



**PSGR  
Krishnammal College for Women**



**College of Excellence, *nirf* 2023-4<sup>th</sup> Rank  
Autonomous and Affiliated to Bharathiar University  
Reaccredited with 'A++' grade by NAAC, An ISO 9001: 2015 Certified Institution  
Peelamedu, Coimbatore-641004**

## **DEPARTMENT OF ZOOLOGY**

### **CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF) (I Semester)**

*(For the students admitted during the academic year 2023-24 onwards)*

### **BACHELOR OF ZOOLOGY 2023 – 2026 BATCH**



College of Excellence, **nirf** 2023-4<sup>th</sup> Rank  
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Peelamedu, Coimbatore-641004

### PROGRAMME LEARNING OUTCOMES (PLO's)

After completion of the programme, the student will be able to

- PLO1:** Appreciate the complexities of various levels of organization in the living forms and address controversial biological issues in a scientific way
- PLO2:** Imbibe transformational impact on the quality of education, and to adopt scientific temper and live with scientific values
- PLO3:** Assess the scope of animal biology, opt relevant areas for inter-disciplinary and trans-disciplinary studies
- PLO4:** Understand and apply the core strands of the knowledge acquired in various disciplines of life sciences to become a potential entrepreneur
- PLO5:** Acquire quality life science education to turn into an outstanding researcher/teacher/career woman/entrepreneur and a responsible citizen

### PROGRAMME SPECIFIC OUTCOME (PSO's)

The students at the time of graduation will

- PSO1:** Gain the knowledge of Zoology through theory and practicals.
- PSO2:** Analyze the relationships among animals with their ecosystems.
- PSO3:** Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms, compare and contrast anatomical and physiological characteristics of animals.
- PSO4:** Understand good laboratory practices as per laboratory standards, handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies, effective communication and skills of problem solving methods.
- PSO5:** Understand the applications of zoological knowledge in Agriculture, Medical and daily life and apply the knowledge for employment- Indian Forest Service, Sericulture, Fisheries, Veterinary, Clinical Laboratory, Museum Curator, departments and Entrepreneurship. They can go for Indian Forest Service and other competitive examinations.

**DEPARTMENT OF ZOOLOGY**  
**CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME**  
**BASED CURRICULAR FRAMEWORK (LOCF)**  
**BACHELOR OF ZOOLOGY – 2023-2026 BATCH**  
**(I Semester)**

*(For the students admitted during the academic year 2023-24 onwards)*

Sem	Part	Subject code	Title of the Paper		Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits	
									CA	ESE	Total		
I	I	TAM2301/ HIN2301/ FRE2301	<b>Language</b> Tamil Paper I / Hindi Paper I / French Paper I	Lang	6	88	2	3	25	75	100	3	
	II	ENG2301	English Paper I	English	6	88	2	3	25	75	100	3	
	III A	AS23C01	Core Paper I – Invertebrata	CC	6	88	2	3	25	75	100	5	
	III A	AS23CP1	Core Practical I	CC	3	45	-	-	-	-	-	-	
	III A	CE23A01	Allied - Chemistry for Biologists - Paper I	GE	4	58	2	3	20	55	75	4	
	III A	CE23AP1	Allied - Chemistry Practical for Biologists Paper I	GE	3	45	-	-	-	-	-	-	
	IV	<b>Non Tamil Students</b>			AECC	2	28	2		100	-	100	2
		NME23B1/ NME23A1	Basic Tamil I/ Advanced Tamil I										
		<b>Students with Tamil as Language</b>			AECC	2	30	-		100	-	100	2
	NME23ES/ NME23WS	Foundation Course I - Introduction to Entrepreneurship / Women Studies											

\*Not considered for Grand Total and CGPA

\*\*outside regular class hours

CC – Core Courses

GE – Generic Elective

AEC – Ability Enhancing Course

CA – Continuous Assessment

ESE - End Semester Examination

## QUESTION PAPER PATTERN

### Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

### 23-24 BATCH ONWARDS

#### CA Question Paper Pattern and distribution of marks UG

##### Core and Allied - (First 3 Units)

##### CA Question from each unit comprising of

One question with a weightage of 2 Marks	: $2 \times 3 = 6$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	: $5 \times 3 = 15$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	: $8 \times 3 = 24$
<b>Total</b>	<b>: 45 Marks</b>

#### End Semester Examination – Question Paper Pattern and Distribution of Marks

##### Core and Allied courses:

##### ESE Question Paper Pattern: $5 \times 15 = 75$ Marks

##### Question from each unit comprising of

One question with a weightage of 2 Marks	: $2 \times 5 = 10$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level):	$5 \times 5 = 25$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level):	$8 \times 5 = 40$

##### Continuous Internal Assessment Pattern

##### Theory

##### I Year UG (23 Batch)

CIA Test	: 5 marks (conducted for 45 marks after 50 days)
Model Exam	: 7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz	: 5 marks
Class Participation	: 5 marks
Attendance	: 3 marks
<b>Total</b>	<b>: 25 Marks</b>

**Practical**

Lab Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks

**Total : 25 marks****ESE Practical Pattern**

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

**WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF  
CONTINUOUS INTERNAL ASSESSMENT**

**Theory**

	CIA I	Model Exam	Seminar/Assignment/ Quiz	Class Participation	Attendance	Max Marks
Core / Allied	5	7	5	5	3	25

**Practical**

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied	10	7	5	3	25

**RUBRICS****Assessment/Seminar****Maximum - 20 Marks (converted to 4 marks)**

Criteria	4 Marks	3 Marks	2 Marks	1 Mark
<b>Focus Purpose</b>	Clear	Shows awareness	Shows little awareness	No awareness
<b>Main idea</b>	Clearly presents a main idea.	Main idea supported throughout	Vague sense	No main idea

<b>Organisation:</b> Overall	Well planned	Good overall organization	There is a sense of organization	No sense of organization
<b>Content</b>	Exceptionally well presented	Well presented	Content is sound	Not good
<b>Style:</b> Details and Examples	Large amounts of specific examples and detailed description	Some use of examples and detailed descriptions	Little use of specific examples and details	No use of examples

### CLASS PARTICIPATION

**Maximum - 20 Marks (converted to 5 marks)**

Criteria	5 Marks	4 Marks	3 Marks	2 Marks	1 Mark	Points scored
<b>Level of Engagement in Class</b>	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class	Student contributes to class and asks questions occasionally	Student rarely contributes to class by offering ideas and asking no questions	Student never contributes to class by offering ideas	
<b>Listening Skills</b>	Student listens when others talk, both in groups and in class. Student incorporates or builds off of the ideas of others.	Student listens when others talk, both in groups and in class.	Student listens when others talk in groups and in class occasionally	Student does not listen when others talk, both in groups and in class.	Student does not listen when others talk, both in groups and in class. Student often interrupts when others speak.	
<b>Behavior</b>	Student almost never displays disruptive	Student rarely displays disruptive behavior	Student occasionally displays disruptive behavior	Student often displays disruptive behavior	Student almost always displays disruptive	

	behavior during class	during class	during class	during class	behavior during class	
<b>Preparation</b>	Student is almost always prepared for class with required class materials	Student is usually prepared for class with required class materials	Student is occasionally prepared for class with required class materials	Student is rarely prepared for class with required class materials	Student is almost never prepared for class.	
					<b>Total</b>	

### MAPPING OF PLOS WITH CLOS

COURSE	PROGRAMME OUTCOMES				
	PLO1	PLO2	PLO3	PLO4	PLO5
<b>COURSE – AS23CO1</b>					
<b>CLO1</b>	S	S	M	M	L
<b>CLO2</b>	S	S	M	M	M
<b>CLO3</b>	S	S	S	S	M
<b>CLO4</b>	S	S	S	S	M
<b>COURSE – AS23CP1</b>					
<b>CLO1</b>	S	S	S	S	S
<b>CLO2</b>	S	S	S	S	S
<b>CLO3</b>	S	S	S	S	S
<b>CLO4</b>	S	S	S	S	S

<b>COURSE NO</b> AS23CO1	<b>COURSE NAME</b> INVERTEBRATA	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		Theory	86	4	-	5

### Preamble

To understand the basic classification, structure and functional details of invertebrates and to appreciate the diversity of life on earth with respect to invertebrates.

### Course Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the distinguished characteristics, the biodiversity, habitat, adaptation, organization and taxonomic status of invertebrates	K <sub>1</sub>
CLO2	Understand the importance of multicellularity significant to anatomical and physiological up gradation of the invertebrates	K <sub>2</sub>
CLO3	Identify the evolution of organ systems and differences in functional morphology of higher invertebrates	K <sub>3</sub>
CLO4	Analyze the advancement in systemic organization of invertebrates and connecting link to Chordates. Infer the application of Recent emerging technologies in learning and research in Zoology	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	L
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M

S- Strong; M-Medium; L-Low



**Unit 1**

(19 hrs)

**Phylum Protozoa**

General characteristics and Classification up to classes

**Type Study: *Paramecium caudatum*** –External features, Nutrition, Locomotion- effective stroke, recovery stroke, Metachronal rhythm, Reproduction-Asexual- Binary fission ,Sexual reproduction Conjugation, Autogamy, Endomixis, Hemimixis and Cytogamy.

**General Essays**

- Locomotion and Reproduction in Protista
- \*Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica*
- Evolution of symmetry and segmentation of Metazoa

**Phylum Porifera**

General characteristics and Classification up to classes

**Type Study: *Leucosolenia botryoides***- External features, Body wall, Spicules, Canal System, Nutrition, Reproduction.

**General Essays:**

- Canal System in sponges
- \*Economic importance of sponges

**Unit 2**

(19 hrs)

**Phylum Coelenterata**

General characteristics and Classification up to classes

Type Study: ***Obelia geniculata*** - External features, Histology of the colony, Cnidoblast and its functions, Life History of Obelia, Metagenesis.

**General Essays**

- \*Corals, coral reefs and coral bleaching
- \*Polymorphism in Coelentrates

**Phylum Helminthes**

General characteristics and Classification up to classes

**Type Study: *Taenia solium***- External features, Body wall, Feeding, Respiratory system, Excretory System-flame cells, Nervous system, Reproductive system, Life cycle- Onchosphere and Cysticercus larvae. Life cycle and pathogenicity of *Taenia solium*

**General Essays**

- \*Life cycle and pathogenicity of: a) *Wuchereria bancrofti*, b) *Dracunculus medinensis*, c) *Ancylostoma duodenale*
- \*Parasitic adaptations in Helminthes.

**Unit 3**

(19 hrs)

**Phylum Annelida**

General characteristics and Classification up to classes

**Type Study: *Megascolex mauritii*** - External features, Body wall, Coelom, Locomotion, Digestive system, Respiratory system, Excretory system-Meganephridia, Micronephridia, Pharyngeal nephridia, Nervous system, Reproductive system.

### General Essays

- Metamerism in annelids.
- \*A Brief Account on Vermiculture.

### Phylum Arthropoda

General characteristics and Classification up to classes

**Type study: *Periplaneta americana*** -External features, Body wall, Mouthparts, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs, excretory system, Reproductive system.

### General Essays

- Peripatus- Affinities as a living fossil.
- Metamorphosis in Insects
- \*A Brief Account on Apiculture.

## Unit 4

(19 hrs)

### Phylum Mollusca

General characteristics and Classification up to classes

**Type Study: *Pila globosa*** -External features, Shell, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs- Eyes, Osphradium, Statocyst, Tentacles, Excretory system, Reproductive system..

### General Essays

- Torsion in Mollusca.
- \*A Brief Account on Pearl Culture.

### Phylum Echinodermata

General characteristics and Classification up to classes

**Type Study: *Asterias rubens***.- External features, Pedicellaria-Structure and Function, Digestive system, Respiratory system, Water vascular system-Structure and Function, Circulatory system-Perihaemal and Haemal system, Nervous system, Sense organs, Excretory system, Reproductive system.

### General Essays

- \*Larval forms of Echinoderms and their evolutionary significance.
- \*Economic importance in Echinoderms.
- Affinities with Chordates

## Unit 5

(10 hrs)

Introduction to technologies in Industrial 4.0, Applications –Automated taxonomic Identification of invertebrates, Confocal Image processing of invertebrates for identification and classification, Bio mimicry/biomimetics of invertebrates –Ant colony optimization algorithms, Beekeeping using Machine learning, Detection and identification of Stored –Grain insects using Deep learning, IOT based smart monitoring for sericulture, \*Virtual e-museum.

\*-Blended Mode

**Text Books:**

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Jordan E.L and Verma P.S	Invertebrate Zoology	S. Chand and Co	2014
2	N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan	A Text Book of Invertebrates	Saras Publications	2013
3	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0			

**Reference Books:**

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1.	Dhami P.S. and Dhami J.K	Invertebrate Zoology	S. Chand & Co	2012, 5 <sup>th</sup> edition
2.	EkambaranathaAyyar, M. & Ananthakrishnan,T.N	Manual of Zoology Vol-I (Invertebrata) Part I & II	Vishwanathan (p) Ltd. Chennai	2010
3.	FatikBaran Mandal	Invertebrate Zoology	Eastern Economy Edition	2012, 1 <sup>st</sup> Edition
4.	Kotpal R.L., Agarwal S.K and Ketarpal R.P.R	Modern Text Book of Zoology Invertebrates	Rastogi Publications	12 <sup>th</sup> Edition 2019
5.	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson	1979, 2 <sup>nd</sup> edition
6.	Ruppert and Barnes, R.D.	Invertebrate Zoology	Holt Saunders International	2006
7.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I.	The Invertebrates: A New Synthesis	Blackwell Science	2002, 3 <sup>rd</sup> Edn.
8.	Jan A. Pechenik	Biology of the Invertebrates	McGraw-Hill Companies	2014, 7 <sup>th</sup> Revised Edition
9	Fatik, Mandal, Baran,	Biology of non-chordates	Publisher: PHI learning Private Limited , Delhi	2018
10.	Fatma El-Bawab	Invertebrate Embryology and Reproduction	Academic Press	2020
11.	John H. Byrne	The Oxford Handbook of Invertebrate Neurobiology	Oxford University Press	2019

**Related Online Contents**

1. Introduction to Industry 4.0 and Industrial Internet of Things by Prof. Sudip Mishra, IIT Kharagpur.
2. A Complete Guide to Industry 4.0-Udemy

## Reference

1. <https://academic.oup.com/sysbio/article/68/6/876/5368535>
2. <https://besjournals.onlinelibrary.wiley.com/doi/10.1111/2041-210X.13428>
3. <https://www.mdpi.com/2313-7673/4/3/62/htm>
4. <https://www.bio-mar.com/biological-materials-biomimetics>
5. <https://www.sciencedirect.com/science/article/abs/pii/S1568494609000672>  
<https://www.hyperhyve.com/post/beekeeping-using-machine-learning>
6. [https://www.researchgate.net/publication/322958397\\_Detection\\_of\\_stored-grain\\_insects\\_using\\_deep\\_learning](https://www.researchgate.net/publication/322958397_Detection_of_stored-grain_insects_using_deep_learning)
7. <https://www.ijrte.org/wp-content/uploads/papers/v8i2/B1801078219.pdf>

<b>COURSE NO</b> AS23CP1	<b>COURSE NAME</b> CORE PRACTICAL I	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		Practical	-	-	90	4

### Preamble

- To enable the students to expose practically
- To learn the taxonomy of invertebrates and Chordates.
- To understand the relationships between invertebrates, Chordates and their environment.
- To learn the location and appearance of internal organs in a typical insect.
- To understand the structure and functional organization of animals.

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	To understand the basic concepts of zoological classification and identify the invertebrates and chordates	K <sub>1</sub>
CLO2	To distinguish the diversity and relationships between major groups of invertebrates and Chordates.	K <sub>2</sub>
CLO3	To examine the morphology and anatomy of invertebrates and Chordates	K <sub>3</sub>
CLO4	To relate the diversity and culture/rearing of invertebrates and chordates and infer their economic utility.	K <sub>4</sub>

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

## CORE PRACTICAL - I AS23CPI

(90 Hrs)

### Dissections

(35 hrs)

#### 1. Cockroach

- a. Digestive system (3 hrs)
- b. Nervous system, (3 hrs)
- c. Male & Female Reproductive systems (3 hrs)

#### 2. Fish

- a. Viscera, (3 hrs)
- b. Digestive system, (3 hrs)
- c. Reproductive system, (3 hrs)
- d. Brain and Cranial nerves system (4 hrs)

#### 3. Earthworm

- a. Digestive system, (3 hrs)
- b. Nervous system (4 hrs)
- c. Reproductive system (3 hrs)

#### 4. Prawn – Nervous system

(3 hrs)

### Mounting

(15 hrs)

- 1. Mounting of scales of fishes (2 hrs)
- 2. Mounting of gill arch (2 hrs)
- 3. Mounting of earthworm setae (2 hrs)
- 4. Mounting of mouth parts of cockroach/mosquito/honey bee (3 hrs)
- 5. Mounting of Prawn appendages (3 hrs)
- 6. Whole mount of Euglena, Amoeba and Paramecium (3 hrs)

### Spotters

**Classify giving reasons:-**Paramecium, Leucosolenia, Obelia colony, Prawn, Octopus, Star fish, Ascidian, Shark, Salamander, Pigeon, Bat (2 hrs)

**Draw labelled sketches:-**T.S. of Tape worm, Leech, Amphioxus, Frog – Skull, Pectoral girdle, Pelvic girdle, Fore limb and Hind limb (2 hrs)

**Relate Structure and function:** - Gemmule, Entire & Scolex of tapeworm, Nereis -parapodium, Heteronereis, Honey bee-Queen, Drone, Worker; Quill feather, Tortoise, Narcine-Electric organ (2 hrs)

**Write descriptive notes:-** Nauplius larva, Pila, Bipinnaria larva, Balanoglossus, Echineis - Sucker fish, Draco - Flying lizard, Rat snake, Cobra, Hyla (2 hrs)

**Give biological significance:** - Chaetopterus, Peripatus, Limulus, Scorpion, Pearl oyster, Hippocampus male and female, Exocetus – Flying fish, Chameleon (2 hrs)

### Field observations combined with photography and/or videography

- 1) Study of live water specimens in nearby water bodies/pond ecosystem (5 hrs)
- 2) Study of insect fauna in the college campus (5 hrs)
- 3) Visit to a sericulture farm/ Apiary/Museum (5 hrs)
- 4) Study of six common birds from different orders (5 hrs)

**Culture Methods**

1) Culture of unicellular organisms (Amoeba/Paramecium/Euglena)

2) Culture of multicellular organisms (Earthworm)

**(10 hrs)****Reference Books:**

<b>S. No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011
2	Lal S. S.	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004
3	Lal S. S.	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004



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## DEPARTMENT OF ZOOLOGY

### CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF) (II Semester)

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After completion of the programme, the student will be able to

**PLO1:** Appreciate the complexities of various levels of organization in the living forms and address controversial biological issues in a scientific way

**PLO2:** Imbibe transformational impact on the quality of education, and to adopt scientific temper and live with scientific values

**PLO3:** Assess the scope of animal biology, opt relevant areas for inter-disciplinary and trans-disciplinary studies

**PLO4:** Understand and apply the core strands of the knowledge acquired in various disciplines of life sciences to become a potential entrepreneur

**PLO5:** Acquire quality life science education to turn into an outstanding researcher/teacher/career woman/entrepreneur and a responsible citizen

### PROGRAMME SPECIFIC OUTCOME (PSO's)

The students at the time of graduation will

**PSO1:** Gain the knowledge of Zoology through theory and practicals.

**PSO2:** Analyze the relationships among animals with their ecosystems.

**PSO3:** Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms, compare and contrast anatomical and physiological characteristics of animals.

**PSO4:** Understand good laboratory practices as per laboratory standards, handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies, effective communication and skills of problem solving methods.

**PSO5:** Understand the applications of zoological knowledge in Agriculture, Medical and daily life and apply the knowledge for employment- Indian Forest Service, Sericulture, Fisheries, Veterinary, Clinical Laboratory, Museum Curator, departments and Entrepreneurship. They can go for Indian Forest Service and other competitive examinations.

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**BASED CURRICULAR FRAMEWORK (LOCF)**  
**BACHELOR OF ZOOLOGY – 2023-2026 BATCH**  
**(II Semester)**

*(For the students admitted during the academic year 2023-24 onwards)*

Sem	Part	Subject code	Title of the Paper		Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits	
									CA	ESE	Total		
II	II	TAM2302/ HIN2302/ FRE2302	Language T/H/F Paper – II	Language	6	88	2	3	25	75	100	3	
	II	ENG2302	English Paper II	English	5	73	2	3	25	75	100	3	
	III A	AS23C02	Chordata Paper II	CC	6	88	2	3	25	75	100	5	
	III A	AS23CP1	Core Practical I	CC	3	45	-	3	25	75	100	5	
	III A	CE23A02	Allied-Chemistry for Biologists-II	GE	5	73	2	3	20	55 <sup>#</sup>	75 <sup>#</sup>	4	
	III A	CE23AP1	Allied -Chemistry Practical for Biologists	GE	3	45	-	3	15	25 <sup>#</sup>	50 <sup>#</sup>	2	
	IV			Online Self Study Courses	-	-	-	-	-	-	-	-	-
			NME23B2/ NME23A2	Basic Tamil/Advanced Tamil**	AEC	2	-	-	-	100	-	100	Grade*
	III B	NM23GAW	Foundation Course –1 (General Awareness)	-	Self study (Online)				100	-	100	Grade*	
V		23PELS1	Professional English (Science /Management/ Humanities/Commerce)	AEC	2	25	5	-	100	-	100	2	

\*Not considered for Grand Total and CGPA

\*\*outside regular class hours

<sup>#</sup> CA conducted for 25 converted to 20, ESE conducted for 100 converted to 55

CC – Core Courses

GE – Generic Elective

AEC – Ability Enhancing Course

CA – Continuous Assessment

ESE - End Semester Examination

## QUESTION PAPER PATTERN

### **Examination System**

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

### **2023-2024 BATCH ONWARDS**

#### **CA Question Paper Pattern and distribution of marks UG**

##### **Language and English**

Section A 5 x 1 (No choice)	: 5 Marks
Section B 4 x 5 (4 out of 6)	: 20 Marks (250 words)
Section C 2 x 10 (2 out of 3)	: 20 Marks (500 words)
<b>Total</b>	<b>: 45 Marks</b>

##### **Core and Allied - (First 3 Units)**

#### **CA Question from each unit comprising of**

One question with a weightage of 2 Marks (No choice)	: $2 \times 3 = 6$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	: $5 \times 3 = 15$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	: $8 \times 3 = 24$
<b>Total</b>	<b>: 45 Marks</b>

#### **End Semester Examination – Question Paper Pattern and Distribution of Marks**

##### **Language and English**

Section A 10 x 1 (10 out of 12)	: 10 Marks
Section B 5 x 5 (5 out of 7)	: 25 Marks (250 words)
Section A 4 x 10 (4 out of 6) :	40 Marks (600 - 700 words)
<b>Total</b>	<b>: 75 Marks</b>

##### **Core and Allied courses:**

**ESE Question Paper Pattern:**  **$5 \times 15 = 75$  Marks**

##### **Question from each unit comprising of**

One question with a weightage of 2 Marks	: $2 \times 5 = 10$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level):	$5 \times 5 = 25$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level):	$8 \times 5 = 40$

#### **Continuous Internal Assessment Pattern**

##### **Theory**

##### **I Year UG (23 Batch)**

CIA Test	: 5 marks (conducted for 45 marks after 50 days)
Model Exam	: 7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz	: 5 marks

Class Participation	: 5 marks
Attendance	: 3 marks
<b>Total</b>	<b>: 25 Marks</b>

### **Practical**

Lab Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks
<b>Total</b>	<b>: 25 marks</b>

### **ESE Practical Pattern**

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

### **Part IV**

#### **Introduction to Entrepreneurship / Women Studies / Value education / Environmental Studies / Design Thinking**

Quiz : 50 marks

Assignment : 25marks

Project / Case study : 25 marks

**Total : 100 Marks**

### **Professional English**

The course offered in alignment with TANSICHE norms with 2 credits.

**Quiz (5 x 20 Marks) : 100 Marks**

### **WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT**

#### **Theory**

	<b>CIA I</b>	<b>Model Exam</b>	<b>Seminar/Assignment/Quiz</b>	<b>Class Participation</b>	<b>Attendance</b>	<b>Max Marks</b>
Core / Allied	5	7	5	5	3	25

#### **Practical**

	<b>Model Exam</b>	<b>Lab Performance</b>	<b>Regularity in Record Submission</b>	<b>Attendance</b>	<b>Maximum Marks</b>
Core / Allied	10	7	5	3	25

## RUBRICS FOR CLASS PARTICIPATION

Level of Engagement in Class : 2 Marks  
 Listening Skills : 2 Marks  
 Behavior : 1 Marks  
 Preparation : 2 Marks  
**Total : 7 Marks**

<b>Level of Engagement in Class</b>	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class	Student contributes to class and asks questions occasionally	Student rarely contributes to class by offering ideas and asking no questions	Student never contributes to class by offering ideas
<b>Criteria</b>	<b>7 MARKS</b>	<b>6 MARKS</b>	<b>5 MARKS</b>	<b>4 MARKS</b>	<b>3 MARKS</b>
Level of engagement in class	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class.	Student contributes to class by offering ideas and asks questions occasionally.	Student contributes to class by offering ideas and asking no questions.	Student never contributes to class by offering ideas.
<b>Listening Skills</b>	Student listens when others talk, both in groups and in class. Student incorporates or builds off of the ideas of others.	Student listens when others talk, both in groups and in class.	Student listens when others talk in groups and in class occasionally	Student does not listen when others talk, both in groups and in class.	Student does not listen when others talk, both in groups and in class. Student often interrupts when others speak.
<b>Behavior</b>	Student almost never displays disruptive behavior during class	Student rarely displays disruptive behavior during class	Student occasionally displays disruptive behavior during class	Student often displays disruptive behavior during class	Student almost always displays disruptive behavior during class
<b>Preparation</b>	Student is almost always prepared for class with required class materials	Student is usually prepared for class with required class materials	Student is occasionally prepared for class with required class materials	Student is rarely prepared for class with required class materials	Student is almost never prepared for

## MAPPING OF PLOS WITH CLOS

COURSE	PROGRAMME OUTCOMES				
	PLO1	PLO2	PLO3	PLO4	PLO5
<b>COURSE – AS23CO2</b>					
<b>CLO1</b>	S	S	M	M	L
<b>CLO2</b>	S	S	M	M	M
<b>CLO3</b>	S	S	S	S	M
<b>CLO4</b>	S	S	S	S	M
<b>COURSE – AS23CP1</b>					
<b>CLO1</b>	S	S	S	S	S
<b>CLO2</b>	S	S	S	S	S
<b>CLO3</b>	S	S	S	S	S
<b>CLO4</b>	S	S	S	S	S

<b>COURSE NO</b> AS23CO2	<b>COURSE NAME</b>  CHORDATA	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		Theory	88	2	-	5

### Preamble

To understand basic classification, structural and functional details of chordates and to interpret the evolutionary relationships among the major taxa

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
<b>CLO1</b>	Identify the general and specific characteristics of the different classes and the organization of the representative types.	K <sub>1</sub>
<b>CLO2</b>	Recognize and describe the major groups of chordates	K <sub>2</sub>
<b>CLO3</b>	Interpret the unique features, taxonomy and functional morphology of different classes of chordates	K <sub>3</sub>
<b>CLO4</b>	To examine chordate diversity, systematics, their affinities, adaptations to different modes of life, evolutionary relationships of the major taxa and their economic importance.	K <sub>4</sub>

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>
CLO1	L	S	M	M	M
CLO2	L	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

## CHORDATA-AS23CO2 (88 hrs)

### UNIT I:

(20 Hrs)

**Phylum Chordata** Introduction, Three fundamental Chordate characters, Advancements of Chordates over other phyla. Brief classification of chordate with characters.

**PROTOCHORDATA-** General Characters and affinities of *Balanoglossus* and *Herdmania*

**Type study: Amphioxus-** Affinities and Systematic Position, Habits and Habitat, External features, Body wall, Coelom, Atrium, Digestive System, Respiratory mechanism, Circulatory system, excretory system and Reproductive system.

#### General Essays

- \*Dipnoi- lung fishes-affinities and systematic Position
- Retrogressive metamorphosis in Urochordata
- General characters of Agnatha and its affinities
- Overview of Phylogenetic analysis using Machine learning

### PISCES- General Characters

General characteristics of Chondrichthyes and Osteichthyes, classification up to order

**Type study: Shark -** Systematic Position, Habits and Habitat, External features, Exoskeleton- Placoid Scales, Digestive System, Respiratory system & Mechanism of respiration, Circulatory system -Blood, Heart and pericardium, Arterial system, Venous system, Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs-Olfactory organs, Eyes, Internal ears, Neuromast or lateral line system, Ampullae of Lorenzini. Urinogenital system.

#### General Essays

- Types of Fins and Scales of fishes
- \*Accessory respiratory organs in fishes
- Migration, Osmoregulation and Parental care in fishes
- General account of a) *Oreochromis mossambicus* b) *Labeo rohita* c) *Catla catla*
- \*Virtual E-museum to identify and learn different species of Pisces

### UNIT II: AMPHIBIA

(17 hrs)

General characteristics and classification up to order

**Type study: Frog-** Systematic Position, Habits and Habitat, External features, Sexual dimorphism, Digestive System, Respiratory system- Cutaneous respiration, Buccal respiration and Pulmonary respiration. Respiratory mechanism-inspiration and expiration. Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs- Taste buds, Olfactory organs, Internal structure and functions of Eye and Ear, Urinogenital system

#### General Essays

- Regeneration in amphibians (Axolotls)
- Origin of Tetrapoda (Evolution of terrestrial ectotherms)
- \*Parental care in Amphibia
- Neoteny and Paedogenesis in Amphibia
- Outline on Image processing for taxonomic classification



### UNIT III: REPTILIA

(17 hrs)

General characteristics and classification up to order

**Type study: Calotes** - Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system- Respiratory mechanism, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system- Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs, Jacobson's organs, internal structure and functions of Eye and Ear, Urinogenital system

#### General Essays

- Affinities of *Sphenodon*
- \*Poison apparatus and Biting mechanism in snakes, First aid treatment for snake bite.
- Common poisonous and non – poisonous snakes in India.
- Extinct Reptiles
- Conservation of reptiles (Turtles and Crocodiles)
- Overview of artificial intelligence for modelling to study Reptile behaviour

### UNIT IV: AVES

(17 hrs)

General characteristics and classification up to order

**Type study: Pigeon** -Systematic Position, Habits and Habitat, External features, Feathers- Structure of a typical feather in Pigeon, Types of feathers in pigeon .Muscular System- Flight muscles, Digestive System, Respiratory system- Syrinx and voice production, Air sacs and functions. Respiratory mechanism, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves, Structure and function of Eye and Ear, Urinogenital system.

#### General Essays

- *Archaeopteryx*—a connecting link
- Beaks and wing adaptation in birds
- \*Flightless birds, Migration in birds.
- GPS Tracking systems to study bird behaviour and predict their migration

### UNIT V: MAMMALIA

(17 hrs)

General characteristics and classification up to order

**Type study: Rabbit**- Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Structure and function of Eye and Ear, Excretory system, Reproductive system.

#### General Essays

- Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages
- Dentition in mammals
- Egg laying and flying mammals
- \*Aquatic adaptations in mammals.
- \*GPS Tracking systems for monitoring the locomotion of wild animals.

\*-Blended Mode

## Text Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Jordan.E.L and Verma.P.S	Chordate Zoology	S.Chand& Co	2014
2	A. Thangamani S. Prasannakumar L.M. Narayanan N. Arumugam,	A Text Book of Chordates	Saras Publications	2013

## Reference Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Ekambaranatha Ayyar.M & Ananthakrishnan.T.N	A Manual of Zoology Vol.II- Part I & II	S.Vishwanathan Pvt.Ltd	2010
2	Kotpal R.L	Modern Text Book of Zoology – Vertebrates	Global Media Publications	2012
3	B Waterman, Allyn J	Chordate Structure and Function	Mac Milan & Co.,	1971
4	Young, J. Z	The Life of Vertebrates	Oxford university press	2004, 3 <sup>rd</sup> Edn.
5	Pough H.	Vertebrate life	Pearson International	9 <sup>th</sup> Edn.
6	Darlington P.J.	The Geographical Distribution of Animals	R.E. Krieger Pub Co.,	3 <sup>rd</sup> Edn.
7	Hall B.K. and Hallgrimsson B.	Strick berger's Evolution	Jones and Bartlett Publishers Inc.	4 <sup>th</sup> Edn.
8.	Malcolm Jollie	Chordate Morphology	Franklin Classics Trade Press	2017
9.	Marshall and Williams Edited by Veer Baala Rastogi	Parker and Haswell Textbook of ZOOLOGY - Vertebrates -	Medtech Science Press	Volume I 2021
10.	Neil Shubin, Kenneth P. Dial, Elizabeth L. Brainerd	Great Transformations in Vertebrate Evolution	University of Chicago Press	2015
11.	Kevin Padian, Vivian de Buffrénil, Armand J. de Ricqlès, Louise Zylberberg	Vertebrate Skeletal Histology and Paleohistology	CRC Press	2021
12.	Ezra Samberg	Vertebrate Zoology	Syrawood Publishing House	2018

## References

1. <https://www.biorxiv.org/content/10.1101/2020.01.10.902239v4.full>
2. <https://www.sciencedirect.com/science/article/abs/pii/S0920548919300935>
3. <https://link.springer.com/article/10.1007/s10336-012-0908-1>
4. <https://wildlifeact.com/about-wildlife-act/monitoring-tracking-technology/>
5. <http://emuseum.psgkwcw.com/>

<b>COURSE NO</b> 23PELS1	<b>COURSENAME</b> <b>SEMESTER– II</b> <b>PROFESSIONAL ENGLISH FOR</b> <b>LIFE SCIENCES</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		-	25	5	--	2

### Objectives

1. To develop the language skills of students by offering adequate practice in professional contexts.
2. To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
3. To focus on developing students' knowledge of domain specific registers and the required language skills.
4. To develop strategic competence that will help in efficient communication
5. To sharpen students' critical thinking skills and make students culturally aware of the target situation.

### Course outcome

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

<b>CLO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CLO1	Recognize their own ability to improve their own competence in using the language	K1
CLO2	Use language for speaking with confidence in an intelligible and acceptable manner	K2
CLO3	Read independently unfamiliar texts with comprehension and understand the importance of reading for life	K3
CLO4	Understand the importance of writing in academic life	K3
CLO5	Write simple sentences without committing error of spelling or grammar	K3

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M
CLO5	S	S	S	S	S

S- Strong; M-Medium

## **Syllabus**

### **UNIT 1: Communication**

**(5 hrs)**

**Listening:** Listening to audio text and answering question Listening to Instructions

**Speaking:** Pair work and small group work.

**Reading:** Comprehension passages –Differentiate between facts and opinion

**Writing:** Developing a story with pictures.

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### **UNIT 2: Description**

**(5 hrs)**

**Listening:** Listening to process description.-Drawing a flow chart.

**Speaking:** Role play (formal context)

**Reading:** Skimming/Scanning- Reading passages on products, equipment and gadgets.

**Writing:** Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.

**Vocabulary:** Register specific -Incorporated into the LSRW tasks.

### **UNIT 3: Negotiation Strategies**

**(5 hrs)**

**Listening:** Listening to interviews of specialists / Inventors in fields (Subject specific)

**Speaking:** Brainstorming. (Mind mapping).Small group discussions (Subject- Specific)

**Reading:** Longer Reading text.

**Writing:** Essay Writing (250 words)

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### **UNIT 4: Presentation Skills**

**(5 hrs)**

**Listening:** Listening to lectures.

**Speaking:** Short talks.

**Reading:** Reading Comprehension passages

**Writing:** Writing Recommendations Interpreting Visuals inputs

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

### **UNIT 5: Critical Thinking Skills**

**(5 hrs)**

**Listening:** Listening comprehension- Listening for information.

**Speaking:** Making presentations (with PPT- practice).

**Reading :** Comprehension passages –Note making.Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)

**Writing:** Problem and Solution essay– Creative writing –Summary writing

**Vocabulary:** Register specific - Incorporated into the LSRW tasks

**Textbooks**

<b>S.No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	TamilNadu State Council for Higher Education (TANSCHÉ)	English for Life Sciences Semester 1	--	--

**Reference Books**

<b>S.No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Sreedharan, Josh	The Four Skills for Communication	Foundation books	2016
2	Pillai, G Radhakrishna, K Rajeevan, P Bhaskaran Nair	Spoken English for you	Emerald	1998
3	Pillai, G radhakrishna, K Rajeevan, P Bhaskaran Nair	Written English for you	Emerald	1998

<b>COURSE NO</b> AS23CP1	<b>COURSE NAME</b> CORE PRACTICAL I	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>Practical</b>	-	-	<b>90</b>	<b>4</b>

### Preamble

- To enable the students to expose practically
- To learn the taxonomy of invertebrates and Chordates.
- To understand the relationships between invertebrates, Chordates and their environment.
- To learn the location and appearance of internal organs in a typical insect.
- To understand the structure and functional organization of animals.

### Course Outcomes

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

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	To understand the basic concepts of zoological classification and identify the invertebrates and chordates	K <sub>1</sub>
CLO2	To distinguish the diversity and relationships between major groups of invertebrates and Chordates.	K <sub>2</sub>
CLO3	To examine the morphology and anatomy of invertebrates and Chordates	K <sub>3</sub>
CLO4	To relate the diversity and culture/rearing of invertebrates and chordates and infer their economic utility.	K <sub>4</sub>

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

**CORE PRACTICAL - I AS23CPI****(90 Hrs)****Dissections (35 hrs)****1. Cockroach**

- a. Digestive system (3 hrs)
- b. Nervous system, (3 hrs)
- c. Male & Female Reproductive systems (3 hrs)

**2. Fish**

- a. Viscera, (3 hrs)
- b. Digestive system, (3 hrs)
- c. Reproductive system, (3 hrs)
- d. Brain and Cranial nerves system (4 hrs)

**3. Earthworm**

- a. Digestive system, (3 hrs)
- b. Nervous system (4 hrs)
- c. Reproductive system (3 hrs)

- 4. **Prawn** – Nervous system (3 hrs)

**Mounting (15 hrs)**

- 1. Mounting of scales of fishes (2 hrs)
- 2. Mounting of gill arch (2 hrs)
- 3. Mounting of earthworm setae (2 hrs)
- 4. Mounting of mouth parts of cockroach/mosquito/honey bee (3 hrs)
- 5. Mounting of Prawn appendages (3 hrs)
- 6. Whole mount of Euglena, Amoeba and Paramecium (3 hrs)

**Spotters**

**Classify giving reasons:-**Paramecium, Leucosolenia, Obelia colony, Prawn, Octopus, Star fish, Ascidian, Shark, Salamander, Pigeon, Bat **(2 hrs)**

**Draw labelled sketches:-**T.S. of Tape worm, Leech, Amphioxus, Frog – Skull, Pectoral girdle, Pelvic girdle, Fore limb and Hind limb **(2 hrs)**

**Relate Structure and function:** - Gemmule, Entire & Scolex of tapeworm, Nereis -parapodium, Heteronereis, Honey bee-Queen, Drone, Worker; Quill feather, Tortoise, Narcine-Electric organ **(2 hrs)**

**Write descriptive notes:-** Nauplius larva, Pila, Bipinnaria larva, Balanoglossus, Echineis - Sucker fish, Draco - Flying lizard, Rat snake, Cobra, Hyla **(2 hrs)**

**Give biological significance:** - Chaetopterus, Peripatus, Limulus, Scorpion, Pearl oyster, Hippocampus male and female, Exocetus – Flying fish, Chameleon **(2 hrs)**

**Field observations combined with photography and/or videography**

- 1) Study of live water specimens in nearby water bodies/pond ecosystem **(5 hrs)**
- 2) Study of insect fauna in the college campus **(5 hrs)**
- 3) Visit to a sericulture farm/ Apiary/Museum **(5 hrs)**
- 4) Study of six common birds from different orders **(5 hrs)**



**Culture Methods**

1) Culture of unicellular organisms (Amoeba/Paramecium/Euglena)

2) Culture of multicellular organisms (Earthworm)

**(10 hrs)****Reference Books:**

<b>S. No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011
2	Lal S. S.	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004
3	Lal S. S.	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004

**Pedagogy:**

Demonstration, practical, dissection, slides, spotters, field visit, culture methods, power point presentation, e-content, group discussion.



**PSGR  
Krishnammal College for Women**



**College of Excellence, *nirf* 2023-4<sup>th</sup> Rank  
Autonomous and Affiliated to Bharathiar University  
Reaccredited with 'A++' grade by NAAC, An ISO 9001: 2015 Certified Institution  
Peelamedu, Coimbatore-641004**

## **DEPARTMENT OF ZOOLOGY**

**CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING  
OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)  
(III Semesters)**

**BACHELOR OF ZOOLOGY  
2023 – 2026 BATCH**



### **PROGRAMME LEARNING OUTCOMES (PLO's)**

After completion of the programme, the student will be able to

- PLO1:** Appreciate the complexities of various levels of organization in the living forms and address controversial biological issues in a scientific way
- PLO2:** Imbibe transformational impact on the quality of education, and to adopt scientific temper and live with scientific values
- PLO3:** Assess the scope of animal biology, opt relevant areas for inter-disciplinary and trans-disciplinary studies
- PLO4:** Understand and apply the core strands of the knowledge acquired in various disciplines of life sciences to become a potential entrepreneur
- PLO5:** Acquire quality life science education to turn into an outstanding researcher/teacher/career woman/entrepreneur and a responsible citizen

### **PROGRAMME SPECIFIC OUTCOME (PSO's)**

The students at the time of graduation will

**PSO1:** Gain the knowledge of Zoology through theory and practicals.

**PSO2:** Analyze the relationships among animals with their ecosystems.

**PSO3:** Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms, compare and contrast anatomical and physiological characteristics of animals.

**PSO4:** Understand good laboratory practices as per laboratory standards, handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies, effective communication and skills of problem solving methods.

**PSO5:** Understand the applications of zoological knowledge in Agriculture, Medical and daily life and apply the knowledge for employment- Indian Forest Service, Sericulture, Fisheries, Veterinary, Clinical Laboratory, Museum Curator, departments and Entrepreneurship. They can go for Indian Forest Service and other competitive examinations.



**DEPARTMENT OF ZOOLOGY  
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED  
CURRICULAR FRAMEWORK (LOCF)  
BACHELOR OF ZOOLOGY – 2023-2026 BATCH**

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits	
									CA	ESE	Total		
III	I	TAM2303/ HIN 2303/ FRE2303	<b>LANGUAGE III</b> T/H/F Paper III	L	6	88	2	3	25	75	100	3	
	II	ENG2303	English Paper-III	E	5	73	2	3	25	75	100	3	
	III		AS23C03	Ecology and Embryology	CC	4	58	2	3	25	75	100	4
			AS23CP2	Zoology Practical II	CC	3	45	-	-	-	-	-	-
			AS23A01/ PL23A01	Invertebrata and Chordata/ Fundamentals of Botany I	GE	5	73	2	3	20	55	75	4
			AS23AP1/ PL23AP1	Zoology Practical/ Botany Practical I	GE	2	30		-	-	-	-	-
III	III	AS23CE1/ CS23SBGP	Coursera – Insect human Interaction/ GEN-AI	DSE /SEC	3	45/44	-/1	-	100	-	100	3	
IV	IV	NM23DTG	Design Thinking	AEC	2	30	-	-	100	-	100	2	
	IV	NM22UHR	Universal Human Values and Human Rights #			-	-	-	100	-	100	G r.	
I - V	VI	16BONL1 16BONL2	Online Course Online Course			-	-	-	-	-	-	-	
	VI	JOB1993	Job Oriented Course			After the class hours							

**L – Language**

**CC – Core Courses**

**GE – Generic Elective**

**E – English**

**CA – Continuous Assessment**

**ESE - End Semester Examination**

**AEC – Ability Enhancement Course**  
**ACC-Additional Credit Course**  
**# - Self Study**

**SEC- Skill Enhancement Course**  
**AECC- Ability Enhancement Compulsory Course,**

€ - CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

### **QUESTION PAPER PATTERN**

#### **Examination System**

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

#### **2023-2024 BATCH ONWARDS**

#### **CA Question Paper Pattern and distribution of marks UG**

##### **Language and English**

Section A 5 x 1 (No choice) : 5 Marks  
Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)  
Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)

**Total : 45 Marks**

##### **Core and Allied - (First 3 Units)**

##### **CA Question from each unit comprising of**

One question with a weightage of 2 Marks (No choice) :  $2 \times 3 = 6$   
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :  $5 \times 3 = 15$   
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :  $8 \times 3 = 24$

**Total : 45 Marks**

#### **End Semester Examination – Question Paper Pattern and Distribution of Marks**

##### **Language and English**

Section A 10 x 1 (10 out of 12) : 10 Marks  
Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)  
Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)

**Total : 75 Marks**

##### **Core and Allied courses:**

##### **ESE Question Paper Pattern: $5 \times 15 = 75$ Marks**

##### **Question from each unit comprising of**

One question with a weightage of 2 Marks :  $2 \times 5 = 10$   
One question with a weightage of 5 Marks (Internal Choice at the same CLO level):  $5 \times 5 = 25$   
One question with a weightage of 8 Marks (Internal Choice at the same CLO level):  $8 \times 5 = 40$

##### **Evaluation pattern for Gen-AI**

Quiz : 50 Marks (5 quizzes with each 10 marks)  
Case study : 25 Marks  
Online Exam : 25 Marks (Departments to plan and conduct the exam)

**Total : 100 Marks**

**WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF  
CONTINUOUS INTERNAL ASSESSMENT**

**Theory**

	CA	Model Exam	Seminar/Assignment/ Quiz	Class Participation	Attendance	Max. Marks
Core / Allied	5	7	5	5	3	25

**Practical**

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied	10	7	5	3	25

**Part IV**

**Value education / Environmental Studies / Design Thinking**

Quiz : : 50marks  
Assignment : 25marks  
Project / Case study : 25marks  
**Total : 100 Marks**

Course Number	Course Name	Category	L	T	P	Credit
AS23CO3	ECOLOGY AND EMBRYOLOGY	Theory	58	2	-	4

### Preamble

To understand the basic concepts of ecology & Embryology and to understand the functional details of environments and embryo & its stages.

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic aspects of ecology and Gametogenesis, Organogenesis in frog and Human Reproduction.	K1
CLO2	Understand the concepts of ecological attributes and physiological processes in Embryology that are distinct and significant	K2
CLO3	Apply the systemic and functional morphology of various aspects of ecology and embryology	K3
CLO4	Analyze the general and specific characteristics within and other environments in relation to abiotic & biotic factors, stages and development of an embryo	K4

### Mapping with Programme Learning Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M

S- Strong; M-Medium; L-Low



## ECOLOGY AND EMBRYOLOGY – AS23CO3

(58 Hrs)

### Syllabus

#### Unit I

(11 Hrs)

Scope of Environmental Biology, Abiotic factors – Soil, Water, Light, Temperature. Biotic Factors, **\*Animal Relationships: Symbiosis, Mutualism, Commensalism, Antagonism, Parasitism, Predation, Competition**, Population attributes: natality, mortality, population growth, population density, growth curves, Age pyramids, Biotic potential, Population regulation. **\*Biogeochemical cycles–Carbon, Oxygen, Nitrogen, Phosphorus and Sulphur cycles.**

#### Unit II

(11 Hrs)

Community ecology – Definition, Types and Characteristics of community, Ecotone and Edge Effect, Ecological niche, Concepts of community, Ecological succession- sere and climax, Significance of succession. Habitat ecology – **\*Marine Habitat-Definition, Stratification**, Pelagic region – communities, plankton, Pelagic adaptations; Intertidal seashore – rocky, muddy, sandy – biota and adaptations. **\*Mangroves –Definition, Mangrove fauna and flora, Ecological conditions of mangroves.**

#### Unit III

(12 Hrs)

Scope of Developmental Biology-definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman). **\*Gametogenesis-Spermatogenesis –Spermiogenesis, Structure and types of sperms; Oogenesis- Growth of oocyte, vitellogenesis**, organization of egg cytoplasm, Polarity and Symmetry, Maturation of egg, egg envelopes, Structure of Ovum; **\*Fertilization-Definition, External and internal fertilization, Mechanism of fertilization.** Cleavage- Patterns of cleavage- radial, spiral and bilateral; Types of cleavage - meroblastic and holoblastic. Blastulation- Types of Blastula; Fate map of frog, Gastrulation in frog. Morphogenetic movements- epiboly and emboly. **\*Types of eggs.**

#### Unit IV

(12 Hrs)

Organogenesis in frog – Development of eye, ear, brain & heart. Organizer concept: Embryonic Induction, Role of organizers in development- Transplantation experiments of Spemann and Mangold. Chemistry of organizers. Extra-embryonic membranes in chick.

**\*Placentation in mammals-Classification of placenta based on Nature of contact, Mode of implantation, Histological intimacy of foetal and maternal tissue. Functions of placenta. \* Metamorphosis in frog, Regeneration**

#### Unit V

(12 Hrs)

**\*Human Reproduction: Puberty, \*Menstrual cycle, Reproductive Hormones Menopause, Pregnancy, Parturition, Lactation, Infertility**, Artificial insemination, Cryopreservation, Embryo transfer, Amniocentesis, Artificial Reproductive Technology-. ZIFT, GIFT and IVF. Birds eye view of stem cells. **\* In vitro fertilization and its ethics.**

**\* Denotes Blended Learning**

### TEXT BOOKS

S. No.	Author	Title of the Book	Publisher and Edition	Year of Publication and Edition
1	Arumugam, N	A Text Book of Embryology	Saras Publication	2014 and 15 <sup>th</sup> edition
2	Verma P.S., Agarwal., V.K	Environmental Biology	S. Chand & Company	2000 and 10 <sup>th</sup> edition

### REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Balinsky, B.I	Introduction to Embryology	Saunders College Publishing	1981 and 5 <sup>th</sup> edition
2	Berrill, N.J	Developmental Biology	Tata Mc Graw Hill Publication Co.Ltd	1986 and 4 <sup>th</sup> edition
3	Clarke,G.L.	Elements of Ecology	John Wiley & Son Inc. New York & London	1954 and 1 <sup>st</sup> edition
4	Kotpal,R.L. and Bali,N.P.	Concepts of Ecology	Vishal Publication, Delhi	1986 and 2 <sup>nd</sup> edition
5	Odum, E.P.	Basic Ecology	Saunders College Publishing , New York	1983 and Revised, Subsequent edition
6	Scott F. Gilbert,	Developmental Biology	Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts	1997 and 7 <sup>th</sup> edition
7	Vijayaraghavan Nair K & P.V. George	A Manual of Developmental Biology	Academica	-
8	Vincent Terrence Robello, John P.C. and Prema A K	Developmental Biology	Zoological Society Study Material Series, Zoological Society of Kerala, Kottayam	2012

#### Pedagogy

- Lecture by chalk and talk, power point presentation, e-content, group discussion, assignment, quiz, peer learning, seminar

#### Course Designers

Dr. M. Sheeba

Course Number	Course Name	Category	L	T	P	Credit
AS23CP2	ZOOLOGY PRACTICAL II	Practical	-	-	90	4

### Preamble

To provide practical knowledge on cell biology, environmental and developmental biology and to develop practical biological skills.

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic concepts biology-based knowledge on the life of animal forms and the environment. To understand the concepts of natural habitats and the effects of ecological parameters. To understand the process by which organisms grow and develop.	K1
CLO2	Understand the components of the ecosystem and their interactions and inter-relationships to sustain life on earth. Analyse the different ecological parameters and to analyse the mechanisms that intervene in developmental alterations.	K2
CLO3	Application of the acquired skills and adopting it for future research.	K3
CLO4	Analyze the practical knowledge on cell biology, environmental and developmental biology and develop practical biological skills.	K4

### Mapping with Programme Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	S	S	S
CLO2	S	M	S	S	S
CLO3	S	S	M	S	M
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

**ZOOLOGY PRACTICAL II – AS23CP2** (90 Hrs)

**Syllabus**

**CELL BIOLOGY** (12 Hrs)

1. Squash preparation of onion root tip.
2. Mounting of giant chromosomes in *Drosophila* larva.

**BIOCHEMISTRY** (6 Hrs)

1. Qualitative analysis of carbohydrates, proteins and lipids.

**ENVIRONMENTAL BIOLOGY** (42Hrs)

1. Estimation of dissolved oxygen in water samples by Winkler's method.
2. Estimation of salinity, pH and temperature in water samples.
3. Estimation of free carbon dioxide in water samples.
4. Mounting and identification of Marine and Fresh water plankton.
5. Identification and study of inter tidal, rocky sandy and muddy shore fauna.
6. Estimation of total alkalinity of water.
7. Estimation of total hardness of water.
8. Trip to a terrestrial ecosystem

**DEVELOPMENTAL BIOLOGY** (30 Hrs)

**Spotters**

1. Observation of different types of eggs – Amphioxus, frog, hen's egg, ovum of mammal
2. Observation of different types of sperms- Sperm of frog, sperm of man.
3. Embryology of Frog – Cleavage, Blastula, Gastrula, Yolk plug.
4. Chick embryo whole mount – 24, 48, 72 & 96 hours.
5. Metamorphosis in frog.
6. Placenta of mammals - pig, sheep and man.

## REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014 and 3 <sup>rd</sup> edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004 and 12 <sup>th</sup> edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004 and 12 <sup>th</sup> edition

### Pedagogy

- Demonstration, practical, dissection, slides, spotters, field visit, culture methods, power point presentation, e-content, group discussion.

### Course Designers

1. Dr. G. Sasikala
2. Dr. M. Sheeba

COURSE NO	COURSE NAME	Category	L	T	P	Credit
AS23A01	INVERTEBRATA AND CHORDATA	Theory	73	2	-	4

### Preamble

An introduction to basic concepts in biology through study of the major lineages of invertebrate and vertebrate animals, with emphasis on the ontogeny, structure, and function of organ systems in an evolutionary context in allied Zoology to understand biodiversity, adaptation, organization and taxonomic position, explaining the basic aspects of classification, structural and functional details of the invertebrates and chordates.

### Course Learning Outcomes

On the successful completion of the course, students will be able to fill up the lacunae in the study of natural sciences.

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the various types of animals, habits, habitat and general characteristic features and classification based on their diversity into invertebrates and chordates	K1
CLO2	To understand the need for taxonomic position of invertebrates and chordates based on their distribution	K2
CLO3	To apply the knowledge of systematics, morphology, functional, and structural modification in invertebrates & chordates during the course of evolution and their significance	K3
CLO4	To analyse the knowledge of anatomy of invertebrates and chordates comparatively to recognize their history, evolutionary trends and significance	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	L	L	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

## INVERTEBRATA AND CHORDATA AS23A01 (73 hrs)

Outline classification of Kingdom Animalia upto class level with two examples, one type study under each phylum to deal with structure, organization, and life cycle.

### Unit 1 (14 hrs)

Phylum Protozoa: **Structure and life cycle of *Paramecium caudatum*** – External features, Nutrition, Locomotion - effective stroke, recovery stroke, Metachronal rhythm, Reproduction- **Asexual - Binary fission, Sexual reproduction – Conjugation**, Autogamy, Endomixis, Hemimixis and Cytogamy.

Phylum Porifera: **Structure and life cycle of *Leucosolenia botryoides***- External features, Body wall, Spicules \***Canal System**, Nutrition, Reproduction.

Phylum Coelenterata: **Structure and life cycle of *Hydra vulgaris***- External features, Histology of body wall, Cnidoblast and its functions, Nutrition, locomotion, Respiration, Excretion and Osmoregulation, Nervous System, \***Reproduction – asexual – budding; sexual – testis and spermatogenesis, ovary and oogenesis, fertilization, development, hatching - regeneration in Hydra.**

### Unit 2 (14 hrs)

Phylum Helminthes: \***Structure and life cycle of *Taenia solium*** - External features, Body wall, Feeding, Respiratory system, Excretory system-flame cells, Nervous system, Reproductive system, \***Life cycle- Onchosphere and Cysticercus larvae.**

Phylum Annelida: \***Structure and life cycle of *Megascolex mauritii*** - External features, Body wall, Coelom, Locomotion, Digestive system, Respiratory system, Excretory system-Meganephridia, Micronephridia, Pharyngeal nephridia, Nervous system, \***Reproductive system.**

Phylum Arthropoda: \***Structure and life cycle of *Periplaneta americana*** - External features, \***Body wall, \*Mouthparts, \*Digestive system**, Respiratory system, Circulatory system, Nervous system, Sense organs, Excretory system, \***Reproductive system.**

### Unit 3 (15 hrs)

Phylum Mollusca: \***Structure and life cycle of *Pila globosa*** - External features, Shell, Digestive system, Respiratory system, Circulatory system, Nervous system, \***Sense organs- Eyes, Osphradium, Statocyst, Tentacles**, Excretory system, Reproductive system.

Phylum Echinodermata: \***Structure and life cycle of *Asterias rubens*** - External features, Pedicellaria-Structure and Function, Digestive system, Respiratory system, Water vascular system-Structure and Function, Circulatory system – Perihæmal and Hæmal system, Nervous system, \***Sense organs**, Excretory system, Reproductive system.

#### Unit 4

(15 hrs)

Phylum Chordata-Morphology and organ systems of Shark & Frog (Excluding endoskeleton)

**Class Pisces: *Scoliodon sorrakowah***- Systematic Position, Habits and Habitat, **\*External features, \*Exoskeleton - Placoid Scales**, Digestive System, Respiratory system & Mechanism of respiration, Circulatory system, Nervous system, **\*Sense organs-Olfactory organs, Eyes, Internal ears, Neuromast or lateral line system, Ampullae of Lorenzini**. Urinogenital system.

**Class Amphibia: *Rana hexadactyla***- Systematic Position, Habits and Habitat, **External features, Sexual dimorphism**, Digestive System, Respiratory system, Circulatory system, Nervous system - **\*Sense organs - Tangoreceptors, Tastebuds, Olfactory organs, \*Internal structure and functions of Eye and Ear**, Urinogenital system

**Class Reptilia: *Calotes versicolor***- Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system - Respiratory mechanism, Circulatory system - Blood, Heart - Internal structure, Arterial system, Venous system. Nervous system - Brain, Spinal cord, cranial nerves and spinal nerves. **\*Sense organs, Jacobson's organs, \*Internal structure and functions of Eye and Ear**, Urinogenital system

#### Unit 5

(15 hrs)

Phylum Chordata - Morphology and organ systems of Pigeon & Rabbit (excluding endoskeleton)

**Class Aves: *Columba livia domestica***- Systematic Position, Habits and Habitat, **\*External features, Feathers** - Structure of a typical feather in Pigeon, **\*Types of feathers in pigeon**, Muscular System - Flight muscles, Digestive System, **\*Respiratory system- Syrinx and voice production, \*Air sacs and functions**. Respiratory mechanism, Circulatory system - Nervous system, **\*Structure and function of Eye and Ear**, Urinogenital system.

**Class Mammalia: *Oryctolagus cuniculus domesticus***- Systematic Position, Habits and Habitat, **\*External features**, Digestive System, Respiratory system, **\*Circulatory system**, Nervous system. **\*Structure and function of Eye and Ear, \*Excretory system**, Reproductive system.

**\* Denotes Blended Learning**



### Text Books

S. No.	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Jordon. E L & Verma PS	Invertebrate Zoology	1 st edition, S. Chand & Co., New Delhi	2015 and revised edition
2	Jordan E L and Verma PS	Chordate Zoology	S. Chand & Co, New Delhi	2013 and 14 revised editions

### REFERENCE BOOKS:

S. No.	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Ekambaranatha Ayyar M	Outlines of Zoology	Viswanathan Publication	1992
2	Fatik Baran Mandal	Invertebrate Zoology	Eastern Economy Edition	2012 and 1 <sup>st</sup> Edition.
3	Jan A Pechenik	Biology of the Invertebrates	McGraw-Hill Companies,	2014 and 7 <sup>th</sup> Revised Edition
4	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson,	1979 and 2 <sup>nd</sup> Edtion
5	Waterman, Allyn J	Chordate structure and Function	Mac Milan & Co., New York	2006 and 4 th edition

**Pedagogy:** Chalk and Talk method, Seminar, Quiz, Group discussion, Powerpoint presentation, videos, e-contents, etc.

### Course Designer(s)

Dr. Susheela.P  
Dr. G. Sasikala

COURSE NO	COURSE NAME	CATEGORY	L	T	P	CREDIT
AS23AP1	ZOOLOGY PRACTICAL	Practical	-	-	60	2

### Preamble

Topics related to fundamentals of zoology, including exposure to diversity in animal groups based on the zoological areas are covered. The practical course is aimed to equipped the students with skills required for animal identification and classification and also applications of zoology in the various allied fields

### Course Learning Outcome

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

CLO Number	CO Statement	Knowledge Level
CLO1	To recall the general taxonomic rules on animal classification and general characteristics of animals	K <sub>1</sub>
CLO2	To understand the basic concepts of Zoology, categorize the diversity found in the animal groups and their evolutionary significance	K <sub>2</sub>
CLO3	To apply the practical skills towards the handling different organisms, use of various tools, technologies and fieldwork modalities	K <sub>3</sub>
CLO4	To analyse and interpret the diversity of organisms, functioning of organ system, and observation and study of nature and develop experimental skills for scientific investigation	K <sub>4</sub>

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	M	M
CLO4	S	S	S	M	M

S- Strong; M-Medium; L-Low

## ZOOLOGY PRACTICAL – AS2AP1

(60 Hrs)

### 1. Dissections:

(30 Hrs)

1. Cockroach Digestive system, Nervous system, Male & Female Reproductive systems
2. Fish (*Tilapia*) - Digestive system
3. Prawn- Nervous system

### Mounting:

1. Mounting of scales of a marketable fish.
2. Mounting of gill arch.
3. Mounting of earthworm setae
4. Mounting of mouth parts of cockroach
5. Mounting of Prawn appendages

### 2. Spotters

(12 Hrs)

- *Paramecium* – Entire, binary fission, conjugation
- *Leucosolenia*
- *Hydra vulgaris* – Entire
- *Taenia solium* – Entire, T.S
- Ascaris -male, female
- Earth worm
- Pila
- Star fish
- Amphioxus
- Shark
- Frog
- Skeleton of frog- Skull, Vertebrae-Typical, VIII, IX, X, Girdles& Limbs
- Calotes
- Pigeon
- Quill feather
- Rabbit
- Mitosis stages

### Frog embryology

- Egg
- Sperm
- Blastula
- Gastrula

### 3. Field observations combined with photography and/or videography

(4 Hrs)

Study of insect fauna in the college campus

### 4. Culture methods

(2 Hrs)

Culture of unicellular organisms.

## 5. Models

(12 Hrs)

- Animal Cell
- Mitochondria
- DNA
- RNA
- Chromosomes
- Alimentary Canal of Man
- Male Reproductive Tract
- Female Reproductive Tract
- Human Placenta
- Protein Structure

### REFERENCE BOOKS:

S. No.	Authors	Title of the Book	Publishers	Year of Publication and edition
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011 and 1 <sup>st</sup> edition
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2020 and 12 <sup>th</sup> edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2020 and 12 <sup>th</sup> edition

**Pedagogy:** Observation of slides, specimens and models; field visit, dissection

**Semester** : III & IV  
**Paper** : Job Oriented Course  
**Title** : Apiculture  
**Subject Code** : JOB1993

**Lecture Hours: 60**

**Unit I** (8 Hrs)

Bee keeping down the ages - Present status of Apiculture in India - Classification and Biology of Honey Bees. Embryology and life history - Anatomy and Physiology of honeybee. Social Organization of Bee Colony

**Unit II** (8 Hrs)

Types of beehives - structure - location, care and management - Genetic studies - breeding of stocks - winter broods. Artificial Bee rearing (Apiary), Bee Pasturage. Selection of Bee Species for Apiculture. Bee Keeping Equipment.

**Unit III** (8 Hrs)

Bee foraging: Pollen and nectar yielding plants. Honey extraction, seasonal maintenance, swarming and supersedure - pheromone. Natural enemies and diseases of honey bees and control methods. Bee poisoning and utility of bees in toxicity studies. Apiculture Management

**Unit IV** (8 Hrs)

Uses of honey and beeswax in Indian medicine. Bee Products and Marketing of Bee products. Economics of bee keeping: Economics in small scale and large scale bee keeping. Economic Value of Commercial Beekeeping.

**Unit V** (8 Hrs)

Preparing bankable bee keeping project: Steps involved in starting a beekeeping project, Prospects of apiculture as self-employment venture. Funding sources for beekeeping projects. Funds mobilization from state and national banks. Grant Resource and utilization.

**FIELD VISIT:** To Apiary unit (10 Hrs)

**INTERNSHIP** (10 Hrs)

## REFERENCE BOOKS

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Sardar Singh	Bee keeping in India	Indian council of Agricultural Research, New Delhi	1962
2	Sharma P.L. and Singh, S.H.,	Hand book of Bee keeping	Controller Printing and Stationery, Chandigarh	1987
3	Roger, A. Morse	The ABC and XYZ of Bee culture	A.I. Root & Co., Medina, Ohio	40 <sup>th</sup> Edn, 1990



**PSGR  
Krishnammal College for Women**



**College of Excellence, *nirf* 2023-4<sup>th</sup> Rank  
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Peelamedu, Coimbatore-641004**

**DEPARTMENT OF ZOOLOGY**

**CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING  
OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)  
(IV Semester)**

**BACHELOR OF ZOOLOGY  
2023 – 2026 BATCH**



**DEPARTMENT OF ZOOLOGY**  
**CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR**  
**FRAMEWORK (LOCF)**  
**BACHELOR OF ZOOLOGY – 2023-2026 BATCH**  
**SEMESTER IV**

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits	
									CA	ESE	Total		
IV	I	TAM2304/ HIN2304/ FRE2304	Tamil Paper IV Hindi Paper IV French paper IV	L	5	73	2	3	25	75	100	3	
	II	ENG2304	English Paper-IV	E	6	88	2	3	25	75	100	3	
	III		AS23C04	Cell Biology and Biochemistry	CC	4	58	2	3	25	75	100	4
			AS23CP2	Zoology Practical II	CC	3	45	-	3	25	75	100	4
			AS23A02/ PL23A02	General principles in zoology/ Fundamentals of Botany II	GE	5	73	2	3	20	55	75	4
			AS23AP1/ PL23AP1	Zoology Practical/ Botany Practical	GE	2	30	-	3	15	35	50	2
III/IV	III	AS23SCE1/ CS23SBGP	Insect human Interaction/ GEN-AI	SEC	3	45	-	-	100	-	100	3	
	IV	NM23EII	Entrepreneurship and Innovation (Ignitex)	AECC	2	30	-	-	100	-	100	2	
	IV	NM23EVS	Environmental Studies	AECC	SS	-	-	-	100	-	100	Gr.	
I - IV	V	COCOACT	Co-Curricular Activities		-	-	-	-	-	100	100	1	
	VI	COM15SER	Community Service 30 Hours	GC	-	-	-	-	-	-	-	-	
I - V	VI	16BONL1 16BONL2	Online Course 1 Online Course 2	ACC	-	-	-	-	-	-	-	-	

L – Language

CC – Core Courses

GE – Generic Elective

AEC – Ability Enhancement Course

ACC-Additional Credit Course

SS - Self Study

€ - CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

E – English

CA – Continuous Assessment

ESE - End Semester Examination

SEC- Skill Enhancement Course

AECC- Ability Enhancement Compulsory Course,



## QUESTION PAPER PATTERN

### Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

### 2023-2024 BATCH ONWARDS

#### CA Question Paper Pattern and distribution of marks

##### UG Language and English

Section A 5 x 1 (No choice) : 5 Marks  
Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)  
Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)

**Total: 45 Marks**

#### Core and Allied - (First 3 Units)

##### CA Question from each unit comprising of

One question with a weightage of 2 Marks (No choice) :  $2 \times 3 = 6$   
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :  $5 \times 3 = 15$   
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :  $8 \times 3 = 24$

**Total : 45 Marks**

#### End Semester Examination – Question Paper Pattern and Distribution of Marks

##### Language and English

Section A 10 x 1 (10 out of 12) : 10 Marks  
Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)  
Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)

**Total : 75 Marks**

#### Core and Allied courses:

**ESE Question Paper Pattern:  $5 \times 15 = 75$  Marks**

##### Question from each unit comprising of

One question with a weightage of 2 Marks :  $2 \times 5 = 10$   
One question with a weightage of 5 Marks (Internal Choice at the same CLO level):  $5 \times 5 = 25$   
One question with a weightage of 8 Marks (Internal Choice at the same CLO level):  $8 \times 5 = 40$

#### Part IV

##### Entrepreneurship and Innovation Assessment Pattern:

Components	Marks
3 Quizzes ( 25 questions in each quiz)	50
30 Venture Activities (Assignment)	30
Milestone 3 ( pitch deck presentation)	20
Total	100

#### Environmental Studies

Quiz : : 50marks  
 Assignment : 25marks  
 Project / Case study : 25marks  
**Total : 100 Marks**

**WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF  
 CONTINUOUS INTERNAL ASSESSMENT**

**Theory**

	CA	Model Exam	Project/Assignment/ Quiz	Class Participation	Attendance	Max. Marks
Core / Allied	5	7	5	5	3	25

**Practical**

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied	10	7	5	3	25

Course Code	Course Title	Category	L	T	P	Credit
AS23C04	CELL BIOLOGY AND BIOCHEMISTRY	Theory	58	2	-	4

### Preamble

To enable the students to explore the intricacies of cell architecture and their complex biochemical interactions.

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To impart knowledge about different areas of cell biology, including cell structure, functions, its organelles and fundamentals of biochemical sciences.	K1
CLO2	Develop a comprehensive understanding of the cellular membranes and matrices	K2
CLO3	Ability to make connections between the molecular mechanisms, holistic understanding of biological organisation and function from the molecules to cells, tissues, organs and entire organism	K3
CLO4	Interpret and evaluate evidence for hypotheses about cell structure and function	K4

### Mapping with Programme Learning Outcomes

CLO s	PLO1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	S	S	M	M
CLO 2	S	S	S	M	M
CLO 3	S	S	S	S	S
CLO 4	M	S	S	S	S

S- Strong; M- Medium; L-Low

## **CELL BIOLOGY AND BIOCHEMISTRY – AS23C04**

**(58 Hrs)**

### **UNIT I**

**(13 Hrs)**

Diversity of cell size and shape. Cell theory, Protoplasm theory. Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells, Various models of plasma membrane structure and function. Microscopes – Principle and Uses of Light microscope, Phase Contrast and Electron Microscope.

### **UNIT II**

**(11 Hrs)**

Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes, ribosomes. Centrioles, Mitochondria – Structure and Functions - Glycolysis, Krebs cycle and oxidative phosphorylation.

### **UNIT III**

**(11 Hrs)**

Structure of Nucleus: Nuclear envelope, nucleolus, functions. DNA – Structure, Watson and Crick model, Replication, super coiling. DNA Repair Mechanism. Giant chromosomes – polytene, lamp brush chromosomes.

### **UNIT IV**

**(11 Hrs)**

RNA - Structure, Types, tRNA structure, Transcription and translation. Cell cycle and its regulation - Mitosis, Meiosis. Cancer – Types and Properties of Cancer Cells; Theories on Carcinogenesis.

### **UNIT V**

**(12 Hrs)**

Scope of Biochemistry–Proteins– Types of Aminoacids, Primary, Secondary, Tertiary, quaternary Structure of Proteins and functions. Classification of carbohydrates. Structure and functions. Lipids classification, structure and functions. Enzymes classification, Michaelis–Menten Equation. Enzyme action – Factors Affecting Enzyme Action, Mechanism of Enzyme Action.

## TEXT BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication	Edition
1	Ambika Shanmugam	Fundamentals of Biochemistry for Medical Students	Wolters Kluwer (India) Pvt Ltd, New Delhi	2016	8 <sup>th</sup> Edition
2	Verma P.S., Agarwal., V.K	Cytology	S. Chand & Company	2012	8 <sup>th</sup> Edition
3	Veer Bala Rastogi	Introduction to Cytology	Introduction to Cytology	2003	

## REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication	Edition
1	Albert L Lehninger	Biochemistry, Second Edition	Kalyani Publishers, New Delhi	2013	2 <sup>nd</sup> Edition
2	De Robertis, E.D.P. and De Robertis, E.M.F	Cell and Molecular Biology	Lippincott Williams and Wilkins, Philadelphia	2017	8 <sup>th</sup> Edition
3	Satyanarayana U and Chakrapani U	Essentials of Biochemistry	Book and Allied (P) Ltd.	2019	3 <sup>rd</sup> Edition
4	Karp, G	Cell and Molecular Biology: Concepts and Experiments	John Wiley & Sons. Inc.	2015	8 <sup>th</sup> Edition

### Pedagogy

- Chalk and Talk method, Seminar, Quiz, Group discussion, Power point presentation

### Course Designers

1. Dr. P.B. Harathi
2. Dr. M. Sheeba

Course Code	Course Title	Category	L	T	P	Credit
AS23CP2	ZOOLOGY PRACTICAL II	Practical	-	-	45	4

### Preamble

To provide practical knowledge on cell biology, environmental and developmental biology and to develop practical biological skills.

### Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic concepts biology-based knowledge on the life of animal forms and the environment. To understand the concepts of natural habitats and the effects of ecological parameters. To understand the process by which organisms grow and develop.	K1
CLO2	Understand the components of the ecosystem and their interactions and inter-relationships to sustain life on earth. Analyse the different ecological parameters and to analyse the mechanisms that intervene in developmental alterations.	K2
CLO3	Application of the acquired skills and adopting it for future research.	K3
CLO4	Analyze the practical knowledge on cell biology, environmental and developmental biology and develop practical biological skills.	K4

### Mapping with Programme Learning Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	S	S	S
CLO2	S	M	S	S	S
CLO3	S	S	M	S	M
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

## **ZOOLOGY PRACTICAL II – AS23CP2**

**(90 Hrs)**

### **CELL BIOLOGY**

**(12 Hrs)**

1. Squash preparation of onion root tip.
2. Mounting of giant chromosomes in *Drosophila* larva.

### **BIOCHEMISTRY**

**(6 Hrs)**

1. Qualitative analysis of carbohydrates, proteins and lipids.

### **ENVIRONMENTAL BIOLOGY**

**(42 Hrs)**

1. Estimation of dissolved oxygen in water samples by Winkler's method.
2. Estimation of salinity, pH and temperature in water samples.
3. Estimation of free carbon dioxide in water samples.
4. Mounting and identification of Marine and Fresh water plankton.
5. Identification and study of inter tidal, rocky sandy and muddy shore fauna.
6. Estimation of total alkalinity of water.
7. Estimation of total hardness of water.
8. Trip to a terrestrial ecosystem

### **DEVELOPMENTAL BIOLOGY**

**(30 Hrs)**

#### **Spotters**

1. Observation of different types of eggs – Amphioxus, frog, hen's egg, ovum of mammal
2. Observation of different types of sperms- Sperm of frog, sperm of man.
3. Embryology of Frog – Cleavage, Blastula, Gastrula, Yolk plug.
4. Chick embryo whole mount – 24, 48, 72 & 96 hours.
5. Metamorphosis in frog.
6. Placenta of mammals - pig, sheep and man.

## REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication	Edition
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014	3 <sup>rd</sup> Edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2020	12 <sup>th</sup> Edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2020	12 <sup>th</sup> Edition

### Pedagogy

- Demonstration, practical, dissection, slides, spotters, field visit, culture methods, power point presentation, e-content, group discussion.

### Course Designers

1. Dr. G. Sasikala
2. Dr. M. Sheeba



Course Code	Course Title	Category	L	T	P	Credit
AS23A02	<b>GENERAL PRINCIPLES IN ZOOLOGY</b>	Allied	73	2	-	4

### Preamble

The course imparts knowledge and understanding of basic cell structure and function, genetics, developmental biology, physiology, and evolution.

### Course Learning Outcomes

On the successful completion of the course, students will be able to understand the structural- functional relationships of living organisms. Students will come to appreciate and enjoy the subject of zoology and be able to place the subject in the larger context of human knowledge and experience on a global scale.

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the fundamentals of cell biology, genetics, animal physiology, embryology and evolution which contribute to form tissue, organs, and organ systems and their functions, diversity and evolutionary relationships among animals	K1
CLO2	Understand how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.	K2
CLO3	Analyze different laws of genetics, physiology of nutrition and digestion, process of reproduction and theories of evolution	K3
CLO4	Apply the knowledge of evolutionary theories to explain unity and diversity of life and significant adaptations to explore animal physiology, embryology and endocrinology	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	L	L	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

**GENERAL PRINCIPLES IN ZOOLOGY- AS23A02****(73 Hrs)****Syllabus****UNIT I Cell Biology & Genetics****(15 Hrs)**

Cell concept-life and living things, cell history, cell theory, cell diversity, internal organization, cell structure and function, Cell types-Prokaryotic, Eukaryotic cell (plant and animal cell), Eukaryotic Animal cell – Structure and functions of Plasma membrane, Golgi apparatus, Mitochondria, Nucleus, Cell cycle - Cell division, Mitosis, Meiosis.

**UNIT II Genetics and Physiology****(14 Hrs)**

Mendel's Laws of inheritance-Punnett square, Types of genetic cross-Monohybrid and dihybrid cross, Sex determination in man. Nutrition in man – food types, vitamins and minerals. Digestion and absorption of food in man, balanced diet.

**UNIT III Embryology****(15 Hrs)**

Gametogenesis – spermatogenesis and oogenesis, Fertilization, cleavage-study of cleavage patterns. Radial and spiral cleavage- Early cleavage in frog- uncleaved egg, two cell stage, morula stage, Blastulation, Gastrulation in Frog - study of different types of eggs- Classification based on amount and distribution of yolk

**UNIT IV Endocrinology****(14 Hrs)**

Structure, secretions and functions of pituitary- Anterior pituitary and posterior pituitary, thyroid, pancreas and reproductive glands – testes, ovary.

**UNIT V Evolution****(15 Hrs)**

Origin of life and evolution of cell- Theories on evolution by Lamarck, Charles Darwin & De Vries, living fossils, organic evolution, Evidences of evolution - fossil evidence, morphological, comparative anatomy, embryological, vestigial structures, biochemical and paleontological evidences. Origin of India and its Mega diversity.

**TEXT BOOKS**

<b>S. No</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>	<b>Edition</b>
1	Verma P.S., Agarwal., V.K.	Cytology	S. Chand and Company	2012	Reprint Edition
2	Arumugam, N.	Cell Biology, Genetics, Embryology	S. Chand and Company	2014	Reprint Edition
3	Arumugam, N	Cell Biology, Genetics & Evolution Volume-3.	Saras Publication	2014	Reprint Edition

4	Verma P.S. & Tyagi B.S.	Animal Physiology,	S. Chand and Company	2012	8 <sup>th</sup> Edition
5	Verma. P.S. and Agarwal. V.K.	Chordate Embryology	S. Chand and Co. Ltd., New Delhi	2010	4 <sup>th</sup> Edition

### REFERENCE BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Berry, A.K.	A Text Book of Animal Physiology with related Biochemistry	Emkay Publications	2020	12 <sup>th</sup> Edition
2	Sarada Subrahmanyam., Madhavan Kutty , K., & Singh H.D.	Text Book of Human Physiology, Reprint	S. Chand & Co,	2010	8 <sup>th</sup> Edition
3	De Rebertis EDP & De Robertis EMF	Cell & Molecular Biology.	BI Wauerly Pvt. Ltd, New Delhi.	2017,	8 <sup>th</sup> Edition
4	Berrill, N.J.	Developmental Biology	McGraw Hill, New Delhi.	1971	
5	Bodmer, Modern Embryology, Hold Rinefiar & Winston. N.Y. Balinsky	Introduction to Embryology International student edition,	Saunders Philadelphia.	2012	5 <sup>th</sup> Edition

Pedagogy

- Chalk and Talk method, Seminar, Quiz, Group discussion, Power point presentation

**Course Designers:** 1. Dr. P.Susheela., 2. Dr. G. Sasikala

Course Code	Course Title	Category	L	T	P	Credit
AS23AP1	ALLIED ZOOLOGY PRACTICAL	Practical	-	-	60	2

### Preamble

Topics related to fundamentals of zoology, including exposure to diversity in animal groups based on the zoological areas are covered. The practical course is aimed to equipped the students with skills required for animal identification and classification and also applications of zoology in the various allied fields

### Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the general taxonomic rules on animal classification and general characteristics of animals	K1
CLO2	To understand the basic concepts of Zoology, categorize the diversity found in the animal groups and their evolutionary significance	K2
CLO3	To apply the practical skills towards the handling different organisms, use of various tools, technologies and fieldwork modalities	K3
CLO4	To analyse and interpret the diversity of organisms, functioning of organ system, and observation and study of nature and develop experimental skills for scientific investigation	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	M	M
CLO4	S	S	S	M	M

S- Strong; M-Medium; L-Low

**ALLIED ZOOLOGY PRACTICAL – AS23AP1 (60 Hrs)**

**1. Dissections: (30 Hrs)**

1. Cockroach Digestive system, Nervous system, Male & Female Reproductive systems
2. Fish (*Tilapia*) - Digestive system
3. Prawn- Nervous system

**Mounting:**

1. Mounting of scales of a marketable fish.
2. Mounting of gill arch.
3. Mounting of earthworm setae
4. Mounting of mouth parts of cockroach
5. Mounting of Prawn appendages

**2. Spotters (12 Hrs)**

- Paramecium – Entire, binary fission, conjugation
  - *Leucosolenia*
  - *Hydra vulgaris* – Entire
  - *Taenia solium* – Entire, T.S
  - Ascaris -male, female
  - Earth worm
  - Pila
  - Star fish
  - Amphioxus
  - Shark
  - Frog
  - Skeleton of frog- Skull, Vertebrae-Typical, VIII, IX, X, Girdles & Limbs
  - Calotes
  - Pigeon
  - Quill feather
  - Rabbit
  - Mitosis stages

**Frog embryology**

- Egg
- Sperm
- Blastula
- Gastrula

**3. Field observations combined with photography and/or videography (4 Hrs)**

Study of insect fauna in the college campus

**4. Culture methods (2 Hrs)**

Culture of unicellular organisms.

**5. Models****(12 Hrs)**

- Animal Cell
- Mitochondria
- DNA
- RNA
- Chromosomes
- Alimentary Canal of Man
- Male Reproductive Tract
- Female Reproductive Tract
- Human Placenta
- Protein Structure

**Reference Books:**

<b>S. No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>	<b>Edition</b>
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014	3 <sup>rd</sup> Edition
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2019	12 <sup>th</sup> Edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2004	12 <sup>th</sup> Edition

**Pedagogy:** Observation of slides, specimens and models; field visit, dissection