functions - Mechanical and chemical digestion of food: Buccal, Gastric and Intestinal digestion - Important digestive enzymes for CHO, Protein, lipids- Absorption of minerals, and vitamins - Hormonal control of secretion of enzymes in gastrointestinal tract. Symptoms and causes of - Peptic ulcer, Gastroparesis, Constipation, Irritable Bowel Syndrome (IBD) Hemorrhoids.

**Self Study - Structure and Functions of digestive system**

**UNIT –II RESPIRATORY SYSTEM AND CIRCULATORY SYSTEM (15 HRS.)**

Histology of trachea and lung - Respiration and Respiratory Muscles-Respiratory pigment- Pulmonary Respiration – Mechanism of Respiration-Transport of O<sub>2</sub>- Oxygen dissociation curve and Bohr effect-Transport of CO<sub>2</sub> –Chloride Shift - carbon monoxide poisoning - Rate & Control of Respiration-BMR, RQ, Anoxia and Hypoxia (Definitions only) - Respiratory disorder - Cyanosis, Apnoea, Asthma, Pneumonia. Composition of Blood – Plasma and Corpuscles- Blood clotting Structure and functions of human heart - **Haemodynamic principle**--Cardiac Cycle.Symptoms and causes of - Stroke - Coronary heart disease - Hypertension - Myocardial infarction.

**Self Study - Respiratory pigment**

**UNIT –III UROGENITAL SYSTEM****(15 HRS.)**

Renal function – Mechanisms of urine formation – Hormonal Control-Urinary bladder – Regulation of water balance - Regulation of acid-base balance- Micturition – Dialysis.

Female Reproductive system and Functions of female sex organs: - Role of Hormones in pregnancy and parturition. Symptoms and causes of - Haematuria, Urinary tract infection, Hypospadias, Interstitial cystitis, Endometriosis.

**Self Study - Renal function****UNIT –IV NEUROMUSCULAR SYSTEM****(15 HRS.)**

Structure of skeletal, non-striated and cardiac muscles- Structure and Properties of muscle – Skeletal, Non-striated & Cardiac-Physiology of skeletal muscle contraction-Electro kinematic theory and Sliding Filament theory. Muscular disorder - Muscular dystrophy, Fibromyalgia

Structure and functions of Neuron- Reflex Action-Reflex Arc-Chemical co-ordination- Synaptic Transmission.Symptoms and causes of- Alzheimer's diseases.

**Self Study - Structure and functions of Neuron****UNIT –V HORMONES AND SENSE ORGANS****(15 HRS.)**

Endocrine glands and their secretions – Structure and Functions of Pituitary, Thyroid, Parathyroid, Pancreas- islets of langerhans, Adrenal glands and. b). Sense organ – Eye – Anatomy & Physiology of Vision – **Myopic retinopathy and Glaucoma.** Ear –Structure and Functions – Cholesteatoma - Crohn's disease.

**Self Study - Sense organ - Eye - Ear general function****REFERENCES:****TEXT BOOK:**

1. Vijaya D.J., (2001). *Prep Manual For Undergraduates Physiology*. 2<sup>nd</sup> edition, Churchill Livingstone, New Delhi.

**REFERENCES:**

1. Kashyap. V., (2019). *A text book of Animal Physiology and Biochemistry*. Kedar Nath Ram Nath, Meerut.
2. Silverthorn D.U., (2016). *Human Physiology an Integrated Approach*. 6<sup>th</sup> edition, Pearson Education Services, Pvt. Limited.
3. Suresh R., (2012). *Essentials of Human physiology*. Regional Institute of Medical Sciences, Imphal, Manipur.
4. Sherwood L., (2009). *Principles of Human Physiology*. 3<sup>rd</sup> edition, Cengage Learning India private Limited, New Delhi.
5. Sarada S., & Madhavan K. K., (2004). *Textbook of Human Physiology*, Revised by H.D. Singh, 6<sup>th</sup> edition, S. Chand and Company Ltd., New Delhi,
6. Parker S., (1996). *Human Body-Eyewitness Science Book*, Dorling Kindersley Ltd., London,
7. Das P.K., (1995). *Hand-Book of Human Physiology*, 1<sup>st</sup> edition. Current Books International, Calcutta,
8. Vidya R., (1993). *Handbook of Human Physiology*, 7<sup>th</sup> edition, Jaypee Brothers Medical Publishers Pvt. Ltd.

#### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.oercommons.org/courses/anatomy-and-physiology-4/view>
2. <https://www.oercommons.org/courses/anatomy-and-physiology-i/view>
3. <https://www.youtube.com/watch?v=X3TARootFfM>
4. <https://openstax.org/books/biology-2e/pages/34-1-digestive-systems>
5. <https://openstax.org/books/anatomy-and-physiology/pages/10-5-types-of-muscle-fibers>
6. <https://openstax.org/books/anatomy-and-physiology/pages/17-1-an-overview-of-the-endocrine-system>

#### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 DIGESTIVE SYSTEM</b>				

1.1	Structure and Functions of digestive system	1	Discussion	Black Board
1.2	Buccal glands, Gastric glands and their functions	2	Chalk & Talk	LCD
1.3	Intestinal glands, Liver and their functions	3	Lecture	PPT & White board
1.4	Mechanical and chemical digestion of food: Buccal, Gastric & Intestinal digestion	2	Lecture	Black Board
1.5	Important digestive enzymes for CHO, Protein, lipids.	2	Lecture	LCD
1.6	Absorption of minerals, and vitamins.	1	Discussion	Google classroom
1.7	Hormonal control of secretion of enzymes in gastrointestinal tract	2	Chalk& Talk	Black Board
1.8	Symptoms and causes of - Peptic ulcer, Gastroparesis, Constipation,	1	Lecture	Black Board
1.9	Symptoms and causes of Irritable Bowel Syndrome (IBD) Hemorrhoids	1	Lecture	PPT
<b>UNIT -2 RESPIRATORY SYSTEM AND CIRCULATORY SYSTEM</b>				
2.1	Histology of trachea and lung.	1	Lecture	Green Board Charts
2.2	Respiration and Respiratory muscles-Respiratory pigment.	2	Discussion	Green Board
2.3	Pulmonary Respiration.	1	Lecture	PPT & White board
2.4	Mechanism of Respiration-Transport of O <sub>2</sub> -Oxygen dissociation curve and Bohr effect.	1	Chalk& Talk	Black Board

2.5	Transport of CO <sub>2</sub> –Chloride Shift - carbon monoxide poisoning	1	Discussion	Google classroom
2.6	Rate & Control of Respiration-BMR, RQ, Anoxia and Hypoxia (Definitions only).	1	Chalk& Talk	Black Board
2.7	Respiratory disorder - Cyanosis, Apnoea, Asthma & Pneumonia.	1	Discussion	Google classroom
2.8	Composition of Blood – Plasma and Corpuscles.	2	Chalk& Talk	Black Board
2.9	Blood clotting.	1	Chalk& Talk	LCD
2.10	Structure and functions of human heart.	1	Lecture	PPT & White board
2.11	Haemodynamic principle-Cardiac Cycle.	1	Chalk& Talk	Black Board
2.12	Symptoms and causes of - Stroke - Coronary heart disease	1	Lecture	PPT & White board
2.13	Symptoms and causes of Hypertension - Myocardial infarction	1	Lecture	PPT & White board
<b>UNIT -3 UROGENITAL SYSTEM</b>				
3.1	Renal function	1	Discussion	Black Board
3.2	Mechanisms of urine formation	1	Chalk & Talk	LCD
3.3	Hormonal control	2	Lecture	PPT &
3.4	Urinary bladder Micturition – Dialysis.	1	Lecture	LCD
3.5	Regulation of water balance - Regulation of acid-base balance-	2	Lecture	Black Board
3.6	Urinary bladder, Micturition –	1	Discussion	Google

	Dialysis.			classroom
3.7	Female Reproductive system	2	Chalk & Talk	PPT
3.8	Functions of female sex organs	1	Discussion	Black Board
3.9	Role of Hormones in pregnancy and parturition.	1	Lecture	Black Board
3.10	Symptoms and causes of – Haematuria & Urinary tract infection,	2	Lecture	LCD
3.11	Symptoms and causes of - Hypospadias, Interstitial cystitis, & Endometriosis.	1	Lecture	Black Board
<b>UNIT -4 NEUROMUSCULAR SYSTEM</b>				
4.1	Structure of skeletal, non-striated and cardiac muscles	1	Lecture	Green Board Charts
4.2	Structure and Properties of muscle – Skeletal, Non-striated & Cardiac	2	Chalk & Talk	Green Board
4.3	Physiology of skeletal muscle contraction	2	Chalk & Talk	Black Board
4.4	Electro kinematic theory and Sliding Filament theory.	2	Chalk & Talk	LCD
4.5	Muscular disorder - Muscular dystrophy, Fibromyalgia	2	Lecture	Black Board
4.6	Structure and functions of Neuron	1	Discussion	Green Board
4.7	Reflex Action-Reflex Arc	1	Chalk & Talk	PPT
4.8	Chemical co-ordination-	2	Chalk &	LCD

	Synaptic Transmission.		Talk	
4.9	Symptoms and causes of- Alzheimer's diseases	2	Lecture	Black Board
<b>UNIT -5 HORMONES AND SENSE ORGANS</b>				
5.1	Endocrine glands and their secretions.	1	Chalk & Talk	Black Board
5.2	Structure and Functions of Pituitary.	2	Chalk & Talk	LCD
5.3	Structure and functions of Thyroid & Parathyroid.	4	Lecture	PPT & White board
5.4	Structure & functions of Pancreas- islets of langerhans,	1	Lecture	Black Board
5.5	Structure and functions of Adrenal glands	1	Lecture	Black Board
5.6	Sense organ – Eye – Anatomy & Subtopics	1	Discussion	Google classroom
5.7	Physiology of Vision – Myopic retinopathy and Glaucoma.	2	Chalk & Talk	LCD
5.8	General functions of eye and ear	1	Discussion	Black Board
5.9	Cholesteatoma & Crohn's disease.	2	Discussion	PPT

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Quiz	Assignment	OBT/PP T				
	10 Mks	10 Mks	5 Mks	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks	

K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

## CIA

Scholastic	<b>35</b>
Non Scholastic	<b>5</b>
	<b>40</b>

**EVALUATION PATTERN**

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

**COURSE OUTCOMES**

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL	PSOs ADDRESSED
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		(ACCORDING TO REVISED BLOOM'S TAXONOMY)	
<b>CO 1</b>	Associate the basic components and functions of the digestive system and their diseases.	<b>K2</b>	PSO1, PSO4, PSO8 & PSO11
<b>CO 2</b>	Organise structure and functions of the respiratory and circulatory system and their diseases.	<b>K3</b>	PSO1, PSO4, PSO10
<b>CO 3</b>	Recognize the organs and functions of urinogenital system and their disease.	<b>K3</b>	PSO1, PSO10
<b>CO 4</b>	Identify the organs, theories and functions of neuromuscular system and their diseases.	<b>K1</b>	PSO1, PSO8, PSO10
<b>CO 5</b>	Analyze the structure and functions of Endocrine glands and sense organs and their disorder	<b>K2</b>	PSO4, PSO 8, PSO10

### Mapping COs Consistency with PSOs

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	2	2	2	3	2	2
CO4	3	2	2	2	2	2	2	3	2	2	2	2
CO5	2	2	2	3	2	2	2	3	2	2	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	1	2	2
CO2	2	2	2	2
CO3	2	2	2	2
CO4	2	1	2	2
CO5	3	1	2	2

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**  
**Dr. Sr. Biji Cyriac**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

## II B.Sc. Zoology SEMESTER – III

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/ WEEK	CREDIT S
UAZO	19Z3CC8	Environmental Biology	Lecture	4	3

### COURSE DESCRIPTION

Review of ecological concepts to the understanding of Environmental biology.

**COURSE OBJECTIVES**

Appreciation of relationships between Environmental biology and other disciplines within Environmental biology.

**UNIT – I ECOSYSTEM****(12HRS.)**

Definition, structure and types of ecosystem. Dynamics of ecosystem: Energy, primary production, food chain, food web, trophic level, ecological pyramids. Brief account of Pond, River, Marine, Forest, Grassland, Desert ecosystem.

**Self-study \_ food chain, food web, Brief account of Pond ecosystem**

**UNIT – II POPULATION ECOLOGY****(12HRS.)**

Characteristics of population: Density, Natality, Mortality, Age distribution, Population growth - survivorship curve, biotic potential, dispersal and dispersion of population, Regulation, Population interactions: Neutralism, symbiosis, antibiosis, parasitism, predation, competition – Gause's principle.

**UNIT – III COMMUNITY & NATURAL RESOURCES****(12 HRS.)**

Characteristics of community: Structure, concept, stratification, ecotone & Edge effect, Ecological Niche, Ecological Succession: process – theory – types, patterns. Natural resources: Types, Soil resources: Profile, soil erosion and management.

**UNIT –IV BIODIVERSITY****( 12HRS.)**

Biodiversity: Definition, types: Genetic, species, ecosystem – bio-geographical classification of India – value of biodiversity – threats – endangered – endemic – hotspots – conservation of biodiversity – types, wildlife conservation, biosphere reserves. Brief account on remote Sensing: types and applications.

**UNIT –V ENVIRONMENTAL POLLUTION****(12 HRS.)**

Definition, Causes, effects and control measures of Air, Water, Soil, Noise, and Nuclear pollution. Case studies: Bhopal episode, stone leprosy, Minamata disease, Chernobyl episode – **Role of an individual in prevention of pollution** – **Environmental Protection Act**- Salient features

**Self Study \_ Case studies: Bhopal episode, stone leprosy, Minamata disease, Chernobyl episode – Role of an individual in prevention of pollution**

**TEXT BOOK:**

1. Arumugam N., (2014). *Concepts of Ecology*.Saras Publication.Nagercoil.
- 2.Asthanks D.K., & Asthana. M.A., (2009).*TextBook of Environmental Studies*. S. Chand & Company Ltd.
- 3.Krishnamurthy K.V., (2007). *An Advanced Textbook on Biodiversity*.4<sup>th</sup> Edition, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

**REFERENCES**

1. Odum E.P.,& Barrett G.W., (2009). *Fundamentals of Ecology*.5<sup>th</sup> Edition, Binding House, New Delhi.
2. Rans S.V.S., (2007). *Essentials of ecology and Environmental Science*. 3<sup>rd</sup> Edition, Prentice-Hall of India Private Limited, New Delhi.
3. Cunningham W.P.,& Cunningham M.A., (2008). *Environmental Science- a global concern*. 10<sup>th</sup> Edition McGraw Hill International, Boston.
4. Chatterji A.K., (2005). *Introduction to Environmental Biotechnology*. Prentice-Hall of India Private Limited, New Delhi.
5. Anand S.B., (2005). *An Introduction to Environmental Management*. Himalaya Publishing House, Mumbai.
6. Ignacimuthu S.J., (2012).*Environmental Studies*. MJP Publishers,Chennai.

**DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)**

1. <https://guides.lib.vt.edu/oer/plants>
2. <https://www.oercommons.org/courses/environmental-biology/view>
3. <https://www.oercommons.org/browse?f.search=Ecology>
4. <https://open.umn.edu/opentextbooks/textbooks/introduction-to-envi>

[ronmental-science-2nd-edition](#)

5. <https://www.nationalgeographic.org/encyclopedia/ecosystem/>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 ECOSYSTEM</b>				
1.1	Definition, structure of ecosystem.	2	Chalk & Talk	Black Board
1.2	Dynamics of ecosystem: Energy, primary production, food chain, food web,	2	Chalk & Talk	Black Board
1.3	trophic level, ecological pyramids.	2	Lecture	PPT
1.4	Brief account of Pond, River ecosystems	2	Chalk & Talk	Black Board
1.5	Marine, Forest	2	Lecture	PPT
1.6	Grassland, Desert ecosystem	2	Lecture	PPT
<b>UNIT -2 POPULATION ECOLOGY</b>				
2.1	Characteristics of population: Density, Natality, Mortality	2	Lecture	LCD
2.2	Age distribution, Population growth - survivorship curve, biotic potential	2	Chalk & Talk	Green Board
2.3	dispersal and dispersion of population, Regulation	2	Lecture	PPT
2.4	Population interactions: Neutralism, symbiosis	2	Chalk & Talk	Black Board
2.5	antibiosis, parasitism	2	Lecture	PPT
2.6	predation, competition Gause's principle	2	Chalk & Talk	Green Board

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT - 3 COMMUNITY &amp; NATURAL RESOURCES</b>				
3.1	Characteristics of community: Structure, concept, stratification	2	Chalk & Talk	Green Board
3.2	Ecotone, Edge effect, Ecological Niche	2	Lecture	PPT
3.3	Ecological Succession: process – theory – types	2	Chalk & Talk	Green Board
3.4	Ecological Succession - patterns.	2	Lecture	PPT
3.5	Natural resources: Types	2	Chalk & Talk	Green Board
3.6	Soil resources: Profile, soil erosion and management.	2	Chalk & Talk	Black Board
<b>UNIT -4 BIODIVERSITY</b>				
4.1	Biodiversity: Definition, types: Genetic, species, ecosystem	2	Chalk &Talk	Green Board
4.2	bio-geographical classification of India – value of biodiversity	2	Chalk & Talk	Green Board
4.3	threats – endangered – endemic – hotspots	2	Lecture	PPT
4.4	– conservation of biodiversity – types,	2	Chalk & Talk	Black Board
4.5	wildlife conservation, biosphere reserves.	2	Lecture	PPT
4.6	Brief account on remote Sensing: types and applications.	2	Chalk &Talk	Green Board
<b>UNIT -5 ENVIRONMENTAL POLLUTION</b>				
5.1	Definition, Causes, effects and control measures of Air, Water pollution	3	Chalk & Talk	Green Board

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
5.2	Definition, Causes, effects and control measures Soil, Noise,	3	Lecture	PPT
5.3	Definition, Causes, effects and control measures Nuclear pollution	2	Chalk & Talk	Black Board
5.4	Case studies: Bhopal episode, stone leprosy, Minamata disease, Chernobyl episode	3	Lecture	PPT
5.5	Role of an individual in prevention of pollution	1	Chalk & Talk	Green Board
5.6	Environmental Protection Act- Salient features	1	Chalk & Talk	Green Board

### INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.	35 Mks.	5 Mks.	40 Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %

Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

## CIA

Scholastic	<b>35</b>
Non Scholastic	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Paraphrase the structure & functions of Ecosystems	K2	PSO1, PSO2 & PSO3



<b>CO 2</b>	Identify the characteristics of a population and their interactions	<b>K3</b>	PSO1& PSO2
<b>CO 3</b>	Categorize community characteristics & value natural resources.	<b>K4</b>	PSO2, PSO3, PSO5 & PSO6
<b>CO 4</b>	Recognize the importance of Biodiversity and its conservation	<b>K1</b>	PSO2, PSO3 & PSO6
<b>CO 5</b>	Show the consequences of Human actions on global environment	<b>K2</b>	PSO2& PSO5

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	3	3	3	3	3	3	2	3	1	2	2
<b>CO2</b>	3	3	3	3	3	3	2	3	1	2	2
<b>CO3</b>	3	3	3	3	3	3	2	3	1	2	2
<b>CO4</b>	3	3	3	3	3	3	3	3	1	2	2
<b>CO5</b>	3	3	1	3	3	3	2	3	1	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	3	3	3
<b>CO2</b>	3	3	3	3
<b>CO3</b>	3	3	3	3
<b>CO4</b>	3	3	3	3
<b>CO5</b>	3	3	3	3

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. V. Bharathy**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

## **II B.Sc. Zoology**

### **SEMESTER – III**

*For those who joined in 2019 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WE E K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>19Z3CC9</b>	<b>Lab - Human Physiology &amp;Environmental Biology</b>	<b>Practical</b>	<b>3</b>	<b>2</b>

#### **COURSE DESCRIPTION**

The course focuses on the interactions between organisms and the environment, and the consequences of these interactions in natural populations, communities and ecosystems through experimental approach

**COURSE OBJECTIVES**

- To gain skills in analyzing the clinical and environmental samples and to learn basic techniques in human physiology and environmental biology
- To understand the functioning of organisms at the molecular, cellular, organ and organism level.

**HUMAN PHYSIOLOGY**

1. Effect of pH and Temperature on salivary amylase activity in man
2. Preparation of haemin and haemochromogen Crystals
3. Test for proteins - Qualitative analysis of proteins – Ninhydrin and Biuret
4. Analysis of blood Sugar and Urea
5. Analysis of Urine Sugar and Albumin
6. Qualitative analysis of urea, ammonia and creatinine
7. Estimation of Uric Acid
8. Spotters - ECG, BMI Chart
9. Spotters - Hormonal disorders – Gigantism, Cretinism, Diabetes & Goitre

**ENVIRONMENTAL BIOLOGY**

1. Estimation of Dissolved O<sub>2</sub> and CO<sub>2</sub> in given water samples
2. Measure pH of different water samples using pH meter, pH paper and indicator solution.
3. Model preparation of food chain, food web in different ecosystem
4. Spotters - *Mysis*, *Lucifer*, *Calanus* and *Zoea*

**REFERENCES:**

1. Rajan S., Christy, S.R., (2011). *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.

3. Tembhare D.B., (2008). *Techniques in Life Sciences*, 1<sup>st</sup> edition., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009). *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.

#### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6825871/>
2. <https://www.youtube.com/watch?v=kwRgNNI6xrM>
3. <https://www.youtube.com/watch?v=frtl5ZoeNQ>
4. <https://www.youtube.com/watch?v=frtl5ZoeNQ&t=286s>
5. <https://www.youtube.com/watch?v=OsdhNtNNNdS>

#### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 HUMAN PHYSIOLOGY</b>				
1.1	Effect of pH and Temperature on salivary amylase activity in man	3	Demonstration & hands on training	Human saliva
1.2	Preparation of haemin and haemochromogen Crystals	3	Demonstration & hands on training	Human Blood
1.3	Test for proteins - Qualitative analysis of proteins – Ninhydrin and Biuret	3	Demonstration & hands on training	Protein Sample
1.4	Analysis of blood Sugar and Urea	3	Demonstration & hands on training	Human Blood
1.5	Analysis of Urine Sugar and Albumin	3	Demonstration & hands on training	Urine sample
1.6	Qualitative analysis of urea, ammonia and creatinine	3	Demonstration & hands on training	

1.7	Estimation of Uric Acid	3	Demonstration & hands on training	
1.8	Spotters - ECG, BMI Chart	3	Discussion	Spotters
1.9	Spotters - Hormonal disorders – Gigantism, Cretinism, Diabetes & Goitre	3	Discussion	Spotters
<b>UNIT -2 ENVIRONMENTAL BIOLOGY</b>				
2.1	Estimation of Dissolved O <sub>2</sub> and CO <sub>2</sub> in given water samples	3	Demonstration & hands on training	Green Board Charts
2.2	Measure pH of different water samples using pH meter, pH paper and indicator solution.	3	Demonstration & hands on training	Green Board
2.3	Model preparation of food chain, food web in different ecosystem	3	Model	
2.4	Spotters - <i>Mysis</i> , <i>Lucifer</i> , <i>Calanus</i> and <i>Zoea</i>	3	Discussion	Preserved slides

CIA

Scholastic	<b>35</b>
Non Scholastic	<b>5</b>
	<b>40</b>

**EVALUATION PATTERN**

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
		<b>1</b>

<b>40</b>	<b>60</b>	<b>100</b>
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## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Associate the effect of pH and temperature on salivary amylase activity in man.	<b>K1</b>	PSO1, PSO2 PSO3
<b>CO 2</b>	Infer the qualitative analysis and estimation of biomolecules.	<b>K1</b>	PSO2, PSO7
<b>CO 3</b>	Compare the preparation of haemin and haemochromogen crystals.	<b>K2</b>	PSO2, PSO5, PSO6
<b>CO 4</b>	Determine the amount of dissolved oxygen and carbon dioxide in the given water samples.	<b>K2</b>	PSO2, PSO7
<b>CO 5</b>	Prepare the models for food chain and food web in different ecosystem and identification of spotters.	<b>K2</b>	PSO2, PSO7

## Mapping COs Consistency with PSOs

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>	<b>PSO11</b>	<b>PSO12</b>
<b>CO1</b>	3	3	3	2	2	2	2	2	2	2	2	2
<b>CO2</b>	2	3	2	2	2	2	3	2	2	2	2	2
<b>CO3</b>	2	2	2	2	3	3	2	2	2	2	2	2
<b>CO4</b>	2	3	2	2	2	2	3	2	2	2	2	2
<b>CO5</b>	2	3	2	2	2	2	3	2	2	2	2	2

## Mapping of COs with POs

<b>CO/PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>
<b>CO1</b>	2	3	2	2
<b>CO2</b>	2	3	2	2

<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2


**COURSE DESIGNER:**

**Dr. Sr. Biji Cyriac**

**Forwarded By**

**II B.Sc. Zoology  
 SEMESTER – III**

*For those who joined in 2019 onwards*

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

<b>PROGRAM ME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>21Q3ACZ1</b>	<b>Plant Diversity &amp; Pathology</b>	<b>Lecture</b>	<b>3</b>	<b>3</b>

**COURSE DESCRIPTION**

To understand the structure & life cycle of Plant groups

**COURSE OBJECTIVES**

To gain knowledge on Algae, Fungi, Plant diseases and to understand the usage of economically important locally available plants

**UNIT –I ALGAE & FUNGI**

**( 9 HRS.)**

General Characters of Algae – Type study - Structure and life history of *Sargassum* – Economic importance of Algae; General characters of Fungi -

Type study - Structure and life history of *Puccinia*- Economic importance of Fungi

**Self-study- Economic importance of Fungi**

**UNIT –II LICHENS & PLANT PATHOLOGY (9 HRS.)**

General Characters of Lichens – Type study - Structure and Reproduction of *Usnea*-Economic importance of Lichens - Causative Organism, Symptoms and Control Measures of the following diseases: Viral disease-Bunchy Top of Banana; Bacterial disease-Citrus Canker; Fungal disease - Tikka disease of Groundnut

**Self-study- Economic importance of Lichens**

**UNIT –III BRYOPHYTES, PTERIDOPHYTES & GYMNOSPERMS (9 HRS.)**

General characters of Bryophytes, Pteridophytes and Gymnosperms - Type study - Structure and life history of *Anthoceros* ,Structure and life history of *Lycopodium* and Structure and life history of *Cycas*(Development of sex organs need not be studied)

**UNIT –IV TAXONOMY OF ANGIOSPERMS (9 HRS.)**

Units of classification, **Binomial Nomenclature** - Bentham and Hooker's classification with reference to the following families Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Poaceae

**Self-study- Binomial Nomenclature**

**UNIT –V ECONOMIC BOTANY (9 HRS.)**

Brief study of the following economic products with special reference to the botanical name, family and morphology of the useful part and its uses

Cereals	- Paddy
Pulses	- Black gram
Fruits	- Mango
Beverages	- Coffee
Narcotics	- Tobacco
Spices and condiments	- Cinnamon
Fibers	- Cotton
Latex	- Rubber
Wood	- Teak wood
Biodiesel	- <i>Jatropha</i>



**Self-study-** Cereals - Paddy, Wood-Teak wood**TEXT BOOKS:**

1. Narayanaswamy R.V. & Rao K.N. *Outlines of Botany*. S. Viswanathan (Printers and Publishers) Pvt. Ltd., Madras (1984).
2. Kumarasen.V & Ragland. A. *Taxonomy of Angiosperm*. Saras Publication, Nagercoil (2004).
3. Pandey B.P. *A text Book of Botany*. Chand and Company Ltd. Ramnagar, New Delhi (2000).
4. Pandey, B.P. *Taxonomy of Angiosperm*. Chand and Company Ltd. Ramnagar, New Delhi (2007).
5. Verma, V. *A Text Book of Economic Botany*. Ane Books Pvt. Ltd. New Delhi (2009).

**REFERENCES**

1. Pandey B.P., *Economic Botany*. S. Chand and Company Ltd., New Delhi (1999).
2. Vashista, B.R., *Algae*. 8th Edition, S. Chand and Company Ltd., New Delhi (2000).
3. Pandey, B.P., *Bryophyta*. 4th Edition, S. Chand and Company Ltd. New Delhi (2000).
4. Vashista, B.R., *Fungi*. 11th Edition, S. Chand and Company Ltd. New Delhi (2000).
5. Vashishta B.R., *Pteridophyta*. S. Chand and Company Ltd. New Delhi (2010).
6. Vashishta. B.R., *Gymnosperms*. S. Chand and Company Ltd. New Delhi (2010).
7. Lawrence, G.H.M., *Taxonomy of Vascular Plants*. Scientific Publishers India. (2012)

**DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)**

1. [https://bio.libretexts.org/Bookshelves/Botany/Book%3ABotanyLabManual\(Morrow\)/02%3AIntroductiontoEcology](https://bio.libretexts.org/Bookshelves/Botany/Book%3ABotanyLabManual(Morrow)/02%3AIntroductiontoEcology)
2. <https://www.medicinalplants-pharmacognosy.com/>

3. <https://courses.lumenlearning.com/boundless-biology/chapter/angiosperms/>
4. <https://courses.lumenlearning.com/boundless-biology/chapter/gymnosperms/>
5. <https://courses.lumenlearning.com/boundless-biology/chapter/importance-of-fungi-in-human-life/>
6. <https://openstax.org/books/concepts-biology/pages/14-3-seed-plants-gymnosperms>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 PLANT ANATOMY</b>				
1.1	General Characters of Algae	1	Chalk & Talk	Black Board
1.2	Type study - Structure and life history of <i>Sargassum</i>	2	Lecture	PPT
1.3	Economic importance of Algae	1	Chalk & Talk	LCD
1.4	General characters of Fungi	2	Lecture	PPT & White board
1.5	Type study - Structure and life history of <i>Puccinia</i>	2	Lecture	Smart Board
1.6	Economic importance of Fungi	1	Lecture	Black Board
<b>UNIT -2 LICHENS AND PLANT PATHOLOGY</b>				
2.1	General Characters of Lichens	2	Lecture	Green Board Charts

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.2	Type study - Structure and Reproduction of <i>Usnea</i> -	3	Chalk & Talk	Green Board
2.3	Economic importance of Lichens	1	Chalk & Talk	Black Board
2.4	Causative Organism, Symptoms and Control Measures of the following diseases: Viral disease- Bunchy Top of Banana	1	Lecture	PPT
2.5	Bacterial disease-Citrus Canker	1	Chalk & Talk	LCD
2.6	Fungal disease - Tikka disease of Groundnut	1	Chalk & Talk	Black Board
<b>UNIT -3 BRYOPHYTES, PTERIDOPHYTES &amp; GYMNOSPERMS</b>				
3.1	General characters of Bryophytes	1	Lecture	PPT
3.2	Pteridophytes	1	Chalk & Talk	LCD
3.3	Gymnosperms	1	Lecture	PPT
3.4	Type study - Structure and life history of <i>Anthoceros</i>	2	Chalk & Talk	LCD
3.5	Structure and life history of <i>Lycopodium</i>	2	Lecture	PPT & White board
3.6	Structure and life history of <i>Cycas</i> (Development of sex organs need not be studied)	2	Lecture	PPT
<b>UNIT -4 TAXONOMY OF ANGIOSPERMS</b>				
4.1	Units of classification, Binomial Nomenclature	1	Discussion	Black Board

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
4.2	Bentham and Hooker's classification	2	Chalk & Talk	Specimen, Black Board
4.3	Rutaceae	1	Chalk & Talk	Specimen, Black Board
4.4	Caesalpiniaceae	1	Chalk & Talk	Specimen, Black Board
4.5	Asclepiadaceae	2	Chalk & Talk	Specimen, Black Board
4.6	Euphorbiaceae	1	Chalk & Talk	Specimen, Black Board
4.7	Poaceae	1	Chalk & Talk	Specimen, Black Board
<b>UNIT -5 ECONOMIC BOTANY</b>				
5.1	Brief study of the following economic products with special reference to the botanical name, family and morphology of the useful part and its uses Cereals- Paddy, Pulses-Blackgram	2	Lecture	Specimen, PPT
5.2	Fruits - Mango Beverages - Coffee	2	Chalk & Talk	Specimen, LCD
5.3	Narcotics Tobacco, Spices and condiments - Cinnamon	2	Lecture	Specimen PPT
5.4	Fibers - Cotton, Latex - Rubber	1	Chalk & Talk	Specimen

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				Specimen
5.5	Wood Teak wood, Biodiesel - <i>Jatropha</i>	2	Chalk & Talk	Specimen

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PP T 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

Scholastic	<b>35</b>
Non Scholastic	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Recognize the structure, life cycle and economic importance of Algae & Fungi	<b>K1</b>	PSO2 & PSO3
<b>CO 2</b>	Identify the plant diseases & control methods and Lifecycle & uses of Lichens	<b>K3</b>	PSO1 & PSO3
<b>CO 3</b>	Show general characters & life cycle of Bryophytes, Pteridophytes and Gymnosperms	<b>K2</b>	PSO4, PSO5
<b>CO 4</b>	Classify the Angiosperms & list their uses	<b>K4</b>	PSO5 & PSO 11

<b>CO 5</b>	Relate the plants to their economic uses	<b>K3</b>	PSO3, PSO4 & PSO 6
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### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	2	3	3	2	2	2	2	2	2	2	2
<b>CO2</b>	3	2	3	2	2	2	2	2	2	2	2
<b>CO3</b>	2	2	2	3	3	2	2	2	2	2	2
<b>CO4</b>	2	2	2	2	3	2	2	2	2	2	3
<b>CO5</b>	2	2	3	3	2	3	2	2	2	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	3	3	3
<b>CO2</b>	3	3	3	3
<b>CO3</b>	3	3	3	3
<b>CO4</b>	3	3	3	3
<b>CO5</b>	3	3	3	3

**Note:** ♦ Strongly Correlated – **3**  
♦ Weakly Correlated – **1**

♦ Moderately Correlated – **2**

**COURSE DESIGNER:**  
**Dr. V. Bharathy**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
Head, Dept. of Zoology  
FATIMA COLLEGE (AUTONOMOUS)  
MADURAI-625 018

**HOD'S Signature  
& Name**

## II B.Sc.Zoology

### SEMESTER – III

*For those who joined in 2019 onwards*

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WE K	CREDIT S
UAZO	21Q3ACZ2	Lab –Plant Diversity & Pathology	Practical	2	2

#### COURSE DESCRIPTION

To understand the structure and function of different plant groups

#### COURSE OBJECTIVES

To gain knowledge in constructing sections of plant material and to understand them.

#### EXPERIMENTS

1. Micro preparations, description and identification of Algae (*Nostoc*, *Cladophora*).



2. Sectioning and identification of Plant diversity materials wherever applicable (*Sargassum, Puccinia, Usnea, Lycopodium* and *Cycas*)
3. Identification of Plant diseases
4. Description of the plants in technical terms belonging to the families prescribed in the syllabus using local flora.
5. Genus, species and family of economically useful plant parts wherever applicable under Economic Botany.
6. Spotters
7. Record Note

### TEXT BOOKS

1. Pandey B.P., (2000). *A text Book of Botany*. Chand and Company Ltd. Ram nagar, New Delhi.
2. Gupta P.K., (2000). *Principles of Plant breeding*. John Wiley, New York.
3. Rao M., (2002). *A text Book of Horticulture*. Laxmi Publications, New Delhi.
4. Ragland A & Jeyakumar., (2010). *Plant physiology*. Saras publication, Nagercoil.
5. Kumarasen V., (2009). *Plant breeding*, Saras publication, Nagercoil.

### REFERENCES

1. Bendre. A . Practical Botany. Deep and Deep Publications (2009).
2. Pandey. B.P. Modern Practical Botany - Vol.1,2&3. S. Chand publications (2011).
3. Bendre. A & Kumar. A. A Text Book Of Practical Botany 2. Deep and Deep Publications (2002).
4. Vashista, B.R. Algae. 8<sup>th</sup> Edition, S.Chand and Company Ltd., New Delhi(2000).
5. Pandey, B.P. Bryophyta. 4<sup>th</sup> Edition, S. Chand and Company Ltd. New Delhi(2000).
6. Vashista, B.R. Fungi. 11<sup>th</sup> Edition, S. Chand and Company Ltd. New Delhi (2000).
7. Vashishta B.R. Pteridophyta. S. Chand and Company Ltd. New Delhi (2010).

8. Vashishta. B.R. Gymnosperms. S. Chand and Company Ltd. New Delhi (2010).

**Digital Open Educational Resources (DOER) :**

1. <https://ccconlineed.instructure.com/courses/4543/pages/botany-slash-plant-diversity>
2. [https://bio.libretexts.org/Bookshelves/Botany/Botany\\_\(Ha\\_Morrow\\_and\\_Algers\)/Unit\\_0%3A\\_Introduction\\_to\\_Botany/01%3A\\_Introduction](https://bio.libretexts.org/Bookshelves/Botany/Botany_(Ha_Morrow_and_Algers)/Unit_0%3A_Introduction_to_Botany/01%3A_Introduction)
3. <https://science.csu.edu.au/herbarium>
4. <https://openstax.org/books/concepts-biology/pages/14-4-seed-plants-angiosperms>
5. <https://plantbiology.siu.edu/facilities/plant-biology-facilities/greenhouse/topics/economic.php>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT – 1 PLANT ANATOMY</b>				
1	Micro preparations, description and identification of Algae ( <i>Nostoc</i> , <i>Cladophora</i> ).	4	Sectioning	Micro preparations, description and identification of Algae ( <i>Nostoc</i> , <i>Cladophora</i> )
2	Sectioning and identification of Plant diversity materials wherever applicable ( <i>Sargassum</i> , <i>Puccinia</i> , <i>Usnea</i> , <i>Lycopodium</i> and <i>Cycas</i> )	12	Sectioning	Sectioning and identification of Plant diversity materials wherever applicable ( <i>Sargassum</i> , <i>Puccinia</i> , <i>Usnea</i> , <i>Lycopodium</i> and <i>Cycas</i> )

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
3	Identification of Plant diseases	3	Discussion	Identification of Plant diseases
4	Description of the plants in technical terms belonging to the families prescribed in the syllabus using local flora.	5	Demonstration	Description of the plants in technical terms belonging to the families prescribed in the syllabus using local flora.
5	Genus, species and family of economically useful plant parts wherever applicable under Economic Botany.	2	Discussion	Genus, species and family of economically useful plant parts wherever applicable under Economic Botany.
7	Spotters	-	Discussion	Spotters

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>40</b>	<b>60</b>	<b>100</b>

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO1</b>	Construct suitable micro preparations	<b>K1</b>	PSO1, PSO2&PSO7
<b>CO2</b>	Construct sections of given plant materials with illustration and description	<b>K1</b>	PSO2,PSO3&PSO7
<b>CO3</b>	Make use of dissection microscope to display the floral parts of Angiosperms	<b>K2</b>	PSO1,PSO2&PSO7
<b>CO4</b>	Identify specimens and slides from Algae, Fungi,Lichens,Bryophytes, Pteridophytes and Gymnosperms included in the syllabus	<b>K2</b>	PSO2,PSO6&PSO7
<b>CO5</b>	Identify the economically useful plants	<b>K2</b>	PSO2,PSO6&PSO7

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	3	3	3	3	3	3	3	3	2	2	2
<b>CO2</b>	3	3	3	3	3	3	3	3	2	2	2
<b>CO3</b>	3	3	3	3	3	3	3	3	2	2	2
<b>CO4</b>	3	3	3	3	3	3	3	3	2	2	2
<b>CO5</b>	3	3	3	3	3	3	3	3	3	2	3

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	3	3	3
<b>CO2</b>	3	3	3	3

<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Note:** ♦ Strongly Correlated – **3**      ♦ Moderately Correlated – **2**  
 ♦ Weakly Correlated - **1**

**COURSE DESIGNER:**  
**Dr. V. Bharathy**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

## II B.Sc.Zoology SEMESTER –III

*For II B.Sc Chemistry those who joined in 2019 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGO RY</b>	<b>HRS/WE EK</b>	<b>CREDI TS</b>
<b>UAZO</b>	<b>21Z3AC C1</b>	<b>Animal Diversity, Physiology &amp; Genetics</b>	<b>Lecture</b>	<b>3</b>	<b>3</b>

### **COURSE DESCRIPTION**

This course is designed for the chemistry student which discusses the branch of Zoology that deals with animal diversity, structure and function of various systems, development and inheritance of man.

### **COURSE OBJECTIVES**

- Attain a precise knowledge on the taxonomy, diversity, anatomy and

physiology all major animal phyla along with several minor phyla with an emphasis on the unique and specific features of each group.

- Understand the structure and function of digestive, excretory, reproductive and sensory systems
- Inculcate the aspect of how generations inherit and vary.

## UNITS

### UNIT –I ANIMAL DIVERSITY

(9 HRS.)

Animal Kingdom: **General characters OF Invertebrates and Chordata: outline classification.** organization, symmetry, body cavity. General characters: Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Molluscs, Echinodermata, Pisces, Amphibians, Reptiles, Aves and Mammalia.

#### Self Study- Outline classification of phyla

### UNIT –II DIGESTION AND RESPIRATION

(9 HRS.)

**Digestion:** Digestive system of human, role of salivary glands, bile and enzymes in digestion of Carbohydrates, Protein and Fat in human. Absorption of Carbohydrates, protein and fat. **Respiration:** External and internal respiration, Structure of Lungs. Mechanism of respiration. Respiratory pigment – Hemoglobin and Hemocyanin. Exchange and transport of gases.

#### Self Study – Structure of Lungs

### UNIT –III CIRCULATION AND EXCRETION

( 9 HRS.)

**Circulation:** Types –open and closed, Components and functions of Blood, Structure and functions of human heart- origin and conduction of heart beat. **Excretion:** Classification of animals based on excretory products, Structure and functions of Kidney and nephron - Physiology of urine formation.

#### Self study –Functions of Kidney

### UNIT –IV REPRODUCTION& SENSORY RECEPTORS

(9 HRS.)

Reproduction: Male reproductive system – structure and Function. Female reproductive system – structure and Function - Menstrual cycle. Sensory Receptors: Photoreceptor – Structure and functions of the eye. Phonoreceptor: Structure and functions of ear.

### **Self Study - Anatomy of Male reproductive and Female reproductive system**

### **Self Study – General function of Ear**

### **UNIT –V MENDELIAN LAWS OF INHERITANCE & ALLELISM (9 HRS.)**

Mendelian laws –law of Dominance, law of Segregation and Monohybrid cross, law of Independent assortment and Dihybrid Cross. Multiple Alleles – **ABO blood grouping**. Sex linked inheritance – X linked genes - Colour blindness, Hemophilia; Y linked genes - Sex Influenced genes – Sex limited genes.

### **UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (HRS.)**

Syndrome - Down Syndrome – Turner’s Syndrome –Klinefelter’s Syndrome

### **REFERENCES**

- 1.Arumugam and Mariakuttikan, (2016). *Animal Physiology*, Saras publications, Nagercoil.
- 2.Meyyan R, (2009). *Genetics*. Saras Publication,3rd Edition , Kanyakumari.
- 3.Arumugam N., (2012) *A Text book of Invertebrates*, 4<sup>th</sup> edition, Saras publication, Nagercoil.
4. Jordan E.L.and Verma P.S., (2001) *Invertebrate Zoology*, S.Chand & Co, New Delhi.
5. Kashyap. V., (2019). *A text book of Animal Physiology and Biochemistry*. Kedar Nath Ram Nath, Meerut.
6. Silverthorn D.U., (2016). *Human Physiology an Integrated Approach*. 6<sup>th</sup> Edition, Pearson Education Services. Pvt. Limited.
7. Suresh R., (2012). *Essentials of Human physiology*. Regional Institute of Medical Sciences, Imphal, Manipur.
8. Sherwood L., (2009). *Principles of Human Physiology*. 3<sup>rd</sup> Edition,

Cengage Learning India private Limited, New Delhi.

9. Sarada S., & Madhavan K. K., (2004). *Textbook of Human Physiology*, Revised by H.D. Singh, 6th Edition, S. Chand and Company Ltd., New Delhi.
10. Snustad, D.P. and Simmons, M.J., (2009). *Principles of Genetics*, V Edition, JohnWiley and Sons Inc.,

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.webmd.com/heart/picture-of-the-heart>
2. <http://www.dnafb.org/1/bio.html>
3. <https://courses.lumenlearning.com/boundless-biology/chapter/laws-of-inheritance/>
4. <https://www.nature.com/scitable/topicpage/gregor-mendel-and-the-principles-of-inheritance-593/>
5. <https://www.jagranjosh.com/general-knowledge/respiratory-system-in-humans-1456486848-1>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 ANIMAL DIVERSITY</b>				
1.1	Animal Kingdom: General characters OF Invertebrates and Chordata	1	Chalk & Talk	Black Board
1.2	Subtopics: Outline classification, organization, symmetry, body cavity.	1	Discussion	Google classroom
1.3	General characters: Protozoa, Porifera and Coelenterata	2	Lecture	PPT & White board
1.4	General characters:	1	Lecture	Smart



	Helminthes and Annelida,			Board
1.5	General characters: Arthropoda and Molluscs,	1	Lecture	Black Board
1.6	General characters: Echinodermata and Pisces,	1	Lecture	Black Board
1.7	General characters: Amphibians and Reptiles	1	Lecture	LCD
1.8	General characters: Aves and Mammalia.	1	Discussion	Black Board
<b>UNIT -2 DIGESTION AND RESPIRATION</b>				
2.1	Digestion: Digestive system of human	1	Lecture	Green Board Charts
2.2	Role of salivary glands, bile and enzymes in digestion of Carbohydrates, Protein and Fat in human.	1	Chalk & Talk	Black Board
2.2	Absorption of Carbohydrates, Protein and Fat.	2	Chalk & Talk	Green Board
2.3	Respiration: External and internal respiration	1	Lecture	Black Board
2.4	Structure of Lungs. Mechanism of respiration,	2	Chalk & Talk	Black Board
2.5	Respiratory pigment – Hemoglobin and Hemocyanin	1	Chalk & Talk	Black Board
2.6	Exchange and transport of gases.	1	Lecture	PPT/LCD
<b>UNIT – 3CIRCULATION AND EXCRETION</b>				
3.1	Circulation: Types –open and closed	1	Chalk & Talk	Black Board
3.3	Components and functions of Blood	1	Chalk & Talk	Black Board

3.4	Structure and functions of human heart	2	Lecture	PPT/LCD
3.5	Origin and conduction of heart beat.	1	Lecture	PPT/LCD
3.6	Excretion: Classification of animals based on excretory products	1	Chalk & Talk	Black Board
3.7	Structure and functions of Kidney and nephron	1	Lecture	PPT/LCD
3.8	Physiology of urine formation	1	Chalk & Talk	Black Board
<b>UNIT – 4 REPRODUCTION &amp; SENSORY RECEPTORS</b>				
4.1	Reproduction	1	Lecture	PPT/LCD
4.2	Male reproductive system – structure and Function.	2	Group Discussion	Smart Board
4.3	Female reproductive system – structure and Function	1	Group Discussion	Smart Board
4.4	Menstrual cycle.	1	Lecture	LCD
4.5	Sensory Receptors: Photoreceptor – Structure and functions of eye.	2	Chalk & Talk	Black Board
4.6	Phonoreceptor: Structure and functions of ear	2	Chalk & Talk	Black Board
<b>UNIT – 5 MENDELIAN LAWS OF INHERITANCE &amp; ALLELISM</b>				
5.1	Mendelian laws –law of Dominance, law of Segregation	2	Chalk & Talk	Black Board
5.2	Monohybrid cross	1	Chalk & Talk	Black Board
5.3	Dihybrid Cross.	1	Lecture	LCD
5.4	Multiple Alleles – ABO blood grouping	2	Chalk & Talk	Green Board
5.5	X linked genes	1	Chalk & Talk	White board

5.6	Y linked genes	1	Lecture	LCD
5.7	Sex Influenced genes – Sex limited genes.	1	Lecture	PPT
<b>UNIT - 6 DYNAMISM</b>				
6.1	Down Syndrome – Turner's Syndrome, Klinefelter's Syndrome		Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

**EVALUATION PATTERN**

SCHOLASTIC					NON – SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

**COURSE OUTCOMES**

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Outline the general characters with of invertebrate and chordata with reference to organization, symmetry, body cavity.	<b>K2</b>	PSO1& PSO4
<b>CO 2</b>	Explain the digestive system, role of enzymes, digestion and absorption of Carbohydrates, Protein and Fat in Man.	<b>K2</b>	PSO1, PSO4 & PSO10
<b>CO 3</b>	Distinguish between internal and external respiration in context to the mode and transport of gas exchange.	<b>K4</b>	PSO1, PSO4 & PSO10
<b>CO 4</b>	Summarize the structure and function of heart, Kidney, eye and ear.	<b>K2</b>	PSO1, PSO4 & PSO10

<b>CO 5</b>	Explain the Mendelian Laws Of Inheritance & Allelism	<b>K2</b>	PSO1, PSO4 & PSO10
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### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO 12
CO1	3	2	2	3	2	2	2	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	3	2	2
CO3	3	2	2	3	2	2	2	2	2	3	2	2
CO4	3	2	2	3	2	2	2	2	2	3	2	2
CO5	3	2	2	3	2	2	2	2	2	3	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	1	1
CO2	3	2	1	1
CO3	3	2	1	1
CO4	3	2	1	1
CO5	3	2	1	1

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. N. Nagarani**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**II B.Sc. Zoology****SEMESTER –III**

*For II B.Sc Chemistry those who joined in 2019 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGO RY</b>	<b>HRS/ WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>21Z3ACC2</b>	<b>Lab - Animal Diversity, Physiology &amp;Genetics</b>	<b>Practical</b>	<b>2</b>	<b>2</b>

**COURSE DESCRIPTION**

Students develop laboratory skills with identification of preserved specimen, manipulation of prepared slides, dissections and display under the microscope

**COURSE OBJECTIVES**

To study the diversity of animals and to understand the fundamental organization of cells.

**INTRODUCTION**

5. Laboratory biosafety guidelines and Regulations of Animal Ethics.
6. Principle and handling of Compound microscope

**ANIMAL DIVERSITY**

3. **Mounting of Body setae of Earthworm.** (Collected from Vermiculture Centres)

4. **SPOTTERS:** Preserved Museum Specimens
5. Invertebrata - *Amoeba*, *Ascaris* (Male & Female), Prawn, Octopus, Starfish (Oral & Aboral view): Chordata – *Anguilla* (Eel), Toad (Bufo), Chamaeleon, Pigeon, Manis

## HUMAN PHYSIOLOGY

1. Preparation and observation of blood smear
2. ABO Blood Grouping
3. Preparation of Haemin Crystals
4. Qualitative analysis of urea and uric acid in the given sample.
5. Effect of temperature on salivary amylase activity in man
6. **SPOTTERS:** Eye, Ear, Heart

## GENETICS

1. Observation of simple Mendelian Traits in the class Population
2. **SPOTTERS:** Drosophila, Mule, Monohybrid cross, Syndrome

## REFERENCES

9. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
10. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
11. Tembhare D.B., (2008) *Techniques in Life Sciences*, 1<sup>st</sup> ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
12. Dutta A., (2009) *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.

## DIGITAL OPEN EDUCATIONAL RESOURCES

11. <https://www.uwlax.edu/biology/zoo-lab/>
12. <http://virtualbiologylab.org/>
13. <https://www.labster.com/simulations/animal-genetics/>
14. <https://libguides.mines.edu/oer/simulationslabs>
15. <https://www.biodiversitylibrary.org/item/29076#page/5/mode/1up>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>ANIMAL DIVERSITY</b>				
1.1	Mounting of Body setae of Earthworm. (Collected from Vermiculture Centers)	2	Hands on Training	Specimen
1.2	Invertebrata - Amoeba, Ascaris (Male & Female), Prawn,	2	Discussion	Museum Specimen
1.3	Octopus, Starfish (Oral & Aboral view)	2	Discussion	Museum Specimen
1.4	Chordata – <i>Anguilla</i> (Eel), Toad ( <i>Bufo</i> ),	2	Discussion	Museum Specimen
1.5	Chamaeleon, Pigeon, Manis	2	Discussion	Museum Specimen
<b>HUMAN PHYSIOLOGY</b>				
2.1	Preparation and observation of blood smear	1	Hands on Training	Blood Sample
2.2	ABO Blood Grouping	1	Hands on Training	Blood Grouping Kit
2.3	Preparation of Haemin Crystals	2	Hands on Training	Microscope
2.4	Qualitative analysis of urea and uric acid in the given sample.	2	Hands on Training	Specimen



2.5	Effect of temperature on salivary amylase activity in man	2	Hands on Training	Stop Clock, Water bath
2.6	SPOTTERS: Eye, Ear, Heart	2	Discussion	Museum Specimen
<b>GENETICS</b>				
3.1	Observation of simple Mendelian Traits in the class Population	2	Hands on Training/Discussion	Black Board
3.2	SPOTTERS: Drosophila, Mule, Monohybrid cross, Syndrome	2	Discussion	Museum Specimen

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>40</b>	<b>60</b>	<b>100</b>

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Outline the Laboratory biosafety guidelines and good laboratory practices.	<b>K1</b>	PSO1, PSO2 & PSO7
<b>CO 2</b>	Dissect and mount the Body setae of Earthworm	<b>K4</b>	PSO1, PSO2, PSO4 & PSO7
<b>CO 3</b>	List out the features of the given spotters <i>Amoeba</i> , <i>Taenia solium</i> , <i>Nereis</i> , <i>Amphioxus</i> (entire), <i>Anguilla</i> (Eel), Toad ( <i>Bufo</i> ), Cobra, Chamaeleon, Pigeon and various Syndromes.	<b>K1</b>	PSO1, PSO7 & PSO8
<b>CO 4</b>	Choose the appropriate qualitative test for the analysis of carbohydrates, proteins, lipids, urea and uric acid in the given sample	<b>K3</b>	PSO2 & PSO4
<b>CO 5</b>	Illustrate the structure of human ear, eye and heart.	<b>K2</b>	PSO1 & PSO4

### **Mapping of COs with PSOs**

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	3	2	2	2	2	3	2	2	2	2	2
CO2	3	3	2	2	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	3	2	2	2	2	2
CO4	3	2	2	3	2	2	3	2	2	2	2	2
CO5	2	3	2	3	2	2	2	2	2	2	2	2


### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	1
CO2	3	2	2	1
CO3	3	2	2	1
CO4	3	2	2	1
CO5	3	2	2	1

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
**Dr. N.Nagarani**

**Forwarded By**

  
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 MADURAI-625 018

**HOD'S Signature  
 & Name**

**II B.Sc.Zoology****SEMESTER –III*****For those who joined in 2019 onwards***

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	19Z3SB1	Vermitechnology	Lecture	2	2

**COURSE DESCRIPTION**

This course imparts knowledge on the culture of earthworms and the preparation of vermicompost by recycling the waste through teaching and fieldtrip and eventually motivate the learners to become an entrepreneur

**COURSE OBJECTIVES**

- To impart the knowledge on the biology of earthworms
- To foster the skills on the preparation of quality vermicompost by recycling the waste
- To understand the prospects and marketing strategies of vermitechnology

**UNITS****UNIT- I BIOLOGY OF EARTHWORMS****(6HRS.)**

Biology of earthworms: Morphology, Digestive and reproductive system of earthworms. Lifecycle of Earthworms: *Eudrilus eugenia*, *Eisenia fetida*, *Perionyx excavatus*.

**Self –study - : Morphology, Digestive and reproductive system of earthworms**

**UNIT - II ECOLOGICAL GROUPS****(6HRS.)**

Ecological groups of earthworms: Saprophages, geophages, humus feeders – Epigeic, endogeic, anecic – earthworm burrows, vermicasts, vermiwash. Importance of earthworm in agriculture, fishing, therapeutics and pollution indicators.

### **UNIT - III VERMICOMPOSTING METHODS (6HRS.)**

**Vermicomposting** – definition, types: small and large scale, pit method, heap method, windrow **method, collection of vermicompost** - Raw materials for composting – requirements of vermicomposting - factors affecting vermicomposting: pH, moisture, temperature, nutritional value of feed.

### **UNIT – IV PROPERTIES OF VERMICOMPOST (6HRS.)**

Physical, chemical and biological properties of vermi-compost. Role of earthworms in composting – vermiculture. Maintenance of composting – Predators of earthworm

### **UNIT – V ECONOMICS AND PROSPECTS (6HRS.)**

Advantages of vermicomposting – economics of vermiculture – NABARD Nationalized banks supports for vermiculture. Prospects of **vermiculture as self employment venture**

### **UNIT – VI DYNAMISM (Evaluation Pattern-CIA only) ( HRS.)**

#### **REFERENCE BOOKS**

1. Sultan A I. *The Earthworm* Bo. Second Revised Edition .Other India Press, Mapusa - 403 507, Goa, 2005.
2. Christy, A.M.V. *Vermitechnology*, MJP publishers, Chennai, 1976.
3. Bhatnagar R.K. & Palta R.K. “*Earthworm Vermiculture and Vermicomposting*”, Kalyani Publishers, Chennai
4. Gupta P.K. *Vermi Composting for Sustainable Agriculture*, AGROBIOS (India), Jodhpur.

#### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://pubmed.ncbi.nlm.nih.gov/21628345/>
2. <https://pubmed.ncbi.nlm.nih.gov/18515003/>
3. [https://www.brainkart.com/article/Vermitechnology\\_39993/](https://www.brainkart.com/article/Vermitechnology_39993/)
4. <https://technology4agri.wordpress.com/2013/02/12/vermitechnology-an-introuction/>
5. [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_vermicompost.html](https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html)

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 BIOLOGY OF EARTHWORMS</b>				
1.1	Biology of earthworms -Morphology	1	Chalk & Talk	Black Board
1.2	Biology of earthworms- Digestive system	1	Chalk & Talk	Black Board
1.3	Biology of earthworms- reproductive system	1	Lecture	PPT & White board
1.4	Lifecycle of Earthworms: <i>Eugenia eudrilus</i>	1	Chalk & Talk	Black Board
1.5	Lifecycle of Earthworms: <i>Eisenia fetida</i> ,	1	Discussion	Google Classroom
1.6	Lifecycle of Earthworms: <i>Perionyx excavatus</i> .	1	PPT	LCD & White Board
<b>UNIT - 2 ECOLOGICAL GROUPS</b>				
2.1	Ecological groups of earthworms: Saprophages	1	Chalk & Talk	Green Board
2.2	Ecological groups of earthworms: geophages	1	Chalk & Talk	Black Board
2.3	Ecological groups of earthworms: humus feeders	1	Chalk & Talk	Black Board
2.4	Epigeic, endogeic, anecic – earthworm burrows	1	Chalk & Talk	Black Board

2.5	Vermicasts, Vermiwash	1	Lecture	PPT
2.6	Importance of earthworm in agriculture, fishing	1	Lecture	PPT
<b>UNIT - 3 VERMICOMPOSTING METHODS</b>				
3.1	Vermicomposting – definition, types: small and large scale	1	Chalk & Talk	Black Board
3.2	Vermicomposting Types: Pit method, Heap method, Windrow method	1	Lecture	PPT & White board
3.3	Collection of vermicompost	1	Lecture	LCD
3.4	Raw materials for composting	1	Lecture	LCD
3.5	Requirements of vermicomposting & nutritional value of feed	1	Lecture	LCD
3.6	Factors affecting vermicomposting: pH, moisture, temperature	1	Lecture	PPT & White board
<b>UNIT - 4 PROPERTIES OF VERMICOMPOST</b>				
4.1	Physical, properties of vermi-compost	1	Chalk & Talk	Black Board
4.2	Chemical properties of vermi-compost	2	Lecture	LCD
4.3	Biological properties of vermi-compost	1	PPT	LCD & White Board
4.4	Role of earthworms in composting vermiculture	2	Lecture	LCD
4.5	Maintenance of composting	1	Lecture	LCD
4.6	Predators of earthworm	1	Chalk & Talk	Black Board
<b>UNIT - 5 ECONOMICS AND PROSPECTS</b>				
5.1	Advantages of vermicomposting	1	Chalk & Talk	Black Board

5.2	Economics of vermiculture	2	Chalk & Talk	Black Board
5.3	NABARD Nationalized banks supports for vermiculture	1	Chalk & Talk	Black Board
5.4	Prospects of vermiculture as self employment venture	2	Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.				
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

**EVALUATION PATTERN**



SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

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

## Mapping of COs with PSOs

PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	3	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	2	2	2
CO3	3	2	2	3	2	2	2	2	2	2	2	2
CO4	3	2	2	3	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	3	2	2	2

**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	2	2	2
CO3	3	2	2	2
CO4	3	3	2	2
CO5	3	2	2	2

Note: ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**

**Dr. N. Malathi**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

**II B.Sc. Zoology**

**SEMESTER –IV**

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGO RY	HRS/WE EK	CREDIT S
UAZO	19Z4CC10	Microbiology	Lecture	5	4

### COURSE DESCRIPTION

This course deals with the study of microorganisms and its interaction with the environment.

### COURSE OBJECTIVES

- To understand the fundamentals of the world of Microbes, distribution and their application for human welfare.
- To understand the structural similarities and differences among various microorganisms.
- To know various types of Culture media and the techniques for isolation of pure cultures of microbes.
- Comprehend the intricate interaction between viruses and host cells.

### UNIT –I INTRODUCTION TO MICROBIOLOGY ( 15HRS.)

The historical development and scope of Microbiology -Sterilization and disinfections - physical and chemical methods - Culture media – Types -Culture techniques – Batch, Continuous, Synchronous and Fed-batch – Methods of culturing bacteria – Isolation of bacteria by Pure culture techniques. - Identification of Bacteria – Staining (Simple & Gram), Phenol red & Lipid hydrolysis Tests and Motility test.

#### Self-Study-Scope of Microbiology

### UNIT –II BACTERIA (15 HRS.)

Outline classification of Bacteria according to Bergey's Manual -Morphology and Physiology of Bacteria – Nutrition(Autotrophic & Heterotrophic) and Growth –Bacterial respiration – (Aerobic & Anaerobic)- Bacterial reproduction- Conjugation, Recombination- Beneficial & Harmful role of Bacteria.

#### Self-Study-Economic importance.

**UNIT –III VIRUSES****(15 HRS.)**

General characteristics of Viruses - Classification and Nomenclature of Viruses-Structure of viruses -DNA & RNA viruses - Shape of Viruses- Polyhedral( Adenovirus) Helical (TMV), Complex (T4 Bacteriophage) - Viral Multiplication – Lytic and Lysogenic Cycle - Virioids and Prions (Short notes only) – Transmission of Viruses in Plants, Animals & Man.

**UNIT –IV MICROBES IN THE ENVIRONMENT****(15 HRS.)**

Bacteriology of Water- Microbes in Pond, lake, Sea and domestic water-methods of purification of water: Water potability analysis, determination of sanitary quality- Microbes in air and Measurement of air contamination - Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle, Nitrogen fixation - Microbes for alternate source of energy - Hydrogen producing bacteria - *Halobacteriumhalobium*.

**Self-Study-Biogeochemical cycles -Nitrogen Cycle****UNIT –V INDUSTRIAL MICROBIOLOGY****(15 HRS.)**

Fermentation technology – Fermentor – Types of fermentor – Production of microbial products through fermentor – Production of Antibiotics (Penicillin, Streptomycin &Tetracyclines), Organic acids (Citric acid & Acetic acid), Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's), Single cell proteins (Bacterial proteins).

**TEXT BOOK:**

Anandhanarayanan.R and Panicker C.K., (2016).Text book of Microbiology, 8<sup>th</sup> Edition, Universities Press (India) Private Limited.

**REFERENCES:**

1. Pelczar, M.J., Chan, E.C.S and Krieig N.R.,(2008). Microbiology, 5th Edition, Tata McGraw Hill Edition. United States.
2. Tortora G.J, Funke B.R and Case C.L., (2009).Microbiology: An Introduction, 11th Edition, United States.
3. Prescott L.M. Harley J.P and Klein D.A., (2010) Microbiology, 8th Edition. New Delhi.
4. Patel A.H. (2008).Industrial microbiology, Macmillan India LTD, Chennai.

**Digital Open Educational Resources (DOER) :**

1. <https://libguides.wccnet.edu/oer-subjects/microbiology>
2. <https://library.fvcc.edu/Microbiology/OER>
3. <https://www.oercommons.org/browse?f.keyword=microbiology>
4. <http://oer2go.org/mods/en-boundless/www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/industrial-microbiology-17/index.html>
5. <https://www.merlot.org/merlot/viewMaterial.htm?id=484489821>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION TO MICROBIOLOGY</b>				
1.1	The historical development and scope of Microbiology	2	Chalk & Talk	Black Board
1.2	Sterilization and disinfections - physical and chemical methods	2	Chalk & Talk	LCD
1.3	Culture media – Types	1	Lecture	PPT & White board
1.4	Culture techniques – Batch, Continuous, Synchronous and Fed-batch	2	Lecture	Smart Board
1.5	Methods of culturing bacteria	2	Lecture	Black Board
1.6	Isolation of bacteria by Pure culture techniques	1	Discussion	Black Board
1.7	Identification of Bacteria	2	Specimen	Microscope

1.8	Staining (Simple & Gram), Phenol red & Lipid hydrolysis Tests and Motility test.	3	Discussion	Black Board
<b>UNIT -2 BACTERIA</b>				
2.1	Outline classification of Bacteria according to Bergey's Manual	2	Lecture	Black Board
2.2	Morphology and Physiology of Bacteria	4	Chalk & Talk	Black Board
2.3	Nutrition( Autotrophic & Heterotrophic) and growth	2	Chalk & Talk	Black Board
2.4	Bacterial respiration (Aerobic & Anaerobic)	3	Lecture	Black Board
2.5	Bacterial reproduction- Conjugation –Recombination	3	Chalk & Talk	Black Board
2.6	Beneficial & Harmful role of Bacteria.	1	Lecture	Black Board
<b>UNIT -3 VIRUSES</b>				
3.1	General characteristics of Viruses	2	Chalk & Talk	Black Board
3.2	Classification and Nomenclature of Viruses	2	Chalk & Talk	LCD
3.3	Structure of viruses –DNA & RNA viruses	2	Lecture	Smart Board
3.4	Shape of Viruses- Polyhedral( Adenovirus)	2	Lecture	Black Board
3.5	Helical (TMV), Complex (T4 Bacteriophage)	2	Lecture	Black Board
3.6	Viral Multiplication – Lytic &	2	Discussion	Black

	Lysogenic Cycle -		n	Board
3.7	Viriods and Prions	1	Lecture	Black Board
3.8	Transmission of Viruses in Plants, Animals & Man.	2	Discussion	Black Board
<b>UNIT -4 MICROBES IN THE ENVIRONMENT</b>				
4.1	Bacteriology of Water	1	Lecture	Black Board
4.2	Microbes in Pond, lake, Sea and domestic water	3	Chalk &Talk	Black Board
4.3	Methods of purification of water: Water potability analysis, determination of sanitary quality	3	Chalk & Talk	Black Board
4.4	Microbes in air and Measurement of air contamination	2	Lecture	Black Board
4.5	Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle	2	Chalk & Talk	Black Board
4.5	Nitrogen fixation	2	Lecture	Black Board
4.6	Microbes for alternate source of energy - Hydrogen producing bacteria - <i>Halobacteriumhalobium</i> .	2	Chalk & Talk	Black Board
<b>UNIT -5 INDUSTRIAL MICROBIOLOGY</b>				
5.1	Fermentation technology	1	Lecture	Black Board
5.2	Fermentor – Types of fermentor	2	Chalk & Talk	Black Board
5.3	Production of microbial products through fermentor	2	Chalk & Talk	Black Board

5.4	Production of Antibiotics (Penicillin, Streptomycin & Tetracyclines)	3	Lecture	Black Board
5.5	Organic acids (Citric acid & Acetic acid)	2	Chalk & Talk	Black Board
5.5	Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's)	3	Lecture	Black Board
5.6	Single cell proteins (Bacterial proteins)	2	Chalk & Talk	Black Board

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mk s.	T2 10 Mk s.	Quiz 5 Mk s.	Assignment 5 Mk s.	OBT/PT 5 Mk s.	35 Mk s.	5 Mk s.	40 Mk s.	
<b>K1</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>-</b>	<b>4</b>	10 %
<b>K2</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>9</b>	<b>-</b>	<b>9</b>	22.5 %
<b>K3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>11</b>	<b>-</b>	<b>11</b>	27.5 %
<b>K4</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>5</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>11</b>	27.5 %
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>5</b>	<b>5</b>	12.5 %
<b>Total</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>40</b>	<b>100 %</b>

CIA	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>



**EVALUATION PATTERN**

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

**COURSE OUTCOMES**

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Examine the culturing methods and phenotypic identification of microbes	K1	PSO1, PSO2, PSO4 & PSO8
CO 2	Examine the taxonomical classification, reproduction and genetic recombination in bacteria.	K1	PSO1, PSO2, PSO4, PSO8
CO 3	Elaborate the morphologic properties and cultivation of viruses.	K2	PSO1, PSO2, PSO4 & PSO8
CO 4	Determine the role of microbes in the environment.	K3	PSO1, PSO2, PSO4 & PSO8
CO 5	Correlate the technology of fermentation with the microbial production industrial products	K4	PSO1, PSO2, PSO4, PSO8

**Mapping of COs with PSOs**

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	2	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	3	2	3	2	2	2	3	2	2	2	2

CO4	3	3	2	3	2	2	2	3	2	2	2	2
CO5	3	3	2	3	2	2	2	3	2	2	2	2


**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	2	2	2
CO4	3	2	2	2
CO5	3	2	3	2

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
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 & Name**

**II B.Sc. Zoology**  
**SEMESTER –IV**

*For those who joined in 2019 onwards*

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
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<b>UAZO</b>	<b>19Z4CC11</b>	<b>Evolution</b>	<b>Lecture</b>	<b>4</b>	<b>3</b>
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### **COURSE DESCRIPTION**

“Nothing in Biology makes sense except in the light of Evolution” – Dobzhansky.

The Course will provide a comprehensive knowledge on the history of evolutionary theories, evidences for evolution, origin of life, natural selection, speciation and human evolution

### **COURSE OBJECTIVES**

- Gain Knowledge on the principles of Evolution.
- Understand the evolution and diversification of fauna of the biosphere since the origin of life.
- Understand the sources of genetic variation and their role in the process of Evolution.
- Inter-relate the role of Isolation, Genetic divergence and Natural Selection in speciation as well as Evolution.

### **UNITS**

#### **UNIT –I EVIDENCES OF EVOLUTION**

**(12 HRS.)**

Origin of life-Chemical origin of life-Oparin concept, Urey and Miller experiment - **Comparative anatomical**, Physiological evidences- Parallel evolution, Homologous structures, Vestigial organs, Convergent evolution-Analogous structures, Atavism, Connecting Links and adaptive radiation and Physiological/ Biochemical **evidences**.

**Self Study - Vestigial organs**

#### **UNIT –II THEORIES OF EVOLUTION**

**(12 HRS.)**

Lamarckism- principles of Lamarckism-examples and Criticism of Lamarckism, Darwinism-Natural selection theory and supplementary theories- Sexual selection theory, Artificial selection theory and theory of Pangenesis, Neo Darwinism- experimental evidences-explanation to the

objections, Mutation theory of De Vries- salient features, progressive species, Retrogressive species, Degressive species and Inconstant species.

**Self Study - Artificial selection theory**

**UNIT –III MODERN SYNTHETIC THEORY (12 HRS.)**

Modern synthetic theory-concepts of Modern synthetic theory-Genetic variation- gene pool-gene frequency-Hardy-Weinberg law-factors causing genetic variation-gene mutation-Chromosomal aberration –Hybridization – Recombination-Genetic Drift- operation of Modern synthesis-isolation and natural selection.

**Self Study - Natural selection**

**UNIT –IV NATURAL SELECTION (12 HRS.)**

Natural selection in action-Types of selection-Directional selection- salient features and examples- industrial Melanism, Stabilizing selection-salient features and examples, Disruptive selection- salient features and examples. Mimicry- definition, Batesian Mimicry- salient features and examples, Mullerian Mimicry- salient features and example.

**Self Study - Industrial Melanism**

**UNIT –V SPECIATION& HUMAN EVOLUTION (12 HRS.)**

Speciation – Types of speciation-mechanism of speciation- Patterns of speciation- Allopatric, Sympatric, Quantum and Parapatric speciation, Brief account on Geological Time scale, Human evolution- Physical/organic evolution- stages of human evolution - fossils of human evolution, Cultural evolution of man- milestones of cultural evolution.

**Self Study - Milestones of cultural evolution**

**UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) ( HRS.)**

**TEXT BOOK:**

Arumugam, N.(2019).*Organic Evolution*.7<sup>th</sup> edition,Saras Publication, Kanyakumari.

**REFERENCE BOOKS:**

1. Kocchar, P.L. (2003). *Genetics and Evolution*. 18<sup>th</sup> edition, Premchand Jain Publishers, New Delhi.
2. Sanjib Chattopadhyay. (2008). *Evolution*. Adaptation and Ethology, second edition, Books & Allied Pvt. Ltd., Kolkata.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <http://evolution.berkeley.edu/evolibrary>
2. <http://www.nature.com/nature/supplements/insights/evolution/index.html>
3. <https://www.yourgenome.org/facts/what-is-evolution#:~:text=In%20biology%2C%20evolution%20is%20the,and%20gradually%20change%20over%20time>.
4. <https://www.nationalgeographic.org/encyclopedia/theory-evolution/>
5. <https://www.nature.com/scitable/knowledge/library/speciation-the-origin-of-new-species-26230527>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 EVIDENCES OF EVOLUTION</b>				
1.1	History of Evolutionary theories	1	Chalk & Talk	Black Board
1.2	Theories of origin of life	1	Chalk & Talk	Black Board
1.3	Biochemical origin of life-Oparin concept	2	Lecture	PPT & White board
1.4	Parallel evolution,	1	Chalk & Talk	Black Board
1.5	Homologous structures,	1	Chalk & Talk	Black Board

1.6	Vestigial organs	1	Discussion	Google classroom
1.7	Convergent evolution & Analogous structures	1	Lecture	PPT
1.8	Atavism & Adaptive radiation	1	Lecture	PPT
1.9	Connecting Links	1	Lecture	LCD
1.10	Biochemical evidences	2	Lecture	PPT & White board
<b>UNIT -2 THEORIES OF EVOLUTION</b>				
2.1	Lamarckism- principles of Lamarckism	1	Chalk & Talk	Green Board
2.2	Lamarckism-examples	2	Chalk & Talk	Black Board
2.3	Criticism of Lamarckism	1	Chalk & Talk	Black Board
2.4	Darwinism-Natural selection theory	1	Chalk & Talk	Black Board
2.5	Supplementary theories- Sexual selection theory	1	Chalk & Talk	Black Board
2.6	Artificial selection theory and theory of Pangenesis	1	Chalk & Talk	Black Board
2.7	Neo Darwinism- experimental evidences	1	Lecture	PPT
2.8	Neo Darwinism-explanation to the objections	1	Chalk & Talk	Black Board
2.9	Mutation theory of De Vries-salient features	1	Lecture	PPT & White board
2.10	Progressive species, Retrogressive species, Degressive species and Inconstant species.	2	Lecture	LCD

<b>UNIT – 3MODERN SYNTHETIC THEORY</b>				
3.1	Modern synthetic theory	1	Lecture	PPT
3.2	Concepts of Modern synthetic theory- Isolation	1	Lecture	PPT & White board
3.3	Genetic variation– gene pool-gene frequency-Hardy-Weinberg law	2	Lecture	LCD
3.4	Factors causing genetic variation	2	Lecture	LCD
3.5	Gene mutation	1	Lecture	LCD
3.6	Chromosomal aberration	1	Lecture	PPT & White board
3.7	Hybridization	1	Lecture	PPT & White board
3.8	Recombination	1	Lecture	PPT & White board
3.9	Genetic Drift & Founders Principle	1	Lecture	LCD
3.10	Operation of Modern synthesis- Natural selection.	1	Discussion	Google classroom
<b>UNIT -4NATURAL SELECTION</b>				
4.1	Natural selection in action	1	Chalk & Talk	Black Board
4.2	Directional selection- salient features and examples	2	Lecture	LCD
4.3	Industrial Melanism	1	Discussion	Google classroom
4.4	Stabilizing selection-salient features and examples	2	Lecture	LCD
4.5	Disruptive selection- salient features and examples	1	Lecture	LCD
4.6	Mimicry- definition, Introduction	1	Chalk &	Black Board

			Talk	
4.7	Batesian Mimicry- salient features and examples	3	Lecture	LCD
4.8	Mullerian Mimicry- salient features and example	1	Lecture	LCD
<b>UNIT - 5 SPECIATION &amp; HUMAN EVOLUTION</b>				
5.1	Speciation – Types of speciation	1	Chalk &Talk	Black Board
5.2	Mechanism of speciation	1	Chalk & Talk	Black Board
5.3	Patterns of speciation-	1	Chalk & Talk	Black Board
5.4	Geological Time scale	2	Lecture	LCD
5.5	Human evolution	1	Chalk & Talk	Black Board
5.6	Physical/organic evolution	1	Lecture	PPT & White board
5.7	Stages of human evolution	1	Lecture	PPT & White board
5.8	Fossils of human evolution,	2	Lecture	PPT & White board
5.9	Phases of cultural evolution	1	Lecture	LCD
5.10	Milestones of cultural evolution	1	Lecture	LCD

**INTERNAL - UG**

	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
Levels	T1	T2	Quiz	Assignment	OBT/PP T				



	10 Mks	10 Mks	5 Mks	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholasti c	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTI C	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Tota l

10	10	5	5	5	5	40	60	100
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## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recognize the basic concepts of origin of life and evidences of evolution.	K1	PSO1, PSO2, PSO4 & PSO8
CO 2	Paraphrase the theories of evolution	K2	PSO1, PSO2 PSO4 PSO8
CO 3	Examine the Modern synthetic theory and the factors causing variation.	K3	PSO1, PSO4 & PSO8
CO 4	Organize the types and salient features of natural selection and mimicry.	K4	PSO1, PSO2 PSO4 & PSO8
CO 5	Interpret the concept of speciation and human evolution	K4	PSO1, PSO3 PSO4, PSO8

## Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	2	3	2	2	2	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	2	2	3	2	2	2	3	2	2	2	2

<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

### Mapping of COs with POs

<b>CO/ PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>

Note: ♦ Strongly Correlated – 3


♦ Moderately Correlated – 2

♦ Weakly Correlated -1

#### **COURSE DESIGNER:**

**Dr. A. Tamil Selvi**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**II B.Sc. Zoology**

**SEMESTER –IV**

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/W EEK	CREDIT S
UAZO	19Z4CC12	Lab - Microbiology & Evolution	Practical	3	2

### COURSE DESCRIPTION

To gain skills in analyzing the clinical and environmental samples and to learn basic techniques in microbiology and evolution.

### COURSE OBJECTIVES

- Understand the basic principles of Microbiology.
- Develop skills and competence in standard microbiological laboratory techniques.
- Demonstrate the natural selection and Hardy-Weinberg Equilibrium

### UNITS

#### UNIT –I MICROBIOLOGY

1. Laboratory biosafety Measures
2. Working Principle and Applications of Autoclave, Laminar Air Flow, Incubator and pH meter
3. Staining - Simple, Negative and Gram Staining
4. Preparation of Media- agar and broth
5. Serial Dilution Technique
6. Isolation of Single Colony using Pour plate, Streak plate, Spread plate.
7. Water quality analysis -MPN method Hanging drop method

#### UNIT –II EVOLUTION

1. Animals of Evolutionary Importance - *Peripatus*, *Limulus* and *Archaeopteryx*
2. Mimicry- Leaf insect and Stick Insect
3. Animals with adaptive coloration – Chameleon
4. Horse Evolution model
5. Human evolution model
6. Homologous organs – forelimb and skeletal of vertebrates

7. Analogus – Wing modification
8. Hardy-Weinberg Equilibrium by using beads
9. Natural selection by using beads

**REFERENCES:**

1. Sinha J., Chatterjee A.K., Chattopadhyay P. (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
2. Armugam, N., & Narayan L.M., (2013). *Practical Zoology (3)*. Saras publication, Tamil Nadu.
3. Rajan S., Christy, S.R. (2011). *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
4. Dutta A. (2009). *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Tembhare D.B. (2008). *Techniques in Life Sciences*, 1<sup>st</sup> edition., Himalaya Publishing House Pvt. Ltd., Mumbai

**DIGITAL OPEN EDUCATION RESOURCES**

1. <http://www.uwyo.edu/molb2021/virtual-edge/>
2. <http://www.evo-ed.org/index.htm>
3. <http://oer2go.org/mods/en-boundless/www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/industrial-microbiology-17/index.html>
4. <https://www.merlot.org/merlot/viewMaterial.htm?id=484489821>
5. <https://www.nationalgeographic.org/encyclopedia/theory-evolution/>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 MICROBIOLOGY</b>				

1.1	Laboratory biosafety Measures	3	Discussion	
1.2	Working Principle and Applications of Autoclave, Laminar Air Flow, Incubator and pH meter	3	Discussion	Instruments
1.3	Staining - Simple, Negative and Gram Staining	3	Hands on training	Slides & Microscope
1.4	Preparation of Media- agar and broth	3	Demonstration & hands on training	Nutrient Agar & broth
1.5	Serial Dilution Technique	3	Demonstration	Sample
1.6	Isolation of Single Colony using Pour plate, Streak plate, Spread plate.	3	Demonstration	Sample from serial dilution technique
1.7	Water quality analysis -MPN method Hanging drop method	3	Demonstration & Hands on training	Culture
<b>UNIT -2 EVOLUTION</b>				
2.1	Animals of Evolutionary Importance - <i>Peripatus</i> , <i>Limulus</i> and <i>Archaeopteryx</i>	3	Demonstration	Spotters
2.2	Mimicry- Leaf insect and Stick Insect	3	Demonstration	Spotters
2.3	Animals with adaptive coloration – Chameleon	3	Demonstration	Spotters

2.4	Horse Evolution model Human evolution model	3	Demonstration	Spotters
2.5	Homologous organs – forelimb and skeletal of vertebrates	3	Demonstration	Spotters
2.6	Analogous – Wing modification	3	Demonstration	Spotters
2.7	Hardy-Weinberg Equilibrium by using beads	3	Demonstration & hands on training	Beads
2.8	Natural selection by using beads	3	Demonstration & hands on training	Beads

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL	PSOs ADDRESSE
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		(ACCORDING TO REVISED BLOOM'S TAXONOMY)	D
CO 1	Find the working Principle and Applications of instruments.	K1	PSO1, PSO2
CO 2	Demonstrate the microbiological techniques and water quality analysis	K3	PSO2, PSO7
CO 3	Identify the animals of evolutionary importance, adaptive coloration and in mimicry.	K3	PSO1, PSO2 PSO7
CO 4	Identify the morphological evidences and the horse and human evolution model.	K3	PSO2, PSO7
CO 5	Analyze the Hardy – Weinberg equilibrium using beads.	K3	PSO1, PSO2, PSO8

[illegible]



### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	2	3	3	2
CO3	2	3	3	2
CO4	2	3	2	2
CO5	2	3	1	2

Note: ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**  
**Dr. Sr. Biji Cyriac**

**Forwarded By**

  
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 & Name**

**II B.Sc. Zoology**  
**SEMESTER –IV**

*For those who joined in 2019 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	21Q4ACZ 3	Developmental Botany & Plant Breeding	Lecture	3	3

### **COURSE DESCRIPTION**

To study basic functioning of plant life.

### **COURSE OBJECTIVES**

To study Plant Anatomy, Physiology, Embryology and Plant breeding techniques

### **UNIT –I PLANT ANATOMY**

**(9HRS.)**

Types of Meristems- Simple permanent tissue, Complex permanent tissue, Primary structure of stem, leaf and root in dicot and monocot plants, secondary growth-dicot stem.

#### **Self-study - Types of Meristems**

### **UNIT –II PLANT PHYSIOLOGY**

**(9 HRS.)**

Transpiration-Types, Mechanism of Transpiration, Absorption of water  
Photosynthesis-Light reaction and Dark reaction, Respiration - Glycolysis, Krebs's cycle - Plant Growth hormones – Physiological role of Auxins, Gibberellin and Cytokinin- Photomorphogenesis (Brief account only)

#### **Self-study- Absorption of water and Photomorphogenesis**

### **UNIT –III EMBRYOLOGY**

**(9 HRS.)**

Structure and development of anther-Male gametophyte – Structure and Development of ovule- Types of ovule- Female gametophyte (*Polygonum* type) - Dicot embryo- crucifer type.

### **UNIT –IV PLANT BREEDING**

**(9 HRS.)**

Crop improvement -Introduction & scope - methods- conventional- mutation

and ploidy breeding; Non-conventional - Somaclonal variation, Somatic embryogenesis- **Hybridization technique** - Interspecific and Intraspecific hybridization.

**Self-study-** Crop improvement - Introduction & scope

### **UNIT -V HORTICULTURE**

**(9 HRS.)**

**Horticultural Tools- Vegetative propagation of plants** – cuttage and layerage  
–Types and advantages - Indoor gardening – Hanging pot and Terrace gardening, Layout of a Kitchen Garden

**Self-study- Lay out of a Kitchen Garden**

### **TEXT BOOKS:**

1. Pandey B.P., (2000). *A text Book of Botany*. Chand and Company Ltd. Ram nagar, New Delhi.
2. Gupta P.K., (2000). *Principles of Plant breeding*. John Wiley, New York.
3. Rao M., (2002). *A text Book of Horticulture*. Laxmi Publications, New Delhi.
4. Ragland A & Jeyakumar., (2010). *Plant physiology*. Saras publication, Nagercoil.
5. Kumarasen V., (2009). *Plant breeding*, Saras publication, Nagercoil.

### **REFERENCES**

1. Pandey B.P., (2007). *Plant Anatomy*, S. Chand & Co. De, New Delhi
2. Bhojwani S.S., & Bhatnagar. S.P., (1994). *Embryology of Angiosperms*. Vikas Publishing House (P) Ltd., New Delhi
3. Rasool S.K., & Sekar T., (2002). *Allied Botany*. Popular Book Hour, Chennai -15
4. Kumar N., (2016). *Introduction To Horticulture*. Oxford and IBH publishing, New Delhi.

**Digital Open Educational Resources (DOER) :**

1. [https://bio.libretexts.org/Bookshelves/Botany/Book%3A Botany Lab Manual \(Morrow\)/02%3A Introduction to Ecology](https://bio.libretexts.org/Bookshelves/Botany/Book%3A_Botany_Lab_Manual_(Morrow)/02%3A_Introduction_to_Ecology)
2. <https://www.medicinalplants-pharmacognosy.com/>
3. <https://manifold.lib.fsu.edu/projects/from-growing-to-biology>
4. <https://courses.lumenlearning.com/wmopen-nmbiology1/chapter/photosynthesis/>
5. <https://courses.lumenlearning.com/wmopen-nmbiology1/chapter/outline-cellular-respiration/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 PLANT ANATOMY</b>				
1.1	Types of Meristems	1	Discussion	Black Board
1.2	Simple permanent tissue	1	Chalk & Talk	PPT
1.3	Complex permanent tissue	2	Chalk & Talk	LCD
1.4	Primary structure of stem, leaf and root in dicot plants	2	Chalk & Talk	PPT & White board
1.5	Primary structure of stem, leaf and root in monocot plants	2	Chalk & Talk	Smart Board
1.6	secondary growth-dicot stem.	1	Lecture	Black Board
<b>UNIT -2 PLANT PHYSIOLOGY</b>				
2.1	Transpiration-Types, Mechanism of Transpiration,	1	Lecture	Green Board Charts

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
2.2	Absorption of water	1	Discussion	Google classroom
2.3	Photosynthesis Light reaction	1	Chalk & Talk	Green Board
2.4	Dark reaction	1	Chalk & Talk	Chart
2.5	Respiration - Glycolysis	1	Chalk & Talk	Chart
2.6	Kreb's cycle	1	Lecture	Black Board
2.6	Plant Growth hormones – Physiological role of Auxins,	1	Lecture	Google classroom
2.7	Gibberellin and Cytokinin	1	Lecture	Google classroom
2.8	Photomorphogenesis (Brief account only)	1	Discussion	Google classroom
<b>UNIT -3 EMBRYOLOGY</b>				
3.1	Structure and development of anther, Male gametophyte	2	Chalk & Talk	Green Board
3.2	Structure and Development of ovule	2	Chalk & Talk	Chart
3.3	Types of ovule	2	Chalk & Talk	Chart
3.4	Female gametophyte ( <i>Polygonum</i> type) -	2	Lecture	Black Board
3.5	Dicot embryo crucifer type.	1	Chalk & Talk	Green Board
<b>UNIT -4 PLANT BREEDING</b>				
4.1	Crop improvement Introduction & scope methods- conventional- mutation and ploidy breeding	3	Chalk & Talk	Chart

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
4.2	Non-conventional - Somaclonal variation	1	Lecture	Google classroom
4.3	Somatic embryogenesis	1	Discussion	Google classroom
4.4	Hybridization technique - Interspecific	2	Chalk & Talk	Chart
4.5	Intraspecific hybridization.	2	Lecture	Google classroom
<b>UNIT -5 HORTICULTURE</b>				
5.1	Horticultural Tools	1	Chalk & Talk	Chart
5.2	Vegetative propagation of plants – cuttage	2	Lecture	Google classroom
5.3	layerage –Types and advantages	2	Lecture	Black Board
5.4	Hanging pot and Terrace gardening	2	Chalk & Talk	Green Board
5.5	Indoor gardening –Layout of a Kitchen Garden	2	Discussion	Google classroom

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks	T2 10 Mks	Quiz 5 Mks	Assignment 5 Mks	OBT/PP T 5 Mks	35 Mks.	5 Mks.	40Mks	
<b>K1</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>10 %</b>

K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING	PSOs ADDRESSED
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		<b>TO REVISED BLOOM'S TAXONOMY)</b>	
<b>CO1</b>	Recall structure & functions of various plant tissues	<b>K1</b>	PSO1, PSO3 & PSO2
<b>CO2</b>	Paraphrase the mechanism of transpiration, photosynthesis, respiration & plant growth regulators	<b>K2</b>	PSO2 & PSO3
<b>CO3</b>	Identify the structure & development Embryology of plant	<b>K3</b>	PSO1, PSO2 & PSO3
<b>CO4</b>	Examine techniques in the crop improvement programmes	<b>K4</b>	PSO2 & PSO3
<b>CO5</b>	Plan a home garden using horticultural techniques	<b>K3</b>	PSO2, PSO6 & PSO9

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	3	3	3	3	3	2	3	3	3	2	2
<b>CO2</b>	3	3	3	3	1	2	3	3	3	2	2
<b>CO3</b>	3	3	2	3	1	2	3	3	3	2	2
<b>CO4</b>	3	3	3	3	1	2	3	3	3	2	2
<b>CO5</b>	3	3	3	3	1	3	3	3	3	2	3

### Mapping of COs with Pos

CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	3	3	3
<b>CO2</b>	3	3	3	3
<b>CO3</b>	3	3	3	3




<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Note:** ♦ Strongly Correlated – **3**      ♦ Moderately Correlated – **2**  
 ♦ Weakly Correlated -**1**

**COURSE DESIGNER:**

**Dr. V. Bharathy**

**Forwarded By**

  
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 MADURAI-625 018

**HOD'S Signature  
& Name**

**II B.Sc. Zoology  
SEMESTER –IV**

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	21Q4ACZ4	Lab - Developmntal Botany & Plant Breeding	Practical	2	2

### COURSE DESCRIPTION

To study basic functioning of plant life.

### COURSE OBJECTIVES

To study Plant Anatomy, Physiology, Embryology and Plant breeding techniques

### UNITS

1. Identification and transverse sectioning of stem, leaf and root prescribed in plant anatomy (Monocot and Dicot)
2. Mounting of leaf Epidermal peel showing Stomata
3. Demonstration to measure rate of Transpiration – Ganong's potometer
4. Demonstration of Rate of Photosynthesis – *Hydrilla* Experiment of Willmont's Bubbler using different colour filters
5. Demonstration of Anaerobic respiration
6. Identification of different stages of embryo in *Tridax*.
7. Demonstration of Emasculation techniques prescribed in the syllabus.
8. Demonstration Horticultural techniques prescribed in the syllabus
9. Spotters
10. Record note

### TEXT BOOKS

1. Pandey B.P., (2000). *A text Book of Botany*. Chand and Company Ltd. Ram nagar, New Delhi.
2. Gupta P.K., (2000). *Principles of Plant breeding*. John Wiley, New York.
3. Rao M., (2002). *A text Book of Horticulture*. Laxmi Publications, New Delhi.
4. Ragland A & Jeyakumar., (2010). *Plant physiology*. Saras publication,

Nagercoil.

5. Kumarasen V., (2009). *Plant breeding*, Saras publication, Nagercoil.

## REFERENCES

1. Pandey B.P. A text Book of Botany. Chand and Company Ltd. Ram nagar, New Delhi (2000).
2. P.K.Gupta, Principles of Plant breeding. John Wiley, New York (2000).
3. Kumarasen.V. Plant breeding, Saras publication (2009)
4. Ragland. A & Jeyakumar. Plant physiology. Saras publication (2010).
5. Pandey B.P. Plant Anatomy, S. Chand & Co. De, New Delhi (2007).
6. Bhojwani, S.S. & Bhatnagar. S.P. Embryology of Angiosperms. Vikas Publishing House (P) Ltd., New Delhi (1994).
7. Rasool S.K. & Sekar T. Allied Botany . Popular Book Hour, Chennai -15 (2002).

## DIGITAL OPEN EDUCATIONAL RESOURCES (DOER) :

1. [https://bio.libretexts.org/Bookshelves/Botany/Book%3A Plant Anatomy and Physiology \(Bellairs\)](https://bio.libretexts.org/Bookshelves/Botany/Book%3A_Plant_Anatomy_and_Physiology_(Bellairs))
2. <https://open.umn.edu/opentextbooks/textbooks/349>
3. <https://libguides.daltonstate.edu/PrinciplesofBiology/labmanual>
4. <https://libguides.cccua.edu/c.php?g=793104&p=5698907>
5. <https://courses.lumenlearning.com/wmopen-nmbiology1/chapter/outline-cellular-respiration/>

## COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>PLANT ANATOMY</b>				
1	Identification and transverse sectioning of	12	Sectioning	Specimen &

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	stem, leaf and root prescribed in plant anatomy (Monocot and Dicot)			Microscope
2	Mounting of leaf Epidermal peel showing Stomata	2	Dissection	Specimen & Microscope
3	Demonstration to measure rate of Transpiration – Ganong's potometer	2	Demonstration	Experimental setup
4	Demonstration of Rate of Photosynthesis – Hydrilla Experiment of Willmont's Bubbler using different colour filters	2	Demonstration	Experimental setup
5	Demonstration of Anaerobic respiration	2	Demonstration	Experimental setup
7	Identification of different stages of embryo in <i>Tridax</i> .	2	Dissection	Specimen & Microscope
8	Demonstration Horticultural techniques prescribed in the syllabus	2	Demonstration	Horticultural tools
9	Spotters	-	Discussion	specimen
10.	Record Note	-	Discussion	Specimen& Black Board

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

MARKS
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<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>40</b>	<b>60</b>	<b>100</b>

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO1</b>	Illustrate the anatomy of Monocot and dicot stem , root and leaf	<b>K2</b>	PSO1,PSO2&PSO7
<b>CO2</b>	Interpret experimental set ups in plant physiology	<b>K2</b>	PSO1, PSO2,PSO3&PSO7
<b>CO3</b>	Apply the horticultural techniques of Cuttage and layerage	<b>K3</b>	PSO2&PSO7
<b>CO4</b>	Make use of emasculation technique	<b>K3</b>	PSO2, PSO7&PSO9
<b>CO5</b>	Identify specimens and slides from Plant anatomy, Physiology, Embryology , Plant Breeding & Horticulture included in the syllabus.	<b>K1</b>	PSO6, PSO7&PSO9

### Mapping of COs with PSOs

<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>	<b>PSO 7</b>	<b>PSO 8</b>	<b>PSO 9</b>	<b>PSO 10</b>	<b>PSO 11</b>
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CO1	3	3	3	3	2	2	3	3	2	2	2
CO2	3	3	3	3	2	2	3	3	2	2	2
CO3	3	3	3	3	3	2	3	3	2	2	2
CO4	3	3	3	3	2	2	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	2	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

**Note:** ♦ Strongly Correlated – 3


♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. V. Bharathy**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
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 MADURAI-625 018

**II B.Sc. Zoology**  
**SEMESTER -IV**

**HOD'S Signature  
& Name**

*For II B.Sc Chemistry those who joined in 2019 onwards*

PROGRA MME CODE	COURSE CODE	COURSE TITLE	CATEGO RY	HRS/WE EK	CREDI TS
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<b>UAZO</b>	<b>21Z4ACC3</b>	<b>Cell &amp; Molecular Biology</b>	<b>Lecture</b>	<b>3</b>	<b>3</b>
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### **COURSE DESCRIPTION**

- This course is designed for the chemistry student which discusses the branch of Zoology that deals with Cell and Molecular Biology.

### **COURSE OBJECTIVES**

- Attain a precise knowledge on the prokaryotic and eukaryotic cell structure and function.
- Provides foundation studies for molecular biology.

### **UNITS**

#### **UNIT –I OUTLINE AND ORGANIZATION OF A CELL (9 HRS.)**

General structure and function of animal cell & cell organelles. Differences between Prokaryotes and Eukaryotes.

**Self Study - Differences between Prokaryotes and Eukaryotes.**

#### **UNIT –II STRUCTURE AND FUNCTIONS OF CELL ORGANELLES (9 HRS.)**

Plasma Membrane: Models, Chemical composition and functions.  
Mitochondria: Structure and Functions. Endoplasmic Reticulum: Structure and functions.

#### **UNIT –III NUCLEAR COMPONENTS AND CELL CYCLE (9 HRS.)**

Nucleus: Structure- nuclear membrane, pore complex, nucleoplasm, chromatin reticulum, nucleolus, chemical composition, functions.  
Chromosomes: Shapes based on position of centromere, functions, Special types- Polytene and lampbrush chromosomes. Brief account on Mitosis and Meiosis.

#### **UNIT –IV MOLECULAR BIOLOGY (9 HRS.)**

DNA as Genetic material – Griffith's experiment, Hershey and Chase

experiment-Structure and types of DNA and RNA-Replication of DNA – Meselson & Stahl experiment-Types of DNA Mutation

### **UNIT –V CENTRAL DOGMA OF MOLECULAR BIOLOGY ( 9 HRS.)**

Transcription in prokaryotes- Properties of Genetic Code. Translation: Protein Synthesis. Gene Regulation - Lac Operon.

### **UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) ( HRS.)**

#### **REFERENCES:**

- 1.Arumugam, N., (2014). *Cell Biology*, Tenth Edition, Saras Publication, Nagercoil.
- 2.Arumugam N. (2014). *Molecular Biology*.Saras Publications, Nagercoil.
- 3.Watson J.D., Baker T.A., Stephen B.P., Gann A., Levine M and Losick R., *Molecular Biology of the Gene*, 5<sup>th</sup> ed., Pearson Education (2004).
- 4.Lodish D.J and Baltimore D. *Molecular Cell Biology*, 5<sup>th</sup> ed., Sci. American Books, W.H. Freeman and Company, New York (2004).
- 5.Wolfe S.L. *An Introduction to Cell and Molecular Biology*, Wadsworth Publishing Company, New York (1995).
- 6.Geoffery M. Cooper and Robert Hausman, (2009). *The Cell: A Molecular Approach*,Fifth edition, ASM Press and Sineur Associates, Inc.
- 7.Rastogi S.C.,(2003).*Cell and Molecular Biology* - Second Edition, New Age International (P) Limited Publishers, Daryaganj, New Delhi.

#### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://teachmephysiology.com/biochemistry/cell-growth-death/dna-replication/>
2. <https://www.nature.com/articles/nature01407>
3. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/cellcycle-mitosis-meiosis>
4. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/geneexpression-regulation>
5. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/dna-genes-chromosomes>



**COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 OUTLINE AND ORGANIZATION OF A CELL</b>				
1.1	General structure and function of animal cell & cell organelles.	1	Chalk & Talk	Black Board
1.2	Subtopics: Cell membrane- structure & Functions	1	Chalk & Talk	LCD
1.3	Mitochondria- structure & Functions	1	Lecture	PPT & White board
1.4	Golgi Bodies, Lysosomes - structure & Functions	1	Lecture	Smart Board
1.5	Endoplasmic Reticulum- structure & Functions	1	Lecture	Black Board
1.6	Nucleus- structure & Functions	1	Discussion	Google classroom
1.7	Cell Inclusions	2	Lecture	Black Board
1.8	Differences between Prokaryotes and Eukaryotes	1	Discussion	Black Board
<b>UNIT -2 STRUCTURE AND FUNCTIONS OF CELL ORGANELLES</b>				
2.1	Plasma Membrane: Models	1	Lecture	Green Board Charts
2.2	Chemical composition	2	Chalk & Talk	Green Board

	and functions			
2.3	Mitochondria: Structure	1	Chalk & Talk	Black Board
2.4	Mitochondria: Functions	2	Chalk & Talk	LCD
2.5	Endoplasmic Reticulum: Structure	1	Lecture	PPT & White board
2.6	Ribosome structure	1	Lecture	Smart Board
2.7	Ribosome functions	1	Lecture	PPT
<b>UNIT -3 NUCLEAR COMPONENTS AND CELL CYCLE</b>				
3.1	Nucleus: Types Structure	1	Lecture	Black Board
3.2	chemical composition, functions.	1	Discussion	Black Board
3.3	Chromosomes: Shapes based on position of centromere - functions	1	Chalk & Talk	Black Board
3.4	Nucleolus – structure and Functions	1	Chalk & Talk	LCD
3.5	Polytene chromosomes	1	Lecture	PPT & White board
3.6	Lampbrush chromosomes	1	Lecture	Smart Board
3.7	Mitosis	1	Lecture	LCD/PPT
3.8	Meiosis	2	Lecture	LCD
<b>UNIT -4 MOLECULAR BIOLOGY</b>				
4.1	DNA as Genetic material	1	Discussion	Black Board
4.2	Griffith's experiment	1	Chalk & Talk	Black Board
4.3	Hershey and Chase experiment	1	Chalk & Talk	LCD
4.4	Structure and types of	2	Lecture	PPT & White

	DNA and RNA			board
4.5	Replication of DNA	2	Lecture	LCD
4.6	Meselson & Stahl experiment	1	Lecture	Black Board
4.7	Types of DNA Mutation	1	Discussion	Google classroom
<b>UNIT -5 CENTRAL DOGMA OF MOLECULAR BIOLOGY</b>				
5.1	Central Dogma of Molecular Biology	1	Discussion	Black Board
5.2	Transcription in prokaryotes	2	Lecture	PPT/LCD
5.3	Properties of Genetic Code.	1	Chalk & Talk	Black Board
5.4	Translation: Protein Synthesis.	3	Lecture	PPT
5.5	Gene Regulation - Lac Operon	2	Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.			40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %

Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

The students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the general structure and function of a prokaryotic and eukaryotic cell.	K2	PSO1, PSO4, PSO8 & PSO10

<b>CO 2</b>	Associate the structure and function of plasma membrane, mitochondria and endoplasmic reticulum	<b>K2</b>	PSO1, PSO4, PSO8 & PSO10
<b>CO 3</b>	Summarize the structure of chromosome	<b>K2</b>	PSO1, PSO4, PSO8 & PSO10
<b>CO 4</b>	Recall the structure and replication of DNA	<b>K1</b>	PSO1, PSO4, PSO8 & PSO10
<b>CO 5</b>	Organize the events in translation, transcription and gene regulation in Prokaryotes	<b>K3</b>	PSO1, PSO4, PSO8 & PSO10

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	3	2	2	3	2	2	2	2	2	3	2
<b>CO2</b>	3	2	2	3	2	2	2	2	2	3	2
<b>CO3</b>	3	2	2	3	2	2	2	2	2	3	2
<b>CO4</b>	3	2	2	3	2	2	2	2	2	3	2
<b>CO5</b>	3	2	2	3	2	2	2	2	2	3	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	2	2	2
<b>CO2</b>	3	2	2	2
<b>CO3</b>	3	2	2	2
<b>CO4</b>	3	2	2	2
<b>CO5</b>	3	2	2	2


**Note:** ♦ Strongly Correlated – 3

♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER**  
**Dr. N. Nagarani**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

**II B.Sc. Zoology**  
**SEMESTER –IV**

*For II B.Sc Chemistry those who joined in 2019 onwards*

PROGRA MME CODE	COURSE CODE	COURSE TITLE	CATEGO RY	HRS/ WEEK	CREDI TS
UAZO	21Z4ACC4	Lab - Cell & Molecular Biology	Practical	2	2

**COURSE DESCRIPTION**

Students develop laboratory skills with identification of preserved specimen, manipulation of prepared slides, dissections and display under the microscope

**COURSE OBJECTIVES**

To study the life science application in molecular field

**UNIT****CELL BIOLOGY**

1. Laboratory rules and regulations
2. **Microscopic** observation of squamous epithelial cheek cells
3. **Squash preparation of mitotic stages** in Onion root tip.
4. Preparation and identification of Polytene Chromosomes in the Salivary gland of *Chironomus* larva

**Spotters:** Stages of Meiosis, Cellular organelles – Mitochondria, Endoplasmic reticulum, Golgi complex, Nucleus, Ribosome

**MOLECULAR BIOLOGY**

1. **Isolation of DNA** from onion bulb (demo).

**Spotters:** DNA Model, DNA Replication

**REFERENCES**

1. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008) *Techniques in Life Sciences*, 1<sup>st</sup> ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009) *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. [http://vlabs.iitb.ac.in/vlabs-dev/labs/zoology\\_lab/labs/exp1/index.php](http://vlabs.iitb.ac.in/vlabs-dev/labs/zoology_lab/labs/exp1/index.php)
2. <https://www.uwlax.edu/biology/zoo-lab/>
3. <https://learn5.open.ac.uk/course/format/sciencelab/section.p>

[hp?name=btm\\_sdk100](http://virtualbiologylab.org/)

4. <http://virtualbiologylab.org/>

5. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/dna-genes-chromosomes>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>CELL BIOLOGY</b>				
1.1	Laboratory rules and regulations	2	Discussion	PPT
1.2	Microscopic observation of squamous epithelial cheek cells	2	Hands on Training	Microscope
1.3	Squash preparation of mitotic stages in Onion root tip.	2	Hands on Training	Microscope
1.4	Preparation and identification of Polytene chromosomes in the Salivary gland of <i>Chironomus</i> larva	2	Hands on Training	Microscope
1.5	Spotters : Stages of Meiosis	2	Discussion	LCD/PPT
1.6	Sub topics: Mitochondria, Endoplasmic reticulum, Golgi complex, Nucleus, Ribosome	2	Discussion	LCD/PPT
1.7	Sub topics: Golgi complex, Nucleus, Ribosome	2	Discussion	LCD/PPT
<b>MOLECULAR BIOLOGY</b>				
2.1	Isolation of DNA from	2	Hands on	Blood



	onion bulb (demo).		Training	Sample
2.2	Spotters: DNA Model	2	Discussion	Model
2.3	DNA Replication	2	Discussion	Model

CIA	
Scholastic	35
Non Scholastic	5
	40

### EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the squamous epithelial cells under microscope	K3	PSO1& PSO2
CO2	Dissect and mount the Polytene Chromosomes in the	K4	PSO1, PSO2, PSO4 & PSO7

	Salivary gland of <i>Chironomus</i> larva.		
<b>CO 3</b>	Interpret the mitotic stages from the squash preparation in Onion root tip	<b>K2</b>	PSO1, PSO2 & PSO7
<b>CO 4</b>	Recognize the features of the given spotters: Stages of Meiosis, Cellular organelles – Mitochondria, Endoplasmic reticulum, Golgi complex, Nucleus	<b>K1</b>	PSO1, PSO4 & PSO10
<b>CO5</b>	Recall the structure and replication of DNA	<b>K1</b>	PSO1, PSO4 & PSO10

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>CO1</b>	3	3	2	3	2	2	2	2	2	3	2
<b>CO2</b>	3	2	2	3	2	2	2	2	2	3	2
<b>CO3</b>	3	3	2	3	2	2	2	2	2	3	2
<b>CO4</b>	3	3	2	2	2	2	2	2	2	3	2
<b>CO5</b>	3	2	2	3	2	2	2	2	2	3	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	3	2	2	2
<b>CO2</b>	3	2	2	2

<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1 **COURSE DESIGNER:**

**Dr. N. Nagarani**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
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 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

## II B.Sc. Zoology SEMESTER –IV

*For those who joined in 2019 onwards*

<b>PROGRA MME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WEE K</b>	<b>CREDIT S</b>
<b>UAZO</b>	<b>19Z4SB2</b>	<b>Mushroom Cultivation</b>	<b>Lecture</b>	<b>2</b>	<b>2</b>

### **COURSE DESCRIPTION**

Develop basic knowledge in **mushroom cultivation and spawn production**

### **COURSE OBJECTIVES**

To understand the value of edible mushrooms, know the cultivation process and thereby increase the employability

### **UNITS**

**UNIT –I INTRODUCTION****( 6 HRS.)**

Morphology of Mushrooms-**Identification of mushrooms** - Edible and poisonous mushrooms Nutritional and medicinal value of edible mushrooms- History of Mushroom cultivation – Present status of mushroom cultivation in India

**Self-study- History of Mushroom cultivation – Present status of mushroom cultivation in India**

**UNIT –II CULTIVATION****( 6 HRS.)**

Compost – Materials for compost preparation - **Methods of Composting**- Characteristics of compost - Spawning – Methods, Types, Storage –Spawn running- Casing - Cropping and Harvesting; Mushrooms farm design Construction and insulation – Growing rooms – Ventilation systems- Seasonal growing -casing pasteurization chamber

**UNIT –III CULTIVATION****( 6 HRS.)**

Cultivation techniques of edible mushrooms -*Pleurotus citrinopileatus*(Oyster mushroom) and *Agaricus bisporus*(Button mushroom)-Processing , grading and preservation of Mushrooms

**UNIT –IV DISEASES AND PESTS****(6 HRS.)**

Management of fungal, bacterial and viral diseases in mushroom; Competitors, pests and nematodes in mushrooms- Precautions to avoid insects, pests and diseases

**UNIT –V ECONOMICS OF MUSHROOM CULTIVATION****(6 HRS.)**

Economics of mushroom cultivation – Fixed costs, variable costs- Economics of canned products - Mushroom Export- Extension training and entrepreneurship - Mushroom Recipes

**TEXT BOOKS**

- 1.Jana B.L., (2014). *Mushroom culture*. Agrotech publishing company. Udaipur
2. Nita B., (2009). *Hand book on Mushrooms*. Oxford & IBH Publishers, New Delhi.

**REFERENCES**

1. Marimuthu T., Krishnamoorthy A.S., Sivaprakasam K., & Jayarajan R., (1991). *Oyster Mushrooms*. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan M., (1990). *Food and Nutrition*. Bappco, The Bangalore Printing and Publishing Co. Ltd., Bangalore.
3. Tewari, Pankaj K.S.C., (1988). *Mushroom cultivation*. Mittal Publications, Delhi.
4. Muthusamy A.D., & Yesurajal., (1999). *Mushroom Culture*. TNAU Publishers, New Delhi.
5. Tripathi D.P., (2005). *Mushroom Cultivation*. Oxford & IBH Publishers New Delhi

#### Digital Open Educational Resources (DOER) :

1. [https://nios.ac.in/online-course-material/vocational-courses/certificate-in-mushroom-production-revised-\(618\).aspx](https://nios.ac.in/online-course-material/vocational-courses/certificate-in-mushroom-production-revised-(618).aspx)
2. <https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf>
3. <http://nsdl.niscair.res.in/jspui/bitstream/123456789/599/1/mushroom%20cultivation%20-%20Formatted.pdf>
4. <http://www.fao.org/3/i0522e/i0522e.pdf>
5. <http://www.nanard.org/search-result.aspx?S=mushroom>

#### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION</b>				
1.1	Identification of mushrooms	1	Chalk & Talk	Black Board
1.2	Edible and poisonous mushrooms	1	Chalk & Talk	LCD
1.3	Morphology of Mushrooms	1	Lecture	PPT & White board
1.4	Nutritional and medicinal value	1	Lecture	Smart

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	of edible mushrooms			Board
1.5	History of Mushroom cultivation	1	Lecture	Black Board
1.6	Present status of mushroom cultivation in India	1	Discussion	Google classroom
<b>UNIT -2 CULTIVATION TECHNIQUE</b>				
2.1	Compost – Materials for compost preparation Methods of Composting- Characteristics of compost	1	Lecture	Green Board Charts
2.2	Spawning – Methods, Types, Storage –Spawn running	1	Chalk & Talk	Green Board
2.3	Casing - Cropping -Harvesting;	1		
2.4	Mushrooms farm design Construction and insulation– Growing rooms	1	Lecture	PPT & White board
2.5	Ventilation systems- Seasonal growing -casing pasteurization chamber	2	Lecture	Smart Board
<b>UNIT -3 EDIBLE MUSHROOM CULTIVATION</b>				
3.1	Cultivation techniques of edible mushrooms - <i>Pleurotus citrinopileatus</i> (Oyster mushroom )	2	Lecture	Smart Board
3.2	<i>Agaricus bisporus</i> (Button mushroom)-	2	Lecture	Black Board
3.3	Processing, grading and preservation of Mushrooms	2	Chalk & Talk	Black Board
<b>UNIT -4 DISEASES AND PESTS</b>				
4.1	Management of fungal, bacterial	1	Chalk & Talk	Green Board
4.2	viral diseases in mushroom	1	Chalk & Talk	Black Board
4.3	Competitors, pests and nematodes in mushrooms	2	Chalk & Talk	Green Board
4.4	Precautions to avoid insects, pests and diseases	2	Lecture	PPT & White

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				board
<b>UNIT -5ECONOMICS OF MUSHROOM CULTIVATION</b>				
5.1	Economics of mushroom cultivation – Fixed costs, variable costs	2	Lecture	Green Board Charts
5.2	Economics of canned products	1	Chalk & Talk	Green Board
5.3	Mushroom Export	1	Lecture	PPT & White board
5.4	Extension training and entrepreneurship	1	Discussion	Google classroom
5.5	Mushroom Recipes	1	Discussion	Google classroom

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PT 5 Mks			40Mks.	
<b>K1</b>	<b>2</b>	<b>2</b>	-	-	-	<b>4</b>	-	<b>4</b>	10 %
<b>K2</b>	<b>2</b>	<b>2</b>	<b>5</b>	-	-	<b>9</b>	-	<b>9</b>	22.5 %
<b>K3</b>	<b>3</b>	<b>3</b>	-	-	<b>5</b>	<b>11</b>	-	<b>11</b>	27.5 %
<b>K4</b>	<b>3</b>	<b>3</b>	-	<b>5</b>	-	<b>11</b>	-	<b>11</b>	27.5 %
<b>Non Scholastic</b>	-	-	-	-	-		<b>5</b>	<b>5</b>	12.5 %

<b>Total</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>40</b>	<b>100 %</b>
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<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

<b>SCHOLASTIC</b>					<b>NON - SCHOLASTIC</b>	<b>MARKS</b>		
<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>C5</b>	<b>C6</b>	<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>40</b>	<b>60</b>	<b>100</b>

### COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO1</b>	State the prospects of mushroom cultivation	<b>K1</b>	PSO1, PSO2, PSO4, PSO9 & PSO11
<b>CO2</b>	Devise a plan for mushroom production unit	<b>K4</b>	PSO1, PSO2 & PSO9
<b>CO3</b>	Outline the techniques in cultivation, grading & processing of edible mushrooms	<b>K2</b>	PSO1 & PSO9



<b>C04</b>	Identify and manage Insect-Pests and diseases affecting mushrooms.	<b>K2</b>	PSO1&PSO9
<b>C05</b>	Prepare a business plan for small scale enterprise	<b>K4</b>	PSO1&PSO9

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
<b>C01</b>	3	3	2	3	3	3	2	3	3	2	3
<b>C02</b>	3	3	2	3	3	3	2	3	3	2	3
<b>C03</b>	3	3	2	3	3	3	2	3	3	2	3
<b>C04</b>	3	3	2	3	3	3	2	3	3	2	3
<b>C05</b>	3	3	2	3	3	3	2	3	3	2	3

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
<b>C01</b>	3	3	3	3
<b>C02</b>	3	3	3	3
<b>C03</b>	3	3	3	3
<b>C04</b>	3	3	3	3
<b>C05</b>	3	3	3	3


**Note:** ♦ Strongly Correlated – 3  
♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**

**Dr. V. Bharathy**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
Head, Dept. of Zoology  
FATIMA COLLEGE (AUTONOMOUS)  
MADURAI-625 018

**HOD'S Signature  
& Name**

### **III B.Sc. Zoology**

#### **SEMESTER – V**

*For those who joined in 2019 onwards*

<b>PROGRAMME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGO RY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>UAZO</b>	<b>19Z5CC13</b>	<b>Fundamental s of Biochemistry</b>	<b>Lecture</b>	<b>6</b>	<b>4</b>

#### **COURSE DESCRIPTION**

This course will impart knowledge on the structure, properties and metabolism of biomolecules and their interaction in the biological system.

#### **COURSE OBJECTIVES**

- Understand the fundamental biochemical principles of biomolecules
- Interrelate the metabolic pathways and its regulation
- Apply this knowledge to perform biochemical experiments

**UNIT – I CARBOHYDRATES****(18 HRS.)**

Outline classification, properties - physical, chemical and Biological significance of carbohydrates. Monosaccharide: structure, biological significance of Glucose and Fructose. Disaccharides: structure, biological significance of Lactose and Sucrose. Polysaccharides: Homopolysaccharide - structure, biological significance of Starch, Glycogen and Cellulose. Heteropolysaccharide: Heparin and Hyaluronic acid.

**Self study - Biological significance of Carbohydrates****UNIT –II LIPIDS****[18 HRS]**

Properties, physiological significance of Simple lipids -Triacyl Glycerol – saturated and unsaturated fatty acids- essential and non-essential fatty acids, Glycerol – structure and biological significance, Waxes – Spermaceti, Complex lipids: structure and biological significance of Phospholipids and Glycolipids. Derived lipids: Structure, biological significance of Cholesterol.

**Self study- Physiological significance of Simple lipids****UNIT – III PROTEINS****[18 HRS]**

Amino acid: basic structure, properties. Classification of amino acids based on the composition of their R group, polarity of R group and biological importance- Essential and non- essential amino acids. Classification of proteins: Simple proteins, Conjugated proteins, Derived proteins. Biological significance of proteins. Organization of Proteins: Primary, Secondary, Tertiary and Quaternary Structure.

**Self study - Biological significance of Proteins****UNIT –IV METABOLISM****[18 HRS]**

Carbohydrate metabolism: Glycolysis, Kreb's cycle, Glycogenesis,

Glycogenolysis, Lipid metabolism:  $\beta$ -oxidation of fatty acids and biosynthesis of Cholesterol, Protein metabolism: Transamination, Deamination and Decarboxylation. Synthesis of Urea.

### **UNIT – V ENZYMES**

**[18**

#### **HRS]**

**Classification**, properties of enzymes. Mechanism of enzymatic reaction – Michaelis - Menten equation. Factors affecting enzymatic reaction rate: Temperature- pH- substrate and enzyme concentration. **Enzyme inhibition**: Competitive, Non-Competitive and Allosteric types. Biological significance of fat soluble and water soluble vitamins.

**Self study - Biological significance of Fat soluble and water soluble vitamins.**

### **TEXT BOOKS**

1. Deb, A.C. (2011). *Concepts of Biochemistry*. Books and Allied (P) Ltd. Kolkata.
2. Jain, J.L. (2007). *Fundamentals of Biochemistry*. Chand & Co, New Delhi.

### **REFERENCE BOOKS:**

1. Stryer, L. (2000). *Biochemistry*. Freeman & Company, San Francisco, Fourth edition).
2. Voet, D. & Voet, J.G. (2004). *Biochemistry*. Wiley-Liss, New York, Third Edition,.
3. Devlin, T.M. (2006). *Text Book of Biochemistry with clinical correlations*. Wiley-Liss, New York.
4. Lehninger, A.L. Nelson, D.L., & Cox, M.M. (2010). *Principles of Biochemistry*. Freeman and company, New York, Fifth edition.

### **DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)**

1. <https://oli.cmu.edu/jcourse/lms/students/syllabus.do?section=de602c450a0001dc2037ef65e65085e6>
2. <https://ecampusontario.pressbooks.pub/mcmasteroerdiscipline/chapter/biochemistry-biomedical-sciences/>

3. <https://biochem.oregonstate.edu/node/392>
4. <https://courses.lumenlearning.com/boundless-biology/chapter/proteins/>
5. <https://courses.lumenlearning.com/boundless-biology/chapter/carbohydrates/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 CARBOHYDRATE</b>				
1.1	Outline classification, properties - physical, chemical and Biological significance of carbohydrates.	3	Chalk & Talk	Black Board
1.2	Monosaccharide: structure, biological significance of Glucose and Fructose.	3	Chalk & Talk	LCD
1.3	Disaccharides: structure, biological significance of Lactose and Sucrose.	3	Lecture	PPT & White board
1.4	Polysaccharides: Homopolysaccharide - structure, biological significance of Starch, Glycogen and Cellulose.	3	Lecture	Smart Board
1.5	Heteropolysaccharide - Intro	3	Lecture	Black Board
1.6	Heparin and Hyaluronic acid.	3	Lecture	Google classroom

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -2 LIPIDS</b>				
2.1	Properties, physiological significance of Simple lipids	3	Lecture	Green Board Charts
2.2	Triacyl Glycerol – saturated and unsaturated fatty acids	2	Chalk & Talk	Green Board
2.3	Essential and non-essential fatty acids	2	Lecture	PPT & White board
2.4	essential and non-essential fatty acids	2	Lecture	Smart Board
2.5	Glycerol – structure and biological significance,	2	Lecture	PPT & White board
2.6	Waxes – Spermaceti	1	Lecture	PPT & White board
2.7	Complex lipids: structure and biological significance of Phospholipids and Glycolipids.	3	Lecture	PPT & White board
2.8	Derived lipids: Structure, biological significance of Cholesterol.	3	Lecture	PPT & White board
<b>UNIT -3 PROTEINS</b>				
3.1	Amino acid: basic structure, properties.	1	Lecture	Smart Board
3.2	Classification of amino acids based on the composition of their R	3	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	group, polarity of R group and biological importance			
3.3	Essential and non-essential amino acids.	2	Chalk &Talk	Black Board
3.4	Classification of proteins: Simple proteins, Conjugated proteins,	3	Lecture	PPT
3.5	Derived proteins	2	Lecture	Black Board
3.6	Organization of Proteins: Primary, Secondary, Tertiary and Quaternary Structure.	4	Chalk & Talk	Black Board
3.7	Biological significance of Proteins	1	Discussion	PPT
<b>UNIT – 4 METABOLISM</b>				
4.1	Carbohydrate metabolism: Glycolysis	3	Chalk & Talk	Green Board
4.2	Kreb's cycle	3	Chalk &Talk	Black Board
4.3	Glycogenesis, Glycogenolysis	2	Chalk & Talk	Green Board
4.4	Lipid metabolism: $\beta$ -oxidation of fatty acids	2	Lecture	PPT & White board
4.5	Biosynthesis of Cholesterol	2	Lecture	PPT & White board
4.5	Protein metabolism: Transamination, Deamination and Decarboxylation.	4	Lecture	PPT &Green Board
4.6	Synthesis of Urea	2	Lecture	PPT & White board
<b>UNIT – 5 ENZYMES</b>				
5.1		3	Lecture	Green

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
	Classification, properties of enzymes.			Board Charts
5.2	Mechanism of enzymatic reaction – Michaelis - Menten equation.	3	Chalk & Talk	Green Board
5.3	Factors affecting enzymatic reaction rate: Temperature- pH- substrate and enzyme concentration.	4	Lecture	PPT & White board
5.4	Enzyme inhibition: Competitive, Non-Competitive and Allosteric types.	4	Discussion	Google classroom
5.5	Biological significance of fat soluble and water soluble vitamins.	3	Discussion	Google classroom

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Quiz	Assignment	OBT/PPT				
	10 Mks.	10 Mks.	5 Mks.	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks .	
<b>K1</b>	2	2	-	-	-	4	-	4	10 %
<b>K2</b>	2	2	5	-	-	9	-	9	22.5 %
<b>K3</b>	3	3	-	-	5	11	-	11	27.5 %



<b>K4</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>5</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>11</b>	<b>27.5 %</b>
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>5</b>	<b>5</b>	<b>12.5 %</b>
<b>Total</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>40</b>	<b>100 %</b>

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

<b>SCHOLASTIC</b>					<b>NON - SCHOLASTIC</b>	<b>MARKS</b>		
<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>C5</b>	<b>C6</b>	<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>40</b>	<b>60</b>	<b>100</b>

### COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Describe the structural, properties, biological significance of carbohydrates, proteins and lipids.	<b>K2</b>	PSO1 PSO2 PSO4

			PSO8 & PSO11
<b>CO 2</b>	Classify lipids based on their complexity	<b>K2</b>	PSO1 PSO4 PSO8 & PSO11
<b>CO 3</b>	Classify amino acids and proteins based on their structure	<b>K2</b>	PSO1 PSO4 PSO8 & PSO11
<b>CO 4</b>	Construct the flow chart to highlight the metabolic pathways of carbohydrates, proteins and lipids.	<b>K3</b>	PSO1 PSO4 PSO8 & PSO11
<b>CO5</b>	List down the factors affecting the normal functions of the enzymes and biological functions of the vitamins.	<b>K1</b>	PSO1 PSO4 PSO8 & PSO11

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
<b>CO 1</b>	3	3	2	3	2	2	2	3	2	2	3	2
<b>CO 2</b>	3	2	2	3	2	2	2	3	2	2	3	2
<b>CO 3</b>	3	2	2	3	2	2	2	3	2	2	3	2
<b>CO 4</b>	3	2	2	3	2	2	2	3	2	2	3	2
<b>CO 5</b>	3	2	2	3	2	2	2	3	2	2	3	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	2
CO5	3	2	2	2


Note: ♦ Strongly Correlated – 3

♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. A. Tamil Selvi Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

### **III B.Sc. Zoology**

#### **SEMESTER -V**

*For those who joined in 2019 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEEK	CREDIT S
UAZO	19Z5CC14	Molecular Biology	Lecture	6	4

#### **COURSE DESCRIPTION**

The course focuses on the structure of DNA double helix, structural

organization of genome of prokaryotes and eukaryotes and the flow of information from genes to proteins through transcription and translation and regulation of gene expression.

### **COURSE OBJECTIVES**

To understand the role of enzymes in the molecular processes of replication, repair mechanisms, transcription, translation and protein degradation.

### **UNITS**

#### **UNIT –I INTRODUCTION**

**(18 HRS.)**

DNA as the genetic material: Griffith experiment, Avery, McCarty, and MacLeod experiment, Hershey-Chase experiment – Organization of Genome of Prokaryotes and Eukaryotes – histones – nucleosomes – heterochromatin & euchromatin, introns, exons – Watson & Crick DNA double helix – Properties of DNA.

**Self-study - Griffith experiment, Hershey-Chase experiment**

#### **UNIT –II DNA REPLICATION AND REPAIR**

**(18 HRS.)**

DNA replication - Semi-conservative mode of replication & Meselson - Stahl experiment - enzymes involved: Primase, DNA Polymerase, Helicase, Topoisomerases, SSBs – Initiation, elongation and termination - DNA damage and repair mechanisms - Direct, Excision, and Mismatch repair mechanisms.

**Self-study - DNA damage**

#### **UNIT –III TRANSCRIPTION**

**(18 HRS.)**

Central dogma of Molecular biology - Transcription: Enzymes involved: RNA polymerase - mechanism of transcription: Initiation, elongation, termination – Promoter sites – Transcription in Eukaryotes – Post-transcriptional modifications: Capping, Splicing and poly adenylation.

**Self-study – Structure of RNA polymerase**

**UNIT –IV TRANSLATION, PROTEIN FOLDING & TARGETING (18 HRS.)**

Properties of Genetic code - Mechanism of translation in Prokaryotes: Initiation, elongation, termination – Gene regulation in prokaryotes - lac operon – Brief account on Post translational modifications - protein targeting - protein degradation.

**Self-study – Properties of genetic code****UNIT –V BIOINSTRUMENTATION (18 HRS.)**

Water as universal solvent, ionization of water, buffer – Principle and applications of pH metry, Colorimeter, Centrifugation - Protein separation: fractionation – dialysis – paper chromatography (ascending, descending and circular), thin layer chromatography - column chromatography – ion exchange chromatography.

**Self-study - Principle and applications of pH metry****UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (18 HRS.)**

Current trends in Molecular Biology

**REFERENCES:**

1. Arumugam N. (2014). *Molecular Biology*. Saras Publications, Nagercoil.
2. Thiravia Raj S. (1993). *Biophysics*, Saras Publication, Kanyakumari.
3. Cooper G.M. and Robert E.H. (2009). *The Cell: A Molecular Approach*, 5<sup>th</sup> ed., ASM Press, Washington, D.C., and Sinauer Associates, Inc., Sunderland, Massachusetts.
4. Brown T.A. (2002). *Genomes*, 2<sup>nd</sup> ed., Wiley – Liss publications, New York.
5. Weaver R. (1999). *Molecular Biology*, WCB / Mc Graw-Hill, London.

6. Watson J.D., Baker T.A., Stephen B.P., Gann A., Levine M and Losick R., (2004). *Molecular Biology of the Gene*, 5<sup>th</sup> ed., Pearson Education.
7. Lodish D.J and Baltimore D. (2004). *Molecular Cell Biology*, 5<sup>th</sup> ed., Sci. American Books, W.H. Freeman and Company, New York.
8. Wolfe S.L. (1995). *An Introduction to Cell and Molecular Biology*, Wadsworth Publishing Company, New York.
9. De Robertis, E.D.P and De Robertis E.M.F. (1988). *Cell and Molecular Biology*, 8<sup>th</sup> ed., International ed., Infomed, Hong Kong.
10. Malacinski G.M. (2008). *Freifelder's Essentials of Molecular Biology*, 4<sup>th</sup> ed., Narosa Publishing House, New Delhi.
11. Rastogi S.C. (2003). *Cell and Molecular Biology*, 2<sup>nd</sup> ed., New Age International Pvt. Limited Publishers, Daryaganj, New Delhi.
12. J. Jeyaraman, (1980). *Techniques in Biology*, School of Biological Sciences, MKU,.
13. S.C.Rastogi, (2003). *Cell and Molecular Biology*, New Age International (P) Ltd Publishers, New Delhi.
14. Subramanian M.A. (2008). *Biophysics- Principles and Techniques*, M.J.P Publishers, Chennai.
15. S.Palanisamy & M.Shanmugavelu, (2006). *Principles of Biophysics*, Paramount Publications.

## DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/geneexpression-regulation>
2. <https://www2.le.ac.uk/projects/vgec/highereducation/topics/dna-genes-chromosomes>
3. <https://www.chemguide.co.uk/organicprops/aminoacids/dna1.html>
4. <https://www.nature.com/scitable/definition/transcription-dna-transcription-87/>
5. <https://courses.lumenlearning.com/wm-biology1/chapter/prokaryotic-translation/>

**COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 INTRODUCTION</b>				
1.1	DNA as the genetic material: Griffith experiment	2	Chalk & Talk	Black Board
1.2	Avery, McCarty, and MacLeod experiment, Hershey-Chase experiment	2	Chalk & Talk	LCD
1.3	Genome of Prokaryotes	3	Lecture	PPT & White board
1.4	Eukaryotes	2	Lecture	Smart Board
1.5	Histones – nucleosomes	2	Lecture	Black Board
1.6	Heterochromatin & euchromatin, introns, exons	1	Discussion	Google classroom
1.7	Watson & Crick DNA double helix	2	Lecture	DNA model
1.8	Properties of DNA	1	Discussion	Black Board
1.9	Semi-conservative mode of replication - Meselson - Stahl experiment.	3	Chalk & Talk	LCD

<b>UNIT -2 DNA REPLICATION AND REPAIR</b>				
2.1	DNA replication	2	Discussion	Black Board
2.2	enzymes involved: Primase, DNA Polymerase	2	Chalk & Talk	LCD
2.3	Helicase, Topoisomerases, SSBs	2	Lecture	PPT & White board
2.4	Initiation, elongation of Replication	2	Lecture	Smart Board
2.5	Termination of Replication	2	Lecture	Black Board
2.6	Direct repair mechanism	2	Chalk & Talk Discussion	Google classroom
2.7	Nucleotide excision repair mechanisms	2	Lecture	Black Board
2.8	Base excision repair mechanisms	2	Discussion	Black Board
2.9	Mismatch repair mechanisms	2	Lecture	Black Board
<b>UNIT -3 TRANSCRIPTION</b>				
3.1	Central dogma of Molecular biology: Transcription	3	Chalk & Talk	Black Board
3.2	RNA polymerase - mechanism of transcription	2	Chalk & Talk	LCD



3.3	Initiation, elongation, termination	5	Lecture	PPT & White board
3.4	Promoter sites	2	Lecture	Smart Board
3.5	Transcription in Eukaryotes	2	Lecture	Black Board
3.6	Post-transcriptional modifications	4	Discussion	Google classroom
<b>UNIT -4 TRANSLATION, PROTEIN FOLDING &amp; TARGETING</b>				
4.1	Properties of Genetic code	3	Chalk & Talk	Black Board
4.2	Mechanism of translation in Prokaryotes: Initiation	3	Chalk & Talk	LCD
4.3	Elongation, termination	4	Lecture	PPT & White board
4.4	Gene regulation in prokaryotes - <i>lac</i> operon	2	Lecture	Smart Board
4.5	Brief account on Post translational modifications	2	Lecture	Black Board
4.6	Protein targeting	2	Discussion	Google classroom
4.7	Protein degradation.	2	Lecture	Black Board
<b>UNIT – 5 BIOINSTRUMENTATION</b>				
5.1	Water as universal solvent, ionization of water, buffer	1	Chalk & Talk	Black Board

5.2	Principle and applications of pH metry	1	Chalk & Talk	LCD
5.3	Colorimeter, Centrifugation	4	Lecture	PPT & White board
5.4	Protein separation: fractionation, dialysis	1	Lecture	Smart Board
5.5	paper chromatography (ascending, decending and circular)	1	Lecture	Black Board
5.6	Thin layer chromatography	1	Discussion	Google classroom
5.7	Column chromatography	2	Lecture	Black Board
5.8	Ion exchange chromatography	1	Discussion	Black Board

### INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Quiz	Assignment	OBT/PP T				
	10 Mks	10 Mks	5 Mks	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks	

K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
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<b>CO 1</b>	Illustrate the Watson and Crick model of DNA double helix; mechanism of DNA replication and the role of enzymes	<b>K1</b>	PSO1 PSO4& PSO8
<b>CO 2</b>	Discuss the different types of DNA damages and repair mechanisms	<b>K2</b>	PSO1& PSO4
<b>CO 3</b>	Describe the transcription and translation in prokaryotes and eukaryotes	<b>K1</b>	PSO1 PSO4& PSO8
<b>CO 4</b>	Discuss the post-transcriptional modifications, properties of genetic code and role of repressor in gene regulation	<b>K2</b>	PSO1& PSO4
<b>CO 5</b>	Employ the appropriate separation technique based on the size, shape, and charge of biomolecules	<b>K3</b>	PSO1 PSO4& PSO8

### Mapping of COs with PSOs

CO/ PSO	PS O1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
<b>CO1</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO2</b>	2	2	2	3	2	2	2	2	2	2	2	2
<b>CO3</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>CO4</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO5</b>	2	2	2	3	2	2	2	2	2	2	2	2

### Mapping of COs with POs


CO/	PO1	PO2	PO3	PO4
-----	-----	-----	-----	-----

PSO				
CO1	2	2	2	2
CO2	2	2	3	2
CO3	2	3	2	2
CO4	2	2	1	2
CO5	2	2	2	2

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
**Dr. J. Asnet Mary**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

### **III B.Sc. Zoology SEMESTER –V**

*For those who joined in 2019 onwards*

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WE EK	CREDITS
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<b>UAZO</b>	<b>19Z5CC15</b>	<b>Lab - Biochemical Analysis</b>	<b>Practical</b>	<b>4</b>	<b>2</b>
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### **COURSE DESCRIPTION**

This course introduces the students to the biochemical analytical experiments for Carbohydrates, Protein and Lipids by providing familiarization with the preparation of reagents, proper use of instrumentation and interpretation of the properties of the Biomolecules.

### **COURSE OBJECTIVES**

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

### **UNITS**

#### **CONTENT**

1. Laboratory biosafety guidelines
2. Preparation of solutions – Percentage, Normality, Molarity, Molality, ppm, preparation of working standard from stock solution.
3. **Qualitative analysis of Carbohydrates**: Barford's Test, Fehling's test, Seliwanoff's test and Iodine test.
4. Qualitative analysis of Proteins: Biuret test, Sakaguchi test and Ninhydrin test.
5. Qualitative analysis of lipids: Saponification test, Iodine Absorption test, Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.
6. **Separation of amino acids by circular paper chromatography.**
7. Demonstration- **Estimation of Glucose** by Anthrone method.
8. Demonstration – **Estimation of Protein** by Lowry's method.
9. Spotters- pH meter, Chromatographic Chamber, Colorimeter, Spectrophotometer & Thin Layer Chromatography

**REFERENCES:**

1. Plummer, D.T. (2008). *An Introduction to Practical Biochemistry*. Tata McGraw- Hill Publication, New Delhi.
2. Wilson, K and Walker, J. (2008). *Practical Biochemistry*. Cambridge State University Press, U.K.
3. Boyer, R.F. (2012). *Modern Experimental Biochemistry*. Pearson Education, India.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <http://www.oercommons.org/courses/biochemistry-3/view>
2. <https://louis.oercommons.org/curated-collections/52>
3. <https://libguides.wesleyan.edu/c.php?g=924060&p=6671362>
4. [https://bio.libretexts.org/learning\\_objectives/laboratory\\_experiments/Biochemistry\\_labs](https://bio.libretexts.org/learning_objectives/laboratory_experiments/Biochemistry_labs)
5. <https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/biochemicalanalysis>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>CONTENT</b>				
1	Laboratory biosafety guidelines	1	Lecture	LCD
2.1	Preparation of solutions -Percentage, Normality, Molarity	2	Chalk & Talk	Black Board
2.2	Preparation of solutions - Molality, ppm, preparation of working standard from stock solution.	2	Chalk & Talk	Black Board
3.1	Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test	1	Demonstration & hands on training	Black Board
3.2	Qualitative analysis of Carbohydrates: Seliwanoff's test and Iodine test.	1	Demonstration & hands on training	Black Board

4.1	Biuret test, Sakaguchi test and Ninhydrin test.	1	Demonstration & hands on training	Black Board
5.1	Qualitative analysis of lipids - Saponification test, Iodine Absorption test	2	Demonstration & hands on training	Black Board
5.2	Qualitative analysis of lipids: Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.	1	Demonstration & hands on training	Black Board
6	Demonstration of Glucose by Anthrone method.	1	Demonstration & hands on training	Green Board
7	Demonstration of Protein by Lowry's method	2	Demonstration & hands on training	Green Board
8	Spotters- pH meter, Chromatographic Chamber, Colorimeter, Spectrophotometer & Thin Layer Chromatography	1	Specimen	LCD

CIA	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

MARKS		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>40</b>	<b>60</b>	<b>100</b>

### COURSE OUTCOMES

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



NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Make use of the knowledge of basic principles of Biochemistry to carry out the biochemical experiments	K3	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 2	Infer the outcome of the qualitative analytical tests of Biomolecules	K2	PSO1, PSO2, PSO4 & PSO8
CO 3	Estimate the biomolecules using standard protocols	K5	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 4	Develop skills in handling basic equipments	K3	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 5	Develop familiarity with the principles of Laboratory safety	K3	PSO1, PSO2, PSO4, PSO7 & PSO8

**Mapping of COs with PSOs**

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	3	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	3	2	3	2	2	3	3	2	2	2	2
CO4	3	3	2	3	2	2	3	3	2	2	2	2
CO5	3	3	2	3	2	2	3	3	2	2	2	2

**Mapping of COs with Pos**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	3	3	2

CO4	3	3	3	2
CO5	3	3	2	3

Note: ♦ Strongly Correlated – 3


♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

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### III B.Sc. Zoology

#### SEMESTER – V

*For those who joined in 2019 onwards*

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WE EK	CREDITS
UAZO	19Z5CC16	Lab - Molecular Biology	Practical	4	2

**COURSE DESCRIPTION**

The course intends to provide hands-on experience on techniques related to isolation and estimation of DNA, RNA and separation of phytoconstituents by paper chromatography and thin-layer chromatography

**COURSE OBJECTIVES**

To gain practical skills to isolate, estimate and separate various biomolecules

**EXPERIMENTS****MOLECULAR BIOLOGY**

1. Laboratory biosafety guidelines.
2. Micropipetting techniques and calculations.
3. Isolation of Genomic DNA from mammalian tissue.
4. Estimation of DNA by DPA method.
5. Isolation of RNA from Yeast.
6. Estimation of RNA by Orcinol method.
7. Isolation of UV mutants using colony plate – Replica plating.
8. Setting up of Southern blotting.
9. Chemical mutagenesis.
10. Genotoxicity assay.
11. **Spotters:** DNA Double Helix Model, DNA Replication, Agarose Gel Electrophoresis, SDS-PAGE.

**BIOSTATISTICS**

1. Calculation of Measures of central tendency & Measures of dispersion using neem leaves
2. Diagrammatic representation of data

**ANIMAL BEHAVIOUR**

1. Social behavior of animals – Ant
2. Geotactic and phototactic behavior of earthworms

**REFERENCES:**

1. Rajan S., Christy, S.R., (2011). *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008). *Techniques in Life Sciences*, 1<sup>st</sup> ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009). *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Plummer T.D., (1990). *An Introduction to Practical Biochemistry*, 4<sup>th</sup> ed., Mc Graw Hill Book Company, Europe.
6. Palanivelu P., (2004). *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students*, 3<sup>rd</sup> ed., Kalaimani Printers, Madurai.
7. Wilson K and Walker J., (2013). *Principles and Techniques of Biochemistry and Molecular Biology*, 7<sup>th</sup> ed., Cambridge University Press, New York.
8. Boyer R., (2000). *Modern Experimental Biochemistry*, 3<sup>rd</sup> ed., Pearson Education Inc.
9. Wilson K and Kenneth H.G., (1992). *A Biologists Guide to Principles and Techniques of Practical Biochemistry*, 3<sup>rd</sup> ed., Cambridge University Press, Cambridge, UK.

#### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view>
2. <https://www.oercommons.org/authoring/2442-adaptation-vampirism-ecology-environment-the-virtu/view>
3. <https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/>
4. <https://userpages.umbc.edu/~jwolf/method1.htm>
5. [https://www.chemsafetypro.com/Topics?CRA?mutagenicity\\_and\\_Genotoxicity.html](https://www.chemsafetypro.com/Topics?CRA?mutagenicity_and_Genotoxicity.html)

**COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>MOLECULAR BIOLOGY</b>				
1.1	Laboratory biosafety guidelines	4	Lecture & Demonstration	Blackboard & Specimen
1.2	Micropipetting techniques and calculations	4	Demonstration	Micropipettes
1.3	Isolation of Genomic DNA from mammalian tissue.	4	Demonstration	Specimen
1.4	Estimation of DNA by DPA method	4	Demo	Calf Thymus DNA
1.5	Isolation of RNA from Yeast.	4	Demo	Specimen
1.6	Estimation of RNA by Orcinol method.	4	Demo	Specimen
1.7	Isolation of UV mutants using colony plate – Replica plating.	4	Hands on training	Bacteria, Laminar air flow
1.8	Setting up of Southern blotting.	2	Hands on training	Buffers
1.9	Chemical mutagenesis	4	Hands on training	Bacteria, chemicals, Laminar air flow
1.10	Genotoxicity assay	4	Hands on training	Tissue sample

1.13	<b>Spotters:</b> DNA Double Helix Model, DNA Replication, Agarose Gel Electrophoresis, SDS-PAGE.	2	Observation	Models, equipments, Agarose gel electrophoretic unit, PAGE unit
<b>BIostatistics &amp; Animal Behaviour</b>				
2.1	Calculation of Measures of central tendency & Measures of dispersion using neem leaves	2	Hands on training	Neem leaves
2.2	Diagrammatic representation of data	2	Hands on training	MS - Excel
2.3	Social behavior of animals	4	Hands on training	Specimen
2.4	Geotactic and phototactic behavior of earthworms	4	Hands on training	Specimen

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

<b>MARKS</b>		
<b>CIA</b>	<b>ESE</b>	<b>Total</b>
<b>40</b>	<b>60</b>	<b>100</b>

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Estimate the pH of different samples	K2	PSO 2
CO 2	Infer the color changes in DNA and RNA estimation	K2	PSO 2 PSO 7
CO 3	Compute the Rf value for paper chromatography	K3	PSO 2
CO 4	Demonstrate the genomic DNA isolation, DNA estimation and chromatography	K3	PSO 2
CO 5	Solve the presence of nucleic acid in the given sample	K3	PSO 2

### Mapping of COs with PSOs

CO/ PSO	PS O1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	3	2	2	2	2	2	2	2	2	2	2
CO2	2	3	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	2	2	2	2
CO3	2	2	2	2

<b>CO4</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – **3**      ♦ Moderately Correlated – **2**  
 ♦ Weakly Correlated - **1**

**COURSE DESIGNER:**

**Dr. J. Asnet MaryForwarded**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
**FATIMA COLLEGE (AUTONOMOUS)**  
**MADURAI-625 018**

**By**

**HOD'S Signature  
& Name**

### **III B.Sc. Zoology SEMESTER –V**

*For those who joined in 2019 onwards*

<b>PROGRAMM E CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGOR Y</b>	<b>HRS/WEE K</b>	<b>CREDIT S</b>
	<b>19Z5ME</b>	<b>Biostatistics</b>	<b>Lecture</b>	<b>5</b>	<b>5</b>



PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	1				

### COURSE DESCRIPTION

This course deals with the application of statistical principles in biology.

### COURSE OBJECTIVES

- To study the **analysis** and statistical significance of biological data.
- Interpret the results using different descriptive statistical methods.

### UNIT - I COLLECTION & PROCESSING OF DATA (15 HRS.)

Introduction-**Collection of data** – primary & secondary, methods of data collection, methods of sampling-Classification of data- Types: geographical, chronological, qualitative & quantitative. Tabulation of data-parts of the table – methods of classification –Individual, Discrete and Continuous series.

### UNIT – II MEASURES OF CENTRAL TENDENCY AND DISPERSION (15 HRS.)

Tabulation of data-Normalization of data-**Analysis of data – Measures of central tendency & Measures of dispersion. Calculation of mean, mode, median, standard deviation, range, variance, coefficient of variance.**

### UNIT – III PRESENTATION OF DATA (15 HRS.)

Presentation of data – techniques of graphic presentation- line graph and histogram-Diagrammatic presentation- line diagram, bar diagram, pie diagram, pictogram and cartogram, Interpretation of data.

**Self-Study-Diagrammatic presentation- line diagram, bar diagram, pie diagram, pictogram and cartogram, Interpretation of data.**

### UNIT - IV CORRELATION& REGRESSION (15 HRS.)

Correlation analysis - Kinds, Degree - Types of correlation- Pearson's Correlation Coefficient (Problems)-Regression analysis- Simple, Linear

Regression (Problems) -Chi- Square Test – goodness of fitness (Problems).

### UNIT -V TEST OF VARIANCE

(15 HRS.)

MS Excel – statistical functions- Test of Significance – Large and Small samples – (Students T test ) - ANOVA- one way and two way.

### TEXT BOOK:

Ramakrishnan P., (2010). *Biostatistics*, Saras publications, Nagarcoil, Tamil Nadu.

### REFERENCES:

1. Khan and Khanum., (2017). *Fundamentals & Biostatistics*, 2nd ed., Ukaaz Publications, Hyderabad.
2. Gurumani N., (2010) *An Introduction to Biostatistics*, MJP Publishers, Chennai.
3. Prasad S., (2012) *Elements of Biostatistics*, Rastogi publications, Meerut.

### Digital Open Educational Resources (DOER):

1. <https://www.oercommons.org/courses/chi-square-test-08-54>
2. <http://www.oercommons.org/courses/biostatistics-methods-2/view>
3. <https://www.oercommons.org/courses/anova-calculations>
4. <https://www.oercommons.org/authoring/21429-wp-12-1-additional-test-of-two-population-variance/view>
5. <https://vivaopen.oercommons.org/courseware/unit/420>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT - 1 COLLECTION & PROCESSING OF DATA				

1.1	Introduction-Collection of data – primary & secondary data	2	Chalk & Talk	Black Board
1.2	Methods of data collection, Methods of sampling	3	Chalk & Talk	Black Board
1.3	Classification of data- Types: geographical, chronological, qualitative & quantitative.	4	Lecture	PPT & White board
1.4	Tabulation of data-parts of the table	2	Lecture	Black Board
1.5	Methods of classification –Individual, Discrete and Continuous series.	4	Lecture	Black Board
<b>UNIT - 2 MEASURES OF CENTRAL TENDENCY AND DISPERSION</b>				
2.1	Tabulation of data-Normalization of data-Analysis of data	2	Lecture	Black Board
2.2	Measures of central tendency & Measures of dispersion	3	Chalk & Talk	Black Board
2.3	Calculation of mean, mode, median	3	Chalk & Talk	Black Board
2.4	Standard deviation	2	Lecture	Black Board
2.5	Range, variance	3	Chalk & Talk	Black Board
2.6	Coefficient of variance	2	Lecture	Black Board
<b>UNIT – 3 PRESENTATION OF DATA</b>				
3.1	Presentation of data – techniques of graphic	5	Chalk & Talk	Black Board

	presentation- line graph and histogram			
3.2	Diagrammatic presentation- line diagram, bar diagram, pie diagram, pictogram and cartogram	8	Chalk & Talk	Black Board
3.3	Interpretation of data	2	Lecture	Black board
<b>UNIT - 4 CORRELATION &amp; REGRESSION</b>				
4.1	Correlation analysis Kinds, Degree - Types of correlation- Pearson's Correlation Coefficient (Problems)	8	Lecture	Black Board
4.2	Regression analysis- Simple, Linear Regression (Problems)	5	Chalk & Talk	Black Board
4.3	Chi- Square Test (goodness of fitness -Problems)	2	Chalk & Talk	Black Board
<b>UNIT - 5 TEST OF VARIANCE</b>				
5.1	MS Excel – statistical functions	4	Lecture	Black Board
5.2	Test of Significance – Large and Small samples (Student T test)	5	Chalk & Talk	Black Board
5.3	ANOVA- one way and two way	6	Chalk & Talk	Black Board

**INTERNAL - UG**

	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
Levels	T1	T2	Quiz	Assignment	OBT/PP T				

	10 Mks	10 Mks	5 Mks	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholasti c	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTI C	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Tota l
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Outline the importance of data collection and its types.	<b>K1</b>	PSO1
<b>CO 2</b>	Estimate and interpret the data, by various measures including mean, median, and standard deviation.	<b>K3</b>	PSO2
<b>CO 3</b>	Apply the basic numeric and graphical techniques to display and summarize the collected data.	<b>K3</b>	PSO8
<b>CO 4</b>	Interpret statistical results effectively in context to Correlation and Regression.	<b>K2</b>	PSO8
<b>CO 5</b>	Choose and apply appropriate statistical methods for analyzing one or two variables.	<b>K2</b>	PSO9

### Mapping of COs with PSOs

<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>	<b>PSO 7</b>	<b>PSO 8</b>	<b>PSO 9</b>	<b>PSO 10</b>	<b>PSO 11</b>	<b>PSO 12</b>
<b>CO1</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO2</b>	2	3	2	2	2	2	2	2	2	2	2	2
<b>CO3</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>CO4</b>	2	2	2	2	2	2	2	2	2	2	2	2
<b>CO5</b>	2	2	2	2	2	2	2	2	1	2	2	2

### Mapping of COs with POs

<b>CO/ PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>
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<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – **3**      ♦ Moderately Correlated – **2**  
 ♦ Weakly Correlated – **1**

**COURSE DESIGNER:**

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**III B.Sc.Zoology**

**SEMESTER –V**

*For those who joined in 2019 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5ME2	Animal Behaviour	Lecture	5	5

### COURSE DESCRIPTION

Students gain knowledge on learning, behaviour and biorhythm in animals.

### COURSE OBJECTIVES

- Acquire fundamental knowledge on the behavioural concept in animals
- Understand the environment, social and reproductive behaviour in animals
- Summarize the phenomenon behind the molecular basis of biological rhythm including circadian.

### UNITS

#### UNIT I – INTRODUCTION TO ANIMAL BEHAVIOUR (15 HRS.)

Origin, history and scope of Ethology. Contribution of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen. Causes - Proximate and ultimate. Types - Innate and Acquired, Instinctive and Motivated behaviour. Patterns of behaviour - Stereotyped Behaviours (Orientation, Reflexes); Hormonal regulation of behaviour, Ethogram.

#### Self-Study - Origin, history and scope of Ethology

#### UNIT II – LEARNING AND MEMORY (15 HRS.)

Types of learning - Physiology and phylogeny of learning - trial and error learning, Imprinting, habituation. Classical conditioning: - Pavlov's experiment; Operant learning – Skinner's experiment, insight, Instrumental conditioning, association learning and reasoning.

#### UNIT III – SOCIAL AND REPRODUCTIVE BEHAVIOUR - (15 HRS.)

Social Behaviour - Communication and the senses; Altruism; Insects' society



with Honey bee as an example; Foraging in honey bee and advantages of the waggle dance. Sexual Behaviour: Courtship and signal: *Hilarasartor* (Balloon fly) and ♂ Stickleback's zigzag dance. Reproductive behaviour – Strategies and mating systems; Selection – Intra-sexual & Inter-sexual; Mating behaviour in Penguins.

**Self-Study - Insects' society with Honey bee as an example**

**UNIT IV – NEURAL AND ECOLOGICAL ASPECTS OF BEHAVIOUR (15 HRS.)**

Role of pheromones in reproductive behaviour. Communication - Chemical, visual, light and audio. Ecological aspects of behaviour - Habitat selection, food selection, anti-predator defence, aggression, host-parasite relations.

**Self-Study – Host-parasite relations**

**UNIT V – BIOLOGICAL RHYTHM (15 HRS.)**

Types and characteristics of biological rhythms: Short- and Long-term rhythms, Circadian rhythms, Tidal rhythms and Lunar rhythms. Concept of synchronization and masking - Photic and non-photic zeitgebers. Circannual rhythms; Photoperiod and regulation of seasonal reproduction in vertebrates - Role of melatonin.

**UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) ( HRS.)**

**REFERENCES:**

1. Arumugam, N and P. Natarajan, (2018). Animal Behaviour – Ethology. SarasPublication. Nagercoil
2. Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). (2004). Chronobiology Biological Timekeeping: Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
3. Saunders, D.S., C.G.H. Steel, X., (2002) Insect Clocks Afopoulou (ed.) R.D. Lewis. (3rd Ed) Barenz and Noble Inc. New York, USA
4. Vinod Kumar (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view>
2. <https://www.oercommons.org/browse?f.keyword=animal-behaviour>
3. <https://www.psychologytoday.com/intl/basics/animal-behavior>
4. <https://seaworld.org/animals/all-about/training/animal-behavior-and-learning/>
5. <https://www.nature.com/subjects/animal-behaviour>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 INTRODUCTION TO ANIMAL BEHAVIOUR</b>				
1.1	<b>Origin, history and scope of Ethology</b>	2	Chalk & Talk	Black Board
1.2	Contribution of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.	1	Lecture	Black Board
1.3	Contribution of Konrad Lorenz, Niko Tinbergen	1	Lecture	PPT & White board
1.4	Causes of behaviour: Proximate and ultimate	1	Lecture	Smart Board
1.5	Types of Behaviour: Innate and Acquired	2	Lecture	Black Board
1.6	Instinctive and Motivated behaviour.	1	Discussion	Google classroom
1.7	Pattern of behaviour: Stereotyped Behaviours (Orientation, Reflexes)	3	Lecture	Black Board

1.8	Hormonal regulation of behaviour	2	Lecture	Black Board
1.9	Ethogram	2	Lecture	Black Board
<b>UNIT -2 LEARNING AND MEMORY</b>				
2.1	Types of learning	1	Lecture	Green Board Charts
2.2	<b>Subtopics:</b> Physiology and phylogeny of learning	2	Chalk & Talk	Green Board
2.3	<b>subtopics:</b> trial and error learning, Imprinting, habituation.	2	Chalk & Talk	Black Board
2.4	Classical conditioning: - Pavlov's experiment	2	Chalk & Talk	LCD
2.5	Operant learning – Skinner's experiment	4	Lecture	PPT
2.6	Insight - Instrumental conditioning, association learning and reasoning.	4	Lecture	PPT
<b>UNIT -3 SOCIAL AND REPRODUCTIVE BEHAVIOUR</b>				
3.1	Social Behaviour: Concept of Society; Communication and the senses	3	Lecture	Black Board
3.2	Altruism; Insects' society with <b>Honey bee as</b> example	2	Discussion	Black Board
3.3	Foraging in honey bee and advantages of the waggle dance	2	Chalk & Talk	Black Board
3.4	Sexual Behaviour: Courtship	3	Chalk &	LCD

	and signal: Hilarasartor (Balloon fly) and ♂ Stickleback's zigzag dance.		Talk	
3.5	Strategies and mating systems	2	Lecture	PPT
3.6	Intra-sexual selection, Inter-sexual selection (	2	Lecture	PPT/LCD
3.7	Mating behaviour in Penguins.	1	Lecture	PPT & White board
<b>UNIT -4 NEURAL AND HORMONAL CONTROL OF BEHAVIOUR</b>				
4.1	Motivation: Role of hormones	2	Discussion	Black Board
4.2	Aggregation	1	Lecture	PPT
4.3	Role of pheromones in reproductive behaviour	3	Chalk & Talk	Black Board
4.4	Communication: Chemical, visual, light and audio.	3	Chalk & Talk	LCD
4.5	Ecological aspects of behaviour: Habitat selection, food selection, anti-predator defenses, aggression,	4	Lecture	PPT & White board
4.6	host parasite relations	2	Discussion	Black Board
<b>UNIT -5 BIOLOGICAL RHYTHM</b>				
5.1	Types and characteristics of biological rhythms	2	Discussion	Black Board
5.2	Short- and Long- term rhythms;	2	Lecture	PPT/LCD

5.3	Circadian rhythms; Tidal rhythms and Lunar rhythms	2	Chalk & Talk	Black Board
5.4	Concept of synchronization and masking; Photic and non-photic zeitgebers	3	Lecture	Green Board
5.5	Circannual rhythms	2	Lecture	PPT
5.6	Photoperiod and regulation seasonal reproduction of vertebrates	3	Lecture	PPT
5.7	Role of melatonin	1	Lecture	LCD

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mk s.	T2 10 Mk s.	Quiz 5 Mk s.	Assignment 5 Mks	OBT/PT 5 Mks	35 Mks.	5 Mks.	40Mk s.	
<b>K1</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>-</b>	<b>4</b>	10 %
<b>K2</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>9</b>	<b>-</b>	<b>9</b>	22.5 %
<b>K3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>11</b>	<b>-</b>	<b>11</b>	27.5 %
<b>K4</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>5</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>11</b>	27.5 %
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>5</b>	<b>5</b>	12.5 %
<b>Total</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>40</b>	<b>100 %</b>

CIA	
Scholastic	35

<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

### EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the scope and history of Ethology	K1	PSO1, PSO3, PSO4 & PSO6
CO 2	Explain the types of learning	K2	PSO1, PSO4 & PSO10
CO 3	Summarize the methods adopted by the animals in mate selection.	K2	PSO1, PSO3, PSO4 PSO8 & PSO10
CO 4	Discuss the various parameters controlling the behaviour in context to nerve and hormone	K6	PSO1, PSO3, PSO4, PSO6 & PSO8
CO 5	Recall the types and features of biological rhythm	K1	PSO1, PSO3, PSO4, PSO8 & PSO10

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	1	3	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	3	2	2
CO3	3	2	1	3	2	2	2	2	2	3	2	2
CO4	3	2	1	3	2	2	2	2	2	2	2	2
CO5	3	2	1	3	2	2	2	3	2	3	2	2


**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	1	1
CO2	2	2	1	1
CO3	2	2	1	1
CO4	2	2	1	1
CO5	2	2	1	1

**Note:** ♦ Strongly Correlated – 3    ♦ Moderately Correlated – 2    ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
**Dr. N. Nagarani**

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**HOD'S Signature  
& Name**

**SEMESTER –V***For those who joined in 2019 onwards*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5SB3	Ornamental Fish Culture	Lecture	2	2

**COURSE DESCRIPTION**

This course familiarizes the status and the importance of ornamental fish industry.

**COURSE OBJECTIVES**

- Enable the students to know about the characteristics of ornamental fishes and their development.
- Know about the diseases caused to them and their preventive measures.
- Motivate them to become an entrepreneur.

**UNITS****UNIT –I INTRODUCTION TO AQUARIUM****(6HRS.)**

Introduction to Fish keeping and Scope and entrepreneurial aspects of Ornamental Fish Culture - Types of Aquarium - Aquarium equipment - Setting up Aquarium.

**Self-study –Scope of Ornamental Fish Culture****UNIT –II COMMERCIALLY IMPORTANT SPECIES****(6 HRS.)**

Species of Ornamental Fishes – Gold fish, Fighter, Guppies, swordtails, mollies; Marine – Angels, Parrot fish, Butterfly fishes, clown fish, anemone- Aquarium Plants – Floating plants – Fairy moss, Indian Fern, Small eared *Salvinia* and Water lettuce; Submerged plants – Japanese Dwarf rust, Madagascar lace plant, *Hydrilla* and *Vallisneria*.

**Self-study – Gold fish, Fighter, Guppies, swordtails, mollies**



**UNIT –III QUALITY MANAGEMENT****(6 HRS.)**

**Water Quality Management** - **Fish Nutrition** – Live feed- *Artemia*, *Tubifex* - Artificial feed.

**UNIT –IV DEVELOPMENT AND PARENTAL CARE****(6 HRS.)**

**Breeding** and development of Aquarium fishes - Parental Care among Aquarium Fishes.

**UNIT –V AQUARIUM DISEASES AND TREATMENT****(6 HRS.)**

Aquarium Fish Diseases – Bacterial- Red pest, Clumnaris, Dropsy, Scale protrusion, Tail Rot and Fin Rot Viral- Lymphocystis/Cauliflower disease Parasitic - Black spot disease, *Ergasilus*, *Uronema marinum*, Leeches.

**TEXT BOOK:**

1. Thara Devi, C.S and Jayashree, K.V., (2009) *Aquarium*. Saras Publication, Nagercoil,

**REFERENCES:**

1. Biswas, S.P., J.N. Das, U.K. Sarkar and Lakra, W.S., (2007) *Ornamental fishes of North East India: An Atlas*: NBFGR.
2. Spotte, S., (1993) *Marine Aquarium keeping: The Sciences, Animals and Art*, John Wiley & Sons, New York.
3. Jhingran, V.G., (1993) *Fish and Fisheries of India*, Hindustan publishing corporation, India, (1975).
4. Rath, A.K., (2011) *Freshwater Aquaculture*, Scientific publishers, Jodhpur, India.
5. Murthi, V.S. (2002) *Marine ornamental Fishes of Lakshadweep*, CMFRI, Special publication.

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5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4952235/>
6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435374/>

7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3648355/>
8. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4203283/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION TO AQUARIUM</b>				
1.1	Introduction to Fish keeping	1	Chalk & Talk	Black Board
1.2	Scope and entrepreneurial aspects of Ornamental Fish Culture	1	Discussion	
1.3	Types of Aquarium	1	Chalk & Talk	Black Board
1.4	Aquarium equipment	2	Chalk & Talk	Black Board
1.5	Setting up Aquarium	1	Chalk & Talk	Black Board
<b>UNIT -2 COMMERCIALLY IMPORTANT SPECIES</b>				
2.1	Species of Ornamental Fishes-Gold fish, Fighter, Guppies, swordtails, mollies. Marine – Angels, Parrot fish	1	Discussion	
2.2	Butterfly fishes, clown fish, anemone	1	Chalk & Talk	Black Board
2.3	Aquarium Plants – Floating plants – Fairy moss, Indian Fern	1	Chalk & Talk	PPT
2.4	Small eared <i>Salvinia</i> and Water lettuce	1	Chalk & Talk	Black Board
2.5	Submerged plants – Japanese Dwarf rust	1	Chalk & Talk	Black Board

2.6	Madagascar lace plant, <i>Hydrilla</i> and <i>Vallisneria</i>	1	Chalk & Talk	Black Board
<b>UNIT -3 QUALITY MANAGEMENT</b>				
3.1	Water Quality Management	2	Lecture	Black Board
3.2	Fish Nutrition	1	Chalk & Talk	Black Board
3.3	Live feed- <i>Artemia</i> , <i>Tubifex</i>	2	Chalk & Talk	Black Board
3.4	Artificial feed	1	Chalk & Talk	Black Board
<b>UNIT – 4 DEVELOPMENT AND PARENTAL CARE</b>				
4.1	Breeding and development of Aquarium fishes	3	Lecture	Black Board
4.2	Parental Care among Aquarium Fishes	3	Chalk & Talk	Black Board
<b>UNIT – 5 AQUARIUM DISEASES AND TREATMENT</b>				
5.1	Aquarium Fish Diseases – Bacterial- Red pest	1	Lecture	Black Board
5.2	Clumnaris, Dropsy, Scale protrusion, Tail Rot and Fin Rot	2	Chalk & Talk	Black Board
5.3	Viral- Lymphocystis/Cauliflower disease	1	Chalk & Talk	PPT
5.4	Parasitic - Black spot disease	1	Chalk & Talk	Black Board
5.6	<i>Ergasilus</i> , <i>Uronema marinum</i> , Leeches	1	Chalk & Talk	PPT

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	List the types of aquarium.	K1	PSO9
CO 2	Plan the use of common aquarium ornamental fish and aquatic plants to decorate it.	K3	PSO9
CO 3	Outline the physico – chemical parameters of water required for the growth of fish.	K2	PSO2 & PSO9
CO 4	Explain the techniques followed in ornamental fish breeding.	K2	PSO4 & PSO9
CO 5	Identify the symptoms of various diseases prevalent in ornamental fish.	K3	PSO9

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	2	2	2	2	2	2	2	3	2	2	2

<b>CO2</b>	2	2	2	2	2	2	2	2	3	2	2	2
<b>CO3</b>	2	2	2	2	2	2	2	2	3	2	2	2
<b>CO4</b>	2	2	2	2	2	2	2	2	3	2	2	2
<b>CO5</b>	2	2	2	2	2	2	2	2	3	2	2	2

### Mapping of COs with POs

<b>CO/ PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>
<b>CO1</b>	2	2	2	2
<b>CO2</b>	2	2	2	2
<b>CO3</b>	2	2	3	2
<b>CO4</b>	3	2	2	2
<b>CO5</b>	2	2	2	2

**Note:** ♦ Strongly Correlated – 3


♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

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**III B.Sc. Zoology**

**SEMESTER – V***For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WE K	CREDIT S
UAZO	19Z5SB4	Sericulture	Lecture	2	2

**COURSE DESCRIPTION**

This course provides the knowledge of rearing of silkworm to produce raw silk.

**COURSE OBJECTIVES**

- Motivate young minds to become an entrepreneur for practicing sericulture as cottage industry.
- Gain knowledge about the diseases that affect silkworms.
- Know the steps involved in reeling process.

**UNITS****UNIT –I INTRODUCTION TO SERICULTURE****(6HRS.)**

Scope of Sericulture– Silk route- Sericulture in India – Sericulture in Tamil Nadu -Role of Central Silk Board- National Sericulture Project (NSP) -Sericulture as Cottage industry - Biology of silkworm - Classification of Silkworm-Mulberry and Non mulberry.

**Self-study – Scope of Sericulture – Sericulture in Tamil Nadu****UNIT – II MULBERRY CULTIVATION****(6 HRS.)**

Moriculture - varieties of mulberry - optimum conditions for mulberry growth - planting systems - Propagation Vegetative - Seedling - Micropropagation - Biofertilizers - Triaccontanol, Green manuring and Seriboost.

**Self-study – Propagation: Vegetative****UNIT –III SILKWORM REARING****(6 HRS.)**

Life Cycle of mulberry Silkworm – Voltinism - Rearing of Silkworms - Rearing

appliances - Rearing methods - Adult and Young rearing methods - types of mountage.

#### **UNIT –IV REELING OPERATIONS**

**(6 HRS.)**

Steps involved in Reeling - cocoon stifling - storage and sorting of cocoons – deflossing - riddling boiling and brushing - reeling operations - Reeling appliances - charka, cottage basin and filature - Raw Silk - Visual and Mechanical tests - marketing.

#### **UNIT –V SILKWORM DISEASES**

**(6 HRS.)**

Diseases of Silkworm – Protozoan diseases – Pebrine - Bacterial diseases: Bacterial Flacherie, Septicemia - Viral diseases: Viral Flacherie, Grasserie, Fungal diseases: Muscardine - Pest of silkworm- Uzifly, Dermestid Beetles

#### **TEXT BOOKS:**

1. Arumugam, N., Murugan, T., Rajeswar, J.J. & R. (2015) *Applied Zoology*, R,Saras Publication, Kanyakumari.
2. Johnson, M & Kesary, M, (2008) *Sericulture*, CSI press, 4<sup>th</sup> Edition, Marthandam.

#### **REFERENCES:**

1. Krishnaswamy S. (1988) *Sericulture Manual* 1, 2 & 3, FAO Publications, New Delhi.
2. Reddy,S. G. (1994) *Silkworm Breeding*, Oxford & INH Publishing Co Pvt. Ltd., New Delhi.
3. Boraiah,G. (1994) *Lectures on Sericulture*, SBS Publishers distributors, Bangalore.
4. Ganga & Sulochana Chetty J.G. (2005) *An introduction to sericulture*, second edition, Oxford & IBH Publishing & Co. Pvt. Ltd., New Delhi.

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2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC379057/>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7904692/>



4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3115026/>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4909305/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION TO SERICULTURE</b>				
1.1	Scope of Sericulture – Silk route- Sericulture in India - Sericulture in Tamil Nadu	1	Chalk & Talk	Black Board
1.2	Role of Central Silk Board – National Sericulture Project (NSP)	1	Chalk & Talk	LCD
1.3	Sericulture as Cottage industry	1	Lecture	PPT
1.4	Biology of silkworm	2	Chalk & Talk	Black Board
1.5	Classification of Silkworm-Mulberry and Non mulberry	1	Chalk & Talk	Black Board
<b>UNIT -2 MULBERRY CULTIVATION</b>				
2.1	Moriculture - varieties of mulberry	1	Chalk & Talk	Black Board
2.2	optimum conditions for mulberry growth	1	Chalk & Talk	LCD
2.3	planting systems	1	Lecture	PPT
2.4	Propagation: Vegetative, Seedling and Micropropagation	2	Chalk & Talk	Black Board
2.5	Biofertilizers -Triacontanol, Green manuring and Seriboost	1	Chalk & Talk	Black Board
<b>UNIT – 3 SILKWORM REARING</b>				

3.1	Life Cycle of mulberry Silkworm, Voltinism	1	Chalk & Talk	Black Board
3.2	Rearing of Silkworms - Rearing appliances and Rearing methods	2	Chalk & Talk	LCD
3.3	Adult and Young rearing methods	2	Lecture	PPT
3.4	Types of mountage	1	Chalk & Talk	Black Board
<b>UNIT – 4 REELING OPERATIONS</b>				
4.1	Steps involved in Reeling -cocoon stifling	1	Chalk & Talk	Black Board
4.2	Storage and sorting of cocoons	1	Chalk & Talk	LCD
4.3	Deflossing, riddling boiling and brushing, reeling operations	2	Lecture	PPT
4.4	Reeling appliances- charka, cottage basin and filature	1	Chalk & Talk	Black Board
4.5	Raw Silk-Visual and Mechanical tests, marketing	1	Chalk & Talk	Black Board
<b>UNIT -5 SILKWORM DISEASES</b>				
5.1	Diseases of Silkworm – Protozoan diseases – Pebrine	1	Chalk & Talk	Black Board
5.2	Bacterial diseases: Bacterial Flacherie, Septicemia	1	Chalk & Talk	LCD
5.3	Viral diseases: Viral Flacherie, Grasserie	1	Lecture	PPT
5.4	Fungal diseases: Muscardine	1	Chalk & Talk	Black Board
5.5	Pest of silkworm- Uzifly, Dermestid Beetles	2	Chalk & Talk	Black Board

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	List the importance of sericulture as cottage industry and the support provided by Central Silk Board.	K1	PSO9
CO 2	Explain the different methods of vegetative propagation followed in mulberry cultivation.	K2	PSO6
CO 3	Outline the life cycle of mulberry silkworm and the methods of rearing.	K2	PSO1 & PSO9
CO 4	Organize the steps involved in processing of silk and its marketing.	K3	PSO9
CO 5	Find various diseases that affect silkworm and cocoon formation	K3	PSO9

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	2	2	2	2	2	2	2	3	2	2	2
CO2	2	2	2	2	2	3	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	3	2	2	2
CO4	2	2	2	2	2	2	2	2	3	2	2	2
CO5	2	2	2	2	2	2	2	2	3	2	2	2

**Mapping of COs with POs**


CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	3	2	2	2
CO3	2	2	2	2
CO4	2	2	3	2
CO5	3	2	2	2

**Note:** ♦ Strongly Correlated – 3 ♦ Moderately Correlated – 2 ♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. S. Barathy**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**III B.Sc. Zoology**

**SEMESTER – VI**

*For those who joined in 2019 onwards*

PROGR AMME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	19Z6CC17	Basic Immunology	Lecture	5	4

### COURSE DESCRIPTION

The course is concerned with the overall organization of the human immune system and the techniques related to immunology.

### COURSE OBJECTIVES

- To understand the immune system and immune response involved in human body.
- To identify the types of immunity, the cellular and molecular basis of immune responsiveness.
- To identify the immunological techniques involving antigen and antibody interactions.
- Learning in depth about the diseases related to immune system

### UNITS

#### UNIT – I IMMUNITY

**(15 HRS.)**

Overview of Immune System: History and Scope of immunology- Cells and organs of the Immune system. Immunity, Types - Innate and acquired - Immunization schedule - children and HPV adults - Primary and secondary lymphoid organs - Immune cells - Types and functions of T cells, B cells and macrophages.

**Self Study - Overview of Immune System: History and Scope of immunology**

#### UNIT – II ANTIGENS AND ANTIBODIES

**(15 HRS.)**

Structure of antigens and super antigens - Types of antigens - antigenicity - immunogenicity - factors influencing immunogenicity - adjuvants and haptens - B and T cell epitopes. Immunoglobulins: Structure and functions

of different classes of immunoglobulins.

### **Self Study - Nature of antigens and antibody**

## **UNIT –III ANTIGEN AND ANTIBODY INTERACTIONS( 15HRS.)**

Antigen and Antibody interactions, Precipitation, Agglutination, Cytolysis, opsonisation, flocculation - complement fixation. **Immunological techniques: Single immunodiffusion, Double immunodiffusion, Radioimmunoassay, Immunoelectrophoresis and ELISA.**

### **Self Study – Applications of immunological techniques**

## **UNIT – IV IMMUNE RESPONSES (15 HRS.)**

Immune responses - Types and mechanism of humoral and cell mediated immune response – Complement pathway: Classical - Alternate - Lectin. Hybridoma technology - Monoclonal antibodies in therapeutic and diagnosis - Transplantation - Types of grafts.

### **Self Study – Transplantation - Types of grafts**

## **UNIT –V HYPERSENSITIVITY AND IMMUNE DISEASE (15HRS.)**

Hypersensitivity reactions - Type I - anaphylactic reactions, Type II - cytotoxic reactions, Type III - immune complex reactions, Type IV - delayed type hypersensitivity reactions. Autoimmune disease – Rheumatoid Arthritis - Immunodeficiency diseases – AIDS and SCID.

### **Self Study – AIDS**

### **REFERENCES:**

#### **TEXT BOOKS:**

1. Dulsy Fatima, (2004), *A Textbook of Immunology*, Saras Publications, Kanyakumari

### **REFERENCES:**

1. Chakravarthy A.K., (2006), *Immunology and Immunotechnology*, Oxford University Press, India.
2. Nandini Shetty., (2005). *Immunology: Introductory text book*. New Age International Publishers, India.

3. Dubey R. C., & Maheshware, D. K., (2004). *A Textbook of Microbiology* S. Chand & Company Ltd, New Delhi.
4. Goldsby R. A., Kindt T.J., Osborne B.A & Kuby J., (2003). *Immunology* 5<sup>th</sup> edition., W. H. Freeman and Company, New York.
5. Roitt I. M. (2001.), *Essential Immunology*, S. Chand & Company Ltd, New Delhi.
6. Benjamini E., Sunshine G and Leskowitz S., (1996). *Immunology: A short course*, 3<sup>rd</sup> edition., Wiley-Liss Inc, New York.
7. Pelczar, M. JE. C., S. Chan and Kreig, N.R. (1980). *Microbiology*, 5<sup>th</sup> edition. McGraw-Hill Book Co., Singapore

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.oercommons.org/courses/immunology-basics/view>
2. <https://open.umich.edu/find/open-educational-resources/medical/immunology-m1#lectures>
3. <https://www.oercommons.org/courses/anatomy-and-physiology-ii/view>
4. <https://www.oercommons.org/courses/biology-ii/view>
5. <https://www.oercommons.org/authoring/51354-anatomy-and-physiology-for-health-care-professionals/1/view>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 IMMUNITY</b>				
1.1	Overview of Immune System: History and Scope of immunology	1	Discussion	Black Board
1.2	Cells and organs of the Immune system.	1	Chalk & Talk	Black Board
1.3	Immunity-Types - Innate	2	Chalk &Talk	LCD



1.4	Acquired immunity	2	Lecture	PPT & White board
1.5	Immunization schedule - children and HPV adults -	1	Lecture	PPT
1.6	Primary Lymphoid organs	2	Lecture	Black Board
1.7	Secondary lymphoid organs	1	Discussion	Google classroom
1.8	Immune cells	2	Chalk & Talk	Black Board
1.9	Types and functions of T cells	1	Discussion	PPT
1.10	Types and functions of B cells	1	Chalk & Talk	Black Board
1.11	Macrophages	1	Lecture	LCD
<b>UNIT -2 ANTIGENS AND ANTIBODIES</b>				
2.1	Nature of antigens	1	Discussion	Black Board
2.2	Super antigens	1	Lecture	Green Board Charts
2.3	Types of antigens	2	Chalk & Talk	PPT
2.4	Antigenicity - immunogenicity - factors influencing immunogenicity	2	Chalk & Talk	Green Board
2.5	Adjuvants and haptens	1	Chalk & Talk	LCD
2.6	B and T cell epitopes..	2	Chalk & Talk	Black Board
2.7	Immunoglobulins	2	Lecture	PPT & White board

2.8	Structure and functions of different classes of immunoglobulins	4	Chalk & Talk	Black Board
<b>UNIT -3 ANTIGEN AND ANTIBODY INTERACTIONS</b>				
3.1	Antigen and Antibody interactions	1	Chalk & Talk	Black Board
3.2	Precipitation & Agglutination	1	Chalk & Talk	LCD
3.3	Cytolysis & opsonisation	2	Lecture	PPT & White board
3.4	Flocculation & complement fixation.	2	Lecture	Smart Board
3.5	Immunological techniques: Single immunodiffusion	1	Lecture	Black Board
3.6	Double immunodiffusion	1	Discussion	Google classroom
3.7	Radioimmunoassay	2	Chalk & Talk	Black Board
3.8	Immunoelectrophoresis	2	Discussion	LCD
3.9	ELISA	2	Chalk & Talk	Black Board
3.10	Applications of immunological techniques	1	Discussion	Google Classroom
<b>UNIT – 4IMMUNE RESPONSES</b>				
4.1	Immune responses - Types	1	Chalk &Talk	Black Board
4.2	Mechanism of humoral response	2	Chalk & Talk	LCD
4.3	Mechanism of cell mediated immune response	4	Lecture	PPT & White board

4.4	Complement pathway: Classical	1	Lecture	Smart Board
4.5	Alternate & Lectin pathway	2	Lecture	Black Board
4.6	Hybridoma technology	2	Discussion	Google classroom
4.7	Monoclonal antibodies in therapeutic and diagnosis.	2	Chalk & Talk	LCD
4.8	Transplantation - Types of grafts	1	Discussion	Black Board
<b>UNIT -5 HYPERSENSITIVITY AND IMMUNE DISEASE</b>				
5.1	Hypersensitivity reactions	2	Chalk & Talk	Black Board
5.2	Type I - anaphylactic reactions	2	Chalk & Talk	LCD
5.3	Type II - cytotoxic reactions	2	Lecture	PPT & White board
5.4	Type III - immune complex reactions	2	Lecture	Smart Board
5.5	Type IV - delayed type hypersensitivity reactions.	2	Lecture	Black Board
5.6	Autoimmune disease – Rheumatoid Arthritis -	2	Discussion	Google classroom
5.7	Immunodeficiency disease - SCID	2	Lecture	PPT
5.8	AIDS	1	Discussion	Black Board

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
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	T1 10 Mks .	T2 10 Mks .	Qui z 5 Mks .	Assignmen t 5 Mks	OBT/PP T 5 Mks	35 Mks.	5 Mks.	40Mks .	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholasti c	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTI C	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Tota l
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the types of immunity, immunization and origin of immune cells	K2	PSO1, PSO4
CO 2	Explain the structure and properties of antigen and antibody	K2	PSO4, PSO8, PSO10
CO 3	Identify the antigen and antibody interactions and the steps involved in the immunological techniques	K3	PSO1, PSO4, PSO8
CO 4	Illustrate the types and mechanism of immune response and events in hybridoma technology	K2	PSO1, PSO8, PSO10
CO 5	Describe the types of hypersensitivity reactions and autoimmune diseases	K2	PSO1, PSO4, PSO8

## Mapping COs Consistency with PSOs

CO/PS O	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PS O1 2
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CO1	3	2	2	3	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	3	2	2	2	2
CO3	3	2	2	2	2	2	2	2	2	2	2	2
CO4	3	2	2	2	2	2	2	2	2	2	2	2
CO5	3	2	2	3	2	2	2	2	2	2	2	2

### Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	1	2
CO 2	2	2	1	2
CO 3	2	2	3	2
CO 4	2	2	3	2
CO 5	3	2	3	2

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**  
**Dr. Sr. Biji Cyriac**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

**III B.Sc. Zoology****SEMESTER –VI*****For those who joined in 2019 onwards***

<b>PROGRAMME CODE</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>UAZO</b>	<b>19Z6CC18</b>	<b>Principles of Biotechnology</b>	<b>Lecture</b>	<b>5</b>	<b>4</b>

**COURSE DESCRIPTION**

This course encompasses a wide range of procedures for modifying living organisms according to human purposes and it is the application of biological organisms, systems, or processes by various industries to learning about the science of life and the improvement of the value of materials and organisms

**COURSE OBJECTIVES**

- To familiarize the use of the techniques of engineering and technology in Biology for the study of living organisms,
- To modify products or processes for specific use.
- To find solution of problems concerning human activities including agriculture, medical treatment, industry and environment

**UNITS****UNIT I: INTRODUCTION OF BIOTECHNOLOGY (15 HRS.)**

Introduction to Biotechnology - Biotechnology as an interdisciplinary pursuit, History and scope of Biotechnology, Applications of Biotechnology,

Biosafety guidelines and Containments - Brief account on Intellectual Property Rights – Copyrights, traditional knowledge and Patents.

**Self – Study - Biotechnology as an interdisciplinary pursuit, History and scope of Biotechnology**

**UNIT II: TOOLS AND TECHNIQUES IN BIOTECHNOLOGY (15 HRS.)**

Basic steps of recombinant DNA technology (Insulin production), Enzymes involved- Ligase, restriction endonuclease, polymerase, modifying enzymes- Klenow fragment, Alkaline phosphatase, DNA methylases. Vectors – pBR322, Phage & Cosmids, Coupling tools- adaptors, Linkers and Homopolymer tailing. **Gene transfer mechanisms** –Transformation, Electroporation, Liposome mediated transfer & Microinjection. Polymerase chain reaction (Working Principle only)

**UNIT III: ANIMAL CELL CULTURE TECHNIQUES (15 HRS.)**

Basic techniques in animal cell culture and organ culture, Primary Culture and Cell lines, Culture media- Natural and Synthetic, Cryopreservation of cultures. Stem cells: culture, types and applications. Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, DNA Fingerprinting - RFLP.

**UNIT IV: APPLIED BIOTECHNOLOGY-I (15 HRS.)**

**Production of human healthcare products** – Insulin, Vaccine (Genetically engineered vaccine - Hepatitis B vaccine, FMD vaccine, & Edible vaccine) - Application of Biotechnology in Agriculture - Biofertilizer –VAM fungi: Mass production and Field applications - Biopesticide - *Bacillus thuringiensis* as a pest control.

**Self- Study - Biofertilizer –VAM fungi**

**UNIT V: APPLIED BIOTECHNOLOGY-II (15 HRS.)**



Application of Biotechnology in Industry: Single Cell Protein - Methods of Production & applications of *Spirulina*. Environmental Biotechnology: Sewage treatment - Primary, Secondary & Tertiary treatment, Composting - Indore & Bangalore method, Bioremediation-Methods - *In situ* Bioremediation, Composting, Land Farming & Digestion in above ground reactors.

### **UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) ( HRS.)**

#### **TEXT BOOK:**

- 1.Kumaresan.V, Biotechnology, Saras Publication, Nagercoil, (2005).

#### **REFERENCE BOOKS:**

- 1.Brown, T.A., Molecular Biology Labfax II: Gene Cloning and DNA Analysis, II Edition, Academic Press, California, USA, (1998).
- 2.Glick, B.R. and Pasternak, J.J., Molecular Biotechnology - Principles and Applications of Recombinant DNA, IV Edition, ASM press, Washington, USA, (2009).
- 3.Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M., An Introduction to Genetic Analysis, IX Edition. Freeman and Co., N.Y., USA, .(2009).
- 4.Snustad, D.P. and Simmons, M.J., Principles of Genetics,V Edition, JohnWiley and Sons Inc., (2009).
- 5.Watson, J.D., Myers, R.M., Cauchy, A. and Witkowski, J.K., Recombinant DNA- Genes and Genomes- A Short Course, III Edition, Freeman and Co., N.Y.,USA, (2007).
- 6.Beauchamp, T.I. and Childress, J.F., Principles of Biomedical Ethics, VI Edition, Oxford University Press, (2008).

#### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.oercommons.org/courseware/lesson/15022/overview>
2. <https://loyalistlibrary.com/biotechnology/oer>

3. <https://www.oercommons.org/authoring/8657-biotechnology-resources>
4. <https://www.nature.com/nbt/articles?type=resource>
5. <https://libguides.umgc.edu/biotechnology>
6. [http://biotechnologygateway.googlepages.com/open\\_access\\_e\\_books.html](http://biotechnologygateway.googlepages.com/open_access_e_books.html)

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION OF BIOTECHNOLOGY</b>				
1.1	Introduction to Biotechnology	2	Chalk & Talk	Black Board
1.2	Biotechnology as an interdisciplinary pursuit	2	Discussion	Google Cllsroom
1.3	History and scope of Biotechnology	2	Discussion	Google Cllsroom
1.4	Applications of Biotechnology	1	Chalk & Talk	Black Board
1.5	Biosafety guidelines	2	Lecture	PPT
1.6	Containments	2	Chalk & Talk	Black Board
1.7	Gentically Engineered Organisms ;Pros and Cons	2	Chalk & Talk	Black Board
1.7	Brief account on Intellectual Property Rights.	2	Discussion	Google classroom
<b>UNIT - 2 TOOLS AND TECHNIQUES IN BIOTECHNOLOGY</b>				
2.1	Basic steps of recombinant DNA	1	Chalk & Talk	Green Board
2.2	Insulin production	2	Chalk &Talk	Black Board
2.3	Enzymes involved- Ligase and Klenow fragment	1	Chalk & Talk	Black Board

2.4	DNA modifying enzymes: Restriction endonuclease	1	Chalk & Talk	Black Board
2.5	Alkaline phosphatase and DNA methylases	1	Chalk & Talk	Black Board
2.6	Vectors – pBR322	1	Chalk & Talk	Black Board
2.7	Vectors- Phage & Cosmids	1	Lecture	PPT
2.8	Coupling tools- Adaptors, Linkers and Homopolymer tailing	2	Chalk & Talk	Black Board
2.9	Gene transfer mechanisms –Transformation & Microinjection	1	Lecture	PPT & White board
2.10	Gene transfer mechanisms Electroporation & Liposome mediated transfer	2	Lecture	LCD
2.11	Polymerase chain reaction (Working Principle only)	2	Lecture	PPT
<b>UNIT - 3 ANIMAL CELL CULTURE TECHNIQUES</b>				
3.1	Basic techniques in animal cell culture	2	Lecture	PPT
3.2	Organ culture	1	Lecture	PPT & White board
3.3	Primary Culture and Cell lines	2	Lecture	LCD
3.4	Culture media- Natural and Synthetic	1	Lecture	LCD

3.5	Cryopreservation of cultures	1	Lecture	LCD
3.6	Stem cells culture	1	Lecture	PPT & White board
3.7	Stem Cells- types and applications	1	Lecture	PPT & White board
3.8	Agarose Gel Electrophoresis	1	Lecture	PPT & White board
3.9	Polyacrylamide Gel Electrophoresis(SDS PAGE)	1	Lecture	LCD
3.10	Southern blotting	1	Lecture	PPT & White Board
3.11	Northern and Western blotting	1	Lecture	PPT & White Board
3.12	DNA Fingerprinting - RFLP	2	Lecture	PPT & White Board
<b>UNIT – 4 APPLIED BIOTECHNOLOGY-I</b>				
4.1	Production of human healthcare products – Insulin	2	Chalk & Talk	Black Board
4.2	Genetically engineered vaccine - Hepatitis B vaccine	2	Lecture	LCD
4.3	FMD vaccine	2	Discussion	Google classroom
4.4	Edible vaccine	1	Lecture	LCD
4.5	Application of Biotechnology in Agriculture	2	Lecture	LCD
4.6	Biofertilizer –VAM fungi	2	Chalk & Talk	Black Board

4.7	Mass production and Field applications	2	Lecture	LCD
4.8	Biopesticide - <i>Bacillus thuringiensis</i> as a pest control.	2	Lecture	LCD
<b>UNIT – 5 APPLIED BIOTECHNOLOGY-II</b>				
5.1	Application of Biotechnology in Industry	1	Chalk & Talk	Black Board
5.2	Single Cell Protein - Methods of Production	2	Chalk & Talk	Black Board
5.3	Single Cell Protein - Applications of <i>Spirulina</i>	1	Chalk & Talk	Black Board
5.4	Environmental Biotechnology	2	Lecture	LCD
5.5	Sewage treatment – Primary	2	Chalk & Talk	Black Board
5.6	Sewage treatment-Secondary & Tertiary treatment	2	Lecture	PPT & White board
5.7	Composting - Indore & Bangalore method	2	Lecture	PPT & White board
5.8	Bioremediation	1	Lecture	PPT & White board
5.9	Methods - <i>In situ</i> Bioremediation, Composting, Land Farming & Digestion in above ground reactors	2	Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
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	T1 10 Mks .	T2 10 Mks .	Qui z 5 Mks .	Assignmen t 5 Mks	OBT/PP T 5 Mks	35 Mks.	5 Mks.	40Mks .	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholasti c	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTI C	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Tota l
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Identify the principles and applications of Biotechnology biosafety guidelines and IPR for the benefit of mankind	<b>K1</b>	PSO1, PSO2 & PSO4
<b>CO 2</b>	Discuss the tools and Techniques to manipulate DNA using rDNA technology for the development of transgenic plants, animals, and microbes or products for specific use	<b>K2</b>	PSO1, PSO2, PSO4 & PSO5
<b>CO 3</b>	Describe basic techniques in animal cell culture and the application of stem cell production.	<b>K1</b>	PSO1, PSO4, PSO6 & PSO10
<b>CO 4</b>	Summarize the biotechnology products and applications in the healthcare products, medicine, agriculture	<b>K2</b>	PSO1, PSO4, PSO6 & PSO10
<b>CO 5</b>	Analyse the appropriate technology and application of biotechnology in industry and environmental sectors to increase SCP production and sewage management.	<b>K3</b>	PSO1, PSO4, PSO6, PSO8 & PSO10

### Mapping of COs with PSOs

<b>CO/ PSO</b>	<b>PS01</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>	<b>PSO 7</b>	<b>PSO 8</b>	<b>PSO 9</b>	<b>PSO1 0</b>	<b>PSO1 1</b>	<b>PSO1 2</b>
<b>CO1</b>	3	2	2	3	2	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	3	2	2	2	2	2	2	2	2
<b>CO3</b>	3	2	2	3	2	2	2	2	2	3	2	2
<b>CO4</b>	3	2	2	3	2	1	2	2	2	3	2	2
<b>CO5</b>	3	2	2	3	2	1	2	1	2	3	2	2

**Mapping of COs with POs**

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	3	2
CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	3	2


**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. N.Malathi**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**III B.Sc. Zoology****SEMESTER –VI**

*For those who joined in 2019 onwards*

PROGRA	COURSE	COURSE	CATEGO	HRS/WEE	CREDIT
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<b>MME CODE</b>	<b>CODE</b>	<b>TITLE</b>	<b>RY</b>	<b>K</b>	<b>S</b>
<b>UAZO</b>	<b>19Z6CC19</b>	<b>Lab - Immunology</b>	<b>Practical</b>	<b>3</b>	<b>2</b>

### **COURSE DESCRIPTION**

The overall objective of this course is to provide the undergraduate students of Zoology an experience of exploring immunological principles through experimentation and to introduce the procedures, basic techniques and instruments used in the clinical laboratories.

### **COURSE OBJECTIVES**

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

### **IMMUNOLOGY**

1. Laboratory biosafety guidelines
2. Virtual dissection and onscreen display of lymphoid organs of mouse.
3. Separation of serum and plasma.
4. Preparation of stained blood film to study various types of blood cells.
5. Separation of lymphocytes from peripheral blood and counting in Haemocytometer.
6. Total W.B.C. & R.B.C. count
7. Differential leukocyte count
8. ABO blood grouping in man.
9. Single radial immunodiffusion.
10. Rheumatoid factors – Demo.

Spotters: Lymphoid organs- thymus, spleen, lymph nodes and Bone marrow,

Ig – Models, ELISA, Western Blot and Flow Cytometry.

## EMBRYOLOGY

Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.

## CLINICAL LABORATORY TECHNIQUES

1. Qualitative analysis of urine for glucose- Benedict's Test.
2. Qualitative analysis of Ketone – Rothera's Test.
3. Qualitative analysis of Creatinine- Jaffe's Test.
4. Field visit to clinical laboratory & report submission
5. Spotter – Amniocentesis, Pregnancy diagnostic Kit, Haemocytometer, Centrifuge and Semi Automated Analyzer

## REFERENCE BOOKS:

1. Hudson, L., Hay, F.C. (1986). *Practical Immunology*. 3rd ed., Blackwell Publishing, London.
2. Garvey, J.S., Cremer, N.E., Sussdorf, D.H. (1983). *Methods in Immunology*. 3rd ed., Benjamin / Cummings Publishing, London.
3. Stites, D.P., Terr, A.L., Parslow, T.G. (1994). *Basic and Clinical Immunology*. Prentice Hall Publishing, Canada.
4. Mukerjee, K.L. and Gosh, S. (2010). *Medical Laboratory Technology*. Volume II, McGraw Hill, New Delhi-17.
5. Harold Varley. (2005). *Practical Clinical Biochemistry*. 4th ed. CBS Publishers Pvt Ltd, New Delhi-02.

## DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://bio.davidson.edu/courses/immunology/Bio307.html>
2. <https://www.oercommons.org/courses/clinical-immunology>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5633739/>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC379057/>

5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7904692/>

### **COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>IMMUNOLOGY</b>				
1.1	Laboratory biosafety guidelines	1	Lecture	LCD
1.2	Virtual dissection and onscreen display of lymphoid organs of mouse	1	Demonstration & hands on training	LCD, Online Virtual Dissection Tools
1.3	Separation of serum and plasma	1	Demonstration & hands on training	Black board
1.4	Preparation of stained blood film	1	Demonstration & hands on training	Microscope
1.5	Separation & counting of lymphocytes	4	Demonstration & hands on training	Microscope
1.6	Total W.B.C. & R.B.C. count	1	Demonstration & hands on training	Microscope
1.7	Differential leukocyte count	1	Demonstration & hands on training	Microscope
1.8	ABO blood grouping	1	Demonstration & hands on training	Teaching Kit PPT & White board
1.9	Single radial immunodiffusion	1	Demonstration & hands on training	Teaching Kit

1.10	Rheumatoid factors	1	Demonstration	Teaching Kit
1.11	Spotters: Lymphoid organs- thymus, spleen, lymph nodes and Bone marrow, Ig – Models, ELISA, Western Blot and Flow Cytometry.	1	Specimen & Models	Microscope
<b>EMBRYOLOGY</b>				
2	Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.	1	Permanent Slides & Preserved Specimen	Microscope
<b>CLINICAL LABORATORY TECHNIQUES</b>				
3.1	Qualitative analysis of urine for glucose- Benedict's Test	1	Demonstration & hands on training	Black Board
3.2	Qualitative analysis of Ketone – Rothera's Test	1	Demonstration & hands on training	Black Board
3.3	Qualitative analysis of Creatinine- Jaffe's Test	1	Demonstration & hands on training	Black Board
3.4	Amniocentesis, Pregnancy diagnostic Kit, Haemocytometer, Centrifuge & Semi Automated Analyser	1	Specimen & Models	Apparatus & LCD
3.5	Field visit to clinical laboratory & report submission	-	On-site Learning	=

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Relate the knowledge of basic principles of immunology to carry out the related experiments	K1	PSO1, PSO2 PSO4, PSO7 PSO8 & PSO10
CO 2	Acquire skills in handling basic equipments	K2	PSO1, PSO2 PSO4, PSO7 PSO8 & PSO10
CO 3	Infer the outcome of the experiments of Immunology	K2	PSO1, PSO2 PSO4, PSO7 PSO8 & PSO10
CO 4	Relate the biochemical properties of Glucose & Ketone bodies while performing the qualitative analytical tests for their detection in urine sample	K1	PSO1, PSO2 PSO4, PSO8 & PSO10
CO 5	Develop familiarity with the principles of Laboratory safety	K3	PSO1 PSO2 PSO4 PSO7 PSO8

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------	--------

CO1	3	3	2	2	2	2	3	3	2	3	2	2
CO2	3	3	2	2	2	2	3	3	2	3	2	2
CO3	3	3	2	2	2	2	3	3	2	3	2	2
CO4	3	3	2	2	2	2	3	3	2	2	2	2
CO5	3	3	2	2	2	2	3	3	2	2	2	2

**Mapping of COs with POs**


CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	3	2
CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	3	3

**Note:** ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**

**Dr. A Tamil Selvi** Forwarded By

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**SEMESTER – VI**  
***For those who joined in 2019 onwards***

PROGR MME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/ WEEK	CREDI TS
UAZO	19Z6CC20	Lab - Biotechnology	Practical	3	2

### **COURSE DESCRIPTION**

Students gain hands-on experience and learn the theoretical basis of lab techniques common to a variety of biological disciplines such as biotechnology, Bioinformatics and Entomology and they will work in groups, learning how to collect, analyze, and present data while using the scientific method to conduct inquiry-based laboratory experiments.

### **COURSE OBJECTIVES**

- Introductory laboratory course in current principles and techniques applicable to research problems in biotechnology, Bioinformatics and Entomology
- Learners can identify insects and able to group them into different taxa
- Learners gain knowledge handling biological database and retrieve information

### **BIOTECHNOLOGY**

1. Laboratory biosafety guidelines
2. Isolation of protein from spinach leaves
3. Estimation of Total soluble proteins using Bradford method
4. Electrophoretic separation proteins

5. Isolation of genomic DNA from goat liver/Bacteria.
6. Isolation of genomic DNA from plant
7. Isolation of Plasmid DNA by alkaline lysis method.
8. Electrophoretic separation of DNA.
9. Demonstration of PCR.
10. Spotters: pBR322, Spirulina, Insulin, Southern blotting, Northern blotting, UV transilluminator

## **UNIT-II ENTOMOLOGY**

1. Collection and Preservation of Insects.
2. Spotters: Mouth parts of Cockroach & Honey bee; Life Cycle of Holometabolous (Butterfly) and Hemimetabolous Insects (Cockroach), Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.

## **UNIT- III BIOINFORMATICS**

1. Sequence retrieval from GenBank
2. Pairwise alignment - BLAST
3. Molecular visualization of Proteins- RASMOL

## **REFERENCE BOOKS:**

1. Rajan S., Christy, S.R., (2011) Experimental procedures in Life Sciences, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008) Techniques in Life Sciences, 1st ed., Himalaya Publishing House

## **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.oercommons.org/courseware/lesson/15022/overview>
2. <https://www.oercommons.org/authoring/8657-biotechnology-resources/4/view>
3. <https://www.wileyindia.com/practical-biotechnology-principles-and-protocols.html>
4. [https://www.researchgate.net/publication/303997580 Principles of Biotechnology-Practical Manual](https://www.researchgate.net/publication/303997580_Principles_of_Biotechnology-Practical_Manual)
5. <https://www.apsnet.org/edcenter/disimpactmngmnt/labexercises/PlantBiotechnology/Pages/Activity5.aspx>



**COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>BIOTECHNOLOGY</b>				
1.1	Laboratory biosafety guidelines	2	PPT & Discussion	LCD
1.2	Isolation of protein from spinach leaves	3	Hands on training	Chemicals, Glassware & Instruments
1.3	Estimation of Total soluble proteins using Bradford method	3	Hands on training	Chemicals, Glassware & Instruments
1.4	Electrophoretic separation proteins	3	Demonstration	Chemicals, Glassware & Instruments
1.5	Isolation of genomic DNA from goat liver.	3	Hands on training	Chemicals, Glassware & Instruments
1.6	Isolation of genomic DNA from plant	3	Hands on training	Chemicals, Glassware & Instruments
1.7	Isolation of Plasmid DNA by alkaline lysis method	3	Hands on training	Chemicals, Glassware & Instruments
1.8	Electrophoretic separation of DNA	3	Hands on training	Chemicals, Glassware & Instruments
1.9	Demonstration of PCR	2	Demonstration	Chemicals, Glassware & Instruments

2.0	Spotters:pBR322, Spirulina, Insulin, Southern blotting, Northern blotting, UV transilluminator	2	Demonstration	Specimens, Models, Print-Outs, Bio-Visula Charts
<b>ENTOMOLOGY</b>				
2.1	Collection and Preservation of Insects.	3	Demonstration	Model and specimens
2.2	Spotters: Mouth parts of Cockroach & Honey bee;	3	Demonstration & Hands on training	Glass Slide, Microscope and chemicals etc.,
2.3	Spotters: Life Cycle of Holometabolous (Butterfly) and Hemimetabolous Insects (Cockroach)	3	Demonstration	Bio-Visual Charts, LCD
2.4	Spotters: Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.	3	Demonstration	Specimens, Models, Preserved Insect Box
<b>UNIT-III BIOINFORMATICS</b>				
3.1	Sequence retrieval from GenBank	3	Demonstration & Hands on training	LCD
3.2	Pairwise alignment - BLAST	3	Demonstration & Hands on training	LCD
3.3	Molecular visualization of Proteins- RASMOL	3	Demonstration & Hands on training	LCD

<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
<b>CO 1</b>	Acquire skills in handling basic equipments	<b>K1</b>	PSO1, PSO2, & PSO7
<b>CO 2</b>	Identify the insects	<b>K1</b>	PSO1, PSO2 & PSO4
<b>CO 3</b>	Estimate the various biomolecules using standard protocols	<b>K3</b>	PSO1, PSO2 & PSO7
<b>CO 4</b>	Identify and comment on the spotters Agarose gel electrophoresis, SDS-PAGE, pBR322, Spirulina and Insulin and Bioinformatics tools	<b>K3</b>	PSO1, PSO2 PSO8 & PSO10
<b>CO 5</b>	Examine the features in mouth parts of Cockroach & Honey bee, Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle	<b>K4</b>	PSO1 & PSO4

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	3	2	2	2	2	3	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	3	2	2	2	2	2
CO4	3	3	2	2	2	2	2	2	2	3	2	2
CO5	3	2	2	3	2	2	2	2	2	2	2	2

**Mapping of COs with POs**

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	2	2
CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	2	2

Note: ♦ Strongly Correlated – 3  
 ♦ Weakly Correlated -1

♦ Moderately Correlated – 2

**COURSE DESIGNER:**  
**Dr. N. Malathi**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature  
 & Name**

**III B.Sc. Zoology**

**SEMESTER –VI**

*For those who joined in 2019 onwards*

PROGR AMME CODE	COURSE CODE	COURSE TITLE	CATEG ORY	HRS/W EEK	CRED ITS
UAZO	19Z6ME3	Embryology	Lecture	5	5

### **COURSE DESCRIPTION**

This course imparts knowledge on the developmental process of egg to the formation of organism.

### **COURSE OBJECTIVES**

To acquaint with the basic concepts of development of Organisms.

### **UNITS**

#### **UNIT –I INTRODUCTION TO EMBRYOLOGY**

**(15 Hrs)**

Historical Thoughts – Theories - Preformation, Epigenesis, Baer's Law, Biogenetic Law, Pangenesis, Germ Plasm, Gradient Theory; Branches and Scope of Embryology

Gametes - Structure and Types of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes.

#### **UNIT II - GAMETOGENESIS & FERTILIZATION**

**(15 Hrs)**

GAMETOGENESIS: Spermatogenesis and Oogenesis; Semination and Ovulation - Hormonal Control and factors affecting Ovulation & Induced Ovulation in Fisheries.

Fertilization - Physical, Chemical, Cytological and Physiological factors; Parthenogenesis – Types & Significance.

#### **UNIT III - EARLY EMBRYONIC DEVELOPMENT**

**(15 Hrs)**

Cleavage: Salient features, Planes, Patterns and Physiology of Cleavage-Morphogenetic movements and Fate map; Cleavage, Gastrulation and Fatemap of Frog, Chick and Rabbit.

#### **UNIT IV – ORGANOGENESIS (15 Hrs)**

Development of Brain, Eye, Heart and Foetal membranes in Chick and

Mammals;Placenta - Characteristics, Classification, Functions and Development.

## UNIT V - HUMAN EMBRYOLOGY

(15 Hrs)

Sexual Cycles; Gastrulation, Implantation, development of germ layer, development of foetus (Brief account on Trimester stages); In vitro Fertilization; Infertility – Types and methods of treatment; Birth Control methods; Embryonic Stem Cell & its applications.

### TEXTBOOKS:

1. Arumugam, N., (2014). *A Text Book of Embryology*. Fourteenth Edition. Saras Publication, Nagarcoil.
2. Bhatnagar S.M., Kothari M.L., Lopa A. Mehta and Natarajan, M., (2000). *Essentials of Human Embryology* -Third Edition, Orient Longman Ltd., Hyderabad, India.

### REFERENCES:

1. Balinsky, B.I., (1981). *Introduction to Embryology*, Saunders, Philadelphia.
2. Majumdar. N.N., (1990). *Text book of Vertebrate Embryology*. Tata Mc-Graw-Hill Publishing Company Ltd, New Delhi.
3. McEwen, R.S., (1969). *Vertebrate Embryology*. Oxford and IBH Publishing Co., New Delhi.
4. Jam, P.C., (1998). *Elements of Developmental Biology*. Vishal Publication, Delhi.
5. Verma, P.S., V.K. Agarwal and Tyagi, (1995). *Chordate Embryology*, S. Chand & Co., New Delhi.
6. Vijiya D Joshi, *Prep Manual for Undergraduates Physiology* (2001), Second Edition, B. I. Published by Churchill Livingstone, New Delh

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://embryology.med.unsw.edu.au/>
2. <https://www.med.umich.edu/lrc/coursepages/m1/embryology/embryo/links.htm>
3. <http://www.tulane.edu/~embryo/>
4. <https://www.3dembryoatlas.com/>
5. <http://www.ncbi.books.cm/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids

<b>UNIT -1 INTRODUCTION TO EMBRYOLOGY</b>				
1.1	Branches and Scope of Embryology	2	Chalk & Talk	Black Board
1.2	Historical Thoughts – Theories - Preformation, Epigenesis, Baer's Law, Biogenetic Law, Pangenesis, Germ Plasm, Gradient Theory	4	Chalk & Talk	LCD
1.3	Gametes - Structure and Types of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes.	4	Lecture	LCD
<b>UNIT -2 GAMETOGENESIS &amp; FERTILIZATION</b>				
2.1	Spermatogenesis and Oogenesis; Semination and Ovulation	4	Lecture	LCD
2.2	GAMETOGENESIS: - Hormonal Control and factors affecting Ovulation & Induced Ovulation in Fisheries.	2	Chalk & Talk	Green Board
2.3	Fertilization - Physical, Chemical, Cytological and Physiological factors	5	Lecture	LCD
2.4	Parthenogenesis – Types & Significance.	2	Lecture	PPT
<b>UNIT -3 EARLY EMBRYONIC DEVELOPMENT</b>				
3.1	Cleavage: Salient features	2	Lecture	PPT

3.2	Cleavage: Planes, Patterns and Physiology of Cleavage	3	Lecture	PPT
3.3	Morphogenetic movements and Fate map	3	Lecture	PPT
3.4	Gastrulation and Fatemap of Frog, Chick and Rabbit.	6	Lecture	PPT
<b>UNIT -4 ORGANOGENESIS</b>				
4.1	Development of Brain, Eye, Heart	9	Lecture	PPT
4.2	Foetal membranes in Chick and Mammals	2	Lecture	PPT
4.3	Placenta - Characteristics, Classification, Functions and Development.	3	Lecture	PPT
<b>UNIT -5 HUMAN EMBRYOLOGY</b>				
5.1	Sexual Cycles; Gastrulation, Implantation, development of germ layer, development of foetus (Brief account on Trimester stages)	7	Lecture	PPT
5.2	In vitro Fertilization; Infertility – Types and methods of treatment	2	Lecture	PPT
5.3	Birth Control methods; Embryonic Stem Cell & its applications.	3	Lecture	PPT

**INTERNAL - UG**



Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

## EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOME

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Recall the basic concepts of developmental biology.	<b>K1</b>	PSO1& PSO2
<b>CO 2</b>	Tell how fertilization, cleavage and gastrulating occur.	<b>K1</b>	PSO3
<b>CO 3</b>	Compare the basic concepts of organogenesis in different organisms.	<b>K2</b>	PSO4
<b>CO 4</b>	Relate the development of egg into a foetus, then into adult, among Vertebrates.	<b>K2</b>	PSO5
<b>CO 5</b>	Associate the embryo development with Phylogeny.	<b>K2</b>	PSO7

### **Mapping of COs with PSOs**

<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>	<b>PSO 7</b>	<b>PSO 8</b>	<b>PSO 9</b>	<b>PSO 10</b>	<b>PSO 11</b>	<b>PSO 12</b>
<b>CO1</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO2</b>	2	2	3	2	2	2	2	2	2	2	2	2
<b>CO3</b>	2	2	2	3	2	2	2	2	2	2	2	2
<b>CO4</b>	2	2	2	2	3	2	2	2	2	2	2	2
<b>CO5</b>	2	2	2	2	2	2	2	3	2	2	2	2

**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	2	3
CO4	2	2	2	2
CO5	2	2	3	2


**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2 ♦

Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. Antony Amala Jayaseeli**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
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 MADURAI-625 018

**HOD'S Signature  
& Name**

**III B.Sc. Zoology**

**SEMESTER –VI**

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WE E K	CREDIT S
UAZO	19Z6ME4	Clinical Laboratory Technique	Lecture	5	5

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WE E K	CREDIT S
		s			

### COURSE DESCRIPTION

This course provides current knowledge and upgraded skills in clinical laboratory techniques.

### COURSE OBJECTIVES

- To perform routine clinical laboratory procedures within acceptable quality control parameters in urine analysis, Haematology, analysis of stool, sputum and semen.
- Perform laboratory testing with accuracy.
- Able to interpret clinical procedures and laboratory test data accurately.

### UNITS

#### UNIT –I LABORATORY SAFETY AND STERILIZATION (15HRS.)

Common laboratory accidents – Universal work precautions (UWP) for lab personnel - good laboratory practice – Sterilization - sterilization by heat – cold – ultra violet radiation – Ionizing radiations – Filtration – chemical sterilization - Laboratory instruments - Light microscope and centrifuge.

#### Self-study – Laboratory instruments: Light microscope and centrifuge

#### UNIT –II ANALYSIS OF URINE (15 HRS.)

Composition of urine - Collection and preservation - Physical parameter: Colour, Odour, pH, Density - Chemical parameters: Sugar (Benedict's test) Albumin (Bence Jones protein test), bile salts, bile pigment, urea, uric acid, creatinine and Ketone bodies (Nitroprusside test) and their clinical significances - Pregnancy tests – Gestational diabetes - Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria).

#### Self-study – Composition of urine

#### UNIT –III HEMATOLOGY (15 HRS.)

Blood: collection of blood & lab procedure- types of anaemia - bleeding time- clotting time - **Total count of RBC & WBC** - Differential count of WBC – Erythrocyte sedimentation rate- blood grouping – haemostasis- bleeding disorder of man - Haemolytic disease of new born, **Platelet count**, reticulocytes count, Absolute Eosinophil count.

### **Self-study – Blood grouping**

## **UNIT –IV ANALYSIS OF STOOL AND SPUTUM (15 HRS.)**

Faeces: Specimen collection – microscopic examination – ova, cysts occult blood, parasitic infestation – amoebic dysentery – Physical and chemical examination of stool - **Stool Culture and sensitivity. Sputum: Macroscopic & Microscopic examination of sputum - AFB staining - Sputum culture.**

## **UNIT –V SEMEN ANALYSIS (15 HRS.)**

Semen: Collection of semen - Semen analysis – motility, total count – abnormality. Cryopreservation. STD: AIDS, syphilis, gonorrhea. Prenatal Diagnosis – Amniocentesis, Chorion villus sampling, Fetoscopy -Need-procedure for collection- Karyotype studies. Safe disposal of bio medical wastes – incineration.

### **TEXT BOOK:**

Sood R. (2009) *Medical Laboratory Technology: Methods and Interpretations* Vol 1, 6<sup>th</sup> ed., Jaypee Brothers Medical Publishers, New Delhi.

### **REFERENCES:**

1. J. E. Park, (2007) *Text Book of Preventive Medicine*, BenansiderBhanot – Napier Town.
2. Kanai L. Mukherjee, (1988) *Medical Laboratory Technology, vol. I*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Kanai L. Mukherjee, (1988) *Medical Laboratory Technology, vol. II* Tata McGraw Hill Publishing Company Ltd., New Delhi
4. Kanai L. Mukherjee, (1990) *Medical Laboratory Technology, vol. III*, Tata McGraw Hill Publishing Company Ltd., New Delhi
5. Monica Cheesbrough, (1998). *Medical Laboratory manual of tropical countries*.

6. Manual of Basic Techniques for a Healthy Laboratory – Published by WHO in 1980 Academic Publishers, Calcutta – 700 073.

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5667583/>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3735139/>
3. <https://www.ncbi.nlm.nih.gov/books/NBK302/>
4. <https://www.ncbi.nlm.nih.gov/books/NBK560808/>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4317545/>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 LABORATORY SAFETY AND STERILIZATION</b>				
1.1	Common laboratory accidents – Universal work precautions (UWP) for lab personnel	4	Chalk & Talk	Black Board
1.2	good laboratory practice	3	Chalk & Talk	LCD
1.3	Sterilization: sterilization by heat – cold – ultra violet radiation – Ionizing radiations	4	Lecture	PPT
1.4	Filtration – chemical sterilization.	4	Lecture	Black Board
1.5	Laboratory instruments: Light microscope and centrifuge		Discussion	
<b>UNIT - 2 ANALYSIS OF URINE</b>				

2.1	Composition of urine - Collection and preservation	2	Chalk &Talk	Black Board
2.2	Physical parameter: Colour, Odour, pH, Density	2	Chalk & Talk	LCD
2.3	Chemical parameters: Sugar (Benedict's test), Albumin (Bence Jones protein test), bile salts, bile pigment, urea	3	Lecture	PPT
2.4	uric acid, creatinine and Ketone bodies (Nitroprusside test) and their clinical significances	3	Lecture	Black Board
2.5	Pregnancy tests – Gestational diabetes	2	Chalk &Talk	Black Board
2.6	Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria)	3	Chalk & Talk	LCD
<b>UNIT -3 HEMATOLOGY</b>				
3.1	Blood: collection of blood & lab procedure	2	Chalk & Talk	Black Board
3.2	types of anaemia	2	Chalk & Talk	LCD
3.3	bleeding time- clotting time	2	Chalk & Talk	Smart Board
3.4	Total count of RBC & WBC - Differential count of WBC- Erythrocyte sedimentation rate -Blood grouping	2	Lecture	Black Board
3.5	haemostasis- bleeding disorder of man - Haemolytic disease of newborn	2	Chalk & Talk	Black Board
3.6	Platelet count, reticulocytes count, Absolute Eosinophil count	3	Chalk &Talk	LCD
<b>UNIT -4 ANALYSIS OF STOOL AND SPUTUM</b>				

4.1	Faeces: Specimen collection	2	Chalk & Talk	Black Board
4.2	microscopic examination – ova, cysts occult blood, parasitic infestation	2	Chalk & Talk	LCD
4.3	amoebic dysentery	1	Lecture	PPT
4.4	Physical and chemical examination of stool	3	Lecture	Smart Board
4.5	Stool Culture and sensitivity	2	Chalk & Talk	Black Board
4.6	Sputum: Macroscopic and Microscopic examination of sputum	3	Chalk & Talk	LCD
4.7	AFB staining Sputum culture	2	Chalk & Talk	Black Board
<b>UNIT -5 SEMEN ANALYSIS</b>				
5.1	Semen: Collection of semen	3	Chalk & Talk	Black Board
5.2	Semen analysis – motility, total count and abnormality , cryopreservation.	3	Chalk & Talk	LCD
5.3	STD: AIDS, syphilis, gonorrhea	3	Lecture	PPT
5.4	Prenatal diagnosis – Amniocentesis, Chorion villus sampling, Fetoscopy -Need, procedure for collection and Karyotype studies	3	Lecture	Smart Board
5.5	Safe disposal of bio medical wastes – incineration	3	Lecture	Black Board

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
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	<b>T1</b>	<b>T2</b>	<b>Qui z</b>	<b>Assignme nt</b>	<b>OBT/P PT</b>				
	<b>10 Mk s.</b>	<b>10 Mk s.</b>	<b>5 Mk s.</b>	<b>5 Mks</b>	<b>5 Mks</b>	<b>35 Mks.</b>	<b>5 Mks.</b>	<b>40Mk s.</b>	
<b>K1</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>10 %</b>
<b>K2</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>9</b>	<b>-</b>	<b>9</b>	<b>22.5 %</b>
<b>K3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>11</b>	<b>-</b>	<b>11</b>	<b>27.5 %</b>
<b>K4</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>5</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>11</b>	<b>27.5 %</b>
<b>Non Scholast ic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		<b>5</b>	<b>5</b>	<b>12.5 %</b>
<b>Total</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>40</b>	<b>100 %</b>

<b>CIA</b>	
<b>Scholastic</b>	<b>35</b>
<b>Non Scholastic</b>	<b>5</b>
	<b>40</b>

## EVALUATION PATTERN

<b>SCHOLASTIC</b>					<b>NON - SCHOLASTI C</b>	<b>MARKS</b>		
<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>C5</b>	<b>C6</b>	<b>CIA</b>	<b>ESE</b>	<b>Tota l</b>
<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>40</b>	<b>60</b>	<b>100</b>

## COURSE OUTCOMES

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	List the different sterilization methods followed in clinical laboratory.	K1	PSO2
CO 2	Explain the collection method and techniques used in laboratory for urine analysis.	K2	PSO2
CO 3	Outline the method of blood collection and related analysis.	K2	PSO2
CO 4	Find the way to process clinical specimens safely according to established procedures.	K3	PSO8
CO 5	Utilize the knowledge of karyotyping in detection of congenital malformations.	K3	PSO1

[illegible]

<b>CO4</b>	2	2	2	2	2	2	2	3	2	2	2	2
<b>CO5</b>	3	2	2	2	2	2	2	2	2	2	2	2


### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
<b>CO1</b>	2	2	2	2
<b>CO2</b>	2	2	3	2
<b>CO3</b>	2	2	3	2
<b>CO4</b>	2	2	2	2
<b>CO5</b>	2	2	3	2

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
**Dr. S. Barathy**

**Forwarded By**

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
 FATIMA COLLEGE (AUTONOMOUS)  
 MADURAI-625 018

**HOD'S Signature**  
**& Name**

### III B.Sc. Zoology

#### SEMESTER –VI

*For those who joined in 2019 onwards*

PROGRA MME CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/ WEEK	CREDIT S
<b>UAZO</b>	<b>19Z6ME5</b>	<b>Bioinformatics</b>	<b>Lecture</b>	<b>5</b>	<b>5</b>

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS

### **COURSE DESCRIPTION**

This course focuses on the various biological databases, sequence analysis of pairwise alignment, multiple sequence alignment and basics of phylogenetic tree construction. It outlines the principle and method of secondary structure prediction and tertiary structure prediction.

### **COURSE OBJECTIVES**

To enable the students to appreciate the significance of computational programs in the development and analysis of biological database

### **UNITS**

#### **UNIT –I COMPUTERS AND BIOLOGICAL DATABASES (15 HRS.)**

Introduction- Definition, History, and scope -World Wide Web - web page -Browsers - search engines - Internet protocol - TCP/IP - Biological Database-classification of databases- Nucleotide sequence database: Genbank, EMBL.

#### **Self-study – History of bioinformatics**

#### **UNIT –II PROTEIN DATABASES (15 HRS.)**

Protein sequence database: UniProtKB - Secondary database: PROSITE - Structure database – PDB - Human genome project.

#### **Self-study - Secondary database**

#### **UNIT –III PAIRWISE ALIGNMENT (15 HRS.)**

DOTPLOT - Similarity and homology – Scoring matrices (PAM&BLOSUM), Local alignment, Global alignment – gapped and ungapped alignment – BLAST: Method and types.

#### **Self-study - DOTPLOT**

**UNIT –IV MULTIPLE SEQUENCE ALIGNMENT (15 HRS.)**

Introduction to Multiple sequence alignment – methods and applications-CLUSTALO. Phylogenetic analysis: rooted and unrooted tree, UPGMA and NJ algorithm.

**Self-study - CLUSTALO****UNIT –V PROTEIN STRUCTURE PREDICTION (15 HRS.)**

Secondary structure prediction: Chou – Fasman method, GOR method –*In silico* structure prediction of proteins - Homology modeling: model generation, validation and refinement – Ramachandran plot.

**Self-study – Threading and *ab initio* modeling****REFERENCES:**

1. Attwood T.K and Smith P.D.J. (2001). *Introduction to Bioinformatics*. 1<sup>st</sup> ed., Pearson Education Pvt. Ltd., New Delhi.
2. Baxevanis A.D. (2003). *A practical guide to the analysis of genes and proteins*. Wiley-Interscience, Singapore.
3. Mount D.W. (2001). *Bioinformatics – Sequence and Genome Analysis*. Cold Spring Harbor Laboratory Press, New York.
4. S.C. Rastogi, N. Mendiratta and P. Rastogi. (2004). *Bioinformatics: Methods and applications*. Prentice – hall of India Private Limited, New Delhi.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
2. [www.uniprot.org](http://www.uniprot.org)
3. [www.rcsb.org](http://www.rcsb.org)
4. <https://prosite.expasy.org>
5. [www.ncbi.nlm.nih.gov/blast/](http://www.ncbi.nlm.nih.gov/blast/)

**COURSE CONTENTS & LECTURE SCHEDULE:**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Lectures</b>	<b>Teaching Pedagogy</b>	<b>Teaching Aids</b>
<b>UNIT -1 BASICS OF COMPUTERS AND BIOLOGICAL DATABASES</b>				
1.1	Introduction- Definition, and scope	3	Chalk & Talk	Black Board
1.2	World Wide Web - web page –Browsers	2	Chalk & Talk	LCD
1.3	search engines	2	Lecture	PPT & White board
1.4	Internet protocol - TCP/IP -	2	Lecture	Smart Board
1.5	Biological Database-classification of databases	2	Lecture	Black Board
1.6	Nucleotide sequence database: Genbank, EMBL.	4	Discussion	Google classroom
<b>UNIT -2 PROTEIN DATABASES</b>				
2.1	Protein sequence database: UniProtKB	3	Lecture	LCD
2.2	Secondary database:	3	Chalk & Talk	Green Board
2.3	PROSITE	3	Lecture	Black Board
2.4	Structure database – PDB	3	Lecture	Black Board
2.5	Human genome project	3	Lecture	Black Board
<b>UNIT - 3 PAIRWISE ALIGNMENT</b>				
3.1	Similarity and homology	3	Chalk & Talk	Black Board
3.2	Scoring matrices	3	Chalk	LCD

	(PAM&BLOSUM)		&Talk	
3.3	Local alignment, Global alignment	3	Lecture	PPT & White board
3.4	gapped and ungapped alignment	3	Lecture	Smart Board
3.5	BLAST: Method and types	3	Lecture	Black Board
<b>UNIT – 4 MULTIPLE SEQUENCE ALIGNMENT</b>				
4.1	Introduction to Multiple sequence alignment	3	Chalk & Talk	Black Board
4.2	methods and applications	3	Chalk & Talk	LCD
4.3	Phylogenetic analysis	3	Lecture	PPT & White board
4.4	rooted and unrooted tree	1	Lecture	Smart Board
4.5	UPGMA	3	Lecture	Black Board
4.6	NJ algorithm	2	Discussion	Google classroom
<b>UNIT -5 PROTEIN STRUCTURE PREDICTION</b>				
5.1	Secondary structure prediction: Chou – Fasman method	3	Chalk & Talk	Black Board
5.2	GOR method	2	Chalk & Talk	LCD
5.3	<i>In silico</i> structure prediction of proteins	4	Lecture	PPT & White board
5.4	Homology modeling: model generation	2	Lecture	Smart Board
5.5	Validation	1	Lecture	Black Board

5.6	Refinement	1	Discussion	Google classroom
5.7	Ramachandran plot	2	Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.				
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

**EVALUATION PATTERN**

SCHOLASTIC	NON - SCHOLASTIC	MARKS
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					C			
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

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

## Mapping of COs with PSOs

PSO	O1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	3	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	2	2	3	2	2	2	2	2	2	2	2
CO5	3	2	2	3	2	2	2	3	2	2	2	2

### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	2	2	2	2
CO3	2	2	3	2
CO4	2	2	2	2
CO5	2	2	3	2

**Note:** ♦ Strongly Correlated – 3

♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER:**

**Dr. J. Asnet Mary**

**Forwarded By**



**Dr. A. TAMIL SELVI**  
Head, Dept. of Zoology  
FATIMA COLLEGE (AUTONOMOUS)  
MADURAI-625 018

**HOD'S Signature  
& Name**

**SEMESTER –VI***For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEG ORY	HRS/WEE K	CREDIT S
UAZO	19Z6ME6	Entomology	Lectur e	5	5

**COURSE DESCRIPTION**

This course provides knowledge about the interaction of insects with human and environment.

**COURSE OBJECTIVES**

- Understand about the classification, biology and control of insects.
- Appreciate the importance of beneficial insects.
- Acquire skills for collecting, mounting and preserving insects for scientific study.

**UNITS****UNIT –I TAXONOMY****(15HRS.)**

Definition & outline **classification** of Class- Insecta upto orders - Salient features of some economically important insect orders: Thysanura, Orthoptera, Isoptera, Hemiptera, Coleoptera, Lepidoptera, Dermaptera, Odonata, Neuroptera and Hymenoptera - Collection of insects - methods - collecting equipment - mounting - preservation.

**Self-study – Mounting and preservation****UNIT –II MORPHOLOGY AND METAMORPHOSIS****(15 HRS.)**

General structural organization of insects: head, compound eyes, antennae, mouthparts; thorax- legs, wings; abdomen – nongenital & genital abdominal appendages. Brief account on metamorphosis, moulting, diapause. Brief account on special glands of insects-wax gland, silk gland and pheromone

gland. Bioluminescence.

**Self-study – mouthparts, metamorphosis, moulting and silk gland**

**UNIT –III BENEFICIAL INSECTS**

**(15 HRS.)**

Beneficial aspects of insects-role of insects as pollinators of crops-insects as bio agents in control of crop pests - insects as suppliers of useful products-honey, propolis, royal jelly, bee wax, silk, natural dye, insect galls, cantharidin - Lac insect: culture - harvesting.

**UNIT –IV HARMFUL INSECTS**

**(15 HRS.)**

Pests-definition, kinds of pests - Brief account & control measures of the following pests: -

Household insect pests- Cockroach & silver fish, medically important insects-*Anopheles*, *Culex*, *Aedes*, sand flies, black flies- insects injurious to livestock-Horse flies, Warble flies.

**UNIT –V INSECT PEST OF AGRICULTURAL CROPS**

**(15 HRS.)**

Pests of crops - brief account on pink cotton boll worm, paddy stem borers, red hairy caterpillar & Rhinoceros Beetle - Pests of stored grains - Rice Weevil, grain moth, Rice moth, flour beetle, Khapra beetle, pulse beetle, management of insect pests of stored food grains - prevention & curative measures, brief account on **Integrated Pest Management** - Chemical, Biological methods of control.

**TEXT BOOK:**

1. Singh R. and Sachan G. C (2012) *Elements of entomology*, Rastogi Publications, Meerut, India.

**REFERENCES:**

1. Vasantharaj D and Kumaraswami, D., (1998) *Elements of Economic entomology*, Popular book depot, Chennai.
2. Romosa W.S and Stoffolano J.G., (1998) *The science of entomology*, Mc Grow-Hill Company, New York.
3. Pedigo LIP, (2002) *Entomology and pest management*, Pearson Education, Singapore.

**DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)**

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4541473/>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6628405/>
3. <https://www.nature.com/articles/501S15a>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6391707/>
5. <https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7164>

**COURSE CONTENTS & LECTURE SCHEDULE:**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 TAXONOMY</b>				
1.1	Definition & outline classification of Class- Insecta up to orders	3	Chalk & Talk	Black Board
1.2	Salient feature of some economically important insect orders Thysanura, Orthoptera, Isoptera,	3	Chalk & Talk	LCD
1.3	Hemiptera, Coleoptera, Lepidoptera	2	Lecture	PPT
1.4	Dermaptera, Odonata, Neuroptera and Hymenoptera	2	Lecture	Black Board
1.5	Collection of insects- methods and collecting equipment	2	Lecture	Black Board
1.6	Mounting and preservation	1	Discussion	
<b>UNIT -2 MORPHOLOGY AND METAMORPHOSIS</b>				
2.1	General structural organization of insects-head	3	Lecture	Green Board Charts
2.2	compound eyes, antennae, Mouth parts	2	Chalk & Talk	Green Board

2.3	thorax-legs, wings; abdomen – nongenital & genital abdominal appendages	3	Chalk & Talk	Black Board
2.4	Brief account on metamorphosis, moulting, Diapause	2	Chalk & Talk	LCD
2.5	Brief account on special glands of insects-wax gland and silk gland	2	Lecture	PPT
2.6	pheromone gland. Bioluminescence	3	Chalk & Talk	LCD
<b>UNIT -3 BENEFICIAL INSECTS</b>				
3.1	Beneficial aspects of insects-role of insects as pollinators of crops	3	Chalk & Talk	Black Board
3.2	insects as bio agents in control of crop pests	3	Chalk & Talk	LCD
3.3	insects as suppliers of useful products-honey	2	Lecture	PPT
3.4	propolis, royal jelly, bee wax	2	Lecture	Black Board
3.5	silk, natural dye, insect galls, cantharidin	2	Lecture	Black Board
3.6	Lac insect: culture - harvesting	3	Lecture	Black Board
<b>UNIT -4 HARMFUL INSECTS</b>				
4.1	Pests-definition, kinds of pests	2	Chalk & Talk	Black Board
4.2	Brief account & control measures of the following pests: -Household insect pests Cockroach	3	Chalk & Talk	LCD

4.3	silver fish	2	Lecture	PPT
4.4	medically important insects- <i>Anopheles</i>	2	Lecture	Black Board
4.5	<i>Culex</i> , <i>Aedes</i> , sand flies and black flies	3	Lecture	Black Board
4.6	Insects injurious to livestock-Horse flies, Warble flies	3	Chalk & Talk	Black Board
<b>UNIT -5 INSECT PEST OF AGRICULTURAL CROPS</b>				
5.1	Pests of crops-brief account on pink cotton boll worm	2	Chalk & Talk	Black Board
5.2	paddy stem borers, red hairy caterpillar	2	Chalk & Talk	LCD
5.3	Rhinoceros Beetle	2	Lecture	PPT
5.4	Pests of stored grains-Rice Weevil, grain moth	2	Lecture	Black Board
5.5	Rice moth, flour beetle, Khapra beetle, pulse beetle	2	Lecture	Black Board
5.6	Management of insect pests of stored food grains-prevention & curative measures	2	Chalk & Talk	Black Board
5.7	Brief account on Integrated Pest Management-Chemical, Biological methods of control	3	Chalk & Talk	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Quiz	Assignment	OBT/PP T				
	10 Mks	10 Mks	5 Mks	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks	

	.								
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

### EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING	PSOs ADDRESSED
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		<b>TO REVISED BLOOM'S TAXONOMY)</b>	
<b>CO 1</b>	List the different methods of insect collection.	<b>K1</b>	PSO1
<b>CO 2</b>	Find the morphological modifications of insects with different functions.	<b>K3</b>	PSO1
<b>CO 3</b>	Summarize the beneficial aspects of insects.Lect	<b>K2</b>	PSO1
<b>CO 4</b>	Explain the harmful effects of insects.	<b>K2</b>	PSO1
<b>CO 5</b>	Identify the agricultural pests and the economic damage caused.	<b>K3</b>	PSO6

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
<b>CO1</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO2</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO3</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO4</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO5</b>	2	2	2	2	2	3	2	2	2	2	2	2

### Mapping of COs with POs


CO/ PSO	PO1	PO2	PO3	PO4
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<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**

**1. Dr. S. Barathy** Forwarded By

  
**Dr. A. TAMIL SELVI**  
 Head, Dept. of Zoology  
**FATIMA COLLEGE (AUTONOMOUS)**  
 MADURAI-625 018

**HOD'S Signature  
& Name**

**III B.Sc.Zoology**

**SEMESTER –VI**

*For those who joined in 2019 onwards*

PROGRAM ME CODE	COURSE CODE	COURSE TITLE	CATEGO RY	HRS/WEE K	CREDIT S
UAZO	19Z6SB5	Apiculture	Lecture	2	2

### COURSE DESCRIPTION

This course is designed for skill development to the student which discusses the branch of Zoology that deals with animal diversity, structure and function of various systems, development and inheritance of man.

### COURSE OBJECTIVES

- Aware of the bee keeping tools and techniques
- Develop skills on bee keeping methods and honey production
- Exercise bee keeping as a hobby or small scale entrepreneurs

### UNITS

#### UNIT I – BEE TYPES (6HRS.)

Introduction to Apiculture - Scope of Apiculture - Honey bee types: *Apis dorsata*, *A. florea*, *A. cerana indica*, *A. mellifera* and *Trigona iridipennis*.

#### UNIT II – BEE COLONY (6HRS.)

Bee colony - Queen, Drones and Workers - Structure of mouthparts and sting – Life cycle of Honey bee.

#### Self- Study – Mouth parts

#### UNIT III – BEE HIVES (6HRS.)

Bee keeping methods - Primitive beekeeping - Modern hives - Langstroth hive and Newton's hive - Bee keeping equipments.

#### UNIT IV – BEE PRODUCTS (6HRS.)

Products of Apiculture - Nutritional and medicinal values of honey - Extraction of honey, Preservation and storage of honey - bee wax and bee venom.

#### Self- Study -Products of Apiculture - Nutritional and medicinal values of honey - Extraction of honey

**UNIT V – BEE ENEMIES****(6HRS.)**

Enemies of bees: Wax moths, Wax beetles and black ants - Bee diseases: Brood diseases, Fungal brood disease - Relationship between plants and Bees. Preventive measure.

**UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)****( HRS.)****REFERENCES:**

1. Jayashree, K.V. Tharadevi, C.S & Arumugam, N. 2014. Apiculture, Saras Publication, Nagercoil, Tamil Nadu.
2. Jayasurya et al., 2013. Economic Zoology, Saras Publication, Nagercoil, Tamil Nadu.
3. Arumugam N, Murugan T, Johnson Rajeswar J and Ram Prabu, R, Economic Zoology, Saras Publication, Kanyakumari, (2015).
4. Vasantharaj D and Kumaraswami, D., (1998) Elements of Economic entomology, Popular book depot, Chennai.
5. Romosa W.S and Stoffolano J.G., (1998) The science of entomology, Mc Grow-Hill Company, New York.
6. Pedigo LIP, (2002) Entomology and pest management, Pearson Education, Singapore.
7. Roger. A.M, 1978. The complete guide to Beekeeping, Pelham books LTD, London.
8. Nagaraja N and D.Rajagopal, 2009. Honey Bees- Diseases, Parasites, Pests, Predators & their management, MJP Publishers, Chennai.
9. Mishra, R.C., 1998. Perspectives in Indian Apiculture, Agro Botanica, New Delhi.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.yourarticlelibrary.com/essay/essay-on-apiculture/42293>
2. <http://network.bepress.com/life-sciences/agriculture/apiculture/>
3. <https://www.oercommons.org/authoring/21640-honey-bees-and-environmental-sustainability-bee-my/view>

4. <https://www.uaex.edu/farm-ranch/special-programs/beekeeping/about-honey-bees.aspx#:~:text=Like%20all%20insects%2C%20a%20honey,and%20contains%20several%20important%20glands.>
5. <https://www.vedantu.com/biology/apiculture-beekeeping>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 BEE TYPES</b>				
1.1	Introduction and Scope of Apiculture	1	Chalk & Talk	Black Board
1.2	<i>Apis dorsata</i> ,	1	Lecture	Black Board
1.3	<i>A.florea</i>	1	Lecture	PPT & White board
1.4	<i>A. cerana indica</i> ,	1	Lecture	Smart Board
1.5	<i>A.mellifera</i>	1	Lecture	Black Board
1.6	<i>Trigona iridipennis</i> .	1	Discussion	Google classroom
<b>UNIT -2 BEE COLONY</b>				
2.1	Bee colony	1	Lecture	Green Board Charts
2.2	Queen, Drones and Workers	1	Chalk & Talk	Green Board
2.3	Structure of mouthparts and sting	2	Chalk & Talk	Black Board
2.4	Life cycle of Honey bee	2	Chalk & Talk	LCD
<b>UNIT -3 BEE HIVES</b>				
3.1	Bee keeping methods	1	Lecture	Black Board

3.2	Primitive beekeeping	1	Discussion	Black Board
3.3	Modern hives	1	Chalk & Talk	Black Board
3.4	Langstroth hive and Newton's hive	1	Chalk & Talk	LCD
3.5	Bee keeping equipments	2	Lecture	PPT & White board
<b>UNIT -4 BEE PRODUCTS</b>				
4.1	Products of Apiculture	1	Discussion	Black Board
4.2	Nutritional value of honey	1	Chalk & Talk	Black Board
4.3	Medicinal values of honey -	1	Chalk & Talk	LCD
4.4	Extraction of honey	1	Lecture	PPT & White board
4.5	Preservation and storage of honey	1	Lecture	LCD
4.6	Bee wax and bee venom.	1	Lecture	Black Board
<b>UNIT -5 BEE ENEMIES</b>				
5.1	Enemies of bees	1	Discussion	Black Board
5.2	Wax moths, Wax beetles and black ants	1	Lecture	PPT/LCD
5.3	Bee diseases: Brood diseases,	1	Chalk & Talk	Black Board
5.4	Fungal brood disease	1	Lecture	PPT
5.5	Relationship between plants and Bees	1	Lecture	PPT

5.6	Preventive measure.	1	Lecture	LCD
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**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks.	OBT/PP T 5 Mks.				
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

**EVALUATION PATTERN**

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain the scope of apiculture in India	K2	PSO1 & PSO11
CO 2	Recall the structure of honey bee	K1	PSO1, PSO4 & PSO10
CO 3	List the equipments used in bee keeping	K1	PSO2, PSO4, PSO8 & PSO10
CO 4	Explain the extraction, Preservation and storage of honey	K2	PSO2, PSO4, PSO8 & PSO9
CO 5	Outline the types of bee diseases	K2	PSO1, PSO4, PSO9 & PSO10

### Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	3	2	2
CO3	2	3	2	3	2	2	2	2	2	3	2	2



<b>CO4</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>

### Mapping of COs with POs


<b>CO/ PSO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>
<b>CO1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO4</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

**Note:** ♦ Strongly Correlated – **3**      ♦ Moderately Correlated – **2**  
 ♦ Weakly Correlated – **1**

### COURSE DESIGNER:

**Dr. N. Nagarani**

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& Name**

**III B.Sc. Zoology  
SEMESTER – VI**

***For those who joined in 2019 onwards***

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WE E K	CREDIT S
UAZO	19Z6SB 6	Dairy Farming	Lecture	2	2

**COURSE DESCRIPTION**

This course provides comprehensive knowledge on the breeds of Dairy animals, their management. The course also introduces the method of preparation and nutritional value of various Dairy products for the benefit of mankind.

**COURSE OBJECTIVES**

- Interpret the management of high yielding dairy species
- Prepare value added products using milk
- Manage Livestock diseases in Animal Husbandry
- Become an entrepreneur

**UNITS****UNIT I: INTRODUCTION****[6 HRS]**

Introduction and Scope of dairy farming. Dairy animals- Dairy Cows: Indigenous- Red Sindhi, Sahiwal and Gir, Exotic- Jersey and Holstein Friesian. Buffaloes- Murrah and Surti, Brief account on the significance of indigenous cow breeds.

**Self Study - Scope of dairy farming****UNIT II: MANAGEMENT OF DAIRY BARN****[6 HRS]**

Brief account on Dairy house. Stages of Management of Dairy Cows: Management of new born calf, Management of Heifer, Management of Milking cow - Feeding and breeding management.

**Self Study - Brief account on Dairy house**

**UNIT III: STERILIZATION OF MILK****[6 HRS]**

Composition and Nutritive value of Milk, Milking machine. Pasteurization - Methods of Pasteurization and advantages. Detection of adulteration of Milk- Lactometer- Methylene Blue Reductase test (MBR) -Sulphuric acid method.

**Self Study - Nutritive value of Milk****UNIT IV: MILK PRODUCTS****[6 HRS]**

Brief account on milk products: Whole milk powder, Skim milk powder, Homogenized milk, Standardized milk and Toned milk, Panir, Rabri, Khoa and Ice cream. Fermented milk products: Kefir, Koumiss, Dahi, Butter milk, Desi butter and Ghee. Cheese: Types-preparation- spoilage of Cheese and Whey.

**Self Study - Ice cream****UNIT V: LIVESTOCK DISEASES****[6 HRS]**

Livestock diseases: Etiology, Mode of transmission, Clinical findings and Control measures of Mastitis, Rinder pest (Cattle Plague-Bovine typhus) and Foot and mouth disease.

**Self Study - Rinder pest****UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)****( HRS.)****REFERENCES:****TEXT BOOK:**

1. Arumugam N, Murugan T, Johnson Rajeswar J and Ram Prabu,R. (2015). *Economic Zoology*. SarasPublication, Kanyakumari.

**REFERENCE BOOKS:**

1. Uma Shankar Singh. (2008). *Dairy Farming*. Anmol Publications, New Delhi.
2. Banerjee, G.C. (2012). *A Text Book of Animal Husbandry*. Oxford & IBH Publication, New Delhi.
3. ICAR. (2000). *Hand book of Animal Husbandry*. The Indian Council for Agricultural Research, New Delhi.

**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://toolkit.climate.gov/case-studies/precise-soil-climate-and-weather-data-help-dairy-optimize-water-use>
2. <https://www.oerafrica.org/resource/farm-milk-production-marketing-and-processing-activities-kiruhura-district-situational>
3. <https://britannica/topics/dairy> farming
4. [https://agritech.tnau.ac.in/farm\\_enterprises/Farm%20enterprises%20Dairy%20unit.html](https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises%20Dairy%20unit.html)
5. <https://www.britannica.com/topic/dairying>

### COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
<b>UNIT -1 INTRODUCTION</b>				
1.1	Introduction to dairy farming	1	Chalk & Talk	Black Board
1.2	Scope of dairy farming	1	Discussion	Google classroom
1.3	Dairy animals- Dairy Cows: Indigenous- Red Sindhi, Sahiwal and Gir	1	Lecture	PPT
1.4	Exotic- Jersey and Holstein Friesian	1	Lecture	PPT& Video
1.5	Buffaloes- Murrah and Surti	1	Lecture	PPT& Video
1.6	Cloning of Cow	1	Chalk & Talk	Black Board
<b>UNIT -2 MANAGEMENT OF DAIRY BARN</b>				
2.1	Brief account on Dairy house	1	Lecture	LCD & Video
2.2	Stages of Management of Dairy Cows: Management of new born calf	2	Lecture	LCD
2.3	Stages of Management of Dairy Cows: Management of Heifer	1	Lecture	LCD

2.4	Stages of Management of Dairy Cows: Management of Milking cow	2	Lecture	LCD
<b>UNIT -3 STERILIZATION OF MILK</b>				
3.1	Composition and Nutritive value of Milk	1	Lecture	PPT
3.2	Milking machine	1	Lecture	LCD & Video
3.3	Pasteurization - Methods of Pasteurization and advantages	2	Chalk & Talk	Black Board
3.4	Detection of adulteration of Milk- Lactometer	1	Chalk & Talk	Black Board
3.5	Detection of adulteration of Milk- - Methylene Blue Reductase test (MBR) -Sulphuric acid method.	1	Chalk & Talk	Black Board
<b>UNIT - 4 MILK PRODUCTS</b>				
4.1	Milk products: Whole milk powder, Skim milk powder, Homogenized milk, Standardized milk and Toned milk	2	Lecture	LCD
4.2	Panir, Rabri, Khoa and Ice cream	1	Lecture	LCD
4.3	Fermented milk products: Kefir, Koumiss, Dahi, Butter milk, Desi butter and Ghee	2	Lecture	LCD
4.4	Cheese: Types-preparation-spoilage of Cheese and Whey	1	Lecture	PPT & White Board
<b>UNIT -5 LIVESTOCK DISEASES</b>				
5.1	Livestock diseases: Introduction	1	Chalk & Talk	Black Board
5.2	Etiology, Mode of transmission,	2	Lecture	LCD

	Clinical findings and Control measures of Mastitis			
5.3	Etiology, Mode of transmission, Clinical findings and Control measures of Rinder pest (Cattle Plague-Bovine typhus)	1	Discussion	Google classroom
5.4	Etiology, Mode of transmission, Clinical findings and Control measures of Foot and mouth disease	2	Lecture	LCD

**INTERNAL - UG**

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

**EVALUATION PATTERN**

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

**COURSE OUTCOMES**

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the features of various indigenous and exotic breeds of dairy cattle.	K3	PSO1, PSO3, PSO4, PSO6 & PSO9
CO 2	Discuss the management of new born calf, Heifer and milk cow.	K2	PSO1, PSO2, PSO3, PSO4, PSO6, & PSO9
CO 3	Summarize the significance of Pasteurization in the preservation of the nutritive value of milk.	K1	PSO1, PSO2, PSO3, PSO4, PSO8, PSO9 & PSO11
CO 4	Develop an idea regarding the formulation of value added dairy products.	K3	PSO1, PSO2, PSO4, PSO6, PSO9 & PSO11
CO 5	Describe the clinical findings, treatment and control measures of livestock diseases.	K2	PSO1, PSO2, PSO3, PSO4, PSO6, PSO8 & PSO9

**Mapping of COs with PSOs**

CO/ PSO	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PS O9	PSO10	PSO11	PSO12
CO1	3	-	3	3	2	3	2	2	3	2	2	2

CO2	3	3	3	3	2	2	2	2	3	2	2	2
CO3	3	3	3	3	2	2	2	2	3	2	3	2
CO4	3	2	-	3	2	2	2	2	3	2	3	2
CO5	3	3	2	3	2	2	2	2	3	2	2	2

**Mapping of COs with POs**


CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	2	2
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	3	2

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2      ♦  
Weakly Correlated -1

**COURSE DESIGNER:**

1. **Dr. A. Tamil Selvi**

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**& Name**

**I B.Sc. Zoology**  
**SEMESTER –II**

*For those who joined in 2019 onwards*



PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGOR Y	HRS/WEE K	CREDIT S
UAZO	21Z2SL 1	Single Cell Protein Culture	Tutorial	-	2

### COURSE DESCRIPTION

This course provides the knowledge of cultivation and usage of Single Cell Protein.

### COURSE OBJECTIVES

- Emphasize the importance of microbes as an alternative source of food.
- Gain knowledge about the nutritive value of SCP.

### UNITS

#### UNIT – I INTRODUCTION

Introduction to Single Cell Protein (SCP ) - History of Single Cell Protein (SCP)– Microorganisms used in single cell protein production- Advantages of SCP – Limitations of using SCP.

#### UNIT –II ALGAL PROTEIN

Algaeas a source of protein-nutritive value - cultivation - extraction of protein - *Spirulina* sp., *Chlorella* sp.

#### UNIT –III BACTERIAL PROTEIN

Bacterial Proteins – Culture - extraction of SCP- *Bacillus* sp., *Pseudomonas* sp., *Methylococcus capsulatus*.

#### UNIT –IV FUNGAL PROTEIN

Fungal Proteins – Culture - extraction from Yeasts - *Candida* sp. & *Saccharomyces* sp. Extraction from Fungi - *Agaricus* sp. & *Aspergillus* sp.

#### UNIT –V SCP PRODUCTION USING WASTE MATERIAL

Production of SCP from Biomass and Waste Materials- Nutritive values of SCP – Dietary supplements for Human, Cattle and birds- Industrially used

SCP (Quoron, Pruteen).

### REFERENCES:

1. Patel, A.H. (2008). Industrial Microbiology, Macmillan India Ltd.
2. Arumugam, N. (2006). Microbiology, Saras Publ. Nagercoil – India
3. Kumarasan, V. (2001). Biotechnology, Saras Publ. Nagercoil – India
4. Dubey, R.C and Maheswari, D.K. (2005). A Text book of Microbiology - S. Chand & Co., New Delhi – India.
5. Rao, A.S. (1997). Introduction to Microbiology – Prentice-Hall, New Delhi, New Delhi – India.

### Digital Open Educational Resources (DOER) :

7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5645522/>
2. <https://pubmed.ncbi.nlm.nih.gov/7180229/>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5937888/>
4. <https://pubmed.ncbi.nlm.nih.gov/8543324/>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6925167/>

## EVALUATION PATTERN

### Self-Learning Courses for UG

#### Internal

**Assignment – 20 Marks**

**Test – 20Marks**

**Total – 40Marks**

#### External

**Objective – 20 Marks**

**Essay Type Qns. – 40 Marks**

**Total – 60Marks**

## COURSE OUTCOMES

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	List the importance of Single cell protein	<b>K1</b>	PSO1
<b>CO 2</b>	Explain the different components present in algal proteins	<b>K2</b>	PSO2
<b>CO 3</b>	Outline the method of extraction of bacterial proteins.	<b>K2</b>	PSO2
<b>CO 4</b>	Organize the steps involved in the cultivation of yeast proteins.	<b>K3</b>	PSO2, PSO6
<b>CO 5</b>	Find the nutritive values of SCP	<b>K4</b>	PSO1, PSO6

### Mapping of COs with PSOs

<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>	<b>PSO 7</b>	<b>PSO 8</b>	<b>PSO 9</b>	<b>PSO 10</b>	<b>PSO 11</b>	<b>PSO 12</b>
<b>CO1</b>	3	2	2	2	2	2	2	2	2	2	2	2
<b>CO2</b>	2	3	2	2	2	2	2	2	2	2	2	2
<b>CO3</b>	2	3	2	2	2	2	2	2	2	2	2	2
<b>CO4</b>	2	3	2	2	2	2	2	2	2	2	2	2
<b>CO5</b>	3	2	2	2	2	3	2	2	2	2	2	2


### Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	2	2	3	2
CO4	2	2	3	2
CO5	2	2	2	2

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

**COURSE DESIGNER:**  
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**HOD'S Signature&  
 Name**

**III B.Sc.**

**SEMESTER – III**

*For those who joined in 2021 onwards  
 (Offered as Interdisciplinary Course with Home Science)*

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	21UG4SLZ	PUBLIC HEALTH & HYGIENE	Self Learning	-	2

### **COURSE DESCRIPTION**

The course is designed to introduce life threatening medical scenarios and to instruct the student how to recognize and respond appropriately to each given situation.

### **COURSE OBJECTIVES**

- To recognize and avoid hazards within her or environment.
- To develop skills necessary for immediate and temporary care care of victims of various cases.

### **UNITS**

#### **UNIT I - NUTRITION AND HEALTH**

Role of international health organization: WHO – UNICEF. Concept of health, Indicators of health.Importance of Nutrition. Nutritional requirements for the special groups (pregnant mother, lactating mother and children).Protein calorie Malnutrition (PCM), National nutrition programme.

#### **UNIT II: ENVIRONMENT AND HEALTH**

Water borne diseases – types, symptoms and treatment.Purification of water - large scale for drinking purpose (slow sand and rapid sand filtration methods).Chlorination of well water.Sanitation.Excreta - Methods of disposal - -types of latrines. National health programmes in India.

#### **UNIT III: COMMUNICABLE AND NON COMMUNICABLE DISEASE**

Epidemiology of Communicable disease- prevention and control -Diarrhoeal diseases- Zoonoses -Viral hemorrhagic fevers - Primary infections of the brain- Mycobacterial infections- Emerging disease threats- Severe Acute Respiratory Syndrome (SARS) and Avian flu- Dengue, Swine, Flu, Chikungunya. Epidemiology, prevention and control of noncommunicable diseases- Rheumatic heart disease- Infective endocarditis- Ischaemic heart disease- Respiratory diseases - Program related to Communicable and Non Communicable diseases

#### **UNIT IV: FAMILY PLANNING, MATERNAL AND CHILD HEALTH**

Family Planning - Objectives and methods - temporary and permanent methods. Maternal Mortality Rate (MMR) - Causes and prevention. Infant Mortality Rate (IMR) - Causes and prevention. Problems of the aged Geriatrics.Immunization schedule for children.

#### **UNIT V: FIRST AID**

Heart attack - Fire accident –Accident – Injuries- Fractures – Stroke- Poison- Electric Shock - Gas leakage - Snake bite and Dog bite

#### **REFERENCE BOOKS**

1. Park J.E., (2017). *Textbook Of Preventive Social Medicine* 24 Th Edition. BanarsidasBhanot Publishers.
2. Vidhya R., (2002). *Hand Book of Preventive and SocialMedicine*.  
**Publisher:** JPB; Nineth edition
3. Sudhar R., Wagh P., Vinod B., Kakade, Jiwan P.S., (2015). *Public Health And Hygiene* Paperback – 2015. Success Publications; First Edition edition (2015).
4. Kumaresan, V., Sorna Raj R., Public Health and Hygiene. Saras Publication
5. Paho, Padro N.A., (2003). *Zoonoses and Communicable DiseasesCommon to Man and Animals* (PAHO Scientific Publications S.) 2003. World Health Organization; 3rd Revised edition edition.

#### **Digital Open Educational Resources**

1. <https://www.healthline.com/health/food-nutrition>
2. <https://www.who.int/health-topics/nutrition>
3. <https://www.healthline.com/health/first-aid>

**EVALUATION**

<b>Internal</b>	<b>External</b>
Assignment – 20 Marks	Objective – 20 Marks
Test – 20Marks	Essay Type Qns. – 40 Marks
Total – 40Marks	Total – 60Marks

**COURSE OUTCOMES**

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

<b>NO.</b>	<b>COURSE OUTCOMES</b>	<b>KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)</b>	<b>PSOs ADDRESSED</b>
<b>CO 1</b>	Discuss the importance, requirement of nutrition for Mother and children	<b>K2</b>	PSO1, PSO4 & PSO11
<b>CO 2</b>	Summarizes about types water borne disease and its remedies	<b>K2</b>	PSO1, PSO4
<b>CO 3</b>	Explain the temporary and permanent methods of family planning	<b>K2</b>	PSO1, PSO4 & PSO8
<b>CO 4</b>	Outlines the types of maternity problems and child health	<b>K2</b>	PSO1 & PSO8
<b>CO 5</b>	Explain the first aid for major health problems	<b>K2</b>	PSO1, PSO3 & PSO4


**Mapping COs Consistency with PSOs**

CO / PS O	PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010	PS011	PS012
CO 1	3			3							1	
CO 2	3			3								
CO 3	3			3				1				
CO 4	1							1				
CO 5	2		2	3								

**Note:** ♦ Strongly Correlated – 3      ♦ Moderately Correlated – 2  
 ♦ Weakly Correlated -1

1. Dr. N. Nagarani (Zoology)
2. Mrs. C. Helen (Home Science)

**Forwarded By**

  
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 MADURAI-625 018

**HOD'S Signature  
& Name**



**III B.Sc.,  
SEMESTER –IV**

*For those who joined in 2019 onwards*

***Interdisciplinary course offered by Department of Zoology & Chemistry***

PROGRAMM E CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDIT S
UAZO	21Z6SLC6	HERBAL COSMETICS	SELF LEARNING	2	2

**COURSE DESCRIPTION**

To enable students to have basic understanding & knowledge about the Herbs used in cosmetics

**COURSE OBJECTIVE:**

This course is designed for the students to learn about

- Commonly available skin and hair care herbs
- The raw materials used in herbal cosmetics
- Standardization of the phytocomponents in cosmetic preparation
- Various formulations of herbal cosmetics.

**UNITS**

**UNIT –I INTRODUCTION TO HERBAL COSMETICS**

Introduction - Historical background and present status of Herbal cosmetics- Quality, safety and efficacy of Herbal cosmetics- Classification of Herbal cosmetics, Drugs and cosmetics act ,1940

**UNIT –II COSMECEUTICAL HERBS**

Morphological characteristics & Chemical properties - Skin care herbs: Aloe,

Khus, Saffron; Hair care herbs: Bhringaraj, Henna, Hibiscus; Fruits & vegetables in hair & skin care: Papaya, Lemon, Neem, Tulsi - Various Oils used in hair & skin care: Coconut oil, Sandalwood oil, Almond oil

### **UNIT –III USES OF BOTANICAL COMPOUNDS**

Secondary metabolites - physical and chemical properties - Lipids: Olive Oil, Sesame Oil – Carbohydrates: Agar, Pectin Sland- Phenols: Cassia, Rosemary – Flavonoids: Tea, Apple – Glycosides: Almond, Mustards Alkaloids: Black Pepper, Vinca, Volatile Oils - Cinnamon, Saffron

### **UNIT –IV STANDARDIZATION OF HERBS**

General methods of extraction of compounds – Solvents and distillation. Chromatographic techniques: Principles of separation and application of Column, Paper, Thin layer and Gas chromatography, HPLC, HPTLC

### **UNIT –V PREPARATION OF HERBAL COSMETICS**

Herbal Cosmetics preparations: Herbal body bath & Massage oils, Butter soap bars, Body powder, Bath salts, Herbal Tooth powder, Lipbalm, Herbal shampoo & Hair oils

### **REFERENCES:**

1. Rosemary Gladstar(2014). *Herbs for Natural Beauty*, Storey Publishing, North Adams.
2. McKenna D.J., Jones K., and Hughes K., (2004). *Botanical Medicines, The Desk Reference for Major Herbal Supplements*, The Haworth Herbal Press, New York.
3. Amrita singh, (2006). *Medicinal plants the world*. Oxford & IBH Co. Pvt. Ltd, New Delhi.
4. Jain S. K., (1999). *Medicinal plants*, National book Trust, India.
5. Burlando B., Verotta L., Cornara L., and Bottini-Mass E., (2010). *Herbal Principles in Cosmetics - Properties and Mechanisms of Action*, CRC Press, London, New York.
6. Roland Hardman (2010). *Traditional Herbal Medicines for Modern Times Herbal Principles in Cosmetics Properties and Mechanisms of*

Action- Taylor and Francis Group, LLC, New York

### Digital Open Educational Resources (DOER) :

1. [http://www.phdmsme.in/uploaded\\_files/project\\_report/1536151263\\_616.pdf](http://www.phdmsme.in/uploaded_files/project_report/1536151263_616.pdf)
2. <https://www.scholarsresearchlibrary.com/articles/herbal-plants-used-as-a-cosmetics.pdf>
3. <https://www.botanylibrary.com/herbal-cosmetics/list-of-herbal-cosmetics-herbal-drugs/16060>
4. <https://www.botanylibrary.com/herbal-cosmetics/list-of-raw-materials-used-for-preparing-herbal-cosmetics-botany/16058>

### EVALUATION PATTERN

Internal	External
Assignment – 20 Marks	Objective – 20 Marks
Test – 20Marks	Essay Type Qns. – 40 Marks
Total – 40Marks	Total – 60Marks

### COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe the history of herbal cosmetics & current regulation in herbal cosmetic preparation	K1	PSO1& PSO2
CO 2	Students will learn about the raw materials used in Formulation cosmetics for skin care and hair care	K1, K2,	PSO3

CO 3	Understand the various chemical diverse constituents of key ingredients of the biological compounds present in cosmetics	K1 & K3	PSO5
CO 4	Identify the extraction techniques applied to natural products	K1, K2, K3 &	
CO 5	Plan the preparations of various herbal cosmetics	K2 & K4	

**COURSE DESIGNER:****1. Dr. V. Bharathy****2. Dr. R. Sarika** **Forwarded By****1. Dr. A. Tamil Selvi** **2. Dr. B. Medona** **HOD's Name & signature**

**Value Added Certificate Course**  
***For those who joined in 2019 onwards***

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS	CREDITS
UAZO	19UGV ACZ1	Herbalism In Health Care	Certificate Course	60	-

### **COURSE DESCRIPTION**

This course deals with the study of Herbs intended for medicinal purposes

### **COURSE OBJECTIVES**

- To know the principles and practices of traditional medicines.
- To demonstrate basic skills in identification of herbs and preparation of herbal drugs

### **UNIT –I TRADITIONAL MEDICINE ( 8HRS.)**

Traditional systems of Medicine - History of Herbs – Definition of Herbs –Different systems of Medicine –Ayurveda, Unani, Siddha and Homeopathy- AYUSH – Central government Organization.

**Self-study- AYUSH – Central government Organization.**

### **UNIT –II COMMON MEDICINAL PLANTS ( 8 HRS.)**

Morphology, Chemical constituents and Medicinal uses of Neem (*Azadirachta indica*), *Aloe vera* (Kumari), *Acalypha indica* (Indian Nettle), *Trigonella foenum-graecum* (Fenugreek), *Vitex negundo* (Chinese chaste tree), *Adhatoda vasica* (Malabar Nut), *Piper nigrum* (Pepper)

### **UNIT –III HOME REMEDIES ( 8HRS.)**

**Herbal remedies** for common cold – *Ocimum sanctum* (Holy Basil), *Coleus amboinicus*- Renal implication of herbal remedies - *Musa paradisiaca*(Plantain), *Tribulus terrestris*(Puncture vine) - Herbal medicines for Gastrointestinal problems – *Allium sativum*(Garlic), *Zingiber officinale*(Ginger) *Trachyspermum ammi*(Caraway seeds) - Herbal remedies for Hepatic disorders – *Phyllanthus niruri* (Stonebreaker) , *Eclipta alba* (False daisy)- Herbal remedies for skin diseases – *Holarrhena antidysenterica* (Tellicherry Bark)

#### **UNIT –IV LIFESTYLE DISORDERS ( 8HRS.)**

Physical Properties, Nutritional value and uses of *Amaranthus sp.*(Greens), *Moringa oleifera*(Drumstick), *Macrotyloma uniflorum*(Horse gram) - Role of Nutraceuticals in Diabetic cure, Management of Obesity, Constipation, Blood pressure & Cardiovascular diseases – Female health disorders.

#### **UNIT –V MARKETING OF HERBAL PRODUCTS ( 8HRS.)**

Marketing-Procurement of Raw materials-Packing(Kinds)-Costing-Distribution to customers(Concepts of marketing)-Adulteration- Trading - Foreign Trade – Export promotion council –Trading in medicinal plants – Local , Domestic and global trading.

#### **Practical aspects: [20 HRS]**

- Herbal Face Powder
- Bath powder
- Herbal hair care: hair conditioner & hair oil
- Cough choornam
- Anti-diabetic Powder
- Triphala and Thirikadugu Choornam
- Astavarga Choornam
- Prasava Lehyam
- Health Mix powder
- Preparation of Amla candy
- Ginger candy

- Gulkand
- Sherbath.

## REFERENCE

1. Schulz V., Haensel R., and Tyler V.E., (2001). *Rational Phytotherapy. A Physician's Guide to Herbal Medicine*, Springer Publishers, Berlin.
2. McKenna D.J., Jones K., and Hughes K., (2004). *Botanical Medicines, The Desk Reference for Major Herbal Supplements*, The Haworth Herbal Press, New York.
3. Amrita singh, (2006). *Medicinal plants the world*. Oxford & IBH Co. Pvt. Ltd, New Delhi.
4. Penguly A., (2006). *The Constituents of medicinal plants*, Allen and Win 2 nd Edition, Australia.
5. Jain S.K., (1999). *Medicinal plants*, National book Trust, India.

## TEXT BOOK

1. Annie R. and Kumaresan V., (2014). *Angiosperms – Taxonomy, Systematic Botany, Economic Botany, Ethnobotany*, Saras Publication, Nagercoil.
2. Arumugam N., Ragland A., Kumaresan V., (2014). *Plant diversity and Medicinal Botany*, Saras Publication, Nagercoil.

## REFERENCES

1. Jain S. K., (1999). *Medicinal plants*, National book Trust, India.
2. Victor S.A., Sudhakar B.D. and Das P.K., *Marketing management*, Directorate Of Distance Education, Pondicherry University
3. Joshi S.G., (2010). *Medicinal Plants*, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Khan N.A. and Iqbal S.A., *Importance of Medicinal Plants*. (2011). DPH Discovery Publishing House Pvt. Ltd, New Delhi.

## DIGITAL OPEN EDUCATIONAL RESOURCES (DOER)

1. <https://www.oercommons.org/courseware/lesson/19559>
2. <https://www.merlot.org/merlot/viewMaterial.htm?id=773402407>
3. <https://www.oercommons.org/courses/classify-the-trees-leaves>

4. <https://www.oercommons.org/authoring/21765-native-plant-medicinal-garden-design-activity>
5. <https://vivaopen.oercommons.org/courseware/lesson/682/student/?task=2>

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO1	Utilize the Traditional systems of Medicine	K1	PSO11
CO2	Outline the importance of herbs used in day today life.	K2	PSO2,PSO6 & PSO11
CO3	Make use of medicinal plants in home remedies.	K2	PSO2,PSO6 &PSO11
CO4	Solve the lifestyle disorders by treating them with herbs.	K3	PSO6&PSO11
CO5	Develop entrepreneurial skill by the preparation of herbal products.	K3	PSO9&PSO11

## Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	2	2	2	2	2	2	2	2	2	3	2
CO2	2	2	2	2	2	2	2	2	2	2	3	2
CO3	2	2	2	2	2	2	2	2	2	2	3	2
CO4	2	2	2	2	2	2	2	2	2	2	3	2
CO5	2	2	2	2	2	2	2	2	3	2	3	2



**Mapping of COs with POs**

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	2	2	2
CO3	2	2	2	2
CO4	2	3	2	2
CO5	2	2	2	2

**Note:** ♦ Strongly Correlated – 3

♦ Moderately Correlated – 2


♦ Weakly Correlated -1

**COURSE DESIGNER:**

1. Dr.V. Bharathy&

2. Dr. X. Devanya Rosaline

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**UNDERGRADUATE**

***For those who joined in 2021 onwards***  
***(Offered as SKILL – EMBEDDED VALUE ADDED CERTIFICATE COURSE***  
***For all students)***

PROGRA MME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDIT S
UAZO	21UGVACZ1	Livestock Farming	Skill – Embedded Value Added Certificate Course	-	2

**COURSE DESCRIPTION**

To apply the principles of management and breeding of domestic, livestock or farm animals for the purpose of obtaining their products (meat, milk, eggs, etc.)

**COURSE OBJECTIVES**

- Understand the methods of rearing farm animals.
- Inculcate the skills needed to formulate the strategies to be adopted for sustainable development.
- Promotion of Dairying for self-employment.

**UNIT - I INTRODUCTION****(12 HRS.)**

Present status and future prospects of livestock development in India.

Buffalo: Breeds of Buffalo, Housing, Feed Management, Milking and Disease Management

**UNIT – II SWINE****(12 HRS.)**

Swine: Importance of pig as a meat animal. Selection of breeds, breeding systems and feeding strategies. Care and Management of pregnant sows and

unweaned piglets.

### **UNIT - III –RABBIT REARING**

**(12 HRS.)**

Rabbit: Economic importance. Important fur and meat type breeds. Housing, handling, feeding, watering, breeding, management, sanitation and health care of rabbits.

### **UNIT - IV -CATTLE FARMING**

**(12 HRS.)**

Important breeds of Cow, Housing and rearing systems. Breeding Management, Prenatal and Postnatal care - Milking management - Machine and hand milking.

### **UNIT - V - SHEEP AND GOAT**

**(12 HRS.)**

Breeds of Sheep and Goat, Nutritional value of Chevon and goat milk, Commercial Rearing of Sheep and goat: Feeding, Housing, Breeding and Health Management Strategies.

### **REFERENCES:**

1. ICAR, *Hand book of Animal Husbandry*, The Indian Council for Agricultural Research, New Delhi.
2. Uma Shankar Singh, (2008) *Dairy Farming*, Anmol Publications, New Delhi.

### **DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.agrifarming.in/livestock-farming>
2. <https://vikaspedia.in/agriculture/livestock/>
3. <https://www.apnikheti.com/en/pn/livestock/bee/dammer-or-stingless-bee>
4. [https://agritech.tnau.ac.in/expert\\_system/poultry/](https://agritech.tnau.ac.in/expert_system/poultry/)
5. [https://agritech.tnau.ac.in/animal\\_husbandry/animhus\\_index.html](https://agritech.tnau.ac.in/animal_husbandry/animhus_index.html)

## COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Illustrate the Breeds of Buffalo and its rearing techniques.	K2	PSO2
CO 2	Plan for a Swine Breeding and Feeding Strategies.	K3	PSO4, PSO11
CO 3	Analyze the rearing methods of Rabbit.	K4	PSO10
CO 4	Assess the Rearing of Sheep and Goat.	K1	PSO9
CO 5	Assess the commercial importance of Livestock Farming.	K5	PSO9

**Mapping of COs with PSOs**

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	3	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	2	3	2
CO3	2	2	2	2	2	2	2	2	2	3	2	2
CO4	2	2	2	2	2	2	2	2	3	2	2	2
CO5	2	2	2	2	2	2	2	2	3	2	2	2

**Mapping of COs with POs**


CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	2	2	2
CO3	1	2	2	2
CO4	2	3	2	2
CO5	2	2	2	2

**Note:** ♦ Strongly Correlated – 3

♦ Moderately Correlated – 2

♦ Weakly Correlated -1

**COURSE DESIGNER****Dr. Antony Amala Jayaseeli****Forwarded By**

  
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