PSGR
Krishnammal College for Women

College of Excellence, nirf 2023-4th 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 2024-27 Batch and onwards)

BACHELOR OF ZOOLOGY
2024 – 2027 BATCH

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PROGRAMME LEARNING OUTCOMES (PLOs)

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 practical

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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(I Semester)

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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	
I	I	TAM2301/ HIN2301/ FRE2301	Language I – T / H / F	Lang	6	88	2	3	25	75	100	3
	II	ENG2301	English Paper I	English	6	88	2	3	25	75	100	3
	III	AS23C01	Invertebrata	CC	6	88	2	3	25	75	100	5
	III	AS24CP1	Zoology Practical I	CC	3	45	-	-	-	-	-	-
	III	CE24A01	Chemistry for Biologists I	GE	4	58	2	3	20*	55*	75	4
	III	CE23AP1	Chemistry Practical for Biologists	GE	3	45	-	-	-	-	-	-
		Non Tamil Students										
	IV	NME23B1/ NME23A1	Basic Tamil I/ Advanced Tamil I	AEC	2	28	2	-	100	-	100	2
		Students with Tamil as Language										
	IV	NME23ES	Introduction to Entrepreneurship	AEC	2	30	-	-	100	-	100	
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-	-	-
I-V	VI	COM15SER	Community Service 30 hours	GC	-	-	-	-	-	-	-	-

L – Language **E - English**
CC – Core Courses **CA – Continuous Assessment**
GE – Generic Elective **ESE–End Semester Examination**
AEC – Ability Enhancement Course
ACC – Additional Credit Course
***CA conducted for 25 converted to 20, ESE conducted for 100 converted to 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 × 1 (No choice) : 5 Marks
Section B 4 × 5 (4 out of 6) : 20 Marks (250 words)
Section C 2 × 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 × 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : 5 × 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : 8 × 3 =24
Total : 45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks
Language and English
Section A 10 × 1 (10 out of 12) : 10 Marks
Section B 5 × 5 (5 out of 7) : 25 Marks (250 words)
Section A 4 × 10 (4 out of 6) : 40 Marks (600 - 700 words)
Total : 75 Marks

Core and Allied courses:
ESE Question Paper Pattern: 5 × 15 = 75 Marks
Question from each unit comprising of
One question with a weightage of 2 Marks : 2 × 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 × 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 × 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
Total : 25 Marks

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.

Part IV
Introduction to Entrepreneurship
Quiz : 50 marks
Assignment : 25 marks
Project / Case study : 25 marks
Total : 100 Marks

MAPPING OF PLOS WITH CLOS

COURSE	PROGRAMME LEARNING OUTCOMES				
	PLO1	PLO2	PLO3	PLO4	PLO5
COURSE – AS23CO1					
CLO1	S	S	M	M	L
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M
COURSE – AS24CP1					
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
AS23CO1	INVERTEBRATA	Theory	88	2	-	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 Learning 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 K1	K1
CLO2	Understand the importance of multicellularity significant to anatomical and physiological up gradation of the invertebrates	K2
CLO3	Identify the evolution of organ systems and differences in functional morphology of higher invertebrates	K3
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	K4

Mapping with Programme Learning 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

INVERTEBRATA – AS23CO1 (88 Hrs)

Unit 1 **(20 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 **(20 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

1. ***Life cycle and pathogenicity of:**
   - **a) *Wuchereria bancrofti***
   - **b) *Drancunculus medinensis***
   - **c) *Ancylostoma duodenale***
2. ***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 and Edition
1	Jordan E.L and Verma P.S	Invertebrate Zoology	S. Chand and Co	2022, 1 edition
2	Nair N. C.	A Text Book of Invertebrates	Saras Publications	2015, 5 edition
3	Kaliraj, P. and Devi, T.	Artificial Intelligence Theory, models and Applications	CRC Press, Taylor & Francis Group	2022
4	Kaliraj, P. and Devi, T.	Innovating with Augmented Reality : Applications in Education and Industry	CRC Press, Taylor & Francis Group	2022
5	Kaliraj, P. and Devi, T.	Big Data Applications in Industry 4.0	CRC Press, Taylor & Francis Group	2022

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1.	Barrington E J W	Invertebrate Structures and Function	English Language Book Society	1979, 1 edition
2.	Ekambaranatha Ayyar, M. & Ananthakrishnan, T.N.	Manual of Zoology Vol-I (Invertebrata) Part I & II	Vishwanathan (P) Ltd. Chennai	1995, 1 edition
3.	Mandal Eatik Baran	Biology of Non chordates	PHI Learning Private Limited	2018, 2 edition
4.	Kotpal R.L., Agarwal S.K and Ketarpal R.P.R	Modern Text Book of Zoology Invertebrates	Rastogi Publications	2011, 3 edition
5.	Robert	Invertebrate Zoology	W. B. Saunders International	1974, 1 edition
6.	Pechenik Jan A	Biology of the Invertebrates	McGraw-Hill International	2016, 7 edition

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
3. Introduction to Industry 4.0

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
6. https://www.hyperhyve.com/post/beekeeping-using-machine-learning
7. https://www.researchgate.net/publication/322958397_Detection_of_stored-grain_insects_using_deep_learning
8. https://www.ijrte.org/wp-content/uploads/papers/v8i2/B1801078219.pdf
9. https://www.perlego.com/book/3799692/industry-40-technologies-for-education-transformative-technologies-and-applications-pdf

Session plan

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
1.	Phylum Protozoa-General characters	CLO1 CLO2	1	Lecture – Chalk and Talk / PPT	Mind map / One minute summery	Participatory Learning
2.	Phylum Protozoa-General characters	CLO1 CLO2	1	PPT / OER	Quiz (Quiz Alize/ Socrative)	Participatory Learning
3.	Phylum Protozoa-General characters	CLO2 CLO3	1	PPT	Think share and write / word cloud	Participatory Learning
4.	Type Study: *Paramecium caudatum* – External features	CLO2 CLO3	1	Group discussion	Sketch board	Participatory Learning
5.	Cont. Nutrition	CLO2 CLO3	1	Group discussion	Sketch board	Participatory Learning
6.	Locomotion-effective stroke, recovery stroke, Metachronal rhythm	CLO1 CLO2	1	Seminar / PPT	Flipped classroom	Participatory Learning
7.	Modes of reproduction, – Sexual reproduction-Conjugation	CLO3 CLO4	1	PPT / OER	Quiz (Quiz Alize/ Socrative)	Participatory Learning
8.	Autogamy, Endomixis, Hemimixis and Cytogamy.	CLO3 CLO4	1	Lecture/ video	Setup Design Activity/ Diagrams	Experimental Learning
9.	Locomotion in Protista	CLO1 CLO2	1	Lecture – Chalk and Talk / PPT	Mind map / One minute summery	Participatory Learning
10.	Reproduction in Protista	CLO3 CLO4	1	OER	Quiz (Quiz Alize/ Socrative)	Participatory Learning
11.	Life cycle and pathogenicity	CLO3 CLO4	1	Lecture / video	Diagrams, Sketch board	Experimental learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	of *Plasmodium vivax* and *Entamoeba histolytica*					
12.	Evolution of symmetry and segmentation of Metazoa	CLO3 CLO4	1	Presentation	Flipped classroom, Blended learning	Experimental Learning
13.	Phylum Porifera- General Characters and classification.	CLO3 CLO4	1	Lecture/ video	Setup Design Activity/ Diagrams	Experimental Learning
14.	Type Study: *Leucosolenia botryoides*- External features, Body wall, Spicules	CLO3 CLO4	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
15.	External features, Body wall, Spicules	CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
16.	*Leucosolenia botryoides* - Canal System,	CLO3 CLO4	1	Presentation	Flipped classroom, Blended learning	Experimental Learning
17.	Nutrition, Reproduction	CLO3 CLO4	1	Lecture/ video	Setup Design Activity/ Diagrams	Experimental Learning
18.	Canal system in sponges	CLO3 CLO4	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
19.	Economic importance of sponges	CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
	Unit- 2					
20.	Phylum Coelenterata-	CLO1 CLO2	1	Insect observation	Think write and share	Experimental Learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	General characters, Classification					
21.	Phylum Coelenterata- General characters, Classification	CLO2 CLO3	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
22.	*Obelia geniculata* - External features Histology of the colony, Cnidoblast and its functions	CLO2 CLO3	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
23.	*Obelia geniculata* - Life History of Obelia, Metagenesis.	CLO3 CLO4	1	Lecture / video	Diagrams, Sketch board	Experimental learning
24.	Corals & coral reefs	CLO2 CLO3	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
25.	Polymorphism in Coelentrates	CLO2 CLO3	1	video/ Lecture	quizlet	Experimental Learning
26.	Phylum Helminthes- General characters and Classification	CLO2 CLO3	1	Virtual lab	Discussion	Experimental Learning
27.	Phylum Helminthes- General characters and Classification	CLO2 CLO3 CLO4	1	Lecture	Quizalize	Experimental Learning
28.	*Taenia solium*- External features, Body wall, Feeding,	CLO3 CLO4	1	Lecture / video	Demonstration	Experimental Learning
29.	Respiratory system	CLO3 CLO4	1	Lecture / video	discussion	Experimental Learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
30.	Excretory system-flame cells	CLO3 CLO4	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
31.	Nervous system	CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
32.	*Taenia solium* Reproductive system, Life cycle- Onchosphere and Cysticercus larvae.	CLO3 CLO4	1	Lecture PPT	Quiz	ParticipatoryLearning
33.	*Taenia solium* Reproductive system, Life cycle.	CLO3 CLO4	1	Lecture / video	Demonstration	Experimental Learning
34.	Onchosphere and Cysticercus larvae	CLO3 CLO4	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
35.	Life cycle and pathogenicity of *Taenia solium,*	CLO3 CLO4	1	OER	Quiz (Quizalize/ Socrative)	Participatory Learning
36.	Life cycle and pathogenicity of a) *Wuchereria bancrofti*	CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
37.	b) *Drancunculus medinensis,* c) *Ancylostoma duodenale*	CLO3 CLO4	1	Brain storming/ PPT	Kahoot/ think write share	Problem-based Learning
38.	Parasitic adaptation in Helminthes.	CLO3 CLO4	1	OER	Quiz (Quizalize/ Socrative)	Participatory Learning
	Unit- 3					
39.	Phylum Annelida- General characters and	CLO1 CLO2	1	OER / PPT	Flipped classroom, Assignment	Participatory Learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	classification					
40.	Type Study:*Megascolex mauritii* - External features	CLO2 CLO3	1	Lecture PPT	Peer teaching	Participatory Learning
41.	Study:*Megascolex mauritii* - External features	CLO2 CLO3	1	Video / Observation	Group discussion	Experimental Learning
42.	Type Study:*Megascolex mauritii* - External features Body wall, Locomotion	CLO3 CLO4	1	Video / Observation	Student seminar	Experimental Learning
43.	*Megascolex mauritii* - Diges system Respiratory sys	CLO2 CLO3	1	Lecture PPT	Quiz	Participatory Learning
44.	Megascolex mauritii - Excretory system- Meganephridia, Micronephridia, Pharyngeal nephridia	CLO2 CLO3	1	Seminar / PPT	Flipped classroom	Participatory Learning
45.	*Megascolex mauritii* - Nervous system, Reproductive system	CLO2 CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
46.	Metamerism in annelids, A Brief Account on vermiculture	CLO3 CLO4	1	Demonstration	Discussion	Experimental Learning
47.	Phylum Arthropoda -	CLO2 CLO3	1	Lecture PPT	Quiz	Participatory Learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	General characters and classification					
48.	Phylum Arthropoda - General characters and classification	CLO2 CLO3	1	Video / Observation	Group discussion	Experimental Learning
49.	*Periplaneta americana* - External features, Body wall, Mouthparts	CLO3 CLO4	1	Lecture PPT	Quiz	Participatory Learning
50.	*Periplaneta americana* - External features, Body wall, Mouthparts	CLO3 CLO4	1	Seminar / PPT	Flipped classroom	Participatory Learning
51.	*Periplaneta americana* – digestive system	CLO3 CLO4	1	Virtual lab	Discussion	Experimental Learning
52.	*Periplaneta americana* - Respiratory system, Circulatory system	CLO3 CLO4	1	Seminar / PPT	Flipped classroom	Participatory Learning
53.	*Periplaneta americana* – Nervous system and sense organs	CLO3 CLO4	1	Demonstration	Discussion	Experimental Learning
54.	*Periplaneta americana* - Excretory system	CLO3 CLO4	1	Chalk & talk/PPT/Dissection	Hands on activity	Experiential Learning
55.	*Periplaneta Americana* – reproductive ,	CLO3 CLO4	1	Chalk & talk/PPT/Dissection	Hands on activity	Experiential Learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	Peripatus- Affinities as a living fossil system					
56.	Metamorphosis in Insects	CLO3 CLO4	1	Chalk & talk/PPT/Dissection	Hands on activity	Experiential Learning
57.	A Brief Account on Apiculture and honey bees.	CLO3 CLO4	1	Chalk & talk/PPT/Dissection	Hands on activity	Experiential Learning
	Unit- 4					
58.	Phylum Mollusca- General characters and classification	CLO2 CLO3	1	ORE / PPT	Flipped classroom, Assignment	Participatory Learning
59.	*Pila globosa* - External features, Shell,	CLO3 CLO4	1	Lecture PPT	Quiz	Participatory Learning
60.	Digestive system	CLO3 CLO4	1	Video / Observation	Group discussion	Experimental Learning
61.	*Pila globosa* - Respiratory system,	CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
62.	Circulatory system	CLO3 CLO4	1	Seminar / PPT	Flipped classroom	Participatory Learning
63.	*Pila globosa* – Nervous system, Sense organs- Eyes, Osphradium, Statocyst, Tentacles	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
64.	*Pila globosa* - – Excretory system,	CLO3 CLO4	1	Virtual lab	Discussion	Experimental Learning
65.	Reproductive system and life cycle	CLO3 CLO4	1	Virtual lab	Discussion	Experimental Learning
66.	Torsion in	CLO3	1	Virtual lab	Discussion	Experimental

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	Mollusca	CLO4				Learning
67.	A Brief Account on Pearl Culture, Pearl industry	CLO3 CLO4	1	Lecture PPT	Student seminar	Participatory Learning
68.	Phylum Echinodermata, General characteristics and Classification up to classes	CLO2 CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
69.	Phylum Echinodermata, General characteristics and Classification up to classes	CLO2 CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
70.	Type Study: *Asterias rubens*- External features, Pedicellaria- Structure and Function	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
71.	Digestive system Respiratory system	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
72.	Water vascular system- Structure and Function	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
73.	Circulatory system- Perihaemal and Haemal system	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
74.	Nervous system Sense organs	CLO3 CLO4	1	PPT	Word cloud	Participatory learning

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
75.	Excretory system, Reproductive system.	CLO3 CLO4	1	Chalk and talk	Sketch board	Participatory learning
76.	Larval forms of Echinoderms and their evolutionary significance, Economic importance in Echinoderms.	CLO3 CLO4	1	Group discussion	Presentation	Participatory learning
	Unit -5					
77.	Affinities with Chordates	CLO2 CLO3	1	Lecture – Chalk and Talk / PPT	Mind map / One minute summery	Participatory Learning
78.	Introduction to Industry 4.0	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
79.	Applications –Automated taxonomic Identification of invertebrates	CLO3 CLO4	1	Video / Observation	Group discussion	Experimental Learning
80.	Applications –Automated taxonomic Identification of invertebrates	CLO3 CLO4		Video / Observation	Student seminar	Experimental Learning
81.	Confocal Image processing of invertebrates for identification and classification	CLO3 CLO4	1	Virtual lab	Discussion	Experimental Learning
82.	Bio mimicry/bio mimetics of invertebrates	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
83.	Ant colony	CLO3	1	Virtual lab	Discussion	Experimental

Module No.	Topic	Knowledge Levels	No of Hours	Content Delivery method	Student engagement	Participatory learning
	optimization algorithms	CLO4				Learning
84.	Beekeeping using Machine learning	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning
85.	Detection and identification of Stored – Grain insects using Deep learning	CLO3 CLO4	1	Lecture – Chalk and Talk / PPT	Mind map / One minute summery	Participatory Learning
86.	IOT based smart monitoring for sericulture, Virtual e-museum.	CLO3 CLO4	1	PPT	Student seminar	Problem-based Learning

Name of the course	Dr. J. Sornapriya	Dr. S. Gandhimathy	Total
Participatory Learning	27%	13%	40
Experimental Learning	23%	17%	40
Problem-based Learning	13%	7%	20

COURSE CODE AS24CP1	COURSE NAME ZOOLOGY PRACTICAL I	Category	L	T	P	Credit
		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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To understand the basic concepts of zoological classification and identify the invertebrates and chordates	K1
CLO2	To distinguish the diversity and relationships between major groups of invertebrates and Chordates.	K2
CLO3	To examine the morphology and anatomy of invertebrates and Chordates	K3
CLO4	To relate the diversity and culture/rearing of invertebrates and chordates and infer their economic utility.	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	S	S
CLO4	S	S	S	S	S

S- Strong

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:-Parамecium, 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, Echeneis - 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:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2019, 9th edition
2	Lal S. S.	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004, 8th edition
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.