

**ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN  
(AUTONOMOUS)**

**NATIONALLY RE-ACCREDITED WITH B<sup>++</sup> GRADE BY NAAC**

**(Affiliated to Mother Teresa Women's University, Kodaikanal) Chinnakalyamputtur,  
Palani**



**UNDER CHOICE BASED CREDIT SYSTEM ACADEMIC YEAR 2023-2026**

**P.G DEPARTMENT OF ZOOLOGY**

**B.Sc., ZOOLOGY**

**SYLLABUS**

**BATCH: 2023-2026**

## ***P G ZOOLOGY DEPARTMENT FACULTY MEMBERS***

---

**Dr.R. UmaMaheswari M.Sc., M.Phil., Ph.D Assistant Professor & Head**

**Mrs.P.Pavatharini M.Sc.,M.Phil., Assistant Professor**

**Mrs.M.Latha Santhi M.Sc.,M.Phil., Assistant Professor**

**Dr.S.Subhashini M.Sc.,M.Phil.,Ph.D Assistant Professor**

**Mrs.K.P.Sasikala M.Sc.,M.Phil., Assistant Professor**

**Mrs.J.R.Hemalatha M.Sc.,M.Phil., Assistant Professor**

**Mrs P.Sumathi M.Sc.,M.Phil., Assistant Professor**



**ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN**

**(Affiliated to Mother Teresa Women's University, Kodaikanal)**

**Nationally Reaccredited with B<sup>++</sup> Grade by NAAC**

**Chinnakalayamputhur**

**Palani - 624 615**

### **PREAMBLE**

The Department of Zoology are established as undergraduate Department in the year 1974 and upgraded as postgraduate in 1987. The Department is enriched by altruistic contribution of a galaxy of teachers. The Department is noted for its good academic record and well-established laboratories. The highlight of the Department is the active participation of the faculty members in Research with many International and National papers in reputed Journals, received many awards and Research grants from various funding agencies such as UGC, DST etc., Our Department tirelessly strives to work towards women's education at all level in the State to be a pioneer in the field of Women Empowerment by introducing relevant papers in the Curriculum to fulfill their local needs through the Board of Studies.

### **COLLEGE VISION**

- Enlightenment and Empowerment of Rural Women.

### **COLLEGE MISSION**

- Providing high quality teaching learning environment with practical exposure
- Imbibing research culture and collaborate programs with local communities
- Imparting strong and supportive education to promote employability
- Encouraging questioning spirit and self – reliance

### **P.G DEPARTMENT OF ZOOLOGY**

### **VISION**

- To create self confidence among the students through up to date curriculum designing.
  - To develop and maximize the learning competency.
  - To inculcate the social and moral values that enables the students to become a good citizen.
  - To develop true research attitude
- MISSION**
- To provide the students with good quality education.
  - That integrates science, technologies and society and to perform value based real-time research activities and there by leaping to excellence.

**M.Sc., Zoology**

## **BLOOM'S TAXONOMY IN FIXING THE LEARNING OBJECTIVES**

Since the Academic year 2023– 2024, the curriculum for Part – III Zoology, B.Sc, has been designed and the learning objectives and outcomes of the programmes are set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into six levels of learning Objectives of each course.

They are

**K1 / Knowledge = Remember**

**K2 / Comprehension = Understand**

**K3 / Application = Apply**

**K4 / Analysis = Analyze**

**K5 / Evaluation = Evaluate**

**K6 / Synthesis = Create**

### **BLOOM'S TAXONOMY ACTION VERBS:**

**K1/ KNOWLEDGE:** Arrange, Define, Describe, Duplicate, Identify, Label, List, Match, Memorize, Name, Order, Outline, Recognize, Relate, Recall, Repeat, Reproduce, Select, State.

**K2/COMPREHENSION:** Classify, Convert, Defend, Describe, Discuss, Distinguish, Estimate,

Explain, Express, Extend, Generalize, Give example(s), Identify, Indicate, Infer, Locate, Paraphrase, Predict, Recognize, Rewrite, Review, Select, Summarize, Translate.

**K3/APPLICATION:** Apply, Change, Choose, Compute, Demonstrate, Discover, Dramatize, Employ, Illustrate, Interpret, Manipulate, Modify, Operate, Practice, Predict, Prepare, Produce, Relate, Schedule, Show, Sketch, Solve, Use, Write.

**K4/ANALYSIS:** Analyze, Appraise, Breakdown, Calculate, Categorize, Compare, Contrast, Criticize, Diagram, Differentiate, Discriminate, Distinguish, Examine, Experiment, Identify, Illustrate, Infer, Model, Outline, Point out, Question, Relate, Select, Separate, Subdivide, Test.

**P.G Department of Zoology OBE syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023**

**K5 / EVALUATION: Appraise, Argue, Assess, Attach, Choose, Compare, Conclude, Contrast,**

**Defend, Describe, Discriminate, Estimate, Evaluate, Explain, Judge, justify,**

**Interpret, Relate, Predict, Rate, Select, Summarize, Support, Value.**

**K6/ SYNTHESIS: Arrange, Assemble, Categorize, Collect, Combine, Comply, Compose,**

**Construct, Create, Design, Develop, Devise, Explain, Formulate, Generate, Plan**

**Prepare, Rearrange, Reconstruct, Relate, Reorganize, Revise, write, Set up,**

**Summarize, Synthesize, Tell.**

<p><b>Programme Outcomes:</b></p>	<p><b>PO1: Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.</p> <p><b>PO2: Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p><b>PO3: Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p><b>PO4: Problem solving: Capacity</b> to extrapolate from what one has learned and apply their competencies to solve different kinds of non familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p><b>PO5: Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p><b>PO6: Research-related skills:</b> A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and effect relationships; ability to plan, execute and report the results of an experiment or investigation</p> <p><b>PO7: Cooperation/Team work:</b> Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team <b>PO8: Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p>
-----------------------------------	--

	<p><b>PO9: Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p><b>PO10 Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p><b>PO 11 Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p><b>PO 12 Multicultural competence:</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p><b>PO 13: Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p><b>PO 14: Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p><b>PO 15: Lifelong learning:</b> Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development /reskilling.</p>
--	---

<b>Programme Specific Outcomes:</b>	<p><b>PSO1 – Placement:</b> To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p><b>PSO 2 - Entrepreneur:</b> To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations</p> <p><b>PSO3 – Research and Development:</b> Design and implement HR systems and practices grounded in researches that comply with employment laws, leading the organization towards growth and development.</p> <p><b>PSO4 – Contribution to Business World:</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p><b>PSO 5 – Contribution to the Society:</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit</p>
-------------------------------------	---

**Internal Question pattern Part III**

Section	Pattern	Marks	Total
A	1-6 MCQ (Answer all)	6x1	6
B	7-8 (either or pattern)	2x4	8
C	9-12 (any two out of four)	2x8	16
		<b>TOTAL</b>	<b>30</b>

**Components of internal assessment**

Components	Calculation		Marks
Test I	30/2	<u>15+15</u>	15
Test II	30/2	2	
Assignment			5
Seminar			5
<b>TOTAL INTERNAL MARKS</b>			<b>25</b>



**Internal Question pattern Part IV (SBC & NME)**

Section	Pattern	Marks	Total
<b>A</b>	<b>1-3 (any two out of three)</b>	<b>2x2</b>	<b>4</b>
<b>B</b>	<b>4-5 (any one out of two)</b>	<b>1x4</b>	<b>4</b>
<b>C</b>	<b>6-7 (any one out of two)</b>	<b>1x7</b>	<b>7</b>
		<b>TOTAL</b>	<b>15</b>
<b>Assignment</b>			<b>5</b>
<b>Seminar</b>			<b>5</b>
<b>Total Internal marks</b>			<b>25</b>

**External Question pattern Part III**

Section	Pattern	Marks	Total
<b>A</b>	<b>1-10 MCQ (Answer all)</b>	<b>10x1</b>	<b>10</b>
<b>B</b>	<b>11-15 (Either or pattern)</b>	<b>5x7</b>	<b>35</b>
<b>C</b>	<b>16-20 (any three out of five)</b>	<b>3x10</b>	<b>30</b>
		<b>TOTAL</b>	<b>75</b>

**External Question pattern Part IV**

Section	Pattern	Marks	Total
<b>A</b>	<b>1-8 (any five out of eight)</b>	<b>5x3</b>	<b>15</b>
<b>B</b>	<b>9-16 (any five out of eight)</b>	<b>5x6</b>	<b>30</b>
<b>C</b>	<b>17-21 (any three out of five)</b>	<b>3x10</b>	<b>30</b>
		<b>TOTAL</b>	<b>75</b>

**Question Pattern**

**Section – A: (10X1=10)**

Ten questions are to be given, testing K1. All questions are to be answered. Each question carries ten marks. Questions must be taken from all units.

**Section – B: (5X7=35)**

Either or pattern questions are to be given, testing K2 and K3. Five questions are to be answered. Each question carries seven marks. Questions must be taken in this order.

Q. No. – 11 (a or b) from Unit – I

Q. No. – 12 (a or b) from Unit – II

Q. No. – 13 (a or b) from Unit – III

Q. No. – 14 (a or b) from Unit – IV

Q. No. – 15 (a or b) from Unit – V

**Section – C: (3X10=30)**

Five questions are to be given, testing K4 and K5. Three questions are to be answered. Each question carries ten marks. Questions must be taken in this order.

Q. No. – 16 from Unit – I

Q. No. – 17 from Unit – II

Q. No. – 18 from Unit – III

Q. No. – 19 from Unit – IV

Q. No. – 20 from Unit – V

**B.Sc., Zoology /TANCHE prescribed syllabus/2023-2026**  
**Credit Distribution Credit Distribution for UG Programmes**

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part1. Language – Tamil	3	6	Part.1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX Evolutionary Biology	4	5	6.1 Core Course – CC XIII Biotechnology	3	6
Part.2 English	3	6	Part.2 English	3	6	Part.2 English	3	6	Part.2 English	3	6	5.2 Core Course – CC X Animal Physiology	4	5	6.2 Core Course – CC XIV Immunology	3	6
1.3 Core Course – CC I Invertebrata	5	5	2..3 Core Course – CC III Chordata	5	5	3.3 Core Course – CC V Cell Biology	4	4	4.3 Core Course – CC VII Developmental Biology	5	5	5.3.Core Course CC –XI Environmental Biology	4	5	6.3 Core Course – CC XV Project 6.4 Lab course XVI Biotechnology Lab Course	3	3
1.4 Core Course – CC Invertebrata Lab course	4	4	2.4 Core Course – CC IV Chordata Lab Course	4	4	3.4 Core Course – CC VI Genetics	4	4	4.4 Core Course – CC VIII Developmental Biology Lab Course	4	3	5. 4.Core Course CC XII Eco Physiology Lab Course	4	5	6.5 Elective XI Wild Life conservation and Management / Agricultural Entomology 6.6 Elective– XII Human Reproductive Biology / Basic course in Ornithology	3	4

[illegible]

**Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**  
**for all UG courses including Lab Hours**  
**First Year – Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses& Elective Courses [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		<b>23</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses& Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		<b>23</b>	<b>30</b>

**Second Year – Semester-III**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses& Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		<b>22</b>	<b>30</b>

**Semester-IV**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses& Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		<b>25</b>	<b>30</b>

**Third Year-Semester-V**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
<b>Part-3</b>	Core Courses including Project / Elective Based	22	26
<b>Part-4</b>	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
		<b>26</b>	<b>30</b>

**Semester-VI**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
<b>Part-3</b>	Core Courses including Project / Elective Based & LAB	18	28
<b>Part-4</b>	Extension Activity	1	-
	Professional Competency Skill	2	2
		<b>21</b>	<b>30</b>

**P.G DEPARTMENT OF ZOOLOGY**  
**BOS 2023-2026**  
**B.Sc., Zoology**  
**First Year**

<b>Semester-I</b>						
<b>Part</b>	<b>Course type and course code</b>	<b>Courses</b>	<b>Credit</b>	<b>No. of Hours</b>	<b>Marks</b>	
					<b>CIA</b>	<b>Ext</b>
Part-1	Language	Tamil	3	6	25	75
Part-2	English	English	3	6	25	75
Part-3	Core Course-I	Invertebrata	5	5	25	75
	Core Course-II	Lab I : Invertebrata Lab course	4	4	25	75
	Generic Elective -I	Allied Zoology I	2	3	25	75
	Generic Elective -II	Allied Zoology Lab course I	2	2	25	75
Part-4	Skill Enhancement Course SEC-1 (NME)	Food, Nutrition & Health	2	2	25	75
	Foundation Course	Foundation Course Fundamentals of Zoology	2	2	25	75
<b>Total</b>			<b>23</b>	<b>30</b>		

<b>Semester-II</b>						
<b>Part</b>	<b>Course type and course code</b>	<b>Courses</b>	<b>Credit</b>	<b>No. of Hours</b>	<b>Marks</b>	
					<b>CIA</b>	<b>Ext</b>
Part-1	Language	Tamil	3	6	25	75
Part-2	English	English	3	6	25	75
Part-3	Core Course-III	Chordata	5	5	25	75
	Core Course-IV	Lab II :Chordata Lab Course	4	4	25	75
	Generic Elective -III	Allied Zoology II	2	3	25	75
	Generic Elective -IV	Allied Zoology Lab Course II	2	2	25	75
Part-4	Skill Enhancement Course -SEC-2 (NME)	Radiation Biology	2	2	25	75
	Skill Enhancement Course -SEC-3	Ornamental Fish Farming and Management	2	2	25	75
<b>Total</b>			<b>23</b>	<b>30</b>		

Semester-III						
Part	Course type and course code	Courses	Credit	No. of Hours	Marks	
					CIA	Ext
Part-1	Language	Tamil	3	6	25	75
Part-2	English	English	3	6	25	75
Part-3	Core Course-V	Cell Biology	4	4	25	75
	Core Course-VI	Genetics	4	4	25	75
	Generic Elective -V	Allied Chemistry	2	3	25	75
	Generic Elective -VI	Allied Chemistry lab Course	2	2	25	75
Part-4	Skill Enhancement Course -SEC-4	Bio composting for Entrepreneurship	2	2	25	75
	Skill Enhancement Course -SEC-5	Medical Laboratory Techniques	2	2	25	75
		E.V.S	-	1		
<b>Total</b>			<b>22</b>	<b>30</b>		

### Second Year

Semester-IV						
Part	Course type and course code	Courses	Credit	No. of Hours	Marks	
					CI A	Ext
Part-1	Language	Tamil	3	6	25	75
Part-2	English	English	3	6	25	75
Part-3	Core Course-VII	Developmental Biology	5	5	25	75
	Core Course- VIII	Lab III: Developmental Biology lab Course	4	3	25	75
	Generic Elective -VII	Allied Chemistry	2	3	25	75
	Generic Elective -VIII	Allied Chemistry Lab Course	2	2	25	75
Part-4	Skill Enhancement Course -SEC-6	Biophysics and Biostatistics	2	2	25	75
	Skill Enhancement Course -SEC-7	Economic Zoology	2	2	25	75
		E.V.S	2	1	25	75
<b>Total</b>			<b>25</b>	<b>30</b>		



### Third Year

Semester-V						
Part	Course type and course code	Courses	Credit	No. of Hours	Marks	
					CIA	Ext
Part-3	Core Course-IX	Evolutionary Biology	4	5	25	75
	Core Course-X	Animal Physiology	4	5	25	75
	Core Course-XI	Environmental Biology	4	5	25	75
	Core Lab Course-XII	Lab IV: Eco Physiology Lab course	4	5	25	75
	Generic Elective - IX	Elective : Animal Behaviour / Aquarium keeping	3	4	25	75
	Generic Elective -X	Elective :Nano biology/ Basics of Marine Biology	3	4	25	75
Part-4	Value Education	Value Education	2	2	25	75
	Summer Internship	Industrial Visit / Field Visit	2	-	100	
<b>Total</b>			<b>26</b>	<b>30</b>		

Semester-VI						
Part	Course type and course code	Courses	Credit	No. of Hours	Marks	
					CIA	EXT
Part-3	Core Course-XIII	Biotechnology	3	6	25	75
	Core Course-XIV	Immunology	3	6	25	75
	Core Course-XV	Project	3	5	25	75
	Core lab Course-XVI	Lab VI :Biotechnology Lab course	3	3	25	75
	Generic Elective –XI	Elective : Wildlife conservation and Management / Agricultural Entomology	3	4	25	75
	Generic Elective - XII	Elective: Human Reproductive Biology / Basic Course in Ornithology	3	4	25	75
Part-4		Extension Activity	1	-	100	
		Professional Competency Skill	2	2	25	75
			<b>21</b>	<b>30</b>		

**Total Credits –140**

## SEMESTER – I

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS	5Hrs/Week	SEMESTER	I
CREDITS	5	COURSE TITLE	CORE I : INVERTEBRATA
<b>Learning Objectives</b>			
LO1	Discuss the basic principles of taxonomy, nomenclature, levels of structural Organization, Locomotion, spicules in poriferans and canal system in sponges.		
LO2	Acquire clear knowledge on corals, coral reefs, polymorphism and parasitic Adaptations of helminthes.		
LO3	Discuss the common helminthes parasites of human and domestic animals and economic importance of earthworm.		
LO4	Understand the larval forms of crustaceans, insect metamorphosis and control of pest.		
LO5	Describe the oyster culture, pearl culture and water vascular system.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Principles of Taxonomy</b> – Binomial Nomenclature Classification of Animal Kingdom. Levels of organization: Grades of organization, symmetry and coelom. <b>Protozoa:</b> General characters and classification up to class with an example. Type study - Paramecium. Locomotion and Nutrition in Protozoa. <b>Porifera:</b> General characters and classification up to classes with an example. Type study - Leucosolenia. Canal system in sponges	12	CO1
II	<b>Coelenterata:</b> General characters and classification up to class with an example. Type study - Obelia. Corals, Coral reefs and their significance. Polymorphism in coelenterates. <b>Platyhelminthes:</b> General characters and classification up to class with an example. Type study - Liver fluke. Parasitic adaptations in Platyhelminthes.	12	CO2
III	<b>Aschelminthes:</b> General characters and classification up to class with an example. Type study - Ascaris. Parasitic adaptations of Helminthes. <b>Annelida:</b> General characters and classification up to class with an example. Type study - Earthworm. Metamerism. Economic importance of earthworm.	12	CO3

IV	<b>Arthropoda:</b> General characters and classification up to class with an example. Type study - Prawn. Larval forms of crustaceans and their significance. Beneficial insects. Mouthparts of insects. Metamorphosis of insect. Pests and pest control. Vectors of Arthropods.	12	CO4
V	<b>Mollusca:</b> General characters and classification up to class with an example. Type study - Pila. Oyster culture and Pearl industry in India. Adaptations in foot in mollusc. <b>Echinodermata:</b> General characters and classification up to class with an example. Type study - Star fish. Larval forms of Echinoderms. Water vascular system in Echinoderms.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Recall the characteristic features invertebrates and chordates.	Knowledge(LevelK1)	
<b>CO2</b>	Classify invertebrates up to class level and chordates up to order level	Comprehension(LevelK2)	
<b>CO3</b>	Explain and discuss the structural and functional organisation of some invertebrates and chordates	Analysis(LevelK3)	
<b>CO4</b>	Relate the adaptations and habits of animals to their habitat	Synthesis(LevelK6)	
<b>CO5</b>	Analyse the taxonomic position of animals.	Synthesis(LevelK6)	
<b>Text Books</b>			
1.	Nair, N.C., Leelavathy, S., Soundara Pandian, N., Murugan, T. & Arumugam, N. (2012). A Textbook of Invertebrates. Saras Publication, Nagercoil.		
2.	Jordan, E.L. & Verma, P.S. (2010). Invertebrate Zoology. S. Chand & Co. Ltd. NewDelhi.		
3.	Kotpal, R.L. (2004). Modern Textbook of Zoology- Invertebrates (9th ed.). RastogiPublications, Meerut.		
4.	Ayyar, E.K. & Ananthakrishnan, T.N. (1992). Manual of Zoology, Vol. I (Invertebrata),Part I & II. S. Viswanathan Printers and Publishers Pvt. Ltd. Madras.		
5.	Dhami, P.S. & Dhami, J.K. (1979). Invertebrate Zoology. Ram Nagar, S. Chand & CoLtd., New Delhi.		

<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
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
<b>Web Resources</b>	
1.	<a href="https://nbb.gov.in/">https://nbb.gov.in/</a>
2.	<a href="http://www.agshoney.com/training.htm">http://www.agshoney.com/training.htm</a>
3.	<a href="https://icar.org.in/">https://icar.org.in/</a>
4.	<a href="http://www.csrtimys.res.in/">http://www.csrtimys.res.in/</a>
5.	<a href="http://csb.gov.in/">http://csb.gov.in/</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	2	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	2	3	3	3	3
<b>Weightage</b>	14	15	15	14	15
<b>Weighted % of Course Contribution to POs</b>	2.8	3.0	3.0	2.8	3.0

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS	4 Hrs/Week	SEMESTER	I
CREDITS	4	COURSE TITLE	CORE – II INVERTEBRATA LAB COURSE
<b>Learning Objectives</b>			
LO1	To identify the different groups of invertebrate animals by observing their external characteristics.		
LO2	To understand the organs, organ system and their functions in lower animals.		
LO3	To get knowledge about the different modes of life and their adaptation based on the environment.		
LO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.		
UNIT	Details	No. of Hrs	Course Outcomes
I	<b>Major Dissection:</b> Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Earthworm: Nervous System, Reproductive system. Pila globosa: Nervous system. Prawn: Nervous system (including Appendages).	12	CO1
II	<b>Minor Dissection:</b> Cockroach: Digestive system. Earthworm: Viscera, Pila globosa: Digestive system (Including radula).	12	CO2
III	<b>Mounting:</b> Earthworm: Body setae; Pineal setae. Pila globosa: Radula. Freshwater muscle: Pedal ganglia.	12	CO3
IV	<b>Mounting:</b> Cockroach: Salivary apparatus, Mouth parts – Honey Bee, House fly and Mosquito mouth parts.	12	CO4
V	<b>Spotters: Protozoa:</b> Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax <b>Porifera:</b> Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule. <b>Coelenterata:</b> Obelia – Colony & Medusa,Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula. <b>Platyhelminthes:</b> Planaria, Fasciola hepatica, Fasciola larval forms –Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium. <b>Nemathelminthes:</b> Ascaris (Male &Female), Drancunculus, Ancylostoma, Wuchereria. Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria,	12	CO5

	Trochophorelarva. <b>Arthropoda:</b> Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male female Anopheles and Culex, Mouthparts of Housefly and Butterfly. <b>Mollusca:</b> Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva <b>Echinodermata:</b> Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva.		
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Identify and label the external features of different groups of invertebrate animals.	Knowledge(LevelK1)	
<b>CO2</b>	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.	Comprehension(LevelK2)	
<b>CO3</b>	Differentiate and compare the structure, function and mode of life of various groups of animals.	Application(LevelK3)	
<b>CO4</b>	To compare and distinguish the dissected internal organs of lower animals.	Analysis(LevelK4)	
<b>CO5</b>	Prepare and develop the mounting procedure of economically important invertebrates.	Application (Level K3)	
<b>Text Books</b>			
1.	Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol. I (Part 1, 2) S. Viswanathan, Chennai		
2.	Ganguly, Sinhaan d A dhikari, 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.		
<b>Reference Books</b>			
1.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). <i>The Invertebrates: A New Synthesis</i> , III Edition, Blackwell Science.		
2.	Barnes, R.D. (1982). <i>Invertebrate Zoology</i> , V Edition. Holt Saunders International Edition.		
3.	Barrington, E.J.W. (1979). <i>Invertebrate Structure and Functions</i> . II Edition, E.L.B.S. and Nelson		
4.	Boradale, L.A. and Potts, E.A. (1961). <i>Invertebrates: A Manual for the use of Students</i> . Asia Publishing Home.		
5.	Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut		

Web Resources	
1.	<a href="https://nbb.gov.in/">https://nbb.gov.in/</a>
2.	<a href="http://www.agshoney.com/training.htm">http://www.agshoney.com/training.htm</a>
3.	<a href="https://icar.org.in/">https://icar.org.in/</a>
4.	<a href="http://www.csrtimys.res.in/">http://www.csrtimys.res.in/</a>
5.	<a href="http://csb.gov.in/">http://csb.gov.in/</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO 10
<b>CO 1</b>	S	S	S	M	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

S-Strong (3)

M-Medium (2)

L-Low (1)

#### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	2	3
<b>CO2</b>	2	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	14	15	15	14	15
<b>Weighted % of Course Contribution to POs</b>	2.8	3.0	3.0	2.8	3



(P.G Department of Zoology TANSCHHE syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>3Hrs/Week</b>	<b>SEMESTER</b>	<b>I</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>ALLIED ZOOLOGY I</b>
<b>Learning Objectives</b>			
LO1	To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterate, Helminthes and Annelid		
LO2	To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata		
LO3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia		
LO4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia		
LO5	To acquire detailed knowledge of select invertebrate and chordate forms		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Diversity of Invertebrates–I</b> Principles of taxonomy. Criteria for classification– Symmetry and Coelom–Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelid up to classes with two examples.	6	CO1
II	<b>Diversity of Invertebrates–II</b> Classification of Arthropoda, Mollusca and Echinodermata up to class level with examples.	6	CO2
III	<b>Diversity of Chordates–I</b> Classification of Prochordata, Pisces and Amphibia up to orders giving two examples.	6	CO3
IV	<b>Diversity of Chordates–II</b> Classification of Reptilia, Aves and Mammalia up to orders giving two examples.	6	CO4

V	<b>Animal organisation Structure and organization of</b> (i) Earthworm (ii)Rabbit (iii) Fish	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Recall the characteristic features invertebrates and chordates.	Knowledge(LevelK1)	
<b>CO2</b>	Classify invertebrates up to class level and chordates up to order level	Comprehension(LevelK2)	
<b>CO3</b>	Explain and discuss the structural and functional organisation of some invertebrates and chordates	Comprehension(LevelK2)	
<b>CO4</b>	Relate the adaptations and habits of animals to their habitat	Comprehension(LevelK2)	
<b>CO5</b>	Analyse the taxonomic position of animals.	Comprehension(LevelK2)	
<b>Text Books</b>			
1.	Ekambaranatha Iyer, - Outlines of Zoology Viswanathan Publication		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Ekambaranatha Iyar and T.N. Anantha Krishnan, -A Manual of ZoologyInvertebrata–Vol II: Viswanathan Publishers.		
2.	Ekambaranatha Iyar and T.N. Anantha Krishnan, -A Manual of Zoology: Chordata Viswanathan Publishers.		
3.	Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.		
<b>Web Resources</b>			
1.	<a href="http://www.sanctuaryasia.com">www.sanctuaryasia.com</a>		
2.	<a href="http://www.iaszoology.com">www.iaszoology.com</a>		

<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	M	S	S	S	M	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	M	M	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	S
<b>CO 5</b>	S	S	S	S	M	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

#### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	2	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	14	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	2.8	3.0	3.0	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>I</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>ALLIED ZOOLOGY LAB COURSE</b>
<b>Learning Objectives</b>			
LO1	To understand the structure and label the various parts of the dissected organisms and to sketch the required system using virtual dissections, charts and web resources.		
LO2	To compare and discuss the difference in the mouth parts of cockroach and mosquitoes by mounting and drawing		
LO3	To identify and understand the different invertebrate and chordate forms and classify them using lab manuals		
LO4	To identify and discuss the significance of pigeon feather.		
LO5	Field trip helps students to understand and apply the theoretical knowledge. To plan the area of research. Campus fauna enables them to understand, identify and classify the various fauna surrounding them		

<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>DISSECTION</b> 1. Cockroach - digestive system 2. Cockroach - nervous system 3. Prawn - nervous system 4. Fish -digestive system	6	CO1
II	<b>MOUNTING</b> 1. Mouth parts- Cockroach 2.Mouth parts - Mosquito 3.Scales -Placoid, Cycloid and Ctenoid 4.Prawn appendages	6	CO2

III	<b>SPOTTERS</b> Amoeba, Entamoeba, Paramecium, Plasmodium, Scypha, Leucosolenia, Sycon sponge, Spicule, Gemmules, Obelia, Physalia, Velella, Corals. Fasciola hepatica, Taenia solium,— entire, Ascaris male and female. Earthworm, Nereis, Prawn, Hirudinaria, Scorpion, Peripatus, Pila, Sepia, Octopus, Nautilus, Asterias, Ophiophrix, Echinus	6	CO3
IV	Amphioxus, Ascidian, Balanoglossus, Shark, Frog, Calotes, Naja naja, Krait, Pigeon, Pigeon feather, Rabbit, Bat.	6	CO4
V	Field visit – Study of fauna in the campus	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Compare and distinguish the dissected internal organs of lower and higher animals.	Knowledge(LevelK1)	
<b>CO2</b>	Prepare and develop the mounting procedure of important invertebrate and chordate anatomical parts and to appreciate the structure, function and mode of life.	Application(LevelK3)	
<b>CO3</b>	Identify and label the external features of different groups of invertebrate animals	Synthesis(LevelK6)	
<b>CO4</b>	Identify and label the external features of different groups of chordate animals	Synthesis(LevelK6)	
<b>CO5</b>	Understand and apply the theoretical knowledge. To plan the area of research and to identify different groups of invertebrate and chordate animals.	Evaluation(LevelK5)	

<b>Text Books</b>	
1.	Ekambaranatha Iyer, - Outlines of Zoology Viswanathan Publication
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Ekambaranatha Iyar and T.N. Anantha Krishnan, - A Manual of Zoology Invertebrata – Vol II: Viswanathan Publishers.
2.	Ekambaranatha Iyar and T.N. Anantha Krishnan, -A Manual of Zoology: Chordata Viswanathan Publishers.
3.	Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.
<b>Web Resources</b>	
1.	<a href="http://www.sanctuaryasia.com">www.sanctuaryasia.com</a>
2.	<a href="http://www.iaszoology.com">www.iaszoology.com</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	M	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	M	S
CO 3	S	S	S	S	S	S	S	S	S	M
CO 4	S	S	S	S	S	M	S	M	M	S
CO 5	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	2	3
CO5	3	3	3	3	3
Weightage	14	15	15	14	15
Weighted % of Course Contribution to Pos	2.8	3.0	3.0	2.8	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>I</b>

CREDITS	2	COURSE TITLE	SEC I (NME)- FOOD, NUTRITION AND HEALTH	
Learning Objectives				
LO1	The course covers the basic concepts of balanced diet for people of different ages			
LO2	Focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.			
UNIT	Details		No. of Hrs	Course Outcomes
I	Nutrition and dietary nutrients: Basic concepts of Food: Components and nutrients. Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people.		6	CO1
II	Macro nutrients and micronutrients: Macronutrients. Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Micronutrients. Vitamins- Water-soluble and Fatsoluble vitamins- their sources and importance. Important minerals viz., Iron, Calcium, Phosphorus.		6	CO2
III	Malnutrition and nutrient deficiency diseases: Definition and concept of health: Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency (Anemia) and Iodine deficiency (Thyroid) their symptoms, treatment, prevention and government initiatives.		6	CO3



IV	<b>Life style dependent diseases:</b> hypertension, diabetes mellitus, and obesity their causes and prevention. Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention.	6	CO4
V	<b>Diseases caused by microorganisms:</b> Food hygiene: Potable water- sources and methods of purification at domestic level. Food and Water-borne infections: Bacterial diseases: cholera, typhoid fever - viral diseases: Hepatitis, Poliomyelitis - Protozoan diseases: amoebiasis, giardiasis - Parasitic diseases: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. Causes of food spoilage and its prevention.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand the role of food and nutrients in health and disease.	Knowledge(LevelK1)	
<b>CO2</b>	Gain knowledge about hygiene, food safety, disease transmission.	Comprehension(LevelK2)	
<b>CO3</b>	Perform food system management and leadership functions that consider sustainability in business, healthcare, community and institutional areas.	Application(LevelK3)	
<b>Text Books</b>			
1.	Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.		
2.	Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; New Age International Publishers.		
2.	Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.		

3.	Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing.
4.	Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.

#### Web Resources

1.	<a href="https://ncert.nic.in/textbook/pdf/kehe103.pdf">https://ncert.nic.in/textbook/pdf/kehe103.pdf</a>
2.	<a href="https://health.gov/our-work/nutrition-physical-activity/dietary-guidelines">https://health.gov/our-work/nutrition-physical-activity/dietary-guidelines</a>
3.	<a href="https://www.preservearticles.com/notes/short-notes-on-food-nutrition-healthnutrients/5104">https://www.preservearticles.com/notes/short-notes-on-food-nutrition-healthnutrients/5104</a>

#### Methods of Assessment

<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	M	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	M	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	M	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

#### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	2	3
<b>Weightage</b>	9	9	9	8	9
<b>Weighted % of Course Contribution to Pos</b>	3.0	3.0	3.0	2.7	3

<b>PROGRAMMECODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSECODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2Hrs/Week</b>	<b>SEMESTER</b>	<b>I</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>FOUNDATION COURSE- FOUNDAMENTALS OF ZOOLOGY</b>
<b>Learning Objectives</b>			

LO1	The course covers the basic concepts of balanced diet for people of different ages		
LO2	Focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Definition of Life, Characteristics of Living organisms, Difference between plants and animals. Definition – Taxonomy, Animal kingdom, System of classification, Binomial nomenclature	6	CO1
II	Biochemistry: Biomolecules, Properties of water, pH - acids and Bases, Definition – isomerisation and Anomers. Carbohydrates - Biological properties, Protein - Biological properties. Physiology : Introduction to biological systems (respiratory system, digestive system)	6	CO2
III	Cell Biology: Definition, cells, Prokaryotic vs Eukaryotic cells, Ultra structure of a cell. Cell organelles in brief - Plasma membrane, Endoplasmic reticulum, Mitochondria, Ribosome, Golgi apparatus, Nucleus. Nucleic Acids – Nitrogenous Bases (Purines and Pyrimidines), Nucleotides and Nucleosides.	6	CO3

IV	Developmental Biology: Definition – Sperm and Egg, Gametogenesis, Fertilization, Types of Cleavage – Holoblastic and Meroblastic, Blastulation, Gastrulation, Ectoderm, Endoderm, Mesoderm. Ecology: Definition, Environment, Ecosystem, Biotic and Abiotic Components, Food chain, Food web, Ecological Pyramid, Populations, communities, Over view of Environmental Pollution.	6	CO4
V	Immunology: Immunity, Definition, Types of Immunity - Innate and Acquired, Antigen- Antibody, Types of Immune responses - primary and secondary, Immunization.	6	CO5
<b>Total</b>		<b>30</b>	

<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	To understand how these cellular components are used to generate and utilize energy in cells.	Knowledge(LevelK1)
<b>CO2</b>	To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.	Comprehension(LevelK2)
<b>CO3</b>	Classify and explain types of immunity, state the significance of antigen and examine their relevance to immunizations.	Comprehension(LevelK2)
<b>CO4</b>	To enable students to learn basic concepts relating to aspects of respiratory and circulatory	Comprehension(LevelK2)
<b>CO5</b>	To understand and recall the basic structure, origin and development of cell organelles.	Knowledge(LevelK1)
<b>Text Books</b>		
1.	Nair, N.C., Leelavathy, S., Soundara Pandian, N., Murugan, T; Arumugam, N. (2012). A Textbook of Invertebrates. Saras Publication, Nagercoil.	
2.	Dr. N. Arumugam <i>et al.</i> , (2013)–Textbook of Immunology, Saras Publication	
3.	Dr.N.Arumugam,(2013),DevelopmentalZoology,SarasPublication,Nagercoil.	

<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
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.	Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn., (paperback) W.W. Norton & Company p.864
<b>Web Resources</b>	
1.	<a href="https://www.noor-book.com/en/ebook">https://www.noor-book.com/en/ebook</a>
2.	<a href="https://ycmou.ac.in/ebooks">https://ycmou.ac.in/ebooks</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	M	S	S	S	S	S	S
CO 3	S	M	S	S	S	M	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

**Mapping with Programme Specific Outcomes**

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	2	3
<b>CO3</b>	3	2	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	14	15	14	15
<b>Weighted % of Course Contribution to POs</b>	3.0	2.8	3.0	2.8	3

## SEMESTER – II

PROGRAMME CODE			PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE			BATCH	2023-2026	
HOURS		5Hrs/Week	SEMESTER	II	
CREDITS		5	COURSE TITLE	CORE -III CHORDATA	
Learning Objectives					
LO1	To understand the structures and distinct features of Phylum Chordata.				
LO2	To understand and able to distinguish the characteristic features of each Subphylum and class.				
LO3	To understand the economic importance of vertebrates				
LO4	To know about the adaptations of vertebrates				
LO5	To understand the evolutionary position of different groups of vertebrates				
UNIT	Details			No. of Hrs	Course Outcomes
I	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).			12	CO1
II	Prochordates and Agnatha: Characteristics of sub phylum Vertebrata, Classification of Vertebrata up to Class level, Agnatha(Petromyzon), - Pisces (Scoliodon sorrakowah) 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.			12	CO2
III	Amphibia:General characters and classification - Origin			12	CO3

	of Amphibia -Type study - Rana hexadactyla –External morphology, Sexual dimorphism, Respiratory system, Sound producing Organ and Circulatory system only. Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in Amphibia.		
IV	<b>Reptilia:</b> General characters and classification – Type study – Calotes versicolor - External morphology, Digestive system, Reproductive system, Endoskeleton- Fore limb and Hind limb. Golden age of Reptiles. Snakes of India. Poison apparatus and biting mechanism of poisonous Snakes.	12	CO4
V	<b>Aves and Mammalia:</b> Aves: General characters and classification –Type study - Columba livia - External morphology, Exoskeleton, Respiratory system, Flight muscles and Sense Organs. Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study- Rabbit –External morphology, Digestive system, Reproductive system, Endoskeleton Pectoral and Pelvic Girdle. Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To understand how these cellular components are used to generate and utilize energy in cells.	Knowledge(LevelK1)	
<b>CO2</b>	To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.	Comprehension(LevelK2)	
<b>CO3</b>	Classify and explain types of immunity, state the significance of antigen and examine their relevance to immunizations.	Application(LevelK3)	
<b>CO4</b>	To enable students to learn basic concepts relating to aspect of Respiratory and circulatory system.	Analysis(LevelK4)	
<b>CO5</b>	To understand and recall the basic structure, origin and development of cell organelles.	Evaluation(LevelK5)	



<b>Text Books</b>	
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
<b>Reference Books</b> (Latest editions, and the style as given below must be strictly adhered to)	
1.	Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
2.	Hall B.K. and Hallgrimsson B. (2008). Strick berger'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.
<b>Web Resources</b>	
1.	<a href="http://tolweb.org/Chordata/2499">http://tolweb.org/Chordata/2499</a>
2.	<a href="https://www.nhm.ac.uk/">https://www.nhm.ac.uk/</a>
3.	<a href="https://bit.ly/3Av1Ejg">https://bit.ly/3Av1Ejg</a>
4.	<a href="https://bit.ly/3kqTfYz">https://bit.ly/3kqTfYz</a>
5.	<a href="https://www.vedantu.com/biology/mammalia">https://www.vedantu.com/biology/mammalia</a>

<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	M	S
<b>CO 3</b>	S	M	S	S	S	S	S	M	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	M
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	3	3	3
<b>CO3</b>	3	2	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	14	14	15	15	15
<b>Weighted % of Course Contribution to POs</b>	2.8	2.8	3.0	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>II</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>CORE – IV CHORDATA LAB COURSE</b>
<b>Learning Objectives</b>			
LO1	To understand the structures and distinct features of phylum Chordata.		
LO2	To understand and able to distinguish the characteristic features of each subphylum and class.		
LO3	To understand and compare the structure of various internal organs in different classes of vertebrates.		
LO4	To know about the classification, adaptations and affinities of chordate animals.		
	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Objectives</b>
I	<b>Dissections:</b> Frog (Demo)/Fish: External features, Digestive system, Arterial system, Venous system, Male and female urinogenital system.	12	CO1
II	<b>Mounting:</b> Fish: Placoid and Ctenoid scales, Frog: Hyoid apparatus and Brain (Demo).	12	CO2
III	<b>Osteology:</b> Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hind limb. Pigeon - skull and lower jaw, synsacrum.	12	CO3
IV	<b>Specimen and Slides:(i) Hemichordata:</b> Balanoglossus, Tornaria larva <b>(ii) Protochordata:</b> Amphioxus <b>(iii) Cyclostomata:</b> Petromyzon, Myxine, Ammocoetus larva <b>(iv) Pisces:</b> Sphyrna Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Anguilla and Protopterus <b>(v).</b> <b>Amphibia:</b> Ichthyophis, Amblystoma, Siren, Hyla, Rachophous, Bufo, Rana, Axolotal larva <b>(vi) Reptilia:</b> Draco, Chamaeleon, Gecko, Uromastix, Vipera russelli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas.	12	CO4

	(vii). <b>Aves:</b> Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume, down (viii) <b>Mammalia:</b> Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog		
V	Embryology: Stages in the development of Amphioxus, Frog and Chick.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Identify and recall the name and distinct external and internal features of animals belonging to phylum Chordata.	Knowledge(LevelK1)	
<b>CO2</b>	Explain the structural organization of various organs and systems in different classes of vertebrates.	Comprehension(LevelK2)	
<b>CO3</b>	Analyse, compare and distinguish the morphological features and developmental stages of chordates	Application(LevelK3)	
<b>CO4</b>	Dissect and explain various organs and internal systems in different vertebrates and correlate its function.	Analysis(LevelK4)	
<b>CO5</b>	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.	Evaluation(LevelK5)	

<b>Text Books</b>	
1.	Lal S,2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.
2.	Verma P.S, 2000. A Manual of Practical Zoology: Chordates, S. Chand Limited, 627pp.
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Robert William Hegner,2015. Practical Zoology, Biblio Life, 522pp.
2.	Young, J, Z., 1972. The life of vertebrates. Oxford Uni. London.
3.	Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan &Co., New York, 587 pp.
<b>Web Resources</b>	
1.	<a href="https://www.youtube.com/watch?v=b04hc_kOY10">https://www.youtube.com/watch?v=b04hc_kOY10</a>
2.	<a href="https://bit.ly/3CzTEy8">https://bit.ly/3CzTEy8</a>
3.	<a href="http://tolweb.org/Chordata/2499">http://tolweb.org/Chordata/2499</a>
4.	<a href="https://www.nhm.ac.uk/">https://www.nhm.ac.uk/</a>
5.	<a href="https://bit.ly/3Av1Ejg">https://bit.ly/3Av1Ejg</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	S	S	M	S	S	S	S	M
<b>CO 3</b>	S	M	S	S	S	S	S	M	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	S	M	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	2
<b>CO3</b>	3	2	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	14	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	2.8	3.0	3.0	3

<b>PROGRAMMECODE</b>		<b>PROGRAMME</b>	<b>B.Sc. ,ZOOLOGY</b>
<b>COURSECODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>3Hrs/Week</b>	<b>SEMESTER</b>	<b>II</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>ALLIED ZOOLOGY II</b>
<b>Learning Objectives</b>			
LO1	To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology.		
LO2	To enable students to comprehend the processes involved during development		
LO3	To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule		
LO4	To enable students to comprehend the basic concepts of human genetics and patterns of inheritance		
LO5	To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Outcome</b>
I	Respiration- Respiratory pigments and transport of gases.	6	CO1
	Mechanism of blood clotting. Types of excretory products–Ornithine cycle. Structure of neuron – Conduction of nerve impulse, Mechanism of vision and hearing.		
II	Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals	6	CO2
III	Immunity Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs–responses in humans; Vaccination schedule.	6	CO3
IV	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.	6	CO4

V	Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour	Application(LevelK3)	
<b>CO2</b>	Analyse the different developmental stages	Analysis(LevelK4)	
<b>CO3</b>	Analyse the working of body and immune systems	Evaluation(LevelK5)	
<b>CO4</b>	Analyse the different patterns of inheritance	Evaluation(LevelK5)	
<b>CO5</b>	Relate the behaviour of animals to physiology. Analyse the different types of behaviour	Analysis(LevelK4)	
<b>Text Books</b>			
1.	Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.		
2.	Verma, P.S. and V. K. Agarwal, 1995. Genetics, 8th Edition, S. Chand & co., New Delhi - 110 055, 567 pp.		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
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.		
<b>Web Resources</b>			
1.	<a href="https://www.youtube.com/watch?v=b04hc_kOY10">https://www.youtube.com/watch?v=b04hc_kOY10</a>		
2.	<a href="https://bit.ly/3CzTEy8">https://bit.ly/3CzTEy8</a>		
3.	<a href="https://www.nhm.ac.uk/">https://www.nhm.ac.uk/</a>		



<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	M	S	S
<b>CO 2</b>	M	S	M	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	S	M	S	S	S
<b>CO 5</b>	S	S	S	M,	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	2
<b>Weightage</b>	15	15	15	15	14
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	2.8

<b>PROGRAMME CODE</b>	<b>UGZOOA</b>	<b>PROGRAMME</b>		<b>B.Sc. ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>		<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>		<b>I &amp; II</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>		<b>ALLIED LAB COURSE II</b>
<b>Learning Objective</b>				
<b>LO1</b>	To understand the experimental concepts of Genetics, Cell biology, Animal physiology & Immunology.			
<b>LO2</b>	To learn the procedure for the Frog blastoderm			
<b>LO3</b>	To study the complex & diverse approaches of Animal Behaviour.			
<b>Details</b>			<b>HRS</b>	<b>COURSE OUTCOME</b>
<b>Unit I</b> <ul style="list-style-type: none"> <li>• Detection of Protein, Lipid and Carbohydrate.</li> <li>• Qualitative Detection of Excretory Products: Ammonia, Urea and Uric Acid.</li> <li>• Estimation of haemoglobin Sahlis method.</li> </ul>			<b>12</b>	CO4
<b>Unit II</b> Observation and studies of prepared micro slide: Frog <ul style="list-style-type: none"> <li>○ Two cell stage</li> <li>○ Four cell stage</li> <li>○ Blastula</li> <li>○ Gastrula</li> </ul>			<b>12</b>	CO3
<b>Unit III</b> <ul style="list-style-type: none"> <li>• ABO Blood grouping in Man.</li> <li>• Rh Blood grouping</li> <li>• Blood smear Preparation.</li> <li>• Structure of Immunoglobulins</li> <li>• Separation of Lymphocytes.</li> </ul>			<b>12</b>	CO2

<b>Unit IV</b>		<b>12</b>	<b>CO1</b>
<ul style="list-style-type: none"><li>• Observation of simple Mendelian Traits</li><li>• Sex Linked inheritance in Man: Colour blindness and haemophilia.</li><li>• Syndromes: Down’s Syndrome, Klinefelter’s Syndrome, Turner’s Syndrome</li></ul>			
<b>Unit V</b>		<b>12</b>	<b>CO2</b>
<ul style="list-style-type: none"><li>• Construction of Nest in Amphibia – Mud Nests, Foam Nests, Gelatinous Bags</li><li>• Construction of Nest in Fishes – Bubble Nest, Weed Nest, Pit Nest.</li><li>• Earthworm behaviors: Investigating Hydrotaxis, Chemotaxis and Phototaxis.</li></ul>			
Total		<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To enhance the knowledge on basic of various physiological systems in relation to their structures.	Knowledge(LevelK1)	
<b>CO2</b>	Identification of developmental stages of Frog.	Comprehension(LevelK2)	
<b>CO3</b>	To understand the Mendelian Laws through Experiments	Application(LevelK3)	
<b>CO4</b>	To apply the concepts of behavioural patterns in studying the behavior of animals.	Analysis(LevelK4)	
<b>Text Books</b>			
1.	Animal Physiology-P.SVerma, B.STyagi, V.K.Agarwal, Iiedt,1978, S.Chand & Company Ltd. Ram Nagar, New Delhi – 110 055.		
2	Practical Immunology 4 <sup>th</sup> Edition Frank .C, Hay. 2002		
3	Biological basis of Behavior: A Program by Frank Joseph Mc Guigan.		
4.	Verma PS and Agarwal VK.(2010).Genetics,S. Chand Publishers, NewDelhi.		
5.	Dr. N. Arumugam <i>et al.</i> ,(2013)–Textbook of Immunology, Saras Publication		
6.	Dr.N.Arumugam,(2013),DevelopmentalZoology,SarasPublication,Nagercoil.		

<b>Reference Books</b> (Latest editions, and the style as given below must be strictly adhered to)	
1.	Bhatnagar SM, Kothari Lopa ML. (1999). Essentials of Human Genetics, 4 th edition- (Reprint 2004) – Orient Longman (P) Ltd., India.
2.	Kuby1.,(992),Immunology, IVEd.,-W.H. Freeman and company.
3.	P.S.VermaandAgarwal,(1975),ChordateEmbryology,XEd.,S.Chand&CompanyPvtLtd.Ramnager, New Delhi.
<b>Web Resources</b>	
1.	<a href="https://www.google.c/url-pal-textbook-of-practical-physiology&amp;psig">https://www.google.c/url-pal-textbook-of-practical-physiology&amp;psig</a>
2.	<a href="https://www.urmc.rochester.edu">https://www.urmc.rochester.edu</a> -Lab-Manual
3.	<a href="https://www.">https://www.</a> -Animal-behaviour-Sixth-Form-
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	M	S	M	S	S
<b>CO 2</b>	M	S	S	M	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	M	S	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	2	3	3	3
Weightage	12	11	12	12	12
Weighted % of Course Contribution to POs	3.0	2.7	3.0	3.0	3

<b>PROGRAMMECODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSECODE</b>		<b>BATCH</b>	<b>2023 - 2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>II</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC II (NME)- RADIATION BIOLOGY</b>
<b>Learning Objectives</b>			
LO1	The course covers basic knowledge on different types of radiation, both in.		
LO2	Biological effects of radiation and risks on cellular level to humans.		
LO3	A deeper knowledge on radiation protection for ionizing and non-ionizing radiation.		
LO4	A deeper knowledge legislation and practical radiation protection technology.		
<b>UNIT</b>		<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Scope of Radiation Biology – Sources of Natural Radiation: Terrestrial and cosmic sources - Man made radiations - Medical (occupational and diagnostic). Types of radiation – Ionizing and non-ionizing radiation.	6	CO1
II	Properties of Radiation – Radiation Units (Becquerel, RAD, Gray & Curie, Sievert). Measurement of Radiation in the Environment - Alpha and Beta counters and Scintillometer.	6	CO2
III	Biological effects of Radiation - Cellular level – Organ and system level – Genetic effects (chromosomal aberrations) – Radiation sickness – Syndromes – Cancer induction.	6	CO3
IV	Radiation safety measures - Safety standards disposal of radioactive waste management. Nuclear reactors – Nuclear energy programme in India. Regulatory authorities– AERB, BARC, DAE, IAEA & ICRP.	6	CO4

V	Applications of Radioisotopes in biology- Auto radiography, Agriculture -insect, pest and disease management- Sterile Insect Technology (SIT); Medicine - (Therapy & diagnosis).	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To describe the various types of ionizing radiation.	Knowledge(LevelK1)	
<b>CO2</b>	To define the radiation units used in measurement/calculations of “dose”.	Comprehension(LevelK2)	
<b>CO3</b>	To describe the biological impact of radiation on living cells and tissues	Application(LevelK3)	
<b>CO4</b>	To highlight the applications of radiation in different fields	Analysis(LevelK4)	
<b>CO5</b>	To create awareness about safety precautions when using radioactive isotopes	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Sharma, B.K., (1990) Environmental Chemistry, Goel Publishing House, Meerut.		
2.	Rao, B.M. (2002), Radioactive Materials, Himalayas publishing House.		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Sood, D.D. Reddy, A.V.R. and Ramamoorthy, N. (2000) Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, Radiochemistry Division, Mumbai.		
2.	Radiation Biology: A Handbook for Teachers and Students International Atomic Agency (IAEA), 2010 - Training Course Series42.		
3.	Kiefer, J. (1990) Biological Radiation Effects, Springer-verlag.		
<b>Web Resources</b>			
1.	<a href="https://www.utoledo.edu/med/depts">https://www.utoledo.edu/med/depts</a>		
2.	<a href="https://www-pub.iaea.org/mtcd">https://www-pub.iaea.org/mtcd</a>		
3.	<a href="https://www.ncbi.nlm.nih.gov/pmc/">https://www.ncbi.nlm.nih.gov/pmc/</a>		

<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	M	S	S	M	S	S	M	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	M	M	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3



<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>II</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC III – ORNAMENTAL FISH FARMING &amp;MANAGEMENT</b>
<b>Learning Objectives</b>			
LO1	To highlight the importance of ornamental fish culture in relation to entrepreneurship development.		
LO2	To enable the identification, culture and maintenance of commercially important ornamental fishes.		
LO3	To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Introduction to ornamental fish keeping.</b> Scope and importance of ornamental fish culture. Domestic and global scenario of ornamental fishes. Commercially important ornamental fishes - Indigenous and exotic varieties.	6	CO1
II	<b>Biology of egg layers and live bearers.</b> Food and feeding in ornamental fishes. Formulated feed live and artificial feed. Breeding, hatchery and nursery management of egg layers (eg.Goldfish) and live bearers (eg.Guppy).	6	CO2
III	<b>Aquarium design and construction;</b> Accessories - aerators, filters and lighting. Aquarium plants. Maintenance of aquarium and water quality management. Ornamental fish diseases, their prevention, control and treatment.	6	CO3
IV	Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies.	6	CO4

V	<b>Practical</b> 1) Identification of locally available ornamental fishes - Egg layers and live bearers. 2) Identification of locally available live feed organisms.	6	CO5
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
On completion of this course, students will;			
<b>CO1</b>	The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.	Knowledge(LevelK1)	
<b>CO2</b>	The knowledge and skills gained on the different aspects of ornamental fish keeping	Comprehension(LevelK2)	
<b>CO3</b>	The students to develop entrepreneurship potential and help in self-employment	Application(LevelK3)	
<b>Text Books (Latest Editions)</b>			
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.		
<b>Reference Books (Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Dey V.K.A. 1997. A handbook on aqua farming ornamental fishes. MPEDA, Kochi.		
2.	Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquaculture. Daya Publishing House, New Delhi.		
<b>Web Resources</b>			
1.	<a href="http://ecoursesonline.iasri.res.in/course/view.php?id=297">http://ecoursesonline.iasri.res.in/course/view.php?id=297</a>		
2.	<a href="https://www.ofish.org/">https://www.ofish.org/</a>		
3.	<a href="https://krishijagran.com/agripedia/income-generation-byornamental-fish-culture/">https://krishijagran.com/agripedia/income-generation-byornamental-fish-culture/</a>		
<b>Methods of Assessment</b>			
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions		
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview		

<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	M	S	S	S	M	S	S	S	S
<b>CO 2</b>	M	S	S	M	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	2	3	3	3
<b>Weightage</b>	9	8	9	9	9
<b>Weighted % of Course Contribution to POs</b>	3.0	2.6	3.0	3.0	3

**SEMESTER – III**

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>CORE V- CELL BIOLOGY</b>
<b>Learning Objectives</b>			

LO1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.		
LO2	To understand how these cellular components are used to generate and utilize energy in cells.		
LO3	To understand the cellular components underlying mitotic cell division.		
LO4	To apply the knowledge of cell biology to selected examples of changes or losses in cell function.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>History of Cell Biology</b> , History of Cell Biology, Tools and Techniques of Cell Biology Cell Fractionation, Homogenization, Histological techniques - Fixation - Staining -Vital Stains. – Cytoplasmic and Nuclear Stains. Microscopes - Types - Light, SEM, TEM.	12	CO1, CO2
II	The Cell - Cell theory - Viruses -Types and Structure - Bacteria – Bacterial membrane - Ultra structure of Plant & Animal cell - Cytoplasm- Structure and Composition, Function - Extra Cytoplasmic Structure -Cilia Flagella - Cytoplasmic Inclusions.	12	CO1, CO2, CO4, CO5
III	Cell components - Plasma Membrane Ultra Structure - Different Models- Functions – Ultra structure, Composition and Function of Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Centrioles and Mitochondria	12	CO1, CO2, CO3, CO4

IV	Nucleus - Ultra structure, Composition and Functions Nuclear Membrane - Nucleoplasm - Chromosomes – Hetero chromatin and Euchromatin - Nucleolus - Nucleolus Cycle - DNA and RNAs -Protein Synthesis regulation.	12	CO1, CO2, CO4, CO5
V	Cell Divisions and Cell Cycle - Amitosis, Mitosis and Meiosis and their Significance - Cancer, Biology – Characteristics of cancer cells, types, theories on Carcinogenesis, Ageing of Cells – Apoptosis.	12	CO1, CO2, CO4
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To understand and recall the basic structure, origin and development of cell organelles.	Knowledge(LevelK1)	
<b>CO2</b>	To integrate and assess the biochemical, cytological and histological tools to infer cellular basis of organization.	Comprehension(LevelK2)	
<b>CO3</b>	To analyze and differentiate organisms based on structure, composition and inter and intra cellular interactions.	Application(LevelK3)	
<b>CO4</b>	To explain the role of cells and cell organelles in various biological processes.	Analysis(LevelK4)	
<b>CO5</b>	To construct and simulate the role of different cytological tools to explain the structure and complexity of cells and cell organelles.	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.		
2.	Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.		
3.	VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.		
4.	Verma, P.S. and V. K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & co., New Delhi - 110 055, 567 pp.		
5.	Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.		

<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn., (paperback) W.W. Norton & Company p.864.
2.	Burke, Jack. D., 1970. Cell Biology, Scientific Book Agency, Calcutta.
3.	Challoner J. (2015) The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd., p.193.
4.	Cohn, N. S., 1979, Elements of Cytology, Freeman Book Co., New Delhi – 110007, 495 pp
5.	Cooper G.M. (2019) The Cell – A Molecular Approach, 8th Edn., Sinauer Associates Inc., Oxford University Press p.813.
6.	DeRobertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and Molecular Biology, 8th Edition, International Edition, Info med, Hong Kong, 734pp.
7.	Dowben, R., 1971. Cell Biology, Harper International Edition. Harper and Row Publisher, New York, 565 pp.
8.	Giese, A.C., 1979. Cell Physiology, Saunders Co., Philadelphia, London, Toronto, 609 pp.
1.	<a href="http://www.microscopemaster.com/organelles.html">http://www.microscopemaster.com/organelles.html</a>
2.	<a href="https://bit.ly/3tXwDSB">https://bit.ly/3tXwDSB</a>
3.	<a href="https://bit.ly/3tWNpRX">https://bit.ly/3tWNpRX</a>
4.	<a href="https://bit.ly/3AuYR9M">https://bit.ly/3AuYR9M</a>
5.	<a href="https://rsscience.com/cell-organelles-and-their-functions/">https://rsscience.com/cell-organelles-and-their-functions/</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	M	S	S	S	S	S
<b>CO 2</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	M	M	S	M	S	M	S	S
<b>CO 5</b>	S	M	S	S	S	S	M	S	S	S

**S-Strong (3) M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	2	3
<b>Weightage</b>	15	15	15	14	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	2.8	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023 - 2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>CORE VI- GENETICS</b>
<b>Learning Objectives</b>			
LO1	To understand the structure and functions of nucleic acids in the cell.		
LO2	To know the causes and effects of mutations.		
LO3	To comprehend the importance of genetic variation in evolution.		
LO4	To know about the harmful effects of genetic variations in humans, their cumulative effect in human population and the molecular basis of variations.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Mendelian Genetics and Inheritance:</b> Mendelian genetics: Mendelian experiments, laws of Mendel, Monohybrid, Dihybrid, back and test cross; Interaction of genes: complementary genes, supplementary genes, inhibiting genes, lethal genes and atavism. Polygenic inheritance- skin colour; multiple alleles- ABO blood group in man, extra chromosomal inheritance- shell coiling, kappa particles; sex linked inheritance – colour blindness and haemophilia in man.	12	CO1, CO2
II	<b>Linkage and Crossing Over:</b> Linkage: Linked genes, complete and incomplete linkage. Crossing over: molecular mechanisms of crossing over, kinds of crossing over, models of recombination.	12	CO1, CO2, CO4, CO5
III	<b>Cytogenetics:</b> Variation in chromosome number and structure: chromosomal mutation and evolution. Gene mutation: types, molecular basis of mutation, mutational hot spots, reversion; radiation and chemical agents as mutagens; Detection of mutation - CIB method	12	CO1, CO2, CO3, CO4, CO5
IV	<b>Human and Microbial Genetics:</b> Human genetics: Karyotype and ideogram; sex determination - Barr body technique, drumstick method; chromosomal abnormalities in humans, Pedigree analysis. Population genetics and evolution: gene pool, gene frequency and genotype frequency; Hardy-Weinberg law of equilibrium.	12	CO1, CO2, CO4, CO5



V	<b>Molecular Genetics:</b> Insertion elements, transposable elements, integrons and antibiotic resistance cassettes; the lactose system and operon model, tryptophan operon.	12	CO1, CO2, CO4, CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand the basis of inheritance and expression of genes.	Knowledge(LevelK1)	
<b>CO2</b>	Correlate changes in genetic makeup and phenotypic changes in progeny.	Comprehension(LevelK2)	
<b>CO3</b>	Analyse the causes of variations in genetic material and predict the effect in a population using different techniques.	Application(LevelK3)	
<b>CO4</b>	Explain the role of cellular processes and different genetic elements in the expression of genes.	Analysis(LevelK4)	
<b>CO5</b>	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution.	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	David E Sadava, 1993. Cell Biology - Organelle Structure and Function, Jones Bartlett Publishers.		
2.	Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.		
3.	Lewin B., 2008. Genes IX, Jones and Bartlett publishers.		
4.	Veer Bala Rastogi., 2019. Text Book of Genetics, Med tech		
5.	Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.		
6.	Verma P. S. and V. K. Agarwal., 2018. Genetics, S. Chand & Company Pvt Ltd.		
<b>References Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Cooper, Geoffrey M., 2018. The cell: A Molecular Approach, Eighth Edition, Oxford University Press.		
2.	De Robertis, E. D. P and E.M.F Robertis, 2017. Cell and Molecular Biology 8 <sup>th</sup> Edition, LWW.		

3.	Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
4.	Fletcher H and Hickey I., 2015. Genetics, IV Edition. GS, Taylor and Francis Group, New York and London.
5.	Gardner, Anne. 2009. Human Genetics, Scion Publishing Ltd.
6.	Klug, W. S., Cummings, M. R., Spencer, C. A., 2012. Concepts of Genetics. X Edition. Benjamin Cummings.
7.	Lodish, Harvey, Arnold Berk <i>et al.</i> , 2007. Molecular cell biology. 6th edition, W. H. Freeman.
8.	Russel, Peter J. 2013. Genetics: A Molecular Approach, Pearson.
9.	Strick Berger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.
<b>Web Resources</b>	
1.	<a href="https://go.nature.com/2XE8V1q">https://go.nature.com/2XE8V1q</a>
2.	<a href="https://bit.ly/3zoTt6B">https://bit.ly/3zoTt6B</a>
3.	<a href="https://bit.ly/2XAm7oa">https://bit.ly/2XAm7oa</a>
4.	<a href="https://bit.ly/2XEbhxi">https://bit.ly/2XEbhxi</a>
5.	<a href="https://bit.ly/3AB4bso">https://bit.ly/3AB4bso</a>
6.	<a href="https://bit.ly/39pZSE4">https://bit.ly/39pZSE4</a>
7.	<a href="https://www.genome.gov/genetics-glossary/Sex-Linked">https://www.genome.gov/genetics-glossary/Sex-Linked</a>
8.	<a href="https://www.vedantu.com/biology/mutagens">https://www.vedantu.com/biology/mutagens</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	M	S	S	M	S	S	S
CO 2	S	S	S	S	S	M	S	M	S	S
CO 3	S	M	S	S	S	S	S	S	S	S
CO 4	S	S	S	S	M	S	S	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

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

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	2
CO5	3	3	3	3	3
Weightage	15	15	15	15	14
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	2.8

(P.G Department of Zoology TANSCHÉ syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC IV- BIOCOMPOSTING FOR ENTREPRENEURSHIP</b>
<b>Learning Objectives</b>			
LO1	To highlight the importance of Bio composting for entrepreneurship in waste management.		
LO2	To enable students for setting up Bio compost units and bins for waste reduction.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Bio composting – Definition, types and ecological importance.	6	CO1, CO2
II	Types of Bio composting technology – Field pits/ground heaps/ tank/large-scale/batch and continuous methods.	6	CO1, CO2,
III	Preparation of Bio compost pit and bed using different amendments.	6	CO1, CO3
IV	Applications of Bio compost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction, etc.	6	CO2, CO3
V	Economics of establishment of a small bio compost unit – project report proposal for Self Help Group (Income and employment generation).	6	CO1, CO2,
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	The students will gain knowledge about the process of Bio composting.	Knowledge(LevelK1)	
<b>CO2</b>	Students will be able to demonstrate Bio composting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane biogases, etc.	Comprehension(LevelK2)	
<b>CO3</b>	To gain knowledge about the economic cost of establishing small Bio compost units as a cottage industry	Application(LevelK3)	

Text Books	
1.	<b>Text Book on Compost Production and Utilization</b> <u>Yuganthaaya singhe Guttila</u> , LAP Lambert Academic Publishing
2.	Edwards, C.A., and Bother, B., 1996. Biology of earthworms, Chapman Hall Publication company.
3.	Edwards, C.A., and Bother, B., 1996. Biology of earthworms, Chapman Hall Publication company.
Reference Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Bikas R. Pati & Santi M. Mandal (2016). Recent trends in composting technology.
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. Bio Greenhouse COST Action FA 1105, www.bio.greenhouse.org.
Web Resources	
1.	<a href="https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html">https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html</a>
2.	<a href="https://bit.ly/3nYvgSF">https://bit.ly/3nYvgSF</a>
3.	<a href="http://caa.gov.in/farms.html">http://caa.gov.in/farms.html</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	M	S	S	S	S	S	S	S
CO 2	S	S	S	M	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	S	S	S

S-Strong (3)

M-Medium (2)

L-Low (1)

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>Weightage</b>	9	9	9	8	9
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	2.6	3

(P.G Department of Zoology TANSCHHE syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023 - 2026</b>
<b>HOURS</b>	<b>2Hrs/Week</b>	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC V- MEDICAL LABORATORY TECHNIQUES</b>
<b>Learning Objectives</b>			
LO1	To understand the different protocols and procedures to collect clinical samples.		
LO2	To demonstrate skill in handling clinical equipment.		
LO3	To explain the characteristics of clinical samples.		
LO4	To evaluate the safety precautions while handling clinical samples.		
LO5	To summarise the control measures to avoid contamination of clinical samples.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Laboratory Safety and Human Health and Hygiene: Laboratory safety –toxic chemicals and bio hazards waste- biosafety level- physiology effect of alcohol, tobacco, smoking, junk food its treatment -biomedical waste management.	6	CO1, CO2
II	Haematology: Composition of blood and their function- collection of blood lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation- bleeding time- clotting time- determination of hemoglobin- erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing	6	CO1, CO3,

III	Medical Microbiology and Instrumentation Techniques: Definition and scope of microbiology- structure and function of cells - parasites -Entamoeba- Plasmodium- Leishmania and Computer tomography (CT scan)– Magnetic Resonance imaging.	6	CO1, CO3, CO4, CO5
IV	Medical Physiology: Cardiovascular system- Blood pressure -Pulse – regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) – significance – ultra sonography.	6	CO1, CO2, CO4
V	Diagnostic Pathology: Handling and labelling of histology. specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation.	6	CO1, CO2, CO4
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology.	Knowledge(LevelK1)	
<b>CO2</b>	Explain the characteristics of clinical samples.	Comprehension(LevelK2)	
<b>CO3</b>	Demonstrate skill in handling clinical equipment	Application(LevelK3)	
<b>CO4</b>	Evaluate the hematological and histological parameters of biological samples.	Analysis(LevelK4)	
<b>CO5</b>	Elaborate the role of medical laboratory techniques in health care industry.	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.		
2.	Guyton and Hall, 2000. Text Book of medical Physiology, 10 <sup>th</sup> edition, Elseiner, New Delhi.		
3.	Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I, II, III. Tata MC Graw Hill, New Delhi.		
4.	Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.		



<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Manoharan, A, and Sethuraman, 2003. Essential of Clinical Hematology, Jeypee brothers, New Delhi.
2.	Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia. Published by Tata McGraw-Hill Education Pvt. Ltd.,
3.	Ochei. J., A. Kolhatkar (2000). Medical Laboratory science:Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.
<b>Web Resources</b>	
1.	<a href="https://bit.ly/3tUs8In">https://bit.ly/3tUs8In</a>
2.	<a href="https://bit.ly/2XKu7mT">https://bit.ly/2XKu7mT</a>
3.	<a href="https://bit.ly/3hNS1EP">https://bit.ly/3hNS1EP</a>
4.	<a href="https://bit.ly/2ZgrLga">https://bit.ly/2ZgrLga</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	M	S	S	S	S
CO 2	S	S	S	M	S	S	S	M	S	S
CO 3	S	M	S	S	S	S	S	S	S	S
CO 4	S	S	S	S	M	S	S	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

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

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	2
<b>Weightage</b>	15	15	15	15	14
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	2.8

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023 - 2026</b>
<b>HOURS</b>	<b>2Hrs/Week</b>	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>ENVIRONMENTAL STUDIES</b>

## **ENVIRONMENTAL STUDIES**

The Earth is an incredibly precious enigma. Environmental Activities for Students are necessary to encourage sustainability. Environmental Activity means any investigation, study, assessment, evaluation, sampling, testing, monitoring, containment, removal, disposal, closure, corrective action, remediation (regardless of whether active or passive), natural attenuation, restoration, bioremediation, response, repair, corrective measure, cleanup or abatement that is required or necessary under any applicable Environmental Law, including institutional or engineering controls or participation in a governmental voluntary cleanup program to conduct voluntary investigatory and remedial actions for the clean-up, removal or remediation of Hazardous Substances that exceed actionable levels established pursuant to Environmental Laws, or participation in a supplemental environmental project in partial or whole mitigation of a fine or penalty.

The students are to be engaged in Environmental activities such as:

- **Start a Garden Club**
- Plant Anything
- Go on a Nature Scavenger Hunt
- **Recycle Waste Materials**
- **Start a Green Team**
- **Do Mini Greenhouse Craft**
- **Create Worm Farm**
- **Take Plastic Pledge**
- Access the Wisdom of Local Community

### **Evaluation:**

The participation and performance of the students in Environmental activities will be assessed and best performers will be rewarded.

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	3

### SEMESTER -IV

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>IV</b>
<b>CREDITS</b>	<b>5</b>	<b>COURSE TITLE</b>	<b>CORE VII-DEVELOPMENTAL BIOLOGY</b>
<b>Learning Objectives</b>			
LO1	To create an awareness to the students about the theories, concepts and basics of Developmental Biology.		
LO2	To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.		
LO3	To make an awareness of the induction, organizers and development of extra embryonic structures.		
LO4	To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing		
LO5	To give an idea about teratogenesis, invitro fertilization, stem cells and amniocentesis to the students		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Gametogenesis &amp;Fertilization</b> Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg - Egg membranes. Types of egg -Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.	12	CO1
II	<b>Blastulation &amp; Gastrulation</b> Cleavage - Planes and Patterns, Factors controlling cleavage- Fate map and its construction. Blastulation – types of blastula. Morphogenetic movements - Gastrulation of frog.	12	CO2
III	<b>Organogenesis</b> Development of Brain, Eye and Heart in frog. Foetal membranes in chick. Placentation in Mammals.	12	CO3
IV	<b>Applied Embryology</b> Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors.	12	CO4

V	<b>Human embryology</b> Reproductive organs, Menstrual cycle and menopause Pregnancy–trimesters – development. Erythroblastosis foetal is -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To describe and illustrate the significance of cellular processes in embryonic development.	Knowledge(LevelK1)	
<b>CO2</b>	To relate the factors that contribute to the developmental process, construct fate maps and illustrate the steps in morphogenesis and organogenesis.	Comprehension(LevelK2)	
<b>CO3</b>	To correlate the involvement of specific cell types in the formation of specific organs and explain the importance of morphogens.	Application(LevelK3)	
<b>CO4</b>	To distinguish between the different types of developmental mechanisms in various organisms and appraise the species-based differences in development.	Analysis(LevelK4)	
<b>CO5</b>	To justify and validate the role of environment and genetics in influencing embryonic development	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India		
2.	Subramaniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.		
3.	Verma, P.S., Agarwal, V. K.2010.Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.		
2.	Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.		
3.	Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.		
4.	Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.		
5.	Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA		

Web Resources	
1.	<a href="https://www.ncbi.nlm.nih.gov/books/NBK10052/">https://www.ncbi.nlm.nih.gov/books/NBK10052/</a>
2.	<a href="https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html">https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html</a>
3.	<a href="https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468">https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468</a>
4.	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand / Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

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

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	M	S	S	S	S	S
<b>CO 3</b>	S	S	M	S	S	S	S	M	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	M	S	S	S	S	S	S	S	S

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	2	3	3	3	3
<b>Weightage</b>	14	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	2.8	3.0	3.0	3.0	3



PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS	3Hrs/Week	SEMESTER	IV
CREDITS	4	COURSE TITLE	CORE VIII- DEVELOPMENTAL BIOLOGY LAB COURSE
<b>Learning Objectives</b>			
<b>LO1</b>	Practical course aims at demonstrating significant quantitative and analytical approaches that enable the students to translate the theoretical foundation developmental biology into practical understanding.		
<b>LO2</b>	Acquire skill in mounting chick blastoderm and observe the stages of chick embryo		
<b>LO3</b>	Apply skill in identifying the developmental stages of frog.		
<b>Details</b>			<b>No. of Hrs</b>
<b>Unit I</b> Gametogenesis - Observation of gametes from gonadal tissue sections 1.Oogenesis:Section through ovary of shrimp, fish, frog and mammals 2. Spermatogenesis: Section through testis of shrimp, fish, calotes and mammals Fertilization 3.Induced spawning in polychaete worm <i>Hydroids elegans</i> 4. <i>In vitro</i> fertilization and development in a polychaete worm <i>Hydroids elegans</i> 5.Observation of egg developmental stages in <i>Emerita emeritus</i>			24
<b>Unit II</b> Embryogenesis 6. Observation and whole mount preparation of the chick blastoderm - 18 hours of development 7. Chick embryonic stage - 24 hours of development 8. Chick embryonic stage - 48 hours of development 9. Chick embryonic stage - 72 hours of development 10. Chick embryonic stage - 96 hours of development Histological observation: Section through various developmental stages in chick embryo			12
			CO1
			CO2

<b>Unit III</b> Experimental Embryology Regeneration in Frog Tadpoles 11.     Blastema formation 12.     Demonstration of regenerative process in tadpole		12	CO3
<b>Unit IV</b> Metamorphosis 13. Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine		6	CO2
<b>Unit V</b> Cryopreservation 14. Demonstration of cryopreservation of gametes of fin fish/shell fish		6	
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To understand the basic stages of developmental biology, process of Gametogenesis and fertilization	Knowledge(LevelK1)	
<b>CO2</b>	To describe the knowledge of developmental biology in laboratory condition	Comprehension(LevelK2)	
<b>CO3</b>	To understand the events of early developmental stages.	Application(LevelK3)	
<b>Text Books</b>			
1.	Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India		
2.	Subramaniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.		
3.	Verma, P.S., Agarwal, V. K.2010.Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.		

<p style="text-align: center;"><b>Reference Books</b>  <b>(Latest editions, and the style as given below must be strictly adhered to)</b></p>	
1.	Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.
2.	Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.
3.	Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.
4.	Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.
5.	Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA
<p style="text-align: center;"><b>Web Resources</b></p>	
1.	<a href="https://www.ncbi.nlm.nih.gov/books/NBK10052/">https://www.ncbi.nlm.nih.gov/books/NBK10052/</a>
2.	<a href="https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html">https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html</a>
3.	<a href="https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468">https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468</a>
4.	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/</a>
<p style="text-align: center;"><b>Methods of Assessment</b></p>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand / Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	M	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	M	S	S	S	S	S
CO 3	M	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	2	3	3
Weightage	9	9	8	9	9
Weighted % of Course Contribution to POs	3.0	3.0	2.6	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>IV</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC VI- BIOPHYSICS AND BIOSTATISTICS</b>
<b>Learning Objectives</b>			
LO1	To understand the concepts of diffusion, osmosis, centrifugal force, surface tension.		
LO2	To understand the techniques for the separation of bio molecules		
LO3	To understand radiology, sonography, Laser techniques for biological and medical application.		
LO4	To know to calculate standard deviation, correlation coefficient, chi-square analysis and student 't' test using the formula.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Biophysical Principles:</b> Physical laws in livings system: diffusion–Factors affecting diffusion- types of diffusion – Fick’s law –Biological significance of diffusion–Osmosis– Osmotic pressure (endocytosis, pinocytosis, phagocytosis, exocytosis plasmolysis).	6	CO1
II	<b>Applications of Biophysics:</b> Principle and applications of colorimeter–Radioactivity: Types of radioactive decay – Radioactive isotopes – Autoradiography – biological impacts.	6	CO2
III	<b>Collection and Classification of Data:</b> Introduction to biostatistics. Definition –characteristics, importance and applications of biostatistics. Collection of data: Primary – secondary data. Types of Classification. Qualitative – quantitative. Variables: discrete – continuous.	6	CO3
IV	<b>Presentation of Data: Tabulation:</b> Types – Components –advantages. Diagrammatic and graphical representations of data: Bar diagrams (Simple, multiple, subdivided and percentage) –Pie diagram – Frequency diagram: histograms.	6	CO4

V	<b>Descriptive Inferential Statistics:</b> Measure of central tendency: Arithmetic mean– median– mode. Measures of dispersion: Standard deviation – Standard error– Coefficient of variance.	6	CO4
	<b>Total</b>	<b>30</b>	
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand and recall the basic biophysical concepts, statistical data and formula.	Knowledge(LevelK1)	
<b>CO2</b>	Apply suitable physical techniques and statistical methods to solve biological problems.	Comprehension(LevelK2)	
<b>CO3</b>	Identify and relate the bio analytical techniques and statistical principles for the application of biological experiments.	Application(LevelK3)	
<b>CO4</b>	Select suitable biophysical techniques to study the biological process and statistical approach to assess the experimental results.	Analysis(LevelK4)	
<b>CO5</b>	Integrate the bio analytical techniques and statistical methods to validate research investigations.	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Antoni samy, B., Solomon Christopher and P. Prasanna Samuel, 2011. Biostatistics: Principles and practices. MacGraw Hill Education Pvt. Ltd. New Delhi. 349pp.		
2.	Betty Karasek, 2015. Advanced concepts of biophysics, Callistro Reference, 198pp.		
3.	Daniel, W.W.,2000. Biostatistics: A foundation for analysis in the health sciences, 7thEd.john Wiley & Sons Ltd. New York. 328pp.		
4	EdwardK. Yeagers, 2018. Basic Biophysics for Biology, CRC Press, USA.195pp		
5	Gurumani, N., 2006. Research methodology for biological sciences, MJP, Chennai.753pp.		
6	Michael C., Whitlock and Dolph Schluter, 2009. The analysis of biological data,2 <sup>nd</sup> Ed. MacMillan Publishers, NewYork, USA.818pp.		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Rodney M.J, Cotterill,2002.Biophysics: An introduction, John Wiley & Sons Ltd. New York.400pp.		
2.	Ronser, B.,2006. Fundamentals of Biostatistics, Thomson Brooks/Cole,6thEd. Duxbury press, Singapore.784pp		
3.	Tanford, C.,1961. Physical chemistry of macromolecules, John Wiley & Sons Ltd. England.710pp.		

Web Resources	
1.	<a href="https://bit.ly/2XGFuML">https://bit.ly/2XGFuML</a>
2.	<a href="http://www.life.uiuc.edu/molbio/geldigest/electro.html">http://www.life.uiuc.edu/molbio/geldigest/electro.html</a>
3.	<a href="http://users.stat.ufl.edu/~winner/sta6934/st4170_int.pdf">http://users.stat.ufl.edu/~winner/sta6934/st4170_int.pdf</a>
4.	<a href="http://www.biostathandbook.com/analysissteps.html">http://www.biostathandbook.com/analysissteps.html</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

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

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	M	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3

(P.G Department of Zoology TANSCHHE syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2 Hrs/Week</b>	<b>SEMESTER</b>	<b>IV</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>SEC VII- ECONOMIC ZOOLOGY</b>
<b>Learning Objectives</b>			
LO1	To understand the culturing techniques and production methods of different farm animals.		
LO2	To know the life history of animals and disease control methods used in farming.		
LO3	To understand the concept of breeding, cross breeding and the importance of high yield varieties.		
LO4	To know about the marketing strategies.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Economic Entomology:</b> Apiculture: Species of honey bees – Social organisation of honey bee – selection of bees and location for apiary –Newton’s bee hive – products of bee keeping. Sericulture: Species of silkworm – life history of mulberry silkworm – Rearing of silkworm. Lac Culture: Introduction – Life history – Host plants – cultivation of Lac.	6	CO1
II	<b>Vermiculture:</b> Introduction: – Vermicomposting: vermicomposting methods – factors affecting vermicomposting – Vermiculture unit. Harvesting of vermicompost. Vermicast – advantages of vermicompost – Vermiwash and its applications.	6	CO2
III	<b>Aquaculture:</b> Fresh water aquaculture: Edible – pearl oyster culture. Ornamental fish culture: Aquarium fishes Aquarium maintenance in home	6	CO3
IV	<b>Poultry Farming:</b> Broiler management Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Women in backyard poultry farming.	6	CO4
V	<b>Dairy Farming:</b> Dairy farming, Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition – Dairying as a source of additional income and employment.	6	CO4
	<b>Total</b>	<b>30</b>	



<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	To identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic aspects of farming.and marketing strategies of products.	Knowledge(LevelK1)
<b>CO2</b>	To assess and integrate the available tools and techniques to increase the productivity in farms.	Comprehension(LevelK2)
<b>CO3</b>	To analyse the pros and cons of different methods of farming	Application(LevelK3)
<b>CO4</b>	To evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc.	Analysis(LevelK4)
<b>CO5</b>	To design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.	Evaluation(LevelK5)
<b>Text Books</b>		
1.	Gupta, P.K., 2008. Vermicomposting for sustainable agriculture, 2 nd Edition, Agrobios, India.	
2.	Abishek Shukla, D., 2009. A Hand Book of Economic Entomology, Vedamse Books, New Delhi	
3.	Banerjee, G.C., 2006. Text book of Animal Husbandry 8 th Ed. Oxford and IBH Publishing Company Ltd., New Delhi.	
4	ICAR, 1997. Handbook of Animal Husbandry– The Indian Council of Agricultural Research, New Delhi.	
5	Jhingran, AVG, 1991. Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.	
6	James. N. Marner, 1975. Principles of dairy processing, wiley eastern limited, New Delhi.	
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>		
1.	Glenn Munroe, 2017. Manual of on-Farm vermicomposting and vermiculture, Holdanca Farms Ltd, Wallace, Nova Scotia.	
2.	Dunham, R.A., 2004. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.	
3.	Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.	
4	Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Inter Science, NewYork.	

<b>Web Resources</b>	
1.	<a href="https://bit.ly/3tXHjk8">https://bit.ly/3tXHjk8</a>
2.	<a href="https://bit.ly/3tUTHBu">https://bit.ly/3tUTHBu</a>
3.	<a href="https://bit.ly/3hVv96q">https://bit.ly/3hVv96q</a>
4.	<a href="https://bit.ly/39nztH1">https://bit.ly/39nztH1</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	M	S	S	S	M	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	M	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>1 Hrs/Week</b>	<b>SEMESTER</b>	<b>IV</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>Environmental Science</b>
<b>Learning Objectives</b>			
LO1	Demonstrate an integrative approach to environmental issues with a focus on sustainability;		
LO2	Use critical thinking, problem-solving, and the methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving;		
LO3	Communicate complex environmental information to both technical and nontechnical audiences		
LO4	Understand and evaluate the global scale of environmental problems and		
LO5	Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world.		
<b>UNIT</b>	<b>Details</b>		
I	<b>Unit – I: The Environment:</b> The Atmosphere, Hydrosphere, Lithosphere, Biosphere, Ecosystem, Biogeochemical Cycle (Carbon Cycle, Nitrogen Cycle),		
II	<b>Unit – II: Environment Pollution:</b> Air Pollution, Water Pollution, Soil Pollution, Radiation Pollution.		
III	<b>Unit – III: Population Ecology:</b> Individuals, Species, Pollution, Community, Control Methods of Population, Urbanization and its effects on Society, Communicable Diseases and its Transmission, Non-Communicable Diseases.		
IV	<b>Unit- IV: Environmental Movements in India:</b> Grassroot Environmental movements in India, Role of women, Environmental Movements in Tamil Nadu, State Pollution Control Board, Central Pollution Control Board.		
V	<b>Unit –V Natural Resources:</b> Conservation of Natural Resources, Management and Conservation of Wildlife, Soil Erosion and Conservation, Environmental Laws: Water Act, 1974, Air Act, 1981, The Wildlife (Protection) Act, 1972, Environment Protection, 1986, Natural Disasters and their Management.		
	<b>Total</b>		<b>30</b>

**Text Books**

1.	Dr Bharucha Erach, Text Book of Environmental Studies for UG Course, University Press (India) Pvt. Ltd.
2.	Dr Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahmedabad – 380 013, India.
3.	Katyal Timi & Satake M., Environmental Pollution, Anmol Publication Pvt. Ltd, New Delhi.
4	G. R. Chhatwal, M. C. Mehra, M. Satake, T. Katyal & Mohan V., Environmental Radiation and Thermal Pollution and their control, Anmol Publications, New Delhi.
5	R. C. Brunner, Hazardous Waste Incineration, Mc Graw Hill Inc.
6	K. C. Agarwal, Environmental Biology, Nidi Publishing Ltd, Bikaner.
7	Dr Bharucha Erach, Text Book of Environmental Studies for UG Course, University Press (India) Pvt. Ltd.
8	Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
9	Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Inter Science, NewYork.

**SEMESTER- V**

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>CORE IX-EVOLUTIONARY BIOLOGY</b>
<b>Learning Objectives</b>			
LO1	Evolutionary biology is a branch of the biological sciences concerned with the origin of life and the diversification and adaptation of life forms over time.		
LO2	This course helps to understand the important processes, principles, and concepts on evolution.		
LO3	To explain the importance of the fossil records in evolutionary studies, and the role of phylogenetic studies in the wider context of biodiversity and conservation.		
LO4	In this course, we will apply the knowledge of human evolutionary history to simulate how genetic variation within and among human populations affects risk, diagnosis, and treatment of modern diseases.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Inorganic and organic evolution-History of evolutionary thought, Primordial earth and primeval atmosphere, Chemical origin of life: Synthesis of organic molecules, Urey-Miller experiment.	12	CO1
II	Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and modern synthetic theory -Animal colouration and Mimicry.	12	CO2
III	Isolating mechanisms - Modes of speciation-Hybridization is an evolutionary catalyst- Law of Adaptive Radiation- Adaptive radiation in reptiles and mammals - Convergence and parallelism.	12	CO3
IV	Morphological, physiological and biochemical, embryological, Palaeontological evidences – evolutionary genomics. Types of rocks - Geological time scale – Nature of fossils- Dating of fossils - Fossil records of man.	12	CO4
V	Natural selection in action in man- level of selection-Eugenics, Euphenics and Euthenics- Adaptation-Evolution and ethics.	12	CO5
	<b>Total</b>	<b>60</b>	

<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	To understand the Primordial earth and theories on origin of life	Application(LevelK3)
<b>CO2</b>	To integrate and assess Lamarckism - Neo Lamarckism – Darwinism	Analysis(LevelK4)
<b>CO3</b>	To analyse various fossil records of man and fossil records of horse, various types of rocks - Geological time scale.	Evaluation(K5)
<b>CO4</b>	To explain the Nature of fossils- Dating of fossils, evidences of evolution, Adaptive radiation in reptiles and mammals,	Evaluation(K5)
<b>CO5</b>	To construct and compile the role of Human Genome Project, Evolution in the diagnosis, and treatment of diseases.	Evaluation(K5)
<b>Text Books</b>		
1.	Ridley, M., 2004. Evolution. III Edition. Blackwell Publishing.	
2.	Lull, R.S. 2010. Organic evolution, The Macmillan, New York.	
3.	Minkoff, E. C. (1983). Evolutionary biology. Reading, MA: Addison-Wesley Publishing Company	
4.	Sober, E. (1994). Conceptual issues in evolutionary biology. Cambridge, MA: MIT Press.	
5.	Dr. Kishore R. Pawar, Dr. Ashok E. Desai, 2019. A text book of Organic Evolution, Nirali Prakashan,	
6.	Rastogi VB. 1991. Organic Evolution. Kedar Nath Ram Nath Publications, Meerut,Uttar Pradesh, India.	
7.	Stricberger, M.W., 1996. Evolution. Jones& Bartlett, USA	
8.	Colbert, E.H. Morales, M. and Minkoff, E.C. 2011. Colbert’s Evolution of The Vertebrates: A History of the Backboned Animals Through Time, Wiley, India.	
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>		
1.	Burns GW. 1972. The Science of Genetics. An Introduction to Heredity. Mac Millan Publ. Co.Inc.	
2.	Gardner EF. 1975. Principles of Genetics. John Wiley & Sons, Inc. New York.	
3.	Harth and Jones EW. 1998. Genetics – Principles and Analysis. Jones and BarHett Publ. Boston.	
4.	Levine L. 1969. Biology of the Gene. Toppan.	
5.	Pedder IJ. 1972. Genetics as a Basic Guide. W. Norton & Company, Inc.	
6.	Rastogi VB. 1991. A Text Book of Genetics. Kedar Nath Ram Nath Publications, Meerut, Uttar Pradesh, India.	
7.	White MJD. 1973. Animal Cytology and Evolution. Cambridge Univ.Press.	

Web Resources	
1.	<a href="https://bit.ly/3nPD09m">https://bit.ly/3nPD09m</a>
2.	<a href="https://bit.ly/3CHOdgL">https://bit.ly/3CHOdgL</a>
3.	<a href="https://bit.ly/2XvcCXl">https://bit.ly/2XvcCXl</a>
4.	<a href="https://bit.ly/2XAL1Vh">https://bit.ly/2XAL1Vh</a>
5.	<a href="https://bit.ly/3zoU9Jl">https://bit.ly/3zoU9Jl</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	S	M	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	M	S	S	M	S
<b>CO 4</b>	S	M	S	S	S	S	S	M	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	2
Weightage	15	15	15	15	14
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	2.8



<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>COREX-ANIMAL PHYSIOLOGY</b>
<b>Learning Objectives</b>			
LO1	To familiarise students with the principles and basic facts of Animal Physiology		
LO2	To give students an insight about the molecular and cellular basis of physiological functions in animals.		
LO3	To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.		
LO4	To make the students aware about how the structure-function relationships and its synchronisation with the molecular signals.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Nutrition &amp; Respiration</b> Nutrition: Digestion and absorption of carbohydrates proteins and lipids. Vitamins—their deficiency. Types of Respiration, Respiratory pigments-structure of Hemoglobin, Transportation of gases—Bohr effect Regulation of respiration-bronchitis, asthma.	12	CO1
II	<b>Circulation &amp; Excretion</b> Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat and its regulation -pace maker – Cardiac cycle – ECG - Pulse and blood pressure. Nephron structure & mechanism of urine formation, Regulation of acid base balance, Excretory products, Osmoregulation in fishes.	12	CO2
III	<b>Muscle &amp; Nerve Physiology</b> Types of muscles – Ultra structure of striated muscle, Muscle contraction & properties, Neurons—structure & types –synaptic transmission, Reflex action, Nerve disorders – epilepsy, Alzheimer's disease.	12	CO3
IV	<b>Sense Organs</b> Structure of eye, physiology of vision, visual elements and pigments, photo chemistry of vision - Eye defects – myopia, hyperopia, presbyopia. Structure of ear and mechanism of hearing - Hearing impairments – deafness, Olfactory, gustatory and tactile sense organs	12	CO4

V	<b>Reproductive Physiology</b> Endocrine glands in man - Hormones, action and disorders –Outline mechanism of hormonal activity. Puberty, adolescence, pregnancy, parturition, and birth control.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Be able to explain how the various organ systems are coordinated and controlled.	Knowledge(LevelK1)	
<b>CO2</b>	Be able to list the functions of various organism relation to physiological process.	Comprehension(LevelK2)	
<b>CO3</b>	Be able to develop the idea of multi-level control and feedback mechanism in relation to various physiological functions.	Application(LevelK3)	
<b>CO4</b>	Beabletounderstandthebasicphysiologicalprocessrelatedto adaptation, metabolism and major requirements.	Analysis(LevelK4)	
<b>CO5</b>	Be able to correlate and understand human physiology.	Evaluation(LevelK5)	
<b>Text Books</b>			
1.	Agarwal R A., Anil K Srivastava., Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 pp.		
2.	Ambika Shanmugam, 2001. Fundamentals of Biochemistry for Medical students, Karthik Offset Printers, Chennai, 590pp		
3.	Berry A.K.1998. A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi, 320 pp.		
4.	Parameswaran, Ananta Krishnan and Ananta Subramanian, 1975. Outlines of Animal Physiology, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.		
5.	Verma P.S., Tyagi B.S & Agarwal V.K., 2010. Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp.		
<b>Reference Books</b>			

<b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Guyton, A.C. and Hall, J.B., 2011. Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 pp.
2.	Ganong, W.F., 2019. Review of Medical Physiology, McGraw Hill, New Delhi., 340 pp.

3.	Hill, W.R., Wyse, G.A and Anderson, M. 2016. Animal Physiology (4th edn). Sinauer Associates is an imprint of Oxford University Press; USA, 828 pp.
4.	Hoar, W.S. 1983. General and Comparative Physiology. Prentice Hall of India, New Delhi, 928 pp.
5	Prosser C.L., 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 pp.
6	Sarada Subrahmanyam, Madhavan Kutty, K., & Singh H.D., 2018. Text Book of Human Physiology, S. Chand & Co, New Delhi.
7	Singh, H.R and Kumar, N. 2017. Animal physiology and biochemistry, Vishal publishing company, Jalandhar, 864 pp.
8	Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi. 210 pp
9	Tortora G.J. & Derrickson B., 2016. Principles of Anatomy and Physiology, John Sons, Inc. 1232 pp.
10	Wood, D.W., 1968. Principles of Animal Physiology, Edward Arnold Ltd, London., 342 pp.

#### Web Resources

1.	<a href="https://microbenotes.com/category/biochemistry/">https://microbenotes.com/category/biochemistry/</a>
2.	<a href="https://www.stem.org.uk/resources/collection/3931/animal-physiology">https://www.stem.org.uk/resources/collection/3931/animal-physiology</a>
3.	<a href="https://animalphys4e.sinauer.com">https://animalphys4e.sinauer.com</a>
4.	<a href="https://nptel.ac.in/courses/102/104/102104042/">https://nptel.ac.in/courses/102/104/102104042/</a>
5.	<a href="https://biochem.oregonstate.edu">https://biochem.oregonstate.edu</a>

#### Methods of Assessment

<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	M	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	M	S	S	S	S
CO 4	S	S	S	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>COREXI - ENVIRONMENTAL BIOLOGY</b>
<b>Learning Objectives</b>			
LO1	To understand the structure and functions of the ecosystem.		
LO2	To explain the relationship between biotic and abiotic factors in an ecosystem.		
LO3	To know the causes and effects of climate change and habitat loss.		
LO4	To bring awareness about the impact of socio-economic development on the environment and the solutions put forward by the government to reduce environmental damage.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Ecosystem:</b> Concept of an ecosystem-Structure and function of an ecosystem- Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological Succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem and Aquatic ecosystems (lakes, rivers, oceans,).	12	CO1
II	<b>Population And Biological Cycles:</b> Structure and distribution – Growth curves - Groups, natality, Mortality Density indices. Population regulation and human population control.	12	CO2
III	<b>Environmental Stresses and Management:</b> Global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition. Pesticides and other chemical in agriculture. Bio indicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.	12	CO3
IV	<b>Environmental Pollution:</b> Definition- cause, effects and control measures of Air pollution -Water pollution -Soil pollution -Marine pollution - Noise pollution.	12	CO4

V	<b>Biodiversity Conservation:</b> Biodiversity crisis – habitat degradation, poaching of wild life. - Socio economic and political causes - loss of biodiversity. - In situ and ex situ conservation of biodiversity -Hot spots of Biodiversity. Green peace movement - Chipko Movement - Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Awareness, Programme, NGOs Natural Disaster Management, Legislations for environmental Protection.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand the fundamental structure and functions of the ecosystem.	Comprehension(LevelK2)	
<b>CO2</b>	Assess the inter-relationship between organisms and between biotic and abiotic factors in an ecosystem.	Comprehension(LevelK2)	
<b>CO3</b>	Analyze the factors that cause pollution, climate change, loss of biodiversity and depletion of resources.	Application(LevelK3)	
<b>CO4</b>	Evaluate the impact of human population growth and socioeconomic development on the structure and function of the ecosystem.	Evaluation(LevelK4)	
<b>CO5</b>	Design plans to scientifically solve environmental problems using biological tools, technologies and government policies.	Evaluation(LevelK4)	
<b>Text Books</b>			
1.	Matthew R. Fisher, 2018. Environmental Biology. Open Oregon Educational Resources. James Madison University.		
2.	Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand, New Delhi.		
3.	Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.		
4.	Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.		

<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Odum E.P.1983. Basic Ecology, Saunders, New York
2.	Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.
3.	Saha, T.K. 2010. Ecology and Environmental biology, Books and Allied, Kolkata.
<b>Web Resources</b>	
1.	<a href="https://bit.ly/2VYWOM5">https://bit.ly/2VYWOM5</a>
2.	<a href="https://bit.ly/2VZQFiT">https://bit.ly/2VZQFiT</a>
3.	<a href="https://bit.ly/3kqdXYA">https://bit.ly/3kqdXYA</a>
4.	<a href="https://bit.ly/39rvvgt">https://bit.ly/39rvvgt</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	M	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	M	M	S	S	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3



<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>CORE XII - ECO-PHYSIOLOGY LAB COURSE</b>
<b>Learning Objectives</b>			
LO1	To demonstrate an understanding of core ecological principles, and define scientific principles and concepts as related to environmental studies and sustainability.		
LO2	To understand the physiological processes that regulate body functions.		
LO3	To strive to demonstrate the role of experimentation in developing our understanding of living animals.		
LO4	To attain knowledge of important biomolecules such as carbohydrates, lipids, amino acids, proteins and enzymes.		
LO5	Measure and interpret experimental data and demonstrate laboratory skills in animal physiology and ecology.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Estimation of Abiotic Factors:</b> Estimation of dissolved Oxygen, Dissolved carbon-di-oxide, Determination of alkalinity in water samples, Determination of salinity of water samples, Determination of bicarbonate and carbonates.	12	CO1
II	<b>Digestive Enzymes:</b> Digestive enzymes in Cockroach, counting of cockroach haemocytes using haemocytometer. <b>Ecological Methods:</b> Estimation of oxygen consumption in an aquatic animal.	12	CO2
III	<b>Biochemical Tests:</b> Use of pH meter for estimation of pH in water and soil samples, Study of micro arthropods of water and soil samples (Tullgren's funnel method and Ladell's Floating Method). Collection, isolation, identification and mounting of marine and freshwater plankton. Study of sandy shore fauna- Study of rocky shore fauna.	12	CO3

IV	<b>Qualitative Detection of Biomolecules:</b> Qualitative tests for identification of carbohydrates, proteins and lipids. Blood grouping - total and differential counts.	12	CO4
V	<b>Field Work:</b> Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	List and recall the basic equipment used in physiology and ecology lab and develop skill about quantitative determination of biomolecules and quantitative analysis of blood.	Application(LevelK3)	
<b>CO2</b>	Demonstrate the instruments, discuss the clinical importance and its applications, and explain the principle of bio instruments.	Analysis(LevelK4)	
<b>CO3</b>	Understand and identify the chemical composition of major and minor nutrients and analyse Physio - chemical parameters that regulate metabolism.	Evaluation(K5)	
<b>CO4</b>	Evaluate and examine the various parameters of haematology and biochemistry and identify the nitrogenous waste products of animals.	Evaluation(K5)	
<b>CO5</b>	Summarise the effect of various physical and chemical factors on enzyme activity/. Compile the changes in various physiological parameters in man and other animals using various tools and techniques.	Evaluation(K5)	
<b>Text Books</b>			
1.	Widmaier, E.P., Raff, H. and Strang, K.T. 2008. Vander's Human Physiology, XI Edition., McGraw Hill., 770 PP.		
2.	Bishop, ML.,Fody, E.P., Schoeff, LE. 2010. Clinical Chemistry: Principles, Procedure, correlations. Wolters Kluwer, India, 298 PP.		

3.	Burtis, C.A. and Ashwood, E.R. 2008. Tietz text book of Fundamentals of clinical chemistry and molecular diagnostics, Elsevier, Philadelphia.
4.	Tortora G.J.& Derrickson B., 2016. Principles of Anatomy and Physiology, John Wiley and Sons, Inc. 1232 PP.
5.	Agarwal RA., Anil K Srivastava.,Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 PP.
6.	Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
7.	Michael, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
8.	APHA, 1992. Standard Methods for the examination of water and waste water, American Public Health association, Washington D.C.
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Hoar, W.S. 1983. General and Comparative Physiology. Prentice Hall of India, New Delhi., 928 PP.
2.	Prosser C.L., 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 PP.
3.	Wood, D.W., 1968. Principles of Animal Physiology, Edward Arnold Ltd, London.,342 PP.
4.	Guyton, A.C. and Hall, J.B., 2011. Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 PP.
5.	Wilson, J.A. 1984, Principles of Animal Physiology, Macmillan Publishing., 426 PP.
6.	Eugenia, 2008. Environmental Biotechnology and cleavers Bioprocesses, London.
7.	Ramesh, R & M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.
<b>Web Resources</b>	
1.	<a href="https://bit.ly/3hNyeFN">https://bit.ly/3hNyeFN</a>
2.	<a href="https://www.medicinenet.com/alp_test/article.htm">https://www.medicinenet.com/alp_test/article.htm</a>
3.	<a href="https://vlab.amrita.edu/?sub=3&amp;brch=63">https://vlab.amrita.edu/?sub=3&amp;brch=63</a>
4.	<a href="https://www.asbmb.org/education/online-teaching/online-lab-work">https://www.asbmb.org/education/online-teaching/online-lab-work</a>
5.	<a href="https://open.umn.edu/opentextbooks/textbooks/687">https://open.umn.edu/opentextbooks/textbooks/687</a>
	<a href="https://bit.ly/3lO29yP">https://bit.ly/3lO29yP</a>

<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand / Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO 10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	S	M	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	M	M	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3

PROGRAMME CODE			PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE			BATCH	2023-2026	
HOURS		4 Hrs/Week	SEMESTER	V	
CREDITS		3	COURSE TITLE	ELECTIVE I-ANIMAL BEHAVIOUR	
Learning Objectives					
LO1	To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours.				
LO2	To understand the biological properties of animal behaviour, with an evolutionary and ecological emphasis.				
LO3	To Compare innate and learned behaviour and differentiate between various mating system.				
LO4	To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behaviour and social systems and animal personality.				
LO5	To discuss how movement and migration behaviours are a result of natural selection				
UNIT	Details			No. of Hrs	Course Outcomes
I	Genetics and Behaviour: Genetic material, Genes and chromosomes, Genetic variation, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness.			12	CO1
II	Evolution and Social Behaviour: Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour. Visual adaptations to unfavourable environments.			12	CO2
III	Animal and the Environment: Coordination and Orientation, Animal Learning, Conditioning and Learning, Biological aspects of learning.			12	CO3
IV	Understanding Complex Behaviour: Decision making in behaviour Animals, Complex behaviour of honeybees, Evolutionary optimality, Mechanism of Decision making. The mentality of Animals: Languages and mental representation, non-verbal communication in human, mental images, Intelligence, tool use and culture, Animal awareness and Emotion.			12	CO4

V	<b>Chronobiology:</b> Organization of circadian system in multi cellular animals; Circadian pacemaker system invertebrates with particular reference to Drosophila. The physiological clock and measurement of day length. The relevance of biological clocks for human welfareClock function(dysfunction);Human health and diseases-Chrono pharmacology, chrono medicine, chronotherapy.	12	CO5
<b>Total</b>			<b>60</b>
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Recall and record genetic basis and evolutionary history of behaviour.	Application(LevelK3)	
<b>CO2</b>	Classify movement and migration behaviours and explain environmental influence upon behaviour.	Analysis(LevelK4)	
<b>CO3</b>	Analyze and identify innate, learned and cognitive behaviour and differentiate between various mating systems.	Comprehension(LevelK2)	
<b>CO4</b>	Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction.	Comprehension(LevelK2)	
<b>CO5</b>	Discuss the rhythmicity of behavioural expressions and the scientific concepts in behaviour and behavioural ecology.	Application(LevelK3)	
<b>Text Books</b>			
1.Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.			
2. DAS H.K.,2005. Text Book of Biotechnology. Wiley Dreamtech Pvt Ltd, New Delhi.			
3. Rastogi, S.C., 2005. Experimental physiology, New age International publishers, New Delhi.			
4. Ramesh, R and M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.			
5. Micheal, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.			
6. Agarwal, A. State of India's Environment: A Citizens Report, Centre for Science and Environment, New Delhi.			
7. Goel, P.K. Water Pollution: Causes, Effects and Control. New Age International, Publishers, New Delhi (2006).			

### REFERENCE BOOKS

(Latest editions, and the style as given below must be strictly adhered to)

1.	Michael D. Breed and Janice Moore, 2012. Animal Behaviour, Academic Press, USA, 359pp.
2.	Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to Animal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp.
3.	Davis E. Davis, 1970. Integral Animal Behaviour, MacMillan Company, London, 118pp.
4.	Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. DeCoursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.

### WEB RESOURCES

1.	<a href="https://www.ncbs.res.in/content/animal-behaviour">https://www.ncbs.res.in/content/animal-behaviour</a>
2.	<a href="https://bit.ly/3i6wUxR">https://bit.ly/3i6wUxR</a>
3.	<a href="https://www.behaviour.univie.ac.at/">https://www.behaviour.univie.ac.at/</a>
4.	<a href="https://www.ru.nl/bsi/">https://www.ru.nl/bsi/</a>

	Methods of Assessment
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	M	S	S	S	S	S	S	S
CO 3	S	M	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	S	M	S
CO 5	S	S	S	S	S	S	S	S	S	S

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

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	3



PROGRAMME CODE			PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE			BATCH	2023-2026	
HOURS		4Hrs/Week	SEMESTER	V	
CREDITS		3	COURSE TITLE	ELECTIVE II - AQUARIUM KEEPING	
Learning Objectives					
LO1		To create knowledge on self-employment opportunity of ornamental fishes			
LO2		To provide the knowledge of ornamental fishes and their equipment			
LO3		To understand the different breeding techniques of ornamental fishes			
UNIT	Details			No. of Hrs	Course Outcomes
I	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.			12	CO1
II	External morphology of a typical fish. Exotic and endemic varieties of ornamental fishes.			12	CO2
III	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			12	CO2
IV	Live fish transport- handling, feeding and forwarding techniques of fish. Fish Diseases and their control.			12	CO3
V	Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Guppies, Mollys, Sword tails, Platy, Siamese fighters and Goldfish, Butterfly fish, Bluemorph and Anemone fish.			12	CO3
Total				60	
Course Outcomes					
Course Outcomes		On completion of this course, students will;			
CO1		Students to learn about different ornamental fishes and identify the diseases of them		Comprehension(LevelK2) Application(LevelK3)	
CO2		To development Entrepreneur potential in the field of aquarium and get self-employment.		Comprehension(LevelK2) Application(LevelK3)	

### TEXT BOOK

1.	A Textbook of Pisciculture and Aquarium Keeping, 2009 by Dr. H.S. Jagtap, Dr.S.N .Mukerjee and Dr.V.K. Garad
2.	JingranV.G.,1991: Fish and Fisheries in India–Hindustan Publ. co. New Delhi
3.	MillDick,1993:AquariumFish,DayaPub.co.,New Delhi

### WEB RESOURCES

1	<a href="https://www.amazon.in/Concept-Aquarium-Fish-Keeping-2/dp/B0B2PPD5JG">https://www.amazon.in/Concept-Aquarium-Fish-Keeping-2/dp/B0B2PPD5JG</a>
2	<a href="https://www.sapnaonline.com/books/textbook-pisciculture-aquarium-keeping-hsjagtap-8170355850-9788170355854">https://www.sapnaonline.com/books/textbook-pisciculture-aquarium-keeping-hsjagtap-8170355850-9788170355854</a>
3	<a href="https://www.saraspublication.com/books/home-aquarium-and-ornamental-fishculture/">https://www.saraspublication.com/books/home-aquarium-and-ornamental-fishculture/</a>

### REFERENCE BOOK

1.	Aquarium Making -Fishkeeping and maintenance ,Mundy Obilor jim,Jim Arts publishing,Norway
2.	The Aquarium Fish Handbook <a href="#">Mary Bailey</a> , <a href="#">Nick Dakin</a> · 1998,Caxton Editions, London
3.	Aquascaping A Step-by-Step Guide to Planting, Styling, and Maintaining Beautiful Aquariums, <a href="#">George Farmer</a> 2020,Skyhorse Publishing NY10018,New york·

	Methods of Assessment
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>(K5)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	M	S
<b>CO 2</b>	M	S	S	S	S	S	S	M	S	S

S-Strong (8)

M-Medium (2)

L-Low (1)

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>Weightage</b>	6	6	6	6	6
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>ELECTIVE -III -NANO BIOLOGY</b>
<b>Learning Objectives</b>			
<b>LO1</b>	This course provides knowledge about the basic concepts of nano biology		
<b>LO2</b>	The learners will be able to acquire skills in the assembly, design and types of nano materials and nano particles,		
<b>LO3</b>	They will be able to appreciate the applications of nano biology in diverse fields.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
<b>I</b>	Nano biology-Definition-concepts and scope. History of nano technology and nano science in Nature; Structure and Properties of nano materials: Size, surface charge, conductivity, optical properties and biocompatibility.	<b>12</b>	<b>CO1</b>
<b>II</b>	Synthesis and characterization of nano materials, Fabrication of nano structures, Metallic nano particles, semi conductor, bio polymeric nanostructures and nano particles.	<b>12</b>	<b>CO3</b>
<b>III</b>	Composition and functional properties of nanostructures: Protein and peptide-based nanostructures, Use of gold, silver and other metallic nano particles.	<b>12</b>	<b>CO1</b>
<b>IV</b>	Strategiestodesignbiologicallyactivenanostructurebasedbiomaterials.Interaction of nano particles with biomolecules to study their conformational and functional properties.	<b>12</b>	<b>CO2</b>
<b>V</b>	BiologicalApplicationsofNanomaterialsandnanoparticles–Therapeutics–biomaterials-Immobilizedenzymes-drugdeliverysystems–BiosensorsCellularimaging tools and diagnostics.	<b>12</b>	<b>CO2</b>
<b>Total</b>			
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand basics of Nano-science and Nano-biology.	Knowledge(LevelK1)	
<b>CO2</b>	Gain knowledge on nano materials and nano particles.	Comprehension(LevelK2)	
<b>CO3</b>	Know the biological applications of nano materials and nano particles.	Application(LevelK3)	
<b>CO4</b>	Apply their knowledge in their career development in higher education, research and development.	Analysis(LevelK4)	
<b>CO5</b>	Understand basics of Nano-science and Nano-biology.	Evaluation(LevelK5)	

### REFERENCES

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

### WEB RESOURCES

1	<a href="https://www.accessengineeringlibrary.com">https://www.accessengineeringlibrary.com</a>
2	<a href="https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf">https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf</a>
3	<a href="https://jnanobiotechnology.biomedcentral.com/">https://jnanobiotechnology.biomedcentral.com/</a>

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	S	S	S	S	S	M	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	M	S	S	S	S	S
CO 4	S	S	M	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

S-Strong (8)

M-Medium (2)

L-Low (1)

### Mapping with Programme Specific Outcomes

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	2
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	14
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	2.8

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>BASICS OF MARINE BIOLOGY</b>
<b>Learning Objective</b>			
<b>LO1</b>	To understand and learn the physical, chemical and biological aspects of marine environment and to gain knowledge about the management of oceans.		
<b>LO2</b>	To introduce students to the marine environment and its indigenous organisms.		
<b>LO3</b>	To study the principles, concepts and facts through which the student can better understand and appreciate the nature of these and its inhabitants.		
<b>LO4</b>	To acquaint the student with the characteristics used to identify and classify marine plants and animals and to develop an awareness of the career possibilities available to students in this area.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Outcomes</b>
<b>I</b>	Marine Ecology: Marine environment- ecological factors-light, temperature, salinity, pressure; Classification of marine environment; Pelagic environment – Planktonic and Nektonic adaptations; Benthic environment-intertidal, in terrestrial and deep-sea adaptations; Distribution and ecological role of other coastal environments - coral reefs, estuaries, mangroves, sea grass beds, kelp forests, polar ice and hydrothermal vents.	<b>12</b>	<b>CO1</b>
<b>II</b>	<b>Physical Oceanography:</b> Physical Properties of Seawater-density, viscosity, surface tension, conductivity and their relationship; temperature distribution in the sea – heat budget, UV radiation; El Nino/La Nina – global impact; Dynamics of the ocean-general surface circulation, Waves, Currents and Tides, Tsunami.	<b>12</b>	<b>CO2</b>
<b>III</b>	<b>Chemical Oceanography:</b> Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements their importance, distribution. Chemistry of seawater constituents concept to chlorinity and salinity-methods of measurements, nutrients, biogeochemical cycles.	<b>12</b>	<b>CO3</b>

<b>IV</b>	<b>Biological Oceanography:</b> Sea as a biological environment- Plankton classification based on size, mode of life and habitat. Phytoplankton and Zooplankton- methods of collection, estimation of standing crop- wet and dry weight estimation- plankton volume settling and displacement methods. Oxidation as carbon (as organic matter). Primary productivity– estimation and factors affecting primary productivity.	<b>12</b>	<b>CO4</b>
<b>V</b>	<b>Marine Pollution and Ocean Management:</b> Ocean pollution- kinds and quantities of pollutants, toxic effects and control measures– oil spills, plastics, nuclear waste disposal in marine environment, Eutrophication. Role of National and international agencies and organizations in ocean management-FAO, UNEP, DOD, WOCE, WHOI, IOI Malta, IMO INMARSAT- IUCN, SCAR, SCOR, Marpol, Traffic. Ocean policy (India)- research and management.	<b>12</b>	<b>CO4</b>
<b>Total</b>		<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Define marine ecosystem, recognize and describe the inter relationship between biology and ocean technology.	Knowledge (Level K1)	
<b>CO2</b>	Articulate and classify the dynamics and the physical attributes of the ocean, interpret the factors which affect the global climate.	Application (Level K3), Synthesis (Level K6)	
<b>CO3</b>	Identify and analyze the physical and biological factors of marine environments, and focus life in the open sea.	Comprehension (Level K2)	
<b>CO4</b>	Evaluate the impact of variations in abiotic factors in marine productivity and justify the role of human activities in the degradation of marine ecosystems.	Analysis (Level K4)	
<b>CO5</b>	Categorize marine pollutants and develop controlling measures in collaboration with the in situations for ocean management.	Application (Level K3), Synthesis (Level K6)	

REFERENCE BOOK	
1.	Barbara E. Curry, 2016. Advances in Marine Biology, Volume 74, 1st Edition. Academic Press ISBN: 9780128036075
2.	Peter Castro, Michael E. Huber, 2015. Marine Biology; Series Botany, Zoology, Ecology and Evolution. McGraw-Hill Education.
3.	Philip V. Mladenov, 2013. Marine Biology: A very short introduction, 1st Edition. Oxford University Press.
4.	Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj C.R, 2012. Marine diversity in India. Zoological Survey of India, Kolkata. 178 pp.
5.	Amy Hill. 2002. Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Series) Walch publishing. Pickard,
6.	Gage J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge
7.	Raymont J.E.G., 1980. Plankton and Productivity in the oceans: Volume 1: Phytoplankton, Pergamon Press.

8.	VanDerSpoel,S.and Pierrot Bults,A.C(Eds)1979.Zoogeography and diversity of plankton.Bungs Scientific Publishers Utrecht, 410pp.
9.	Riley,J.P. and Sikkrow, 1975-1984. Chemical Oceanography Vols. 1to8. Academic Press London.

### WEB RESOURCES

1.	<a href="https://www.livescience.com">https://www.livescience.com</a>
2.	<a href="https://www.icriforum.org">https://www.icriforum.org</a>
3.	<a href="https://www.cbd.int">https://www.cbd.int</a>

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	M	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	M	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	M	S

**S-Strong (8)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	2	3
Weightage	15	15	15	14	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	2.8	3



PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS	2Hrs/Week	SEMESTER	V
CREDITS	2	COURSE TITLE	Value Education

### Learning Objectives

This course aims to

LO1 – build physical and mental strength of the learners

LO2 – strengthen the emotional and spiritual aspects of the learners.

LO1 – make the learners responsible and cooperative citizens

LO3 – develop democratic way of thinking and inculcate spirit of national integration

LO4 – develop the practice of paying respect for dignity of individual and diversity in society

### COURSE CONTENT

- 1) யோகமும் உடல்நலமும் (16 hours)
  - 1.1 உடலமைப்பு – 3 உடல்கள் - ஐந்தில் அளவுமுறை
  - 1.2 எளியமுறை உடற்பயிற்சி – கைப்பயிற்சி – கால் பயிற்சி - மூச்சுபயிற்சி – கண் பயிற்சி – கபாலபதி
  - 1.3 மகராசனம் 1-2 – உடல் தேய்த்தல் - அக்குபிரஷா பயிற்சி – உடல் தளர்த்தல்
  - 1.4 யோகாசனங்கள்: ஸூரியாஸனம் - பத்மாசனம் - வஜ்ராசனம் - சக்கராசனம் (பக்கவாட்டில்) – விருச்சாசனம் - யோக முத்ரா – பச்சி மோத்தாசனம் - உஸ்ட்ராசனம் - வக்கராசனம் - சலபாசனம்
- 2) உயிர்வளமும் - மனவளமும் (16 hours)
  - 2.1 இளமை காதல் - முதுமையைத் தள்ளிப்போடுதல்
  - 2.2 பாலுணர்வும் ஆன்மீகமும் - வித்தின் மகிமை - இல்லற வாழ்வு – கற்புநெறி
  - 2.3 மனதின் பத்து படிநிலைகள்
  - 2.4 மன அலைச்சுழல் - மன ஓர்மைக்கான பயிற்சிகள்
- 3) குணநலப்பேறு (16 hours)
  - 3.1 வாழ்வின் நோக்கம் - வாழ்க்கைத் தத்துவம்
  - 3.2 அகத்தாய்வு – எண்ணம் ஆராய்தல்
  - 3.3 ஆசை சீரமைத்தல்
  - 3.4 சினம் தவிர்த்தல்
- 4) மனிதவள மேம்பாடு (16 hours)
  - 4.1 கவலை ஒழித்தல்
  - 4.2 வாழ்த்தும் பயனும்
  - 4.3 நட்பு நலம்
  - 4.4 தனிமனித அமைதி – உலக அமைதி
- 5) இயற்கை நியதி (16 hours)
  - 5.1 ஒருங்கிணைப்பு ஆற்றல் - செயல்விளைவுத் தத்துவம்
  - 5.2 மனத்தூய்மை, வினைத்தூய்மை – கருமையம்
  - 5.3 அன்பும் கருணையும்
  - 5.4 பண்பாட்டுக் கல்வி – ஐந்தொழுக்கப் பண்பாடு

<b>Reference Book</b>
Manavalakalai Yoga, Vethathri Publications, Tamil Nadu, 2008.

**Evaluation Pattern**

Practical [Performing Yoga & Meditation] – 25 marks

Theory [End-Semester Examination] – 75 marks

**Question**

**Pattern**

Section – A      Ten objective type questions with multiple answers are to be given. (10X1=10)

Section – B      Five short essay type questions in ‘Either – or’ pattern are to be given. (5X7=35)

Section – C      Five long essay type questions are to be given. Three questions are to be answered. (5X10=30)

\*\*\*\*\*

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>-Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>Summer Internship / Industrial Training</b>

### **Learning Objectives**

LO1 – To offer a hands-on-learning experience, that allows the learners to maximize the outcome and benefits of their theoretical knowledge through practical implementation.

LO2 – By adding technical skills, soft skills and professional experience to the learners' resume, they can enhance their chances of securing the job they desire

LO3 – To provide the learners an experience of the real corporate world and thus help them understand the expectations and requirements of the industry

LO4 – To enable the learners build their network and professional relationships, which turns them into confident future professionals.

### **Duration of the Training:**

- The learners of all the Under-Graduation Programmes are to undergo the Internship / Industrial Training during the summer vacation, after completion of the IV Semester examinations. The training period is 30 working days.
- Evaluation:
- After completion of the training, the evaluation of the performance of the learners will be done in the V semester.
- Two credits will be awarded for the best performers.
- Viva-voce examination will be conducted and the learners have to appear for the Viva-voce individually.
- At the time of Viva-voce, the learners have to submit the given records to the examiner.
- Work Diary, endorsed by the trainer
- A complete report on the objectives, modules and outcomes.
- A certificate, duly signed and issued by the trainer

### SEMESTER - VI

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>6 Hrs/Week</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>CORE XIII- BIOTECHNOLOGY</b>
<b>Learning Objectives</b>			
LO1	To impart the skills required to explain the protocols for genetically manipulating cells and produce transgenic animals.		
LO2	To encourage the use of the apt molecular techniques to evaluate and Analyze animal traits and diseases at the genomic level and employ methods for easy taxonomical identification and classification for biodiversity and environmental studies.		
LO3	To study methods of transgenesis and to consider their use in improving animal husbandry and animal health.		
LO4	To motivate students to review the ethics and speculate on the environmental implications of animal biotechnological methods		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Fundamentals of Biotechnology</b> : Animal cell culture: Basic requirements and techniques of cell culture, natural and synthetic culture media, primary culture and cell lines; Stem cells: types, culture and applications; r-DNA technology: Enzymes; Vectors – pBR322, Phage lambda, Cosmid, HAC, BAC, YAC; Host cells; Gene cloning: steps in cloning, selection of clones – chromogenic substrate, antibiotics.	12	CO1
II	<b>Techniques in Animal Biotechnology</b> : Isolation and purification: DNA and mRNA; Blotting techniques: Methods of different types of blotting; DNA sequencing: Sanger method, DNA chips, microarray; PCR: principle, types and application; Gene library: screening with probes; Site directed mutagenesis: principle and application; Gene transfer in animal cells: transfection, liposomal, viral mediated, electroporation, biolistic, direct DNA injection.	12	CO2

III	<b>Transgenic Animal Technology:</b> Transgenesis: Concept, transgenes, transgenic animal models - knock out mice, sheep; Applications of transgenesis: Molecular farming, Transgenic fishes, transgenic live stocks, and animals as bioreactors.	12	CO3
IV	<b>Animal Biotech and Health Care:</b> Medical biotechnology: Monoclonal antibodies, recombinant vaccines –hepatitis B, hormones – insulin. DNA diagnostic systems: tuberculosis, AIDS, genetic diseases; Gene therapy: Ex vivo and in vivo, role in cancer treatment; CRISPR gene editing. Molecular markers: RFLP, RAPD, DNA fingerprinting and application.	12	CO4
V	<b>Applications and Ethics:</b> Human genome project: Mapping of human genome, applications, ethics; Industrial biotechnology: Bioreactors - Basic concepts of fermentation, bioreactor design, production of ethanol and streptomycin; Ethics: Socio ethical problem, recent trends in animal biotechnology, ethical implications.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To describe the methodologies for handling animal cells based on their diverse characteristics and identify the correct biotechnological tools to obtain the desired products from the cells.	Application(LevelK3)	
<b>CO2</b>	To develop and explain the protocols for genetically manipulating cells and produce transgenic animals	Analysis(LevelK4)	
<b>CO3</b>	To select the apt molecular techniques to evaluate and analyze animal traits and diseases at the genomic level and devise methods for easy taxonomical identification and classification for biodiversity and environmental studies.	Analysis(LevelK4)	
<b>CO4</b>	To choose the correct methods of transgenesis and to consider their use in improving animal husbandry nationally and globally	Evaluation(LevelK5)	
<b>CO5</b>	To speculate on the environmental implications of animal biotechnological methods and design responsible, ethical solutions to livestock production and health issues.	Application(LevelK3)	

<b>Text Books</b>	
1.	Singh B. D., 2015. Biotechnology: Expanding horizon, Kalyani publishers.
2.	Sasidhara, R., 2015. Animal biotechnology, MJP publishers.
3.	Dubey R. C., 2014. A text Book of Biotechnology, S. Chand & Co Ltd, Ram Nagar, New Delhi.
4.	Dubey S. K., Bandana Ghosh, 2012. Fish biotechnology, Wisdom Press.
5.	Dubey R.C., 2014. Advanced Biotechnology, S. Chand Publication.
6.	Ruby, R.C., 2012. A text book of biotechnology, S. Chand Company, New Delhi.
7.	Sambamurthy K., Ashutosh Kar., 2009. Pharmaceutical Biotechnology, New Age International (P) Ltd.
8.	Ramdoss P., 2009. Animal Biotechnology- Recent concepts and developments, MJP publishers.
9.	Sathyanarayran U., 2008. Biotechnology, Books and Allied, Kolkata.
10.	Ignacimuthu, S., 2008. Basic Biotechnology, Tata McGraw hill, New Delhi.
11.	Rastogi S. C., 2007. Biotechnology: Principles and applications, Alpha Science publishers. Ranga, M.M., 2003. Animal biotechnology, Agrobios, New Delhi.
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Veer Bala Rastogi, 2016. Principles of Molecular biology, Medtech, Maine, USA.
2.	Michael Crichton, 2014. Essentials of Biotechnology, Medtech, Maine, USA.
3.	Godbey W.T., 2014. An Introduction to Biotechnology, Academic press, New York, USA.
4.	Peters, P., 2009. Biotechnology – A guide to genetic engineering, WMC brown publisher, UK.
5.	Ramawat, K.G and Shailey Goyal, 2009. Comprehensive biotechnology, S.Chand company, New Delhi, India.
6.	Primrose S.B., R. M. Twyman and R. W. Old, 2001. Principles of gene manipulation, Wiley- Blackwell, UK.
7.	Primrose S. B., 2001. Molecular Biotechnology, Panima Publishing Corporation, New Delhi, India.
8.	Hames B.D. and Higgins S.J. 1995. Gene Probes: A Practical Approach, Oxford University Press, UK.

Web Resources	
1.	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/</a>
2.	<a href="https://www.isaaa.org/resources/publications/pocketk/40/default.asp">https://www.isaaa.org/resources/publications/pocketk/40/default.asp</a>
3.	<a href="https://www.ncbi.nlm.nih.gov/books/NBK207574/">https://www.ncbi.nlm.nih.gov/books/NBK207574/</a>
4.	<a href="https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf">https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf</a>
5.	<a href="https://go.nature.com/3zAZmO9">https://go.nature.com/3zAZmO9</a>

Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	M	S	S	S	S	S
<b>CO 4</b>	S	M	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3



<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>6Hrs/Week</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>CORE XIV- IMMUNOLOGY</b>
<b>Learning Objectives</b>			
LO1	To understand the fundamentals of immunology in protection against disease and also the key principles of antigen- antibody reaction in the immune system.		
LO2	To list basic mechanisms that regulate immune responses, describe the main steps in the generation of cells and organs of the immune system.		
LO3	To describe the basic mechanisms that provide innate immunity and antigen processing and presentation.		
LO4	To differentiate B and T cell receptors, organs, and microenvironments of the Immune System.		
LO5	To promote critical thinking and provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics and cell biology.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Immune Cells and Organs:</b> Overview of Immune System - General concepts and Haematopoiesis. Cells of the immune system - T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils -Mast cells and dendritic cells. Organs of the Immune system: Primary lymphoid organs - Thymus and bone marrow; Secondary Lymphoid organs - Lymph nodes and spleen; Lymphatic tissues - Peyer's patches and Kupffer cells, MALT, GALT and CALT.	12	CO1
II	<b>Innate and Adaptive Immunity:</b> Innate and Adaptive Immunity; Anatomical barriers, Inflammatory response, Cells and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral). Receptors and Signalling: Cytokines and Chemokines - General Properties of Cytokines and Chemokines. Major	12	CO2

	Histocompatibility Complex (MHC): Organization and inheritance of the MHC. Structure and cellular distribution of HLA antigens.		
III	<b>Antigen and Antibodies:</b> Antigens- Antigenicity and immunogenicity: Properties -foreignness, molecular size, heterogeneity. B & T epitopes, T-dependent and T-independent B cell responses. Antibodies: Structure, function and properties of the Immunoglobulins, Different classes of Immunoglobulins; antigenic determinants on antibodies (isotype, allotype and idiotype). Hybridoma technology - production of monoclonal antibodies and catalytic antibodies (abzymes).	12	CO3
IV	<b>Hypersensitivity and Autoimmune Diseases:</b> Hypersensitivity: classification and brief description of various types of hypersensitivities. Autoimmunity: cause of autoimmune diseases - classification of autoimmune diseases. Transplantation immunology: Types of grafts, immunologic basis of graft rejection, immunosuppressive therapy and clinical transplantation.	12	CO4
V	<b>Clinical Immunology:</b> Immunity and tumours- tumour antigens (TSTA and TAA), immune response to tumors. Tumour evasion of the immune system, Immunotherapy for tumors. Immunity against - viral, bacterial and parasitic infections. Vaccines: Types and uses - Immunization schedule for children.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Understand and recall the basic structural and functional components of the immune system, compare and contrast cells with respect to origin and maturation.	Comprehension(LevelK2)	
<b>CO2</b>	Classify and explain types of immunity, state the significance of antigen and examine their relevance to immunizations.	Comprehension(LevelK2)	

<b>C03</b>	Describe and differentiate the biological characteristics of the antibodies, analyze and formulate the procedure for antibody production	Application(LevelK3)
<b>C04</b>	Compare and rate the mechanism of various types of hypersensitivity reactions, assess and identify the different types of autoimmune diseases.	Knowledge(LevelK1)
<b>C05</b>	Summarize immune responses against pathogens	Application(LevelK3)
<b>Text Books (Latest Editions)</b>		
1.	Kuby, J, Punt, J, Stranford, S, Jones, Pand Owen, J, 2018. Immunology, 8th Edition, W.H. Freeman Publishing, New York, 944 pp.	
2.	Roitt, M, Peter J. Delves, Seamus J. Martin and Dennis R. Burton, 2017. Essential Immunology, 13th Edition, Wiley-Blackwell Publishing, USA, 576 pp.	
3.	Coleman, R.M., 2014. Fundamental Immunology, 2nd Edition, Published by McGraw Hill Education India, 357 pp.	
4.	Raj Khanna, 2011. Immunology, Oxford University press, New Delhi. 428 pp.	
5.	Rao, C.V. 2011. Immunology, Narosa Publishing House, New Delhi, 426 pp.	
<b>Reference Books (Latest editions, and the style as given below must be strictly adhered to)</b>		
1.	Abul A. Andrew, Lichtman. H, Shiv. P, 2014. Cellular and Molecular Immunology, 8th Edition, Published by W.B. Saunders, 544 PP.	
2.	Chapel. H, Haeney. M, Misbah. S, and Snowden. N, 2006. Essentials of Clinical Immunology, 5th Edition. Blackwell Publishing, 368 PP.	
3.	William R. Clark, 1985. The Experimental Foundations of Modern Immunology, Published by Johns Hopkins University Press, New York. 326 PP.	
4.	Kenneth Murphy & Casey Weaver, 2016. Janeway's Immunology, Garland Science publishers, 924 pp.	
<b>Web Resources</b>		
1.	<a href="https://www.aaaai.org/">https://www.aaaai.org/</a>	
2.	<a href="https://www.bsaci.org/">https://www.bsaci.org/</a>	
3.	<a href="https://www.immunology.org/">https://www.immunology.org/</a>	
4.	<a href="https://nptel.ac.in/courses/102/103/102103038/">https://nptel.ac.in/courses/102/103/102103038/</a>	
5.	<a href="https://microbenotes.com/category/immunology/">https://microbenotes.com/category/immunology/</a>	

<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### **Mapping with Programme Outcomes**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO8</b>	<b>PO 9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	M	S	S	S	S	S	S	S
<b>CO 2</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	M	S	S	S	S	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	M	S	S	S	S

**S-Strong(3)**

**M-Medium (2)**

**L-Low (1)**

#### **Mapping with Programme Specific Outcomes**

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3

(P.G Department of Zoology TANSCHfE syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>5Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>4</b>	<b>COURSE TITLE</b>	<b>Project with Viva Voce (Individual Project)</b>

### **Learning Objective**

Other than class room teaching through theory and practical lectures, internships, field visits, assignments and seminars, the learners are put in the practice of doing research at the Under-Graduation level itself.

### **Methodology**

- Every individual learner has to carry out a minor research work
- The area of focus can be related to the core subjects
- Inter-disciplinary research works are encouraged.
- The project work must retain its originality and avoidance of plagiarism is mandatory

### **Evaluation Pattern**

- After completion of eighty percent of the working days in the concerned semester, the candidate has to submit the research/ project work to the Examination section of the institution for evaluation.
- The final product of the research work must be duly signed by the candidate, the Research Supervisor and the Head of the Department
- The Examination section of the institution will fix a date for Viva-voce examination. Each individual has to appear for the Viva-voce.

### **Allocation of Marks**

CIA – 25 marks

- The research supervisor will award the marks assessing the performance of the researcher throughout the process of research Viva-voce – 75 marks
- The student will appear for Viva-voce examination. The examiner will assess the quality of the research, subject knowledge and the presentation of the learner.

### **Thrust Areas for Research**

Biochemistry

Immunology

Genetics

Environmental Science

Ornithology

Ornamental Fish Culture

Entomology

(P.G Department of Zoology TANSCHÉ syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>3Hrs/Week</b>	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>CORE XV-BIOTECHNOLOGY LAB COURSE</b>
<b>Learning Objectives</b>			
LO1	To encourage students to interpret the organization of genomic material and to research theories of genetic inheritance.		
LO2	To impart the skills required to prepare samples of genetic molecules and to determine their purity, structure and characteristics and to analyze genomic preparations.		
LO3	To study the changes in genetic material and to predict and consider the consequences of those changes.		
LO4	To encourage students to report and justify the results of molecular and genetic experiments in an accurate and meaningful manner.		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	<b>Isolation of genetic molecules:</b> Isolation of DNA from spleen. Total RNA isolation from plant/animal cells	12	CO1
II	Qualitative and quantitative analysis of genetic molecules: Determination of the purity of isolated DNA and RNA samples by UV Spectrophotometry. Quantitative estimation of DNA by Spectrophotometry	12	CO2
III	<b>Molecular analysis:</b> Agarose gel electrophoresis of DNA. Restriction fragment length polymorphism study. Eliza, Western Blot.	12	CO3
IV	Blood Grouping. Total WBC and RBC. Estimation of Haemoglobin. Preparation of Serum components. Radial Immunodiffusion test. Double Immunodiffusion test. Restriction Digestion of plasmid DNA. Ligation of restricted fragments.	12	CO4

V	Basic animal cell culture technique and transgenesis: Trypsinization of liver cells. Determination of the viability of trypsinized cells by Trypan Blue method. Creation of transgenic flies through virtual lab activity ( <a href="https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html">https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html</a> )	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To describe, examine and interpret the organization of genomic material and to research theories of genetic inheritance.	Application(LevelK3)	
<b>CO2</b>	To prepare samples of genetic molecules and to determine their purity, structure and characteristics.	Knowledge(LevelK1)	
<b>CO3</b>	To experiment with genomic preparations and devise techniques to distinguish genetic material in different organisms to survey biodiversity.	Analysis(LevelK4)	
<b>CO4</b>	To assess the changes in genetic material and to predict and consider the consequences of those changes.	Comprehension(LevelK2)	
<b>CO5</b>	To report and justify the results of molecular and genetic experiments in an accurate and meaningful manner.	Comprehension(LevelK2)	
<b>Text Books</b>			
1.	Surya Nandan Meena, Milind Naik, 2019. Advances in Biological Science Research: A Practical Approach, Academic Press, New York, USA.		
2.	Michael Perlin, William Beckerson, Adarsh Gopinath, 2017. Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.		
3.	Saxena J., Baunthiyal M., Ravi I., 2015. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology, Scientific Publishers, India.		
4.	Bansal M.P., 2013. Molecular Biology and Biotechnology: basic experimental protocols, The Energy and Resources Institute (TERI), New Delhi, India.		
5.	Chaitanya K.V., 2013. Cell and molecular biology: A Lab Manual, Phi Learning Pvt. Ltd., New Delhi, India.		

<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>	
1.	Andreas Hofmann, Samuel Clokie, 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.
2.	Sarah Stauffer, Aaron Gardner, Wilko Duprez, Dewi Ayu Kencana Ungu, Philip Wismer, 2018. Labster Virtual Lab Experiments: Basic Genetics, Springer Publishers, NY, USA.
3.	Leonard Davis, Mark Dibner, James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Publishing Co., NY, USA.
4.	Robert F. Schleif, Pieter C. Wensink, 2012. Practical Methods in Molecular Biology, Springer-Verlag, NY, USA.
5.	Ian Freshney R., 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, John Wiley & Sons, USA.
<b>Web Resources</b>	
1.	<a href="https://www.jove.com/">https://www.jove.com/</a>
2.	<a href="https://vlab.amrita.edu/?sub=3&amp;brch=77">https://vlab.amrita.edu/?sub=3&amp;brch=77</a>
3.	<a href="http://cbii-au.vlabs.ac.in/">http://cbii-au.vlabs.ac.in/</a>
4.	<a href="https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html">https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html</a>
5.	<a href="https://www.ibiology.org/biology-techniques/">https://www.ibiology.org/biology-techniques/</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations



### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	M	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	S	S
CO 5	S	S	M	S	S	S	S	S	S	S

**S-Strong(3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	3

PROGRAMME CODE			PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE			BATCH	2023-2026	
HOURS		4 Hrs/Week	SEMESTER	VI	
CREDITS		3	COURSE TITLE	ELECTIVE –IV WILD LIFE CONSERVATION AND MANAGEMENT	
Learning Objectives					
LO1		To understand and discuss the importance of wildlife, its values, modern concepts in relevant conservation policies.			
LO2		To assess and instill strong foundations on wildlife policies and be familiar with a variety of laws and regulations			
LO3		To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.			
UNIT		Details		No. of Hrs	Course Outcomes
I		Biodiversity Extinction and Conservation Approaches: Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.		12	CO1
II		Theory and Analysis of Conservation of Populations: Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis-conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species.		12	CO2

III	<b>National and International Efforts for Conservation:</b> International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest & Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031, Wildlife Protection Act 1972, National and State Biodiversity Action Plans and other Forests and Environmental Acts.	12	CO3
IV	<b>Wildlife in India:</b> Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wild life Habitat: Characteristic, Fauna and Adaptation with special reference to tropical forest. Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and Corridors. Community Reserve and Conservation Reserves.	12	CO4
V	<b>Management of Wildlife:</b> Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.	12	CO5
<b>Total</b>		<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife.	Comprehension(LevelK2)	
<b>CO2</b>	To integrate and assess the National, international approaches for biodiversity conservation.	Analysis(LevelK4)	
<b>CO3</b>	To analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.	Application(LevelK4)	
<b>CO4</b>	To explain the role PVA models, Wildlife conservation approaches, and limitations.	Evaluation(LevelK5)	
<b>CO5</b>	To construct and simulate National and International strategies for Conservation, Wild life laws and ethics.	Application(LevelK4)	

<b>Text Books</b>	
1.	Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.
2.	Aaron, N.M.1973 Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A.
3.	Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
4.	Justice Kuldip Singh 1998. Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun
5.	Hosetti, B.B. 1997 Concepts in Wildlife Management, Daya Publishing House, Delhi. Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.
6.	
<b>Reference Books</b> (Latest editions, and the style as given below must be strictly adhered to)	
1.	Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
2.	Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
3.	Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
4.	Goutam Kumar Saha and SubhenduMazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.
<b>Web Resources</b>	
1.	<a href="https://bit.ly/39oPj44">https://bit.ly/39oPj44</a>
2.	<a href="https://bit.ly/3lHdEYJ">https://bit.ly/3lHdEYJ</a>
3.	<a href="https://bit.ly/3CwBCfY">https://bit.ly/3CwBCfY</a>
4.	<a href="https://bit.ly/3EDYr3a">https://bit.ly/3EDYr3a</a>
5.	<a href="https://bit.ly/3tVtG4U">https://bit.ly/3tVtG4U</a>
<b>Methods of Assessment</b>	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge

<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

### Mapping with Programme Outcomes

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 2</b>	M	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	M	S	S	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	2
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	2	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	14	15	14
<b>Weighted % of Course Contribution to POs</b>	3.0	3.0	2.8	3.0	2.8

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>ELECTIVE V- AGRICULTURAL ENTOMOLOGY</b>
<b>Learning Objectives</b>			
LO1	Explain the basic concepts of entomology and observe the pest status of agriculture.		
LO2	Illustrate and examine the systemic and functional morphology of various group of agricultural insect pests.		
LO3	Differentiate and classify the various groups of insect animals and estimate biodiversity.		
LO4	To compare and distinguish the general and specific characteristics integrated pest management.		
LO5	Infer and integrate the economic importance of insect species		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hrs</b>	<b>Course Outcomes</b>
I	Outline classification of insects - Causes for insect assuming pest status - Methods of collection, mounting and preservation of insect pests.	12	CO1
II	Insect vectors of plant diseases, Insect pests of stored grains their preventive and curative methods, Most common insect pests of the following plants and their control measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton. Locust and its control. Insect pollinators and scavenger	12	CO2
III	Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees for apiary, Newton's bee hive, enemies and diseases of honey bees. Sericulture: Introduction, types of silk worms, silk worm races, life history of mulberry silk worm, features of sericulture industry, pests and diseases of silk worm. Lac Culture.	12	CO3
IV	IPM, physical, mechanical, chemical and biological control methods, Pesticide application equipment	12	CO4

V	Introduction and steps towards IPM, Pheromones, anti feedents, repellents and biopesticide.	12	CO5
	<b>Total</b>	<b>60</b>	
<b>Course Outcomes</b>			
<b>Course Outcomes</b>	On completion of this course, students will;		
<b>CO1</b>	Examine and identify the systemic and functional morphology of various group of agricultural insect pests.	Knowledge(LevelK1)	
<b>CO2</b>	List the economic importance of agricultural insect species.	Comprehension(LevelK2)	
<b>CO3</b>	Explain the pest status in agriculture and control measures.	Comprehension(LevelK2)	
<b>CO4</b>	To compare the methods and outcomes of integrated pest management.	Knowledge(LevelK1)	
<b>CO5</b>	Differentiate and classify the various groups of insects and estimate the biodiversity.	Application(LevelK4)	
<b>Text Books</b>			
1.	David,B and Ananthakrishnan, T.N.2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd.,New Delhi, India.		
2.	Vasanthraj David, B. and Ramamurthy, VV. 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.		
3.	Pruthi,H.S.1969.Text book on Agricultural Entomology, I.C.A.R. Publication, New Delhi.		
4.	Awasthi, V.B. 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers		
<b>Reference Books</b> <b>(Latest editions, and the style as given below must be strictly adhered to)</b>			
1.	Abishek Shukla, D. 2009.A Hand Book of Economic Entomology, Vedamse Books, New Delhi.		
2.	MinistryofAgriculture,GovernmentofIndia,1995.ManualonIntegratedPest Management in Rice and Cotton		
3.	John WilliamS. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.		

Web Resources	
1.	<a href="http://www.fao.org">http://www.fao.org</a>
2.	<a href="http://flybase.bio.indiana.edu/">http://flybase.bio.indiana.edu/</a>
3.	<a href="http://www.ipm.ucdavis.edu">http://www.ipm.ucdavis.edu</a>
4.	<a href="http://www.ent.iastate.edu/list/www.entsoc.org">http://www.ent.iastate.edu/list/www.entsoc.org</a>
Methods of Assessment	
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	S	S	M	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S	S

S-Strong(3)

M-Medium (2)

L-Low (1)

#### Mapping with Programme Specific Outcomes

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	14	15	15	15
Weighted % of Course Contribution to POs	3.0	2.8	3.0	3.0	3



(P.G Department of Zoology TANSCHÉ syllabus 2023-24 onwards BOS dt 12.07.2023 Academic council 20.07.2023)

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>4 Hrs/Week</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>3</b>	<b>COURSE TITLE</b>	<b>ELECTIVE – VII HUMAN REPRODUCTIVE BIOLOGY</b>
<b>Learning Objectives</b>			
<b>LO1</b>	To enable students to understand the endocrine structures and hormones associated with the physiology of reproductive system		
<b>LO2</b>	To enable students to learn about the male reproductive system and accessory glands and regulation		
<b>LO3</b>	To enable students to learn about the female reproductive system and regulation of its function		
<b>LO4</b>	To enable students to comprehend about fertilization, pregnancy, parturition and lactation		
<b>LO5</b>	To equip students with knowledge on causes of infertility, reproductive health, assisted reproductive technology and associated ethical issues		
<b>UNIT</b>	<b>Details</b>	<b>No. of Hours</b>	<b>Course Outcomes</b>
<b>I</b>	Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation; Puberty	12	<b>CO1</b>
<b>II</b>	Outline and histoarchitecture of male reproductive system; Testis: Cellular functions; Spermatogenesis and its hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract; Andropause	12	<b>CO2</b>
<b>III</b>	Outline and histo architecture of female reproductive system; Ovary: oogenesis and its hormonal regulation; Steroid ogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation, changes in the female tract; Menopause	12	<b>CO3</b>

IV	Ovum transport in the fallopian tubes; Sperm transport in the female tract, Fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foetal – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation	12	CO4
V	Infertility in male and female: causes, diagnosis and management; Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, Stem Cell banks, <i>in vitro</i> fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; ethical issues related to ART; Surrogate motherhood; ethical issues; Consanguinity; Foetal Loss and Birth Defects and Adoption	12	CO5
Total		60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Recall the structure and functioning of the male and female reproductive system, associated endocrinology, causes for infertility and assisted reproductive technology	Knowledge(LevelK1)	
CO2	Describe the structure and physiology functions of male and female reproductive systems.	Application(LevelK3)	
CO3	Explain the role of structures, accessory glands and hormones associated with the reproductive tracts and their control	Analysis(LevelK4)	
CO4	Explain them mechanism of sex determination.	Evaluation(LevelK5)	
CO5	Discuss age-associated physiological changes in the reproductive tract	Synthesis(LevelK6)	

<b>REFERENCE BOOKS</b>		
1.	Cassan, A. (2005). <i>Human reproduction and Development (Inside the Human Body)</i> . New York: Chelsea Clubhouse.	
2.	Field, M.A. (1990). <i>Surrogat Mother hood</i> . Mass achusetts: Harvard University.	
3.	Gardner, D. K. (2001). <i>Textbook of Assisted Reproductive Techniques: Laboratory and Clinical Perspectives</i> . London: MartinDunitz.	
4.	Gardner, D. K. (2006). <i>In vitro Fertilization: A Practical Approach</i> . CRC Press.	
5.	Johnson, M. H. (2018). <i>Essential Reproduction</i> . New Jersey: Wiley-Blackwell.	

6.	Jones,R.E.(2013). <i>Human Reproductive Biology</i> .Amsterdam: Elsevier.
7.	Neill, Jimmy D. ed (2006). Knobil and Neill's Physiology of Reproduction. Volume I. Third edn. Elsevier Academic Press.
8.	Pinon, R. (2003). <i>Biology of Human Reproduction</i> . California: University Science Books.

#### Web Resources

1.	<a href="https://ncert.nic.in/ncerts/l/lebo103.pdf">https://ncert.nic.in/ncerts/l/lebo103.pdf</a>
2.	<a href="https://ncert.nic.in/textbook/pdf/lebo103.pdf">https://ncert.nic.in/textbook/pdf/lebo103.pdf</a>
3.	<a href="https://www.eshre.eu/">https://www.eshre.eu/</a>

#### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
<b>CO 1</b>	S	S	S	S	M	S	S	S	S	S
<b>CO 2</b>	S	S	S	S	S	S	S	S	S	S
<b>CO 3</b>	S	S	M	S	S	S	S	S	S	S
<b>CO 4</b>	S	S	S	S	S	S	S	M	S	S
<b>CO 5</b>	S	S	S	S	S	S	S	S	S	S

S-Strong (3)

M-Medium (2)

L-Low (1)

#### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	2	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	14	15	15
<b>Weighted % of Course Contribution to POs</b>	3	3	2.8	3	3

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2023-2026	
HOURS	4 Hrs/Week	SEMESTER	VI	
CREDITS	3	COURSE TITLE	ELECTIVE – II -BASIC COURSE IN ORNITHOLOGY	
Learning Objectives				
LO1	To equip students with the required knowledge to understand the taxonomic position and role played by birds in the ecosystem, their importance to humans and their evolution			
LO2	To enable students to comprehend the biological evolution of birds and their structural adaptations			
LO3	To enable students to understand and learn aspects of bird behavior			
LO4	To enable students to learn about the breeding biology of birds			
LO5	To equip students with a knowledge of macro ecology of birds, bird populations and communities, bird diseases, bird conservation and on the role of citizen science in ornithology.			
UNIT	Details		No. of Hours	Course Outcomes
I	Introduction to Ornithology ; Bird Lore ; Birds and Humans ; Classification of Birds, Bird Evolution and Speciation; Endemism		12	CO1
II	External Morphology of the Bird; Structure of bird feather, Internal Structure of the Bird ; Adaptations to Flight		12	CO2
III	Bird Behaviour: Foraging, Roosting, Vocalization, Imprinting, Feather care, Bird Intelligence, Social Behaviour, Mixed Species Flocks, Migration.		12	CO3
IV	Breeding Biology: Differential investment of sexes; territoriality, courtship and display behaviour, nesting, eggs, incubation and care of young, brood parasitism.		12	CO4
V	Studying bird populations and communities, sampling methods; Macro ecology; Molecular Techniques in Ornithology; Avian Disease; Citizen Science and Ornithology; Threats faced by birds; Bird Conservation with case studies.		12	CO5
Total			60	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Recall the taxonomic position of birds, their external morphology and internal parts, types of bird behaviour, sampling methods and types of avian diseases.	Knowledge(LevelK1)
CO2	Identify the external parts of the bird, internal structures of The bird and different types of bird behaviour.	Comprehension(LevelK2)
CO3	Differentiate birds based on their morphology, foraging Strategies and other behaviour	Comprehension(LevelK2)
CO4	Explain and discuss show birds evolved, bird adaptations of light, different aspects of bird behaviour, threats to birds and the role of citizen science in ornithology	Knowledge(LevelK1)
CO5	Discuss and analyse case studies relating to bird conservation.	Application(LevelK4)
TEXT BOOKS		
1	The book of Indian birds, <a href="#">Sálim Ali</a> · 2002, Bombay Natural History Society, Mumbai	
2	Joy Of Bird Watching, <a href="#">Vishwa Mohan Tiwari</a> · 2006, National book trust, India.	
3	. Birds in Agriculture, Dr.Raju kasambe, Goreganon, Bombay Natural History Society, Mumbai	
REFERENCE BOOKS		
1.	Lovette, I.J and Fitzpatrick, J.W. (2016). <i>Handbook of Bird Biology</i> , 3 <sup>rd</sup> ed. Wiley.2.Birkhead,T.(2013). <i>Bird Sense: Whatit's like to be a bird?</i> Blooms bury, NY.	
2.	Birkhead,T., Wimpenny,J.,andMontgomerie,B.(2014). <i>TenThousandBirds:4.Ornithologysince Darwin</i> . Princeton University Press, Princeton, NJ.	
3.	Gill,F.B, and Prum, R.O.(2019). <i>Ornithology</i> ,4 <sup>th</sup> ed.Macmillan	
WEB RESOURCES		
1.	<a href="https://bookauthority.org/books/beginner-ornithology-books">https://bookauthority.org/books/beginner-ornithology-books</a>	
2.	<a href="https://www.nhbs.com/3/ornithology">https://www.nhbs.com/3/ornithology</a>	
3.	<a href="https://www.bibliovault.org/BV.titles.epl?tquery=Ornithology">https://www.bibliovault.org/BV.titles.epl?tquery=Ornithology</a>	

### Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	M	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	M	S	S	S	S	S	S	S	S	M
CO 5	S	S	S	S	S	S	S	S	S	S

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	2	3
CO5	3	3	3	3	3
Weightage	15	15	15	14	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	2.8	3

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS	2Hrs/Week	SEMESTER	VI
CREDITS	2	COURSE TITLE	Professional Competency Course: Intellectual Property Rights

<b>Learning Objectives:</b>		
The main objectives of this course are:		
<b>LO1</b>	Students should gain basic knowledge intellectual property.	
<b>Units</b>		
<b>I</b>	Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO - TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.	
<b>II</b>	Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad	
<b>III</b>	International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.	
<b>IV</b>	Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.	
<b>V</b>	Infringement of IPRs, Enforcement Measures, Emerging issues - Case Studies.	
<b>Expected Course Outcome:</b>		
On the successful completion of the course, student will be able to		
CO1	Claim the rights for the protection of their invention done in their project work.	Knowledge(LevelK1), Application(LevelK3)
CO2	Identify criterias’ to fit one’s own intellectual work in particular form of IPRs	Application(LevelK4), Evaluation(LevelK5)
CO3	To get registration in our country and foreign countries of their invention, designs and thesis or theory written by students during their project.	Knowledge(LevelK1), Comprehension(LevelK2), Application(LevelK3)

<b>TEXT BOOKS</b>										
1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012 2. S.V Satakar Intellectual property Rights and Copy Rights, Ess Publication, New Delhi, 2002.										
<b>REFERENCE BOOKS</b>										
1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012. 2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011. 3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.										

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	S	M	M	M
CO2	S	S	M	S	M	S	S	S	M	L
CO3	S	M	M	S	M	L	L	S	L	S

\*S-Strong      M-Medium      L – Low

#### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	3



<b>PROGRAMMECODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSECODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>2Hrs/Week</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>Extension Activity</b>

The institution aims at developing amongst students a sense of participation in nation building through extension and outreach programmes. This deepens understanding of the social environment and enriches her personality through actual participation in day-to-day life of the society. This process of learning is not only a desirable supplement to the classroom education but develops in the student a sense of responsibility, tolerance and cooperation.

**Objectives:**

- To arouse social consciousness of the students by providing them opportunities to work with and among the people.
- To develop an awareness and knowledge of social realities to have concern for the well being of the community and engage in creative and constructive social action.
- To provide with rich and meaningful educational experiences to them in order to make their education complete and meaningful.
- To develop skill needed in the exercise of democratic leadership and programme development to help them get self-employed.
- To give them the opportunities for their personality development.
- Understand the community in which they work.
- Understand themselves in relation to their community.
- Identify the needs and problems of the social and involve them in problem solving process.
- Develop among themselves a sense of civic responsibility.
- Utilize their knowledge in finding practical solution to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities.
- Gain skill in mobilizing community participation.
- Acquire leadership qualities and democratic attitude.
- Develop capacity to meet emergencies and natural disasters.
- Practice national integration and social harmony.

**Evaluation:**

The performance of the students in extension activities throughout the semester will be assessed and the credit will be awarded by the faculty.

**VALUE ADDED COURSE  
&  
EXTRA CREDIT COURSES**

## VALUE ADDED COURSE

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	30	<b>SEMESTER</b>	<b>II</b>
<b>CREDITS</b>	--	<b>COURSE TITLE</b>	<b>VALUE ADDED COURSE I: FIRST AID AND SAFETY MANAGEMENT</b>

### LEARNING OBJECTIVE

- To be familiar with the fundamental concept of first aid and safety methods.
- To learn the skill to manage the medical emergency and action at emergency.
- To acquire the knowledge on various accidents and community emergency.
- To know the causes and symptoms of diabetes mellitus.
- To study the emergency and to learn community casualty.

<b>UNIT</b>	<b>CONTENT</b>
<b>I</b>	<b>BASIC CONCEPTS</b> Fundamental Concepts Managing an incident, Action at an emergency, Traffic accidents, Fires, Electrical incidents, Water incidents, Major incident/Mass casualties.
<b>II</b>	<b>FIRST AID FIRST AID BOX</b> First aid for Drowning, First aid for Fire Injuries, First Aid for Severe Burns, First Aid for Mild Burn, First Aid for Injuries on the Play Field, First aid for snake biting, poisoning and stings, Transporting the Person for Medical Help After Giving First Aid.
<b>III</b>	<b>INJURY</b> Assessing casualties Assessing the sick or injured, mechanism of injury, primary survey, secondary survey, Head to toe examination, monitoring vital sign. Breathing and circulation, lifesaving priorities, unconscious adults, unconscious child, unconscious infant.
<b>IV</b>	<b>MEDICAL EMERGENCY</b> Heart attack, Stroke, Diabetes mellitus, Hyperglycemia, Hypoglycemia, Seizures in adults, Seizures in children, Childbirth, Emergency childbirth.
<b>V</b>	<b>COMMUNITY EMERGENCY</b> Fire explosions, Earthquakes, Flood and famine, Burns, Road accidents, Accessing a conscious and unconscious casualty.

### TEXTBOOKS

1.First Aid, CPR and AED, 5th ed A. Thygerson, B. Gulli & J.R. Krohmer. Jones & Bartlett. ISBN: 0763742090.2006.

### REFERENCE BOOKS

1. The authorized manual of St. John Ambulance, St. Andrew's Ambulance association and the British red cross society. 2002.
2. Dorling Kindersley- First Aid manual, 5th edition, , London.2001.
3. Clement, Text book on First Aid & Emergency Nursing, First edition, JP brothers, 2012.

<b>COURSE OUTCOME (CO)</b>		
<b>K3</b>	<b>CO1</b>	Develop knowledge about the basics measures to be taken during an emergency.
<b>K2</b>	<b>CO2</b>	Understand the situation and act accordingly.
<b>K3</b>	<b>CO3</b>	Know and apply the first aid service for various casualties.
<b>K3</b>	<b>CO4</b>	Acquire skill to service for medical emergency.
<b>K5</b>	<b>CO5</b>	Attain knowledge about uncommon health, environmental conditions, and mitigation strategies.

**S-Strong; H-High; M-Medium; L-Low**

<b>BLOOM'S MAPPING</b>							
<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1</b>	S	M	S	S	S	M	M
<b>CO2</b>	S	S	S	M	S	S	M
<b>CO3</b>	M	S	S	S	S	S	S
<b>CO4</b>	S	S	M	S	S	S	S
<b>CO5</b>	S	S	S	S	S	S	M

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	30	<b>SEMESTER</b>	<b>IV</b>
<b>CREDITS</b>	2	<b>COURSE TITLE</b>	<b>VALUE ADDED COURSE II: BEHAVIORAL STUDY OF BIRDS</b>

#### **LEARNING OBJECTIVE**

- To give an introduction to bird science.
- To understand about the method of studying migration.
- To understand the diversity of foods and foraging.
- To understand the breeding territories of birds.
- To know about the bird distribution and its population studies.

<b>UNIT</b>	<b>CONTENT</b>
<b>I</b>	<b>INTRODUCTION TO ORNITHOLOGY</b> Terminology used in ornithology- types of bills, types of feet- Identification of birds in the field based on tail, bill, crest, leg & color.
<b>II</b>	<b>EQUIPMENT'S USED IN THE FIELD STUDY</b> Fields guides- Photography- Identification of calls- feet and beak modification in birds. Bird migration- method of studying migration.
<b>III</b>	<b>DIVERSITY OF FOODS AND FORAGING BEHAVIOR</b> Social foraging, mating preferences- Pair bonds, courtship, and divorce – production and control of the song – functions of bird song.
<b>IV</b>	<b>TIMING OF BREEDING</b> Breeding territories nest and nest building egg & clutch size, clutch, and egg replacement. Incubation and hatching – caring for young.
<b>V</b>	<b>AVIAN POPULATION CHANGE</b> Over time and space – methods of estimation- classifying bird species assemblages- recent avian extinctions causes of avian population decline.

#### **TEXTBOOKS**

1. Salim Ali.S. and Ripley SD. Handbook of the birds of India and Pakistan. Compact edition Oxford University Press and BNHS Mumbai .2011.
2. Chinnasathan and Bal Pandey.The Nesting behavior of Indian Birds, Sugeeth Publication,2001.

B.Sc ZOOLOGY MTWU SYLLABUS 2021 ONWARDS Page 89.

#### **REFERENCE BOOKS**

- 1.Caughley G.Sinclair.AR.Wildlife ecology and management. Back well Science.2000.
- 2.Dewsbur, D.A Comparative animal behavior. McGraw Hill Book Company. 1998.
- 3.Drickamer , L.C. S.H. Vessey and E.M. Jakob Animals Behavior. Mc Graw Hill. 2002.

<b>COURSE OUTCOME (CO)</b>		
<b>K2</b>	<b>CO1</b>	Able to know the introduction and terminology of ornithology.
<b>K2</b>	<b>CO2</b>	Know the importance of equipment used in the field to apply for ornithology studies.
<b>K3</b>	<b>CO3</b>	learn about diversity of foods and foraging behavior.
<b>K4</b>	<b>CO4</b>	Assess their breeding and migration.
<b>K5</b>	<b>CO5</b>	Create awareness to protect them from extinction.

**S-Strong; H-High; M-Medium; L-Low**

<b>BLOOM'S MAPPING</b>							
<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1</b>	S	S	S	S	S	M	M
<b>CO2</b>	S	M	S	S	S	S	S
<b>CO3</b>	M	S	S	S	S	S	S
<b>CO4</b>	S	S	S	S	S	S	S
<b>CO5</b>	S	S	S	S	S	S	M

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	<b>30</b>	<b>SEMESTER</b>	<b>VI</b>
<b>CREDITS</b>	<b>2</b>	<b>COURSE TITLE</b>	<b>VALUE ADDED COURSE III: FORENSIC BIOLOGY</b>

#### **LEARNING OBJECTIVE**

- To know the evidence for crime investigation.
- To study the offences based on firearms, tool marks and impressions.
- To interpret crime investigations and predict the sexual and non-sexual offences.
- To analyze the sources of drugs and poisons and to discuss the ill effects and withdrawal symptoms.

<b>UNIT</b>	<b>CONTENT</b>
<b>I</b>	<b>EVIDENCE</b> Classification – identification – comparison – collection methods – preservation of hair, nail, fiber, paint, glass, soil etc. – socio-economic offences.
<b>II</b>	<b>FIREARMS, TOOL MARK AND IMPRESSIONS</b> Firearms – bullet comparisons – cartridge cases – gun powder residues – primer residues – collection and preservation of fire arm evidences – tool marks and impressions.
<b>III</b>	<b>FINGERPRINTS</b> Blood, wounds, lethal and sexual offences: Dermatoglyphics – henry system – primary classification – computerized prints –digital forensics – types of injuries, wounds and signs in sexual and non-sexual offences – symptoms of death – time of death – postmortem changes – blood stains – blood grouping – semen analysis – disputed paternity – DNA tests – case study.
<b>IV</b>	<b>FORENSIC ENTOMOLOGY</b> Insects of forensic importance – sarcophagi – venoms and poisons – methods employed for forensic purposes – forensic lab visit.
<b>V</b>	<b>DRUGS AND FOOD POISONS</b> Classification – sources of drugs, narcotics, cosmetics and abortifacients – physiological and psychological effects – withdrawal syndrome – signs of food poisoning – types of poisons – medico legal cases.

#### **TEXTBOOKS**

1.Parikh CK (1999) Parikh's textbook of medical jurisprudence, forensic medicine and toxicology. 7 th Edition, CBS Publishing and distributors, New Delhi.

#### **REFERENCE BOOKS**

Saferstein R (1978) Criminalistics, an introduction to forensic science. Prentice Hall of India, New Delhi. Simpson K (1979) Forensic Medicine. 8th Edition, ELBS, London.



<b>COURSE OUTCOME (CO)</b>		
<b>K1</b>	<b>CO1</b>	To know the scientific methods of crime investigation.
<b>K2</b>	<b>CO2</b>	To understand collection, identification, and preservation of physical evidence.
<b>K3</b>	<b>CO3</b>	To gain knowledge about dwells on firearms, tool marks and impressions, fingerprints, wounds, and sexual offences.
<b>K4</b>	<b>CO4</b>	Forensic entomology, drugs and food poisons are comprehensively included.
<b>K5</b>	<b>CO5</b>	Outline the classification and sources of drugs and poisons and to discuss the ill effects and withdrawal symptoms.

S-Strong; H-High; M-Medium; L - Low

<b>BLOOM'S MAPPING</b>							
<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1</b>	S	M	S	S	S	M	M
<b>CO2</b>	S	S	S	M	S	S	M
<b>CO3</b>	M	S	S	S	S	S	S
<b>CO4</b>	S	S	M	S	S	S	S
<b>CO5</b>	S	S	S	S	S	S	M

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2023-2026
HOURS		SEMESTER	I
CREDITS	2	COURSE TITLE	EXTRA CREDIT PAPER I: BIODIVERSITY CONSERVATION
<b>LEARNING OBJECTIVE</b> <ul style="list-style-type: none"><li>○ To give introduction to Wildlife management and Conservation.</li><li>○ To make student aware of the various areas of wildlife.</li><li>○ To Know about the Job opportunities in forest areas.</li></ul>			
<b>UNIT</b>	<b>CONTENT</b>		
<b>I</b>	<b>INTRODUCTION TO WILDLIFE</b> Scope and opportunities of Wildlife Sciences – Major types of forest types of India - Protected areas – Sanctuaries - National Parks – Tiger reserves – Biosphere Reserves and their role.		
<b>II</b>	<b>WILDLIFE CONSERVATION</b> IUCN Red Data list – CITES – Endangered Mammals of India and Conversation – Project Tiger and Project Elephant. Conservation of Indian rhino, lion and Thar. Importance of Zoo in Conservation.		
<b>III</b>	<b>ORNITHOLOGY</b> Terms used in description of Birds Plumage and parts – Types of Bills – Types of feet – Identification of birds in the field based on tail, bill, crest, leg and colour.		
<b>IV</b>	<b>INDIAN BUTTERFLIES</b> Butterflies and Moths – Identification of types of Swallowtails: Club tails – Roses - Bird wings – Mime –Mormon – Raven - Helen - peacock – Jay – Blue bottles – Sword tails – Zebra. Whites, sulfurs and orange-tips.		
<b>V</b>	<b>IMPORTANT RESERVES</b> History, Location, Habitats, Fauna and importance of Mudumalai Tiger Reserve – Sathyamangalam Tiger Reserve – Kalakkad Mundanthurai Tiger Reserve – Anamalai Tiger Reserve – Gulf of Mannar Joint Forest Management - Tribes and forestry programmes - Watershed management – Deforestation – impacts – Afforestation – Habitat fragmentation – corridors – Human Animal Conflicts – Mitigation of Conflicts.		
<b>TEXTBOOKS</b> 1.Balakrishnan M. (2016). Wildlife Ecology and Conservation, Scientific publishers, Jodhpur, India. 2.Caughley G and Sinclair AR. (2006). Wildlife Ecology and Management, Blackwell Science, United Science. 3.Ranga MM. (2002). Wildlife Management and Conservation, Agro-Bios publications, Jodhpur, India. 4.Reena Mathur. (2018). Wildlife Conservation and Management, Rastogi publication, Meerut. 5. Sale JB and Berkmueeller K. (1998). Manual of Wildlife Techniques for India, Establishment of the Wildlife Institute, India. Field document 11.			

### REFERENCE BOOKS

1. Ali S, Ripley SD. (1983). Handbook of The Birds of India and Pakistan, Compact edition. Oxford University Press and BNHS, Mumbai.
2. Divan S and Rosencranz A. (2001). Environmental Law and Policy in India: Cases, Materials and Statutes, New Delhi: Oxford University Press.
3. Kehimkar ID. (2008). Book of Indian Butterflies, Oxford University Press.
4. Prater SH and Barruel P. (1997). The Book of Indian Animals, Bombay: Bombay Natural History Society.

### COURSE OUTCOMES

CO1	To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.
CO2	To assess and instil strong foundations on wildlife policies and be familiar with a variety of laws and regulations
CO3	To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.
CO4	To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation approaches and develop the role PVA models for protection of Endangered species
CO5	To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation.

### Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	2
Weightage	15	15	15	15	14
Weighted % of Course Contribution to POs	3.0	3.0	3.0	3.0	2.8

<b>PROGRAMME CODE</b>		<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2023-2026</b>
<b>HOURS</b>	30	<b>SEMESTER</b>	<b>III</b>
<b>CREDITS</b>	2	<b>COURSE TITLE</b>	<b>EXTRA CREDIT PAPER II: MEDICAL EMERGENCY MANAGEMENT</b>

#### **LEARNING OBJECTIVE**

- To understand the scope and role of First Aid Treatments.
- To manage the various incidents using First Aid Treatment measures.
- To describe the various medical emergency situations.
- To learn handling techniques of First Aid Treatment.

<b>UNIT</b>	<b>CONTENT</b>
<b>I</b>	<b>FIRST AID AND AIDER</b> Precaution and Preparation, Action of Emergency: Protection from infection, dealing casualty and use of medications.
<b>II</b>	<b>INCIDENTS AND ACCIDENTS</b> Pandemic diseases (virus and Bacteria). Traffic accidents, Fire accidents, Electrical incidents, and Water incidents.
<b>III</b>	<b>MEDICAL SITUATIONS</b> Heart attack, Stroke, Hyper and Hypoglycemia, Seizures. Common Diseases: Fever, Allergy, Anaphylactic shock, Headache, Migraine, Sore throat, Earache and toothache, Abdominal pain, Vomiting and Diarrhea.
<b>IV</b>	<b>FIRST AID MATERIALS</b> Dressings, Cold compresses, Removing clothing and headgear. Casualty handling, Principles of bandaging and types (Roller and Tubular), square knots, hand, and foot cover. Emergency Action: Cardiopulmonary Resuscitation for an adult and infant and chest compression. Community Emergency: Fire explosions, Earthquakes, Flood and Famine.
<b>V</b>	<b>PRACTICAL ASPECTS</b> 1. Blood Pressure checking Sitting, Standing and Lying Position 2. Cardiopulmonary Resuscitation (CPR)-handling Test 3. RBC and WBC Count 4. Estimation of Bleeding and Clotting time 5. Checking Heart Beat and Pulse Rate.

<b>COURSE OUTCOME (CO)</b>		
<b>K1</b>	<b>CO1</b>	To impart idea about the wildlife Management techniques.
<b>K2</b>	<b>CO2</b>	To train the students to assess various conservation strategies.
<b>K3</b>	<b>CO3</b>	Gain knowledge about terminology of wildlife.
<b>K4</b>	<b>CO4</b>	To identify the birds and butterflies.
<b>K5</b>	<b>CO5</b>	Understand the importance of fauna in different reserves.

**TEXTBOOKS**

Textbook on First Aid and Emergency Nursing, 1 st edition, JP brothers, New Delhi.

**REFERENCE BOOKS**

1.American college of emergency physicians. (2014). First Aid Manual, 5 th edition, Dorl Kindersley, Publication, London. 2 Clement. (2012).

2.Philip Jevons. (2006). Emergency care and First Aid for Nurses, A practical Guide, Churchill Living Stone, London.

3.St. John Ambulance, St. Andrew's Ambulance association and the British red cross society. (2006).

First Aid Manual, 9 th edition, Publication Dorling Kindersley, London.

**COURSE OUTCOME (CO)**

<b>K1</b>	<b>CO1</b>	To understand the significance of First Aid Treatments.
<b>K2</b>	<b>CO2</b>	To utilize the possible measures for life saving in an unconscious casualty.
<b>K3</b>	<b>CO3</b>	To explain the First Aid management for respiratory, wounds and circulation problems.
<b>K4</b>	<b>CO4</b>	To list the techniques and equipment's for First Aid.
<b>K5</b>	<b>CO5</b>	To plan the First Aids for emergency in community and natural disorders.

**S-Strong; H-High; M-Medium; L-Low**

<b>PROGRAMME CODE</b>	<b>UGZOOA</b>	<b>PROGRAMME</b>	<b>B.Sc., ZOOLOGY</b>
<b>COURSE CODE</b>		<b>BATCH</b>	<b>2022-2025</b>
<b>HOURS</b>	30	<b>SEMESTER</b>	<b>V</b>
<b>CREDITS</b>	2	<b>COURSE TITLE</b>	<b>EXTRA CREDIT PAPER III: PARASITOLOGY</b>

#### **LEARNING OBJECTIVE**

- To understand the concept of parasitology.
- To know the morphology of parasite.
- To understand the biological description of all types of parasites.

<b>UNIT</b>	<b>CONTENT</b>
<b>I</b>	<b>INTRODUCTION TO PARASITOLOGY</b> Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship.
<b>II</b>	<b>PARASITIC PROTISTS</b> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Entamoeba histolytica.
<b>III</b>	<b>PARASITIC PLATYHELMINTHES</b> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Taenia solium.
<b>IV</b>	<b>PARASITIC NEMATODES</b> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Ascaris lumbricoides,
<b>V</b>	<b>PARASITIC ARTHROPODA</b> Biology, importance and control of ticks, mites, Pediculus humanus (head and body louse), Xenopsylla cheopis and Cimex lectularius. Parasitic Vertebrates - A brief account of parasitic vertebrates, Vampire bat.

#### **TEXTBOOKS**

1. Arora, D. R and Arora, B. Medical Parasitology. II Edition. CBS Publications and Distributors. 2001.
2. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi 1998.

#### **REFERENCE BOOKS**

1. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. Biology of Disease. Taylor and Francis Group. 2007.
2. K. D. Chatterjee. Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd. 2009.

<b>COURSE OUTCOME (CO)</b>		
<b>K1</b>	<b>CO1</b>	Understand the general introduction about parasitism.
<b>K2</b>	<b>CO2</b>	Know the morphological feature of parasites.
<b>K3</b>	<b>CO3</b>	Comprehend the Platyhelminthes parasitic life.
<b>K4</b>	<b>CO4</b>	Acquire knowledge on nematode parasites.
<b>K5</b>	<b>CO5</b>	Gain knowledge about vertebrate parasites.

Strong; H-High; M-Medium; L -

Low

<b>BLOOM'S MAPPING</b>							
<b>PO</b> <b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO1</b>	S	S	S	S	S	M	M
<b>CO2</b>	S	S	S	M	S	S	M
<b>CO3</b>	S	S	S	S	S	S	S
<b>CO4</b>	S	S	S	S	S	S	S
<b>CO5</b>	S	S	S	S	S	S	M