Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, Tamil Nadu.

Nationally Re-Accredited with A^{++} by NAAC V cycle – CGPA 3.53

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF ZOOLOGY

TEACHING PLAN (PG)

ODD SEMESTER

2025 – 2026

DEPARTMENT OF ZOOLOGY

VISION

Empower the students with Academic skills, Research aptitude and social commitment through holistic education.

MISSION

1. Foster knowledge and skills through innovative teaching and instill moral and ethical values.
2. Render opportunities for critical thinking, communication, and collaboration.
3. Create research ambience to promote innovations and contemporary skills relevant to local and global needs.
4. Inspire to explore the natural resources and connect with nature.
5. Promote passion to serve the local community by creating empowered women of
6. Commitment and social consciousness through outreach and exposure programmes.
7. Facilitate life-long learning, participatory leadership, and commitment to society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

POs	Upon completion of M.A./ M. Sc. /MSW Degree Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve socio ecological issues and pursue research.	M1, M2
PEO2	continue to learn and advance their career in industry both in private and public sectors	M4 & M5
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	M2, M5 & M6

PROGRAMME OUTCOMES (POS)

PO	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	**PEO1 & PEO2**
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	**PEO1, PEO 2 & PEO3**
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	**PEO 2**
PO4	develop innovative initiatives to sustain ecofriendly environment	**PEO1, PEO 2**
PO5	pursue active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	**PEO 2**
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	**PEO1, PEO 2 & PEO3**
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	**PEO3**

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of M.Sc. Programme, the graduates will be able to:	PO addressed
PSO1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO1, PO2
PSO2	carryout experimental techniques, analyze statistically, draw conclusions, write report, present effectively and publish in indexed journals effectively	PO2, PO4, PO5, PO6
PSO 3	develop personal and key transferable skills and entrepreneurial skills through industrial / field visits and internships.	PO2, PO3
PSO 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO1, PO2, PO3, PO4, PO6
PSO 5	discriminate societal and environmental problems, adopt relevant technology, synthesis solution and claim for IPR	PO4, PO5, PO7

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Core Course I: Structure and Function of Invertebrates
Semester : I
Course Code : ZP231CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CC1	**5**	1	–	1	**5**	**7**	**105**	**25**	**75**	**100**

Learning Objectives:

1. To realize the range of diversification of invertebrate animals.
2. To understand the concept of classification and their characteristic features of major group of invertebrates.
3. To know the functional morphology of system biology of invertebrates
4. To enable to find out the ancestors or derivatives of any taxon.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the general concepts and major groups in animal classification, origin, struct5re, functions and distribution of life in all its forms.	**K1**
2.	understand the evolutionary process. All are linked in a sequence of life pattern	**K2**
3.	apply this for pre-professional work in agriculture and conservation of life forms.	**K3**
4.	analyze what lies beyond our present knowledge of life process.	**K4**
5.	evaluate and to create the perfect phylogenetic relationship in classification	**K5**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5-** Evaluate

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**STRUCTURE AND FUNCTION IN INVERTEBRATES**								
	1	Principles of Animal taxonomy	4	1	K1 (R) & K3 (Ap)	Lecture with PPT, ICT Tools: NCBI/BLAST	Inquiry-Based Learning; Concept Mapping	YouTube: (Shomu's Biology), Notes	Formative Quiz using / Google Forms, Quizzes, Online Assignment, CIA I
	2	Species concept	3	1	K2 (U) & K3 (Ap)	Lecture with examples , Comparative chart using Interactive PowerPoint	Group discussion on different species concepts, Concept map	Encyclopedia of Life (EOL) YouTube: *Shomu's Biology – Species Concepts*	MCQs, Short answers, Quizizz CIA I
	3	International Code of Zoological Nomenclature	4		K2 (U) & K3 (Ap)	Chalk and board, Interactive PPT	Role play, Peer Quiz	ICZN.org, IT IS, **I**ntegrated Taxonomic Information System (ITIS)	Fill in the blanks, Conceptual Quiz, CIA I
	4	Taxonomic procedures	4	1	K3(Ap) K4 (An)	Flow charts, Demonstration,	Experiential learning, Jigsaw	Biodiversity Heritage	Specimen identification,

						Interactive PPT, VAK method.		Library (BHL), LMS	Practical quiz, CIA I.
	5	New trends in taxonomy	4		K4 (An) K5 (E)	Demonstration, Flow Chart	Experiential learning	NCBI, BLAST, Google classroom	Performance based ssessment CIA I.
II	**ORGANIZATION OF COELOM**								
	1	Acoelomates; Pseudocoelomates; Coelomates	2	1	K1 (R) & K3 (Ap)	PPT with visual diagrams, Whiteboard explanation	Chart-making, Think–Pair–Share	YouTube Lectures, LMS,	Diagram labelling, MCQs, oral quiz, CIA I
	2	Protostomia and Deuterostomes	2		K2 (U) K4 (An)	Animated embryology video, Lecture with chalk-and-talk	Flowchart, Peer Teaching	YouTube videos, Animal Development, Simple Notes	Short answers, flowchart fill-in tasks, CIA I
	3	Locomotion: Flagellar movement in Protozoa	4	1	K2 (U) K3 (Ap)	Interactive PPT, Flipped class room,	Video-based learning, Concept mapping	YouTube: Euglena movement,	Diagram drawing, short explanation Questions, CIA II
	4	Locomotion: ciliary movement in Protozoa	4		K2 (U) K3 (Ap)	Animated PPT, Lecture with chalk-and-talk	Sketching protozoan movement, Video-based learning	E notes, YouTube videos	Labelling cilia diagram, MCQ, Quizzes CIA II
	5	Hydrostatic movement in Coelenterata	3		K2 (U) K3 (Ap)	Interactive PPT, Demonstration (balloon as hydrostat),	Inquiry-based learning, Model building,	YouTube: Hydra video, Google classroom	Group poster. . Label diagram, CIA II

	6	Hydrostatic movement in Annelida and Echinodermata	4	1	K3 (Ap) K4 (An)	PPT with videos, Comparative diagram explanation	Poster creation, Peer teaching of annelid vs echinoderm movement	YouTube videos: Earthworm & sea star movement, Mentimeter	Comparison chart, MCQ & short answer, CIA II
III	**NUTRITION AND DIGESTION**								
	1	Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan	4	1	K1 (R), K2 (U),	Blended Learning, Illustrative lecture	Inquiry-Based Learning, Peer Teaching	Video Lectures	Quizizz/ Google Forms, Written Assignment, CIA II
	2	Filter feeding in Polychaeta	3		K1(R), K2 (U)	Collaborative Learning,	Group Discussion, Peer Teaching	PPT, You-tube Videos	
	3	Filter feeding and digestion in Mollusca and	3		K1 (R), K2 (U), K3 (Ap),	Lecture, Flipped learning	Group Discussion, Peer Teaching	PPT, You-tube Videos	Quizizz/ Google Forms, Assignment, I CIA
	4	Respiration: Organs of respiration: Gills, lungs and trachea;	2		K1 (R), K2 (U), K3 (Ap)	Lecture,	Illustrative learning	PPT, You-tube Videos	
	5	Respiratory pigments	3	1	K1 (R), K2 (U), K3 (Ap),	Interactive lecture, Collaborative Learning	VAK learning	PPT, You-tube Videos	
	6	Mechanism of respiration	3		K1 (R), K2 (U), K3 (An).	Flipped Classroom,	Peer Learning, Team work	Interactive and e-books	Open Book Test, Mind map, I CIA

IV	EXCRETION AND NERVOUS SYSTEM								
	1	Excretion: Organs of excretion: coelom, coelomoducts,	3	1	K2 (U), K3 (Ap), K5 (E)	Cooperative Learning, Blended Learning Direct Instruction	Peer Instruction,	PPT, You-tube Videos	Quizizz/ Google Forms, Written Assignment, Oral Test, II CIA
	2	Nephridia and Malpighian tubules;	3		K1 (R), K2 (U)	Collaborative Learning, Lecturing	Peer Teaching,	PPT, You-tube Videos	
	3	Mechanisms of excretion; Excretion and osmoregulation.	3		K3 (Ap), K4 (A)	Illustrative lecture, Inquiry-Based Learning	Blended Learning	Video Lectures, PPT, You-tube Videos	Flow chart/ mind map, Open Book Test, II CIA
	4	Nervous system: Primitive nervous system: Coelenterata and Echinodermata	3	1	K1 (R), K2 (U)	Blended Learning, Illustrative lecture	Inquiry-Based Learning, Peer Teaching	PPT, You-tube Videos	Quizizz/ Google Forms, Written Assignment, I CIA
	5	Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta)	3		K1 (R), K2 (U), K3 (Ap),	Interactive lecture, Collaborative Learning	VAK learning	PPT, You-tube Videos	Open Book Test, Mind map I CIA
	6	Mollusca (Cephalopoda)	2		K1 (R), K2 (U), K3 (Ap)	Collaborative Learning,	Group Discussion, Peer Teaching	Video Lectures, PPT, You-tube Videos	Flow chart/ mind map, Open Book Test, I CIA

	7	Trends in neural evolution	2		K1 (R), K2 (U), K3 (Ap),	Lecture, Flipped learning	Group Discussion, Peer Teaching	Lectures, PPT, You-tube Videos	MCQ, I CIA
V	**INVERTEBRATE LARVAE**								
	1	Invertebrate larvae: Larval forms of free-living invertebrates -	5	1	K1 (R), K2 (U), K3 (Ap),	Cooperative Learning, Blended Learning Direct Instruction	Peer Instruction,	PPT, You-tube Videos	Flow chart, II CIA
	2	Larval forms of parasites;	3		K1 (R), K2 (U), K3 (Ap)	Collaborative Learning, Lecturing	Peer Teaching,	PPT, You-tube Videos	Open Book Test, Mind map, II CIA
	3	Strategies and Evolutionary significance of larval forms.	4		K1 (R), K2 (U), K3 (Ap),	Illustrative lecture, Inquiry-Based Learning	Blended Learning	Video Lectures, PPT, You-tube Videos	Fill in the blanks, CIA I
	4	Minor Phyla: Concept and significance;	4		K1 (R), K2 (U), K3 (Ap)	Blended Learning, Illustrative lecture	Inquiry-Based Learning, Peer Teaching	PPT, You-tube Videos	MCQ & short answer, CIA II
	5	Organization and general characters	3		K1 (R), K2 (U), K3 (Ap)	Interactive lecture, Collaborative Learning	VAK learning	PPT, You-tube Videos	Open Book Test, II CIA

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Skill Development**
Activities (Em / En /SD): **Hands on Training (Problem solving)**

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Environment Sustainability**

Activities related to Cross Cutting Issues:- **Collection of invertebrates from Holy Cross Campus, Collection of beneficial Invertebrates**

Assignment: Online Assignment **PPT of respective seminar** (Last date to submit: 05-09-2025)

Seminar Topics:

1. Principles and Scope of Animal Taxonomy
2. Species Concepts in Zoological Classification
3. International Code of Zoological Nomenclature (ICZN)
4. Modern Taxonomic Procedures and Tools
5. Recent Trends in Animal Taxonomy
6. Acoelomates: Structure and Evolutionary Significance
7. Pseudocoelomates: Functional Morphology and Examples
8. Coelomates: Comparative Analysis of Protostomes and Deuterostomes
9. Flagellar and Ciliary Locomotion in Protozoa
10. Hydrostatic Locomotion in Coelenterata
11. Locomotory Mechanisms in Annelida
12. Hydraulic Movement in Echinodermata
13. Feeding and Digestion Patterns in Lower Metazoans
14. Filter Feeding Mechanisms in Polychaeta
15. Feeding Strategies in Mollusca
16. Digestive Physiology of Echinodermata
17. Respiratory Organs in Invertebrates: Gills, Lungs, and Trachea
18. Respiratory Pigments: Structure, Function, and Evolution
19. Mechanisms of Respiration in Aquatic and Terrestrial Invertebrates
20. Excretory Organs in Invertebrates: Coelom and Coelomoducts
21. Structure and Function of Nephridia and Malpighian Tubules
22. Osmoregulation in Marine and Freshwater Invertebrates
23. Primitive Nervous Systems: Coelenterata and Echinodermata
24. Advanced Nervous Systems in Annelids and Arthropods
25. Cephalopod Nervous System and Neural Complexity

26. Trends in Neural Evolution Among Invertebrates
27. Larval Forms of Free-living Marine Invertebrates
28. Larval Strategies of Parasitic Invertebrates
29. Minor Phyla: Classification, Features, and Evolutionary Significance

Sample questions

Part A

1. **Choose the correct one**: **CO 3 (Ap)**
   Which one of the following is the correct hierarchy in biological classification?
   a) Class → Order → Phylum → Family
   b) Phylum → Class → Order → Family
   c) Family → Order → Class → Phylum
   d) Order → Class → Phylum → Family
2. **Assertion (A):** Protostomes exhibit spiral cleavage. **CO 4, (An)**
   Reason (R): Their blastopore becomes the anus.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, R is false
   d) A is false, R is true
3. **True or False:** Trachea are respiratory structures present in molluscs. **CO 3 (Ap1)**
4. **Choose the correct one:** **CO 4 (An)**
   Malpighian tubules are excretory organs in
   a) Annelida b) Mollusca c) Arthropoda d) Echinodermata
5. Which of the following is a larval form of Echinodermata? **CO 2 (U)**
   a) Trochophore b) Tornaria c) Bipinnaria d) Nauplius

Part B

1. Differentiate between biological and phylogenetic species concepts. **CO 3 (Ap)**
2. Describe the role of coelom in locomotion in invertebrates. **CO 2 (U)**
3. Describe the mechanism of filter feeding in Polychaetes and Molluscs. (**CO 3 (Ap)**
4. Explain the osmoregulatory mechanisms in freshwater vs marine invertebrates. **CO 4 (An)**
5. Describe the organization and significance of minor phyla. **CO 2 (U)**

Part C

1. Analyse the influence of molecular taxonomy in redefining classical taxonomy. **CO 5 (E)**
2. Compare and contrast the coelomic conditions in acoelomates, pseudocoelomates, and coelomates. **CO 4 (An)**
3. Discuss the adaptive significance of respiratory organs across invertebrate groups. **CO 1 (R)**
4. Evaluate the excretory structures in invertebrates and relate them to habitat and mode of life. **CO 5 (E)**
5. Analyse the strategies and significance of larval adaptations in free-living and parasitic invertebrates. **CO 4 (An)**

Head of the Department
Dr. A. Shyla Suganthi

Course Instructor
Dr. A. Shyla Suganthi
Dr. C. Josephine Priyadhearshini
Dr. S. Prakash Shoba

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Core Course II - Comparative Anatomy of Vertebrates
Semester : I
Course Code : ZP231CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CC2	5	1	-	1	5	7	105	25	75	100

Learning Objectives:

1. To impart conceptual knowledge about the animal life in the air and their behaviours.
2. To understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

Course outcomes

On successful completion of the course, the student will be able to**:**		
CO1	remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	**K1**
CO2	understand the evolutionary process. All are linked in a sequence of life patterns.	**K2**
CO3	apply this for pre-professional work in agriculture and conservation of life forms.	**K3**
CO4	analyse what lies beyond our present knowledge of life process.	**K4**
CO5	evaluate and to create the perfect phylogenetic relationship in classification.	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyse; **K5** - Evaluate

Teaching plan
Total Contact hours: 105 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**ORIGIN OF VERTEBRATES**								
	1.	Concept of Protochordata.	3	1	CO-1 (R)	Brainstorming & Group Discussion	Inquiry-Based Learning, Peer Teaching.	PPT, Video Lectures	Short Test, Rapid fire test, Written notes I CIA
	2.	The nature of vertebrate morphology.	3		CO-2 (U)	Lecture method-using Chalk and talk	Collaborative Learning, Inquiry based learning	Video Lecture,	Peer review – MCQ I CIA
	3.	Vertebrate Morphology: Definition.	3	1	CO-2 (U) CO-1 (R)	Problem solving, Integrative Teaching	Interactive Class notes	PPTs	Oral test, Quiz Surprise test I CIA
	4.	Scope of vertebrate morphology.	3		CO-2 (U) CO-3 (Ap)	Reflective Thinking, Lecture method, Flipped learning.	Group Presentations, Peer Teaching.	Video Lectures, PPT	Seminar, Oral Question Answer, Summary Writing, I CIA
	5.	Relation of vertebrate morphology to other disciplines,	3	1	CO-2 (U) CO-4 An) CO-5 (E)	Review, Brainstorming and Lecture	Inquiry based learning, Case-Based Learning	Video Lecture, E-notes	Seminar, Short Test – MCQ I CIA

	6.	Importance of the study of vertebrate morphology.	3		CO-2 (U) CO-4 An)	Peer tutoring, Lecture using PPT	Collaborative Learning, Interactive Class notes	E-Content, Videos	Seminar, Quiz Concept Explanation I CIA
II	**ORIGIN AND CLASSIFICATION OF VERTEBRATES**								
	1.	Vertebrate integument and its derivatives.	3	1	CO-1 (R) CO-2 (U)	Group Discussion, Reflective Thinking	Verbal Quiz, Think-Pair-Share	YouTube Videos, PPT	Seminar, Summary Writing Written Notes, II CIA
	2.	Development of skin and its derivatives.	3		CO-1 (R) CO-2 (U)	Lecture using Chalk and talk, Group Discussion	Group Discussions, Peer-teaching	Video Lecture,	Oral Test MCQ II CIA
	3.	General structure of skin and its derivatives.	3	1	CO-2 (U) CO-3(Ap)	Lecture with Visual Aids (Specimen/ Charts/ Pictures/	Collaborative Learning, Interactive Class notes	PPT, Videos	Seminar, Quiz - Google classroom II CIA
	4.	Functions of skin and its derivatives. -	3		CO-1 (R) CO-4 (An)	Brainstorming and Illustrative Lecture	Inquiry-Based Learning, Peer Teaching.	Video Lectures, PPTs	Group Discussion– Written Notes, II CIA
	5.	Glands, scales, horns, claws.	3	1	CO-2 (U) CO-5 (E)	Demonstration, Interactive lecture using video links	Inquiry based learning, Peer teaching	PPTs, Video Lecture,	Seminar, Class Test Peer review – MCQ II CIA
	6.	Nails, hoofs, feathers and hairs.	3		CO-2 (U) CO-4 (An)	Group Discussion, Review	Collaborative Learning, Interactive Class notes	PPT, Videos	Seminar, Quiz Illustrative Diagrams, Essay Writing II CIA

	III	**GENERAL PLAN OF CIRCULATION IN VARIOUS GROUPS**							
	1	Blood.	3	1	CO-1 (R) CO-4 (An)	Peer teaching, Differentiated instruction	Explaining concept, Answering questions from peer	E-Notes, PPT	Quiz, Group Discussion
	2	Evolution of the heart.	3		CO-2 (U) CO-5 (E)	Collaborative learning, Experiential learning	Peer review, Group reflection	PPT, YouTube Video	Seminar, Album preparation
	3	Evolution of aortic arches and portal systems.	3	1	CO-2 (U) CO-5 (E)	Lecture using PPT, Inquiry-Based Learning	Reflective thinking, Formulating questions,	PPT, Video Lecture	Mind Map, Class test
	4	Respiratory system: Characters of respiratory tissue.	3		CO-1 (R) CO-2 (U)	Experiential learning	Simulation, Group discussion	PPT, E-Notes	Seminar, Quiz
	5	Internal and external respiration.	3	1	CO-1 (R) CO-5 (E)	Flipped classroom	In Class discussion, Discussion on material referred	PPT, E - Notes	Seminar, Open Book Test, Online assignment
	6	Comparative account of respiratory organs.	3		CO-2 (U) CO-5 (E)	Brainstorming and Illustrative Lecture	Guided Inquiry based learning	PPT, E-Notes	Seminar, Class Test
	IV	**SKELETAL SYSTEM**							
	1	Skeletal system: Form, function, body size.	3	1	CO-1 (R) CO-2 (U)	Collaborative learning, Lecture using PPT	Simulation, Peer review	E-Notes, YouTube Video	Seminar, Class test

	2	Skeletal elements of the body.	3		CO-1 (R) CO-4(An)	Lecturing, Active learning	Think-pair-share, Peer tutoring, Group discussion	E- Notes	Seminar, Mind map, Open Book Test
	3	Comparative account of jaw suspensorium.	3	1	CO-2 (U) CO-3 (Ap) CO-5 (E)	Lecture with Visual Aids (PPT, Pictures), Cooperative learning	Group discussion, Peer feedback	PPT	Seminar, Illustrative diagram
	4	Vertebral column.	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An)	Reflective thinking - KWL	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching.	Video Lectures, PPT	Home assignment – Written Notes, I CIA
	5	Limbs and girdles.	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Brainstorming, Lecture with Visual Aids (Specimen/ Charts/ Pictures/ PPT)	Guided Inquiry based learning	Video Lecture,	Peer review – MCQ I CIA
	6	Evolution of Urinogenital system in vertebrate series.	3	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Demonstrative lecture & Cooperative learning	Collaborative Learning, Interactive Class notes	PPT, Videos	Seminar, Quiz questioning in the classroom I CIA
V	**SENSE ORGANS**								
	1.	Simple receptors.	3	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Integrative Teaching, Concept-based discussion	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching	Video Lectures, Notes/ PPT	Seminar, Short test – Class test, Oral test I CIA

	2.	Organs of Olfaction and taste.	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Interactive lecture with Visual Aids such as Charts, Drawings, Pictures & PPT etc., Cooperative learning	Peer group discussion	YouTube Video, PPT	Illustrative Diagrams - Online Assignment II CIA
	3.	Lateral line system; Electroreception.	3	1	CO-1 (R) CO-3 (Ap)	Illustrative Lecture, Video, Peer teaching	Collaborative Learning, Peer teaching	PPT, E-Notes	Quiz, Seminar II CIA
	4.	Nervous system: Comparative anatomy of the brain in relation to its functions	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Brainstorming, Inquiry based learning, Interactive lecture with Visual Aids such as Charts, Drawings, Pictures & PPT etc.	Memory Game, Peer teaching	Youtube Videos	Mind map, Slip test II CIA
	5.	Comparative anatomy of spinal cord.	3	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Collaborative teaching using pictures/ charts	Peer Learning, Interaction in the class	E-Notes, Ms-PPT	Diagram, Open Book Test II CIA
	6.	Nerves - Cranial, Peripheral and Autonomous nervous systems.	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Illustrative lecture with Visual Aids such as Charts, Drawings, Pictures & PPT etc.,	Collaborative Learning, Group Discussion	YouTube Videos, Ms-PPT	Seminar, Preparation of study materials II CIA

I. Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities for Employability

A. Debate on "Endocrine vs. Exocrine: Which is More Vital for Survival?"

B. Mind map on Skeletal elements of the body.

C. Group Discussion on Peripheral and Autonomous nervous systems.

D. Assignment & Seminar Topics:

1. Scope of vertebrate morphology
2. Relation of vertebrate morphology to other disciplines
3. Importance of the study of vertebrate morphology.
4. Vertebrate integument and its derivatives
5. Comparative anatomy of exocrine glands in vertebrates
6. Comparative study of Nails in vertebrates
7. Blood of vertebrates.
8. Anatomy of the hearts of birds
9. Anatomy of the heart of amphibians and reptiles
10. Characters of respiratory tissues.
11. Lungs in vertebrates.
12. Internal and external respiration.
13. Accessory respiratory organs in vertebrates.
14. Skeletal elements of the body.
15. Jaw suspension in different vertebrates.
16. Locomotion in vertebrates.
17. Anatomy of the vertebral column of a mammal (Rabbit).
18. Anatomy of the Limbs of an amphibian (Frog).
19. Anatomy of the Girdles of an amphibian (Frog).
20. Receptors of a fish (Shark).
21. Organ of olfaction of a reptile (Snake).

22. Organ of taste of a mammal (Man).
23. Electroreceptors of a fish (Ray fish).
24. Anatomy of the brain of a mammal (Man).
25. Cranial nerves of a fish (Shark).
26. Anatomy of the hearts of mammals.
27. Anatomy of the heart of reptiles
28. Electroreception
29. Structure and function of human brain

II. Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity):

Environment Sustainability –

Activities related to Environment Sustainability – Biodiversity

1. Flow Chart - Types of Scales, their structure and uses.

2. Album preparation – Structure of heart in different vertebrates.

3. Gamified Quiz – Vertebrates & identification (clues)

III. Sample questions

Part A

1. Craniostylic jaw suspension is found in mammals. **(State True/False) CO 3 (Ap)**
2. Identify the Phylum to which Protochordata belongs **CO 3 (Ap)**
   a) Chordata b) Arthropoda c) Mollusca d) Protozoa
3. The coronary arteries **CO 1 (R)**
   a) arise from the arch of the aorta and fill during diastole.
   b) arise from the ascending aorta **and** fill during systole.
   c) arise from the arch of the aorta and fill during systole.
   d) arise from the ascending aorta and fill during diastole.

4. Cerebral hemispheres in Eutherians are connected internally by..... **CO 1 (R)**
   a) Corpus callosum b) Corpus luteum c) Corpus albicans d) Corpus aqueduct
5. Vertebrate integument includes feathers, scales, hoofs, and horns. (**State True or False**) **CO 4 (An)**

Part B

1. Describe the importance of vertebrate integument in protection, thermoregulation, and sensory perception. **(CO-2, U)**
2. Evaluate the scope of vertebrate morphology in comparison to other scientific fields**. CO 5 (E)**
3. Evaluate the difference between internal and external respiration in vertebrates. **CO 5 (E)**
4. State the skeletal elements present in the body of a vertebrate. **CO 1 (R)**
5. How do electroreceptors work in different vertebrates? **CO 3 (Ap)**

Part C

1. Analyze the significance of studying vertebrate morphology within the context of modern biology through the composition of an essay. **CO 4 (An)**
2. Explain the roles and adaptations of nails and hoofs in vertebrates. **CO 3 (Ap)**
3. Analyse the various types of respiratory organs in vertebrates**.** **CO 4 (An)**
4. Evaluate the evolution of the urinogenital system in vertebrates. **CO 5 (E)**
5. Compare the anatomy of the spinal cord of different vertebrate groups. **CO 4 (An)**

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. S. Mary Mettilda Bai
Dr. P.T. Arokya Glory
Dr. Jeni Chandar Padua

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Core Lab Course I: Lab Course in Invertebrates & Vertebrates
Semester : I
Course Code : ZP231CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CP1	-	-	4		3	4	60	25	75	100

Learning Objectives:

1. Understanding the salient features and functional anatomy of different systems and the skeletal system in invertebrates & vertebrates.
2. Developing the skill in mounting techniques of the biological samples.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
CO1	understand the structure and functions of various systems in animals	**K1**
CO2	learn the adaptive features of different groups of animals	**K2**
CO3	learn the mounting techniques	**K3**
CO4	acquire strong knowledge on the animal skeletal system	**K4**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Core Lab Course – I: Lab Course in Invertebrates & Vertebrates
Semester : I
Course Code : ZP231CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CP1	-	-	4	-	3	4	60	25	75	100

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1	understand the structure and functions of various systems in animals	K 1
2	learn the adaptive features of different groups of animals	K2
3	learn the mounting techniques	K3
4	acquire strong knowledge on the animal skeletal system	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze; **K5** - Evaluate

Teaching plan
Total Contact hours: 60 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
	INVERTEBRATES (30 hours)							
1	Dissection – Earthworm (Nervous system)	3	1	CO-2 (U) CO-3 (Ap) CO-4 (An)	Demonstration Hands-on	Dissection record, Observation note	*YouTube Channels*: 1. Biology Animations by Dr. Binocs, 2. Shomu's Biology 3. Swayam/ NPTEL Zoology Labs *Virtual Labs*: 1. Amrita Virtual Lab – Zoology 2. McGraw-Hill Virtual Dissection Tools, E – Practical Manual	Dissection record, Observation note
2	Dissection – Pila (Digestive and Nervous systems)	4		CO-2 (U) CO-3 (Ap) CO-4 (An)	Hands-on, Labelled sketch	Record drawing, Viva		Record drawing, Regularity-based
3	Dissection – Sepia (Nervous system)	3	1	CO-2 (U) CO-3 (Ap) CO-4 (An)	Instructor-guided dissection	Performance check		Performance-based, \ Regularity-based
4	Dissection – Cockroach (Nervous system)	2		CO-2 (U) CO-3 (Ap) CO-4 (An)	Hands-on, Chalk & Talk	Viva, Drawing		Performance-based, \ Regularity-based Drawing
5	Dissection – Grasshopper (Digestive system and Mouthparts)	3	1	CO-2 (U) CO-3 (Ap) CO-4 (An)	Hands-on, Diagrammatic explanation	Observation note		Performance-based, \ Regularity-based

6	Dissection – Prawn (Appendages, Nervous and Digestive systems)	2		CO-2 (U) CO-3 (Ap) CO-4 (An)	Demonstration and discussion	Assessment rubric	Demonstration Virtual lab, E – Practical Manual	Drawings and comparisons Performance-based, \ Regularity-based
7	Dissection – Crab (Nervous system)	2	2	CO-2 (U) CO-3 (Ap) CO-4 (An)	Comparative illustration	Drawings and comparisons	Biology Animations by Dr. Binocs, E – Practical Manual	Drawings and comparisons Performance-based, \ Regularity-based
8	Slide Study – Protozoa and Coelenterata Slide Study – Helminths Slide Study – Crustacea (Mysis of Prawn)	2		CO-2 (U) CO-3 (Ap)	Microscope slide viewing	Spot test	Microscope Virtual Tools: Histology Atlases, E – Practical Manual	Spot test Regularity-based
	Spotters – Scorpion, Penaeus, Hippa, Perna	1		CO-2 (U) CO-3 (Ap)			Sketch, 3D Specimens E – Practical Manual	Spot test Regularity-based

VERTEBRATES								
1	Nervous system of Indian dog shark – Dissection	2	1	CO-1 (R) CO-3 (Ap)	Demonstration Illustration	Hands-on Activity	*Virtual Lab*	Performance Assessment, Observation Note

2	Study of the following specimens with special reference to their salient features and their modes of life: *Amphioxus* sp. (Lancelet) *Ascidia* sp. (sea squirt) *Scoliodon laticaudatus* (Indian dog shark)	2		CO-1 (R) CO-3 (Ap)	Demonstration, Illustration	Hands-on Activity with Specimens	YouTube	Specimen Study, Microscopic view, Observation Note
3	*Trygon* sp. (Sting ray). *Torpedo* sp. (Electric ray) *Arius maculatus* (Cat fish) *Belone cancila* (Flute fish)	2	1	CO-2 (U) CO-3 (Ap)	Chalk and Board, Demonstration	Hands-on Activity with Specimens	*E-Content*	Specimen Study, Observation Note
4	*Exocoetus poecilopterus* (Flying fish), *Mugil cephalus* (Mullet), *Tilapia mossambicus* (Tilapia)	2		CO-2 (U) CO-3 (Ap)	Demonstration	Hands-on Activity with Specimens	*YouTube Videos*	Specimen Study, Observation Note
5	*Rachycentron canadum* (Cobia), *Tetrodon punctatus* (Puffer fish), *Dendrophis* sp. (Tree snake)	2	1	CO-2 (U) CO-3 (Ap)	Demonstration, Drawing	Experimental Learning	*Animated Video*	Specimen Study, Pictorial representation
6	Study of the different types of scales in fishes: 1. Cycloid scale 2. Ctenoid scale 3. Placoid scale	4	1	CO-2 (U) CO-3 (Ap)	Demonstration	Demonstration and mounting	Video links	Microscopic View, Pictorial representation
7	Study of the frog skeleton system (Representative samples): Entire skeleton Skull, Hyoid apparatus	4	1	CO-2 (U) CO-4 (An)	Illustration	Experimental Learning	YouTube	Specimen Study, Pictorial representation

8	Pectoral girdle and sternum, Pelvic girdle, Fore limb Hind limb	3		CO-3 (Ap) CO-4 (An)	Illustration	Model/ Chart based/ Specimen based Learning	3D Images / Videos	Drawing Activity in Observation Note
9	Mounting Weberian ossicles of fish	3		CO-3 (Ap) CO-4 (An)	Illustration	Virtual Videos/ Specimen based Learning	3D Images / Videos	Dissection, Drawing Activity in Observation Note

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training, Illustrative Diagrams

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Professional Ethics

Environment Sustainability activities related to Cross Cutting Issues: NIL

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. S. Mary Mettilda Bai.
Dr. Jeni Chandar Padua

Teaching plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Elective Course I: Biomolecules and their Interaction
Semester : I
Course Code : ZP241EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU231CC1	3	1	-	1	3	5	75	25	75	100

Learning Objectives

1. Students should know the fundamentals of biochemistry.
2. To develop analytical and communicative skills to conduct experiments and interpretation of the results

Course Outcome

On the successful completion of the course, student will be able to:		
CO1	define structure and types of chemical bonds in biomolecules such as hydrogen ions, water, protein, carbohydrate, lipid, nucleotides, enzymes and vitamins.	**K1**
CO2	explain the fate of biomolecules in different metabolic pathways.	**K2**
CO3	apply cognitive, technical and creative skills to pursue higher studies and employability in industrial, biomedical and research laboratories.	**K3**
CO4	analyse biomolecules in biological systems and relate deficiency disorders.	**K4**
CO5	design biochemical experiments and publish the results through effective written and oral communication after drawing accurate conclusions.	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Teaching plan
Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**BASICS OF BIOPHYSICAL CHEMISTRY AND BIOCHEMISTRY**								
	1.	Structure of atoms, molecules and chemical bonds -	2	1	CO-1 (R) CO-2 (U)	Brainstorming & Group Discussion	Peer feedback on reflective practices	PPT, Video Lectures	Short Test, Seminar I CIA
	2.	Stabilizing interactions in biomolecules: stability of protein and nucleic acid structures	2		CO-2 (U)	Lecture method-using Chalk and talk	Collaborative Learning, Inquiry based learning	Video Lecture,	Peer review – MCQ I CIA
	3.	Hydrogen bonding, covalent bonding, hydrophobic interactions, and disulfide linkage.	2	1	CO-1 (R) CO-2 (U)	Problem solving, Integrative Teaching	Interactive Class notes	Animated video lectures, YouTube channels	Oral test, Seminar, Quiz I CIA
	4.	pH and Hydrogen ion concentration - buffers - 'Henderson-Hasselbalch' equation - buffer systems in blood - acidosis and alkalosis	2		CO-2 (U) CO-3 (Ap)	Reflective Thinking, Lecture method, Flipped learning.	Group Presentations, Peer Teaching.	Video Lectures, PPT	Oral Question Answer I CIA

	5.	Water – colligative properties - water turnover and balance - electrolyte balance - dehydration and water intoxication.	2	1	CO-2 (U) CO-4 An) CO-5 (E)	Review, Brainstorming and Lecture	Inquiry based learning, Case-Based Learning	Video Lecture, E-notes	Seminar, Short Test – MCQ I CIA
	6.	Thermodynamics - Enzyme kinetics	2		CO-2 (U) CO-4 (An)	Peer tutoring, Lecture using PPT	Collaborative Learning, Interactive Class notes	E-Content, Videos	Quiz Concept Explanation I CIA
II	**CARBOHYDRATES**								
	1.	Classification, structure, properties of mono, oligo and polysaccharides and biological role of carbohydrates.	3	1	CO-1 (R) CO-2 (U)	Group Discussion, Reflective Thinking	Group Discussions, Peer-teaching	YouTube Videos, PPT	Seminar, Class test, I CIA
	2.	Carbohydrate metabolism - glycogenesis, glycogenolysis, glycolysis, Krebs cycle,	2		CO-1 (R) CO-2 (U)	Lecture using Chalk and talk, Group Discussion	Group Discussions, Peer-teaching	Video Lecture,	Oral Test MCQ I CIA
	3.	Electron transport and Oxidative phosphorylation, Energetics of glucose metabolism	3	1	CO-2 (U) CO-3 (Ap)	Lecture using Chalk and talk,	Collaborative Learning, Interactive Class notes	PPT, Videos	Seminar, Discussion, I CIA
	4.	Pasteur effect– HMP shunt - gluconeogenesis -	2		CO-1 (R) CO-4 (An)	Brainstorming and Illustrative Lecture	Group discussion	Video Lectures, PPTs	Group Discussion– Written Notes,

		glyoxylate pathway - Cori cycle.							II CIA
	5.	Regulation and hormonal control of carbohydrate metabolism.	2	1	CO-2 (U) CO-5 (E)	Demonstration, Interactive lecture using video links	Group discussion Inquiry based learning, Peer teaching	PPTs, Video Lecture,	Seminar, Class Test Peer review – MCQ II CIA
	III	**PROTEINS**							
	1	Classification, structure, Ramachandran plot, properties and biological role.	3	1	CO-1 (R) CO-4 (An)	Peer teaching	Explaining concept, Answering questions from peer	E-Notes, PPT	Group Discussion I CIA
	2	Amino acids - classification, structure and properties	2		CO-2 (U) CO-5 (E)	Collaborative learning, Experiential learning	Peer review, Group reflection	PPT, YouTube Video	Seminar I CIA
	3	Metabolism of proteins - deamination, transamination - transmethylation and decarboxylation of amino acids	3	1	CO-2 (U) CO-5 (E)	Lecture using PPT, Inquiry-Based Learning	Reflective thinking, Formulating questions,	PPT, Video Lecture	Mind Map, Class test I CIA
	4	Glycogenic and ketogenic amino acids - formation and transport of ammonia	2		CO-1 (R) CO-2 (U)	Lecture using Chalk and talk,	Group discussion	Animated video lectures, YouTube channels	Seminar, Quiz II CIA

	5	Glucose-alanine cycle - Ornithine cycle.	2	1	CO-1 (R) CO-5 (E)	Peer tutoring, Lecture using PPT	Class discussion	Animated video lectures, YouTube channels	Seminar, Open Book Test, Online assignment, II CIA
	IV	**LIPIDS**							
	1	Classification, structure and biological role - chylomicrons,	3	1	CO-1 (R) CO-2 (U)	Collaborative learning, Lecture using PPT	Simulation, Peer review	E-Notes, YouTube Video	Seminar, Class test, II CIA
	2	VLDL, LDL, HDL - Lipid metabolism - theories of oxidation of fatty acids	2		CO-1 (R) CO-4 (An)	Lecturing, Active learning	Think-pair-share, Peer tutoring, Group discussion	PPT	Seminar, Mind map, Open Book Test, II CIA
	3	Oxidation of any one fatty acid and its bioenergetics (palmitic acid) -	3	1	CO-2 (U) CO-3 (Ap) CO-5 (E)	Lecture with Visual Aids (PPT, Pictures), Cooperative learning	Group discussion, Peer feedback	Animated video lectures, YouTube channels	Seminar, Illustrative diagram, II CIA
	4	Ketogenesis - biosynthesis of palmitic acid	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An)	Reflective thinking	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching.	Video Lectures, PPT	Home assignment – Written Notes, II CIA
	5	metabolism of cholesterol. Integration of carbohydrate,	2	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Lecture with chalk and talk	Guided Inquiry based learning	Video Lecture,	Peer review – MCQ II CIA

		protein and lipid metabolism							
V	**NUCLEOTIDE, ENZYMES AND VITAMINS**								
	1.	Biosynthesis and degradation of purines and pyrimidines.	3	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An)	Integrative Teaching	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching	Video Lectures, Notes/ PPT	Seminar, Class test, Oral test II CIA
	2.	Enzymes: classification, nomenclature, Michaelis - Menten constant, enzyme inhibition.	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Interactive lecture with Visual Aids. Cooperative learning	Peer group discussion	YouTube Video, PPT	Illustrative Diagrams - Online Assignment II CIA
	3.	Mechanism of enzyme action, factors affecting enzyme activity, isozymes, coenzymes.	3	1	CO-1 (R) CO-3 (Ap)	Illustrative Lecture, Video, Peer teaching	Collaborative Learning, Peer teaching	PPT, E-Notes	Quiz, Seminar II CIA
	4.	Vitamins: Classification and structure of fat soluble and water soluble,	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Interactive lecture with Visual Aids such as Charts, Drawings, Pictures & PPT	Memory Game, Peer teaching	You tube Videos	Mind map, Slip test II CIA
	5.	Biochemical role of vitamins. Biosynthesis of vitamin C.	2	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Collaborative teaching using pictures/ charts	Peer Learning, Interaction in the class	E-Notes, PPT	Diagram, Open Book Test II CIA

Course Focussing on Employability/ Entrepreneurship/ Skill Development : **Employability**
Activities (Em/ En/SD): **Flow Chart of metabolic pathway of nucleic acids**
Course Focussing on Cross Cutting Issues **:** Professional Ethics/ **Human Values**
Activities related to Cross Cutting Issues: **Chart preparation of Vitamins**
Assignment:

1. Topic: Structure of mono, oligo and polysaccharides – Models making
2. Topic: Conformation of proteins

Seminar

1. Structure of atoms, molecules and chemical bonds
2. Hydrogen bonding, covalent bonding, hydrophobic interactions, and disulfide linkage.
3. Water – colligative properties.
4. Water turnover and balance, electrolyte balance, dehydration and water intoxication.
5. pH and Hydrogen ion concentration
6. Classification, structure and properties of mono, oligo and polysaccharides
7. Kreb's cycle
8. Biological role of carbohydrates.
9. Carbohydrate metabolism – glycogenesis and glycogenolysis
10. HMP shunt
11. Classification, structure and properties of proteins
12. Classification, structure and properties of Amino acids.
13. Glycogenic and ketogenic amino acids.
14. Glucose-alanine cycle and Ornithine cycle.
15. Deamination
16. Decorboxylation
17. LDL
18. HDL
19. Biosynthesis of palmitic acid

20. Integration of protein metabolism
21. Integration of lipid metabolism
22. Mechanism of enzyme action
23. Enzyme classification
24. Isozymes, coenzymes.
25. Factors affecting enzyme activity
26. Fat soluble vitamins
27. Water soluble vitamins
28. Biochemical role of vitamins
29. Vitamin deficiency disorders

Sample questions

Part A

1. Which of the following colligative properties not is correctly associated with an aqueous solution of water? **K2 (U)**
2. a) Elevation of boiling point b) Reduction of vapor pressure c) Depression of freezing point d) Specific gravity **K1 (R)**
3. Catalyzing biochemical reactions is the biochemical role of carbohydrates **True / False** **K2 (U)**
4. **Assertion (A**): Amino acids are amphoteric compounds **K4 (An)**

   Reason (R): Aminoacids contain both amino and carboxyl groups

   a) Statement A is correct, but B is wrong
   b) Statement A is wrong and B is correct
   c) Statement A and B are wrong
   d) Statement A and B are correct
5. The molecule which acts directly on an enzyme to lower its catalytic rate is _____ **K4 (An)**

   a) Repressor b) Inhibitor c) Modulator d) Regulator
6. Which of the following represents the two-dimensional structure of proteins? **K3 (Ap)**

   a) Quaternary b) Tertiary c) Secondary d) Primary

Part B

1. Discuss how the arrangement of electrons in an atom's outer shell affects its ability to bond with other atoms. **K2 (U)**

2. Discuss the role of pH in enzyme activity, metabolic processes, and homeostasis. **K1 (R)**
3. Explain different types of carbohydrates . **K2 (U)**
4. Differentiate VLDL, HDL, LDL and its clinical significance. **K3 (Ap)**
5. Evaluate the competitive inhibition. **K4 (An)**

Part C

1. Analyze the concept of pH and its importance in biological systems. **K1 (R)**
2. Discuss the structure of carbohydrates and their various functions in living organisms **K2 (U)**
3. Additionally, discuss how the presence of amino groups affects the chemical properties and biological functions of molecules. **K3 (Ap)**
4. Analyse the Michaelis Menten Hypothesis in enzyme kinetics. **K2 (U)**
5. Evaluate the fat-soluble vitamins. **K4 (An)**

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. Bhuvenhwari
Dr. Punitha

Teaching Plan

Department : ZOOLOGY
Class : I M. Sc.
Title of the Course : Elective – II (a): Biostatistics
Semester : I
Course Code : ZP231EC4

Course Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
ZP231DE1	3	1	-	1	3	75	25	75	100

Learning Objectives:

1. To enable the students to understand the basic concepts in Biostatistics and analyse the data to derive inferences in various biological experiments.
2. To develop analytical skills of statistics and draw valid conclusions in research.

Course outcomes

On the successful completion of the course, student will be able to:		
1	recall different biological data, methods of collection and analysis of data.	**K1**
2	comprehend the design and application of biostatistics relevant to experimental and population studies.	**K2**
3	acquire skills to perform various statistical analyses using modern statistical techniques and software.	**K3**
4	analyze the data and interpret the results manually or by using software	**K4**
5	evaluate on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	**K5**

K1- Remember; **K2**- Understand; **K3**- Apply; **K4**-Analyze; **K5**-Evaluate

Teaching plan
Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Course outcome and Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Unit I**								
	1	Definition, scope and application of statistics; Primary and secondary data: Source and implications	2	1	K1 (R) K2 (U)	Introductory session, Group Discussion	Think-Pair-Share, Inquiry-Based Learning	*Video Lectures*	Formative Quiz using Google Forms, Seminar Internal test – I
	2	Classification and tabulation of biological data: Types and applications. Variables: Definition and types.	2		K2 (U)	Mind mapping, Peer tutoring,	Think-Aloud	Video Lectures	Worksheet, Internal test – I Formative Quiz using Google Forms, Seminar
	3	Frequency distribution: Construction of frequency distribution table for grouped data	2	1	K2 (U) K3 (Ap)	Lecture using ppt, Problem solving	Collaborative Learning, Concept Mapping	PowerPoint with graphical representations of data	Worksheet, Internal test – I Formative Quiz using Google Forms, Seminar

	4	Graphic methods: Frequency polygon and ogive curve	3		K2 (U)	Applying experimental data	Experimental learning	Youtube Videos of graphical method and train using excel	Worksheet, Internal test – I Formative Quiz using Google Forms, Seminar
	5	Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.	3	1	K3 (Ap) K4(An)	Analogical Pedagogy, Integration with Mathematical Insights	Peer Learning, DIY Activity, Real-World Application Projects	Online Tutorials and Notes and train using excel	Worksheet, Internal test – I Formative Quiz using Google Forms, Seminar Problem solving
II	**Unit – II**								
	1	Measures of central tendency: Mean, for continuous and discontinuous variables.	3	1	K2 (U) K3 (Ap) K4 (An)	Problem solving, Applying experimental data Application-Based Learning	Blended Learning	YouTube Lectures YouTube Lectures	Internal test – I Work sheet
	2	Median continuous and discontinuous variables.	3		K2 (U) K3 (Ap) K4 (An)	Problem solving Applying experimental data Application-Based Learning	Flipped classroom Experimental learning	YouTube Lectures	Problem-Solving Internal test – I Seminar

	3	Mode for continuous and discontinuous variables.	3	2	K2 (U) K3 (Ap) K4 (An)	Problem solving, Applying experimental data Application-Based Learning	Flipped classroom Experimental learning	Video Lectures	Problem-Solving Assignments, Internal test – I Seminar
	4	Measures of dispersion: Range, variation, Standard deviation	2		K3 (Ap)		Analogical Reasoning, Peer Teaching	YouTube Lectures	Problem-Solving Work sheet
	5	Standard error , Coefficient of variation.	1		K4 (An)		Hands-On Experiments	Interactive tools for dipole interactions.	Problem-Solving Work sheet
III	**Unit -III**								
	1	Probability: Theories and rules	3	1	K1(R), K2 (U)	Lecturing	Think-pair-share	Video Lectures	MCQs, CIA I
	2	Probability - Addition and multiplication theorem	3		K2 (U) K3 (Ap)	Problem-Based Learning	Problem solving	Problems	Solving problems, CIA I
	3	Probability distribution: Properties and application of Normal distribution	2	1	K2 (U) K3 (Ap)	Collaborative Learning	Group activities, simulations	YouTube concept videos	Numerical problem, CIA I
	4	Binomial distributions.	2		K1 (R) K2 (U)	Group discussions, defining problems, brainstorming	Problem-Based Learning	Problems for practice	Quizzes, CIA I

	5	Poisson distributions.	2	1	K2(U), K3(Ap)	Flipped Classroom	Collaborative problem-solving sessions, application of concepts in every day. contexts	Textbook notes	Oral Test, CIA I
IV	**Unit- IV**								
	1	Hypothesis testing: Student 't' test - paired sample and mean difference 't' tests.	3	1	K3 (Ap) K4 (An)	Inquiry-Based Learning	Simulation-Based Learning	Video lectures	Quizzes, CIA II
	2	Correlation: Types - Karl Pearsons Co-efficient, Rank correlation,	2		K4 (An) K5 (E)	Lecture, Chalk and Board	Think-Pair-Share	Textbook notes	Short Answers, CIA II
	3	Significance test for correlation coefficients.	2	1	K3 (Ap) K4 (An)	Collaborative Learning	problem-solving tasks	Practice problems	MCQ, CIA II
	4	Regression analysis: Computation of biological data	2		K2 (U) K3(Ap)	Problem based Learning	solving complex problems	YouTube videos	Problem solving, CIA II
	5	calculation of regression co-efficient	2	1	K2 (U) K3(Ap)	Flipped classroom	peer explanations	Video tutorial	Slip test, CIA II
	6	graphical representation and prediction.	1		K4 (An)	Peer Teaching	Demonstrating concepts Cooperative learning – Peer group discussion	Practice problems	MCQ, CIA II

V	Unit-V								
	1	Analysis of variance: one way classification	2	2	K2 (U) K4 (An)	Conceptual Approach Lecture –ppt Problem solving	Case study and problem solving	Statistics 101: One-way ANOVA, A Visual Tutorial	Problem solving CIA II and quiz II
	2	Two-way classification.	2		K2 (U) K4 (An)	Lecture –ppt Problem solving	Case study and problem solving		Problem solving CIA II and quiz II
	3	Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS). Contd.	2		K2 (U) K3 (Ap) K4 (An)	Tutorial video, usage of software	Learn SPSS through soft ware Demonstration	Biostatistics : Introduction to SPSS	CIA II and quiz II
	4	Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).contd.	2	3	K3 (Ap)	Problem-Based Learning	Demonstration	Textbook notes	Short test CIA II
	5	Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).	2		K5 (E)	Collaborative Learning	Demonstrating concepts	Practice problems	Assignment, CIA II

Course Focussing : Employability/ Skill Development
Activities: **Prepare a chart on Presentation of data**
Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Professional ethics
Activities related to Cross Cutting Issues: Statistical analysis of a data
Assignment: Perform an experiment and analyze data

Seminar topics

1. Primary data
2. Secondary data
3. Classification of biological data
4. Variables -Types
5. Construction of frequency distribution table.
6. Graphical Presentation of data
7. Diagrammatic Presentation of data – Histogram, Bar diagram
8. Diagrammatic Presentation of data -Pictogram and pie chart
9. Measures of central tendency -Mean
10. Measures of central tendency -Median
11. Measures of central tendency -Mode
12. Measures of dispersion -Standard deviation
13. Measures of dispersion -Range, Standard error and coefficient of variation
14. Probability -theorems
15. Normal distribution
16. Binomial Distribution
17. Poisson Distribution
18. Correlation
19. Regression
20. Student ‘t’ test
21. ANOVA-One way
22. ANOVA- Two way
23. SPSS -overview, features and applications
24. SPSS types , procedures

25. Correlation problems
26. Regression problems
27. Student ‘t’ test -problems
28. ANOVA- problems
29. Mean, median and mode problems

Part A

1. Which graphical method is used to represent the distribution of continuous data? **CO-2; K2 (U)**
   a) Bar diagram
   b) Pictogram
   c) Pie chart
   d) Histogram
2. Find the **mean** for the following data: **CO-4; K4 (An)**
   45,65,34,21,56, 76,45, 45, 49
3. **Solve 12!** CO-4; K4 (An)
4. What statistical technique is used to test for differences among multiple groups' means? **CO-1; K1 (R)**
5. **Assertion (A):** Analysis of variance (ANOVA) can be used to compare means of more than two groups. **CO-4; K4 (An)**
   Reason (R): ANOVA uses t-tests to compare means between groups and determines if the differences are statistically significant.
   a) Statement ‘**A’** and ‘**R’** are true. b) Statement ‘**A’** and ‘**R’** are false.
   c) Statement ‘**A’** is true and statement ‘**R’** is false.
   d) Statement ‘**A’** is false and statement ‘**R’** is true.

Part B

1. What is the significance of primary and secondary data in statistical analysis? **CO-2; K2 (U)**
2. Calculate the mean, median, and mode for the following dataset: 12, 15, 18, 20, 22, 22, 25. **CO-4; K4(An)**

3. Find the answer for the following questions: **CO-4; K4 (An)**

(i) In a deck of 52 playing cards, what is the probability of drawing a king?

(ii) A jar contains 7 white marbles and 3 black marbles. If one marble is drawn at random, what is the probability that it will be white?

4. What is regression? Explain the steps involved in performing regression analysis on biological data. **CO-2; K2 (U)**

5. What is SPSS? What are the main features of SPSS. **CO-2; K2 (U)**

Part C (12 marks)

1. A biologist collected data on the lengths of a certain species of fish in a lake. The data consists of the following lengths (in cm): 25, 28, 29, 30, 31, 32, 32, 33, 33, 35, 36, 37, 37, 38, 39, 40. Create a histogram to represent the frequency distribution of the fish lengths using appropriate intervals and labels. **CO-4; K4 (An)**

2. Compute the standard deviation and coefficient of variation for the following data of length (cm) of fish. CO**-4; K4 (An)**

Length (cm)	0-6	6-12	12-18	18 - 24	24 - 30
No. of fishes	8	16	32	18	6

3. Explain the properties of the normal distribution. What is its mean, variance, and shape characteristics? **CO-2; K2 (U)**

4. Define the 't' distribution and discuss its primary uses in statistical analysis. From the following data, find if there are significant differences in the mean weight of the fishes.: **CO-4; K4 (An)**

Weight (gms)	25	33	28	27	22	26	23	24
Frequency	8	7	10	9	4	9	6	5

5. What is Analysis of Variance (ANOVA) and why is it used in statistical analysis? **CO-2; K2 (U)**

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. Vinoliya Josephine Mary
Dr. X. Venci Candida

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Elective Lab Course I: Biomolecules and Their Interaction and Biostatistics
Semester : I
Course Code : ZP231EP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EP1	-	-	2	-	2	2	30	25	75	100

Learning Objectives:

1. Understanding the salient features and functional anatomy of different systems and the skeletal system in invertebrates & vertebrates.
2. To design experimental problems, analyze and evaluate critically with inferential biostatistics.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	learn and study of chemical and physical structure of biological macromolecules.	**K1**
2	explain the role pf biomolecules in the system of animals. Explains about probability.	**K2**
3	apply appropriate statistical methods to analyze the data. Estimate the quantity of biomolecules in various tissue samples.	**K3**
4	analyze the phsyico-chemical properties of samples and interpret the results using statistical methods and interpret the collected data using statistical methods.	**K4**
5	evaluate quantitatively the biological experiments and asses the hypothesis.	**K5**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze**, K5-** Evaluate**, K6-**Create

Teaching Plan
Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Colorimetry: Verification of Beer-Lambert's Law	2	2	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Demonstration, Hands-on Practice	Group Experimentation	YouTube tutorials, Virtual Colorimeter Simulations	Performance-based, Viva Voce, Lab Record
2	Preparation of Solutions (Normality, %, ppt, ppm)	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Problem-Solving	Collaborative Preparation	Calculation Worksheets	Lab Record, Spot Test
3	Quantitative Estimation of Glucose using Standard Graph Method	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Inquiry-Based, Experimental Method	Small Group Analysis, Graph Plotting	Simulated Glucose	Lab Performance, Interpretation of results
4	Determination of Velocity of Salivary Amylase Activity (Michaelis-Menten Equation - MM)	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Experimental Analytical Thinking	Time-based Observation	Animated videos on Enzyme Kinetics, MM Plot Tools,	MM Plot Accuracy, Calculation, Record Keeping
5	Determination of pH of unknown using pKa (Henderson-Hasselbalch equation)	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An)	Conceptual Discussion and Lab work	Think-Pair-Share, Case	Interactive pH Simulation (PhET), HH	Accuracy in pH Calculation,

				CO-5 (E)		based application	Equation Videos	Problem Solving
6	**Instruments/Charts/ Models** (Colorimeter, pH Meter, Centrifuge, Chromatogram, PAGE)	1		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Observation, Model Explanation	Hands-on Model Exploration	Instrument Videos (Colorimeter, PAGE), Chromatography Demos,	Spotters, Short Answer Questions, Instrumental Identification
7	Measures of central tendency: mean, median and mode.	3	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Inquiry-Based, Experimental Method, problem solving	Think-Pair-Share, Case based application	YouTube tutorials, SPSS software usage	Quizzes, Data interpretation Test, Hands on Activity Assessment
8	Measures of dispersion-Standard deviation and standard error.	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Experimental Method, problem solving	Think-Pair-Share, Case based application	YouTube tutorials, SPSS software usage	Quizzes, Data interpretation Test, Hands on Activity Assessment
9	Correlation co-efficient: Length and width of molluscan shells.	3		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Experimental Method, problem solving	Think-Pair-Share, Case based application	YouTube tutorials, SPSS software usage	MCQ, Quizzes, Data interpretation Test, Hands on Activity Assessment
10	Probability: Coin tossing (two coin and three coin)	2		CO-1 (R) CO-2 (U) CO-3 (Ap)	Experimental Method, problem solving	Think-Pair-Share, Case	YouTube tutorials, SPSS software usage	MCQ, Quizzes, Data

				CO-4 (An) CO-5 (E)		based application		interpretation Test, Hands on Activity Assessment
11	Test of significance (student's t-test).	2		CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Conceptual Discussion and Lab work	Think-Pair-Share, Case based application	YouTube tutorials, SPSS software usage	Quizzes, Data interpretation Test, Hands on Activity Assessment
12	**Charts/ Models**: Histogram, polygon frequency, pie chart, cartogram, bar diagram	2	1	CO-1 (R) CO-2 (U) CO-3 (Ap) CO-4 (An) CO-5 (E)	Observation, Model Explanation	Hands-on Model Exploration	E books, Demo Videos YouTube resources	Spotters, Short Answer Questions,

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Prepare a standard solution of the given sample and measure its optical density at different concentrations. Verify the linearity using Beer-Lambert's law.
2. Estimate the glucose concentration in the given unknown solution using the DNS method. Plot a standard curve and determine the glucose concentration from the graph.

3. Determine the velocity of salivary amylase activity at various substrate concentrations. Plot Michaelis-Menten and Lineweaver-Burk graphs and calculate Km and Vmax.
4. Determine the pH of an unknown solution using a pH meter. Using the known pKa value of acetic acid, calculate the ratio of acetate to acetic acid using the Henderson-Hasselbalch equation.
5. Given leaf length data from 10 different trees, compute the mean, median, and mode.
6. Given Shell length, calculate the standard deviation and standard error.
7. Toss three coins 30 times and record the frequencies of each outcome. Calculate experimental probabilities and compare them with theoretical probabilities.
8. Using the given data on length and width of molluscan shells, compute the Pearson correlation coefficient.
9. Using the provided experimental data of two groups (e.g., treated vs control), perform Student's t-test to determine if the difference between means is statistically significant.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. J. Vinoliya Josephine Mary

Dr. S. Bhuvaneshwari

Teaching Plan

Department : Zoology
Class : II M.Sc. Zoology
Title of the Course : Core Course VII: Genetics and Evolution
Semester : III
Course Code : ZP233CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233CC	5	–	–	1	5	6	90	25	75	100

Learning Objectives:
1. To explore the molecular principles of heredity and the evolutionary processes.
2. To develop skills to assess heritability, identify genetic disorders, and construct phylogenetic trees.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	relate the principles of inheritance and evolution.	K1
2	describe the mechanisms of heredity and speciation.	K2
3	apply the genetic and evolutionary concepts to real-world scenarios.	K3
4	analyse the cause for variation and adaptation.	K4
5	evaluate the impact of genetic variation on biodiversity.	K5

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5-** Evaluate

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**MENDELIAN GENETICS**								
	1	Mendelian principles.	3	1	K1(R), K2(U), K5(E)	Blended Learning, Illustrative lecture	Inquiry-Based Learning, Peer Teaching	Video Lectures, Notes/Slides	Formative Quiz using Quizizz/ Nearpod / Kahoot / Google Forms, Written Assignment, Seminar Presentation, I CIA
	2	Gene interactions – complementary, Supplementary, and epistatic.	2		K1(R), K2(U), K3(Ap), K5(E)	Lecture with Derivation & Demonstration, Socratic Questioning	Problem-Solving Worksheets, Team work	E-Notes, Ms-PPT	
	3	Multiple allelism	2	1	K1(R), K2(U), K3(Ap), K5(E)	Illustrative Lecture, Problem-solving sessions using real-world applications	Collaborative Learning, Concept-based discussion and Mapping	Ms-PPT	Formative Quiz using Quizizz/ Nearpod / Kahoot / Google Forms, Written Assignment - Class notes, Seminar Presentation, I CIA
	4	Linkage and crossing over – types – mechanism – theories.	3		K2(U), K3(Ap), K4(A), K5(E)	Interactive lecture using blackboard	Problem-Based Learning	Ms-PPT, YouTube Videos	
	5	Chromosome mapping - Linkage maps, tetrad analysis,	3	1	K1(R), K2(U), K3(Ap), K5(E)	Integrative lecture, Flipped Classroom	Peer Learning, Team work	Ms-PPT, E-Notes	Formative Assignment - Worksheet/Problem-Solving Assignments/

		Mapping with molecular markers and somatic cell hybrids.							Seminar Presentation/ Open Book Test, I CIA
	6	Polygenic inheritance. Heritability and its measurements.	2		K1(R), K2(U), K4(A), K5(E)	Brainstorming, Illustration with Examples & Charts	Group Discussion, Peer Teaching	Ms-PPT, Video	
II	**MOLECULAR AND HUMAN GENETICS**								
	1	Gene concept. Mutation - types and effects of gene mutation. Mutagens – chromosomal mutation.	3	1	K2(U), K3(Ap), K5(E)	Cooperative Learning, Direct Instruction	Peer Instruction, Blended Learning	Ms-PPT, E-Notes	Seminar Presentation, Oral Test, II CIA
	2	DNA damage and repair.	3		K1(R), K2(U)	Collaborative Learning	Peer Teaching	E-Notes	
	3	Human chromosomes, Karyotyping, Chromosomal banding and painting Pedigree analysis.	3	1	K3(Ap), K4(A)	Illustrative lecture, Conceptual analysis using Case studies	Activity (Chart/ Diagram/ Mind Map) based learning	Video Lectures	Formative Assignment - class notes/ chart/ mind map, Open Book Test, Seminar Presentation, II CIA
	4	Genetic Disorders - Phenylketonuria, Alkaptonuria, albinism, Gout, ADA deficiency	3		K2(U), K3(Ap), K4(A)	Brainstorming, Panel Discussion	Peer Teaching, Mind Map	E-Notes	

	5	Genetic Disorders - Von Gierke's disease, G6PD deficiency, Tay Sach's disease	1		K2(U), K3(Ap), K5(E)	Cooperative learning, Group discussion	Peer group Discussion	Ms-PPT	Formative Assignments - MCQ/ Mind Map/ Presentation/ Short-answer conceptual questions, II CIA
	6	Genetic Disorders - Gaucher's disease, sickle cell anemia, thalassemia. Genetic counseling.	2	1	K2(U), K3(Ap), K5(E)	Brainstorming, Illustration with case studies	Peer Group Discussion, Peer Teaching	YouTube Videos, Ms-PPT	
III	**POPULATION GENETICS AND EVOLUTION**								
	1	Mendelian populations - Hardy Weinberg law and genetic equilibrium.	2	1	K1(R) & K3 (Ap)	Mathematical Derivations, Concept Mapping	Seminar	Video Lectures	Rubric-Based Assessment: MCQs Fill in the-blank, CIA - I
	2	Calculation of gene frequencies for autosomal - dominant and recessive alleles	2		K2(U) & K4 (An)	Core Conceptual Approach, Analysis - Based Teaching	Z-A approach, Problem Solving	Visual and animated tutorials	Written exams: Numerical problems on Gene frequencies CIA I
	3	Calculation of gene frequencies for codominant alleles and multiple alleles	2	1	K1(R) & K3(Ap)	Concept Building, Mathematical Insights	Blended learning	YouTube lectures	Numerical problem CIA I
	4	Elementary evolutionary forces.	2		K1(R) & K4(An)	Reflective thinking	VAK learning	Interactive PPT	Short test CIA I

	5	Genetic load and death	2	2	K4(An)	Lecture method	Interactive Simulation	Visual and animated tutorials	Oral CIA I
	6	Neutralist hypothesis	2		K5 (E)	Blended Learning	Inquiry-Based Learning	Visual and animated tutorials	One- word test, CIA I
		Genetic polymorphism	2		K1(R) & K3(Ap)	Group Discussion	Seminar	Visual and animated tutorials	Open Book Test, CIA I
IV	**MOLECULAR EVOLUTION**								
	1	Origin of life	1	1	K1(R) & K3 (Ap)	Group discussion	Flipped Classroom,	YouTube videos	Mind map, CIA II
	2	Principles of molecular evolution studies	1		K2(U)	Inquiry-Based Learning,	Peer Teaching	YouTube Lecture	Short test, CIA II
	3	Molecular clock	1		K3(Ap)	Problem-Based Learning	Group Discussion	YouTube Videos	One-word test, CIA II
	4	Phylogenetic tree - Distance Matrix	2	2	K3(Ap)	Blended Learning	Seminar		Slip test CIA II
	5	Phylogenetic tree - Parsimony based approach	2		K4(An)	Lecture method	Peer Teaching	Visual and animated tutorials	Class test, CIA II
	6	Phylogenetic tree - kinds of molecular phylogenies	1		K4(An)	Chalk and Talk	Role reverts	Visual and animated tutorials	Oral, CIA II
		Universal Tree of Life. Phylogenetic and biological concept of species	3	2	K5(E)	Chalk and Talk	Group discussion	Interactive PPT	Mind map, CIA II

		Speciation - allopatry and sympatry. Adaptive radiation.	2		K4(An) & K5 (E)	Fish Bowl	Seminar	YouTube Videos	Pictorial representation, CIA - II
V	**ORIGIN OF HIGHER CATEGORIES**								
	1	Major trends in the origin of higher categories. Microevolution, macroevolution, mega evolution.	3	2	K1(R), K3 (Ap)	Inquiry-Based Learning,	Peer Teaching	YouTube Lecture, Interactive PPT	Quiz, Google Forms, Written Assignment, CIA I
	2	Evolution rates, phyletic gradualism and punctuated equilibrium.	3		K2(U), K3 (Ap)	Problem-Based Learning	Group Discussion	YouTube Videos, Interactive PPT	MCQ, Google Forms, Written Assignment, CIA I
	3	Origin and Evolution of Primates: Evolution of Anthropoid Primates.	3		K1(R), K3 (Ap)	Blended Learning	Group discussion	Interactive PPT, YouTube Videos	Mind map, Flow Chart preparation, CIA II
	4	The first hominids -Australopithecines and origin of modern man	3	2	K1(R), K4(An)	Blended Learning	Inquiry-Based Learning	Visual and animated tutorials, Interactive PPT	Open book test, CIA II
	5	Bipedalism – communication - speech - language - altruism and morality.	2		K2(U), K5 (E)	Flipped learning	Group discussion	Interactive PPT, YouTube Videos	Mind map, Flow Chart preparation, CIA II

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Skill Development**
Activities (Em / En /SD): **Hands on Training on Problem solving.**
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Environment Sustainability**
Activities related to Cross Cutting Issues:-

Assignment: Adaptive Radiation (Last date to submit – 01-09-2025)
Assignment: Punnett Square for gene interactions of qualitative characters

Seminar Topics:

1. Monohybrid Cross
2. Dihybrid Cross
3. Genetics of ABO blood group
4. Disorders of aminoacid metabolism
5. Complementary and Supplementary genic interaction
6. Haemoglobin Disorders
7. DNA Repair
8. Mendelian populations - Hardy Weinberg law and genetic equilibrium.
9. Genetic polymorphism
10. Phylogenetic tree - Distance Matrix
11. Speciation - allopatry and sympatry.
12. Microevolution
13. Evolution rates

Head of the Department
Dr. A. Shyla Suganthi

Course Instructor
Dr. C. Josephine Priyatharshini
Dr. S. Mary Mettilda Bai
Dr. S. Prakash Shoba

Teaching Plan

Department : Zoology
Class : II M.Sc.
Title of the Course : Core Course VI: Advanced Animal Physiology
Semester : III
Course Code : ZP233CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233CC2	5	–	–	1	**5**	**6**	**90**	**25**	**75**	**100**

Learning Objectives:

1. To impart knowledge on the structure and functions of various organs, organ systems and associated disorders.
2. To develop skills relevant for pursuing higher education and apply the knowledge in their life.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall the structure and functions of organ systems.	**K1**
2	compare the structure, functions and regulation of the different organs and organ systems of animals.	**K2**
3	relate the functions of different organ systems in maintaining homeostasis.	**K3**
4	analyze the physiological changes in relation to environmental conditions.	**K4**
5	evaluate the effect of physical factors on physiological functioning of different organs.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**NUTRITION**								
	1	Types of Nutrition in Animals	2	1	K1 (R)	Lecture with PPT & Charts	Think-Pair-Share	Textbook, YouTube Animations	MCQs, I CIA
	2	Feeding Mechanisms in Animals	1		K2(U)	Diagram-based teaching	Student Seminar	PPT, Short videos	Quizzes, I CIA
	3	Functional Anatomy of Human Digestive System	3	1	K2(U), K3(Ap)	Lecture with Models	Labelling Worksheets	Charts, Models	Labelling Test, I CIA
	4	Movements of Gastrointestinal Tract	2		K3(Ap)	Animation-based Explanation	Role Play or Demonstration	Animation, Diagrams	Short Answers, I CIA
	5	Secretory Functions of Alimentary Tract and Glands	2	1	K1(U)	Flowcharts, Chalk & Talk	Group Discussion	Flowcharts	Oral Q&A, I CIA
	6	Digestion and Absorption	2		K4(An)	Concept Mapping	Peer Teaching	PPT, Simulation Videos	Concept Maps, I CIA
	7	Gastrointestinal Disorders	3		K5(E)	Case-based Learning	Student Seminar	WHO Website, Pathology Texts	Case Study, I CIA
II	**RESPIRATION AND HOMEOSTASIS**								
	1	Functional anatomy of the respiratory system of man	1	1	K2(U), K3(Ap)	Lecture with Models Seminar	Model making, Seminar,	Models, 3D anatomy videos	Labelling test,

							Labelling		Diagram-based MCQ
	2	Transport of respiratory gases	1		K2(U), K4(An)	Video – based Explanation	Peer teaching, Concept map	YouTube videos, PPT animation	Short answer questions, Oral quiz
	3	Regulation of respiration	2	1 1	K2(U), K4(An)	Concept Mapping	Flow Chart	Smart board animation	MCQs, Conceptual diagram test
	4	Respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis.	2		K1(R), K3(Ap)	Case-based Learning	Poster presentation, Student Seminar	WHO resources, CDC website	Online Quiz, Seminar
	5	Homeostasis. Osmoregulation - types and mechanism,	2		K2(U),	Chalk and talk, Flow Chart	Think-pair-share, Concept simulation, Student Seminar.	Animated video lectures, YouTube channels, e-books	Worksheet activity, Seminar
	6	Thermoregulation – classification and mechanism.	2		K2(U), K3(Ap)	Chalk and Talk, Flow Chart	Interactive models. Simulation games	Video Simulation,	Quiz, Group presentation
	7	Deep S e a physiology,	1	1	K2(U), K3(Ap)	Flipped Classroom	Think Pair Share,	YouTube Videos	MCQ worksheet
	8	High altitude and space physiology	1		K2(U), K4(An)	Case based Learning	Mind Map, Concept mapping,	YouTube Videos, Articles	MCQ and short answers

							Seminar presentation		
	9	Bioluminescence - physiology and functions.	2		K2(U), K3(Ap)	PPT based Presentation, Interactive storytelling.	Visual storytelling, Video annotation	Interactive PPT, Videos	Observation-based quiz,
III	**CIRCULATION**								
	1	Haemopoiesis	2	1	K1(R), K2(U)	Lecture with ppt	Student Seminar	Slide share PPT https://youtu.be/0deCbmh7PHs	I Internal test and quiz Oral questioning
	2	Blood clotting.	1		K2(U), K3(A)	Animated video/lecture	Flow chart preparation	Video (YouTube) https://youtu.be/ZcoEajlESiI	Worksheet I Internal test
	3	Myogenic and neurogenic heart.	1	1	K3(A), K4(An)	Interactive class	Peer-teaching	Difference between Neurogenic heart and Myogenic heart, YouTube Science Explored	II Internal test Difference between myogenic and neurogenic heart
	4	Functional anatomy of the human heart,	2		K3(A), K4(An)	Video lecture	Student Seminar Model and experiential learning	https://youtu.be/UMTDmP81mG4	I Internal test Diagram and long answer test
	5	cardiac cycle, pacemaker,	2		K2(U), K3(A)	Lecture with ppt	Chart preparation-group activity	e-notes pdf	Chart preparation assessment, I Internal test

	6	heart rate, regulation of cardio-vascular system.	2		K2(U)	Video lecture ppt	Peer teaching	e-notes pdf	Short test, assignment, I Internal test
	7	heart diseases - atherosclerosis, coronary thrombosis and angina pectoris,	2	1	K2(U), K3(A)	Case study	Student Seminar	https://youtu.be/Oqt9TgWcrxI	Case study analysis of heart attack
	8	Angiogram and Angioplasty..	1		K1(R), K2(U) K3(A)	Video lecture	Discussion	https://youtu.be/-BuazAhs7uA	Peer assessment, I Internal test
	9	Lymphatic system - organization, composition and functions	2		K1(R), K2(U) K3(A)	Model/video lecture	Student Seminar	https://youtu.be/eWUAB194qhU	Concept map I Internal test
IV	**NEURO-MUSCULAR SYSTEM**								
	1	Structure of neuron, neurotransmitter	1	1	K1(R), K2(U)	Lecture with ppt	Model making	Video lecture Animated PPT	Short test II Internal test and quiz
	2	Synapse, nerve impulse conduction, reflex activity	2		K2(U), K3(A)	Animated video/lecture	Role play	3D model, Video (YouTube)	Worksheet Diagram evaluation, II Internal test
	3	Electroencephalogram (EEG), MRI	2		K3(A), K4(An)	e- MRI Interactive class	Peer-teaching	https://www.imaios.com/en/e-mri/mri-instrumentation-and-mri-safety/magnetic-field-gradients	Mind map II Internal test

	4	Neural disorders - meningitis and epilepsy.	2		K3(A), K4(An)	Clinical case studies	Student Seminar	E notes pdf	CIA II Quiz-oral
	5	Types of muscle, structure and properties of skeletal muscle,	2	1	K2(U), K3(A)	Anatomical slides, chart	Chart preparation-group activity	Skeletal Muscle Structure greatpacificmedia https://open.oregonstate.education/aandp/chapter/10-2-skeletal-muscle/	Chart preparation and assessment, II Internal test
	6	Mechanism of muscle contraction,	2		K2(U)	Video lecture ppt	Peer teaching	Dr. G Bhanu Prakash Animated Medical Video	Long answer test and assignment, II Internal test
	7	Neuromuscular junction.	2		K2(U), K3(A)	Video lecture ppt	Role play	YouTube videos Alila Medical Media	
	8	Sense organs - structure and functions of skin	1	1	K1(R), K2(U) K3(A)	Model/video lecture	Student Seminar	YouTube videos Bio Scholar	Peer assessment, II Internal test
	9	Structure and functions of eye.	1		K1(R), K2(U) K3(A)	Model/video lecture	Student Seminar	YouTube videos Iken Edu	
V	**EXCRETION AND REPRODUCTION**								
	1	Patterns of excretion	1	1	K1(R), K2(U)	Chalk & talk comparative table	Think-Pair-Share	NCERT diagrams, Animated PPT	Quiz, II CIA
	2	Structure and function of kidney of man	2		K2(U), K3(A)	Model-based explanation, animation	Student Seminar	3D model, Video (YouTube)	Diagram evaluation, Spot test, II CIA

	3	Nephron, formation of urine	2		K2(U), K4(An)	Digital diagrams	Peer-teaching	Animated videos	Worksheet evaluation, II CIA
	4	Counter current mechanism, micturition	1	1	K3(A), K4(An)	Concept mapping	Case-based learning	E notes pdf	Concept map evaluation, II CIA
	5	Renal disorders – nephritis, renal calculi, Dialysis	2		K2(U), K5(E)	Clinical case studies	Student Seminar	Manocha Academy videos	Poster and peer assessment, II CIA
	6	Structure of testis and ovary (human)	3		K2(U)	Anatomical models, chart	Label test	Digital atlas, YouTube videos	MCQ, II CIA
	7	Oestrus and menstrual cycle, ovulation, pregnancy,	2	1	K2(U), K3(A)	Comparative chart & timeline	Pair work: menstrual cycle tracker	E notes, Menstrual cycle chart	Oral quiz and assignment, II CIA
	8	Parturition and lactation, hormonal regulation of reproduction.	2		K4(An), K5(E)	Discussion, Flow chart	Jigsaw technique	Khan Academy videos, Hormone chart	Group activity evaluation, II CIA

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/ En/SD): Model making

Course Focussing on Cross Cutting Issues

Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity) Human Values and Gender Equity

Activities related to Cross Cutting Issues: Chart showing menstrual cycle

Assignment: Model making – Structure of Digestive System

Seminar Topics

1. Feeding mechanisms in animals.
2. Gastrointestinal disorders - Gallstones, liver cirrhosis.
3. Gastrointestinal disorders - gastritis, peptic ulcer and appendicitis.

4. Structure and function human respiratory organ
5. Respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis.
6. Homeostasis
7. Functional Anatomy of Human Heart
8. Heart diseases - atherosclerosis, coronary thrombosis and angina pectoris
9. Composition and function of lymphatic system
10. Structure and functions of skin
11. Structure and functions eye.
12. Neural disorders - meningitis and epilepsy.
13. Structure and function of kidney.
14. Renal disorders – nephritis, renal calculi, dialysis

Sample questions

Part A

1. **Match the following and choose the correct answer** **CO-4 (An)**

A. Jellyfish	- 1) Bubble net
B. Whales	- 2) Siphon
C. Scallops	- 3) Baleen plates
D. Gray whale	- 4) Swimming legs
	5) Appendages

2. Which part of the respiratory system is known as the voice box? **CO-3 (Ap)**
   a) Trachea b) Larynx c) Bronchi d) Pharynx
3. Vitamin B12 and folic acid are necessary for the maturation of RBCs. **True or False CO-2 (U)**
4. .**Assertion (A)**: Botulinum Toxin is a neuromuscular blocker **CO-3 (Ap)**
   Reason (R): It prevent transmission of impulses from nerve fiber to the muscle fiber.
   a) Statement A is correct, but B is wrong
   b) Statement A is wrong and B is correct
   c) Statement A and B are wrong
   d) Statement A and B are correct
5. Expand FSH. **CO-2 (U)**

Part B

1. How do villi and microvilli contribute to the efficiency of nutrient absorption in the small intestine? **CO-4 (An)**
2. Examine how factors such as pH and temperature influence the binding and release of oxygen by hemoglobin. **CO-5 (E)**
3. Describe the causes and symptoms for Angina pectoralis **CO-2 (U)**
4. Explain the mechanism of muscle contraction. **CO-2 (U)**
5. Discuss the different patterns of excretion in animals. **CO-3 (Ap)**

Part C

1. Discuss the significance of enzyme specificity in the breakdown of different types of nutrients. **CO-3 (Ap)**
2. Discuss the role of the hypothalamus in thermoregulation, including its thermoregulatory set point and feedback mechanisms.

CO-3 (AP)

3. Describe the process of blood clotting. **CO-2 (U)**
4. Write about the structure of the eye and explain the physiology of vision. **CO-2 (U)**
5. What is tubular reabsorption? Evaluate the mechanism of tubular reabsorption. **CO-5 (E)**

Head of the Department

Dr. A. Shyla Suganthi

Course In charge

Dr. X. Venci Candida
Dr. J. Vinoliya Josephine Mary
Dr. C. Anitha

Teaching Plan

Department : Zoology
Class : II M.Sc. Zoology
Title of the Course : Core Lab Course IV: Lab on Genetics and Evolution and Advanced Animal Physiology
Semester : III
Course Code : ZP233CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233CP1	-	-	6	-	5	6	90	25	75	100

Learning Objectives:

1. To equip the students to analyse the physiological, genetical and evolutionary processes.
2. To develop the skills of writing the report and presentation.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	explain the fundamental principles of Mendelian inheritance, population genetics, adaptive radiation and function of organ and organ systems	K1
2.	interpret the importance of genic inheritance, changes in gene and gene frequencies in a population and physiology of the organ system.	K2
3.	apply the genetic, evolutionary, and physiological concepts.	K3
4.	analyse the causes of genetic variation, adaptation and physiological changes.	K4
5.	design experiments based on Hardy-Weinberg Law, enzyme activity and effect of physical factors on physiological activities.	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Total Contact hours: 90 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
GENETICS AND EVOLUTION (45 hours)								
1	Demonstration of dihybrid cross using beads.	3	2	CO-2 (U) CO-3 (Ap)	Experimental Learning	Hands-on Learning	Virtual Lab	Model making
2	Identification of sex and mutant forms of *Drosophila*.	4		CO-2 (U) CO-3 (Ap)	Z-A approach	Hands-on Learning	YouTube	Microscopic view
3	Observation of frequency of the following Mendelian genetic traits in a human population: widow's peak, attached ear lobe, dimple in chin	4	2	CO-2 (U) CO-3 (Ap)	Chalk and Board	Inquiry based Learning	Technology based Learning	Oral Q & A
4	Study of mode of inheritance of the following Mendelian traits by pedigree charts: interlocking of fingers, ABO blood group	3	2	CO-2 (U) CO-3 (Ap)	Chalk and Board	Inquiry based Learning	Technology based Learning	Oral Q & A
5	Calculation of gene frequencies of multiple alleles (ABO blood group) using Hardy-Weinberg formula.	4		CO-3 (Ap) CO-4 (An)	Experiential Learning, Inquiry-Based Pedagogy	Peer Learning through group tasks	Calculator	Problem solving method

6	Demonstration of natural selection using beads.	4	2	CO-2 (U) CO-4 (An)	Problem-Based Learning	Z-A approach	Calculator	Mathematical calculation
7	Study of analogy (wings of animals).	2		CO-1 (R) CO-2 (U) CO-3 (Ap)	VAK learning	Illustrative method	YouTube	Pictorial representation
8	Study of homology (fore limbs and hind limbs of vertebrates).	2	2	CO-1 (R) CO-2 (U) CO-3 (Ap)	VAK learning	Illustrative method	YouTube	Pictorial representation
9	Study of adaptive radiations in feet and beaks of birds.	2		CO-1 (R) CO-2 (U) CO-1 (R)	VAK learning	Illustrative method	YouTube	Pictorial representation
10	**Charts/ Slides/ Models/ Bookplates/ Instruments:** Karyotype of syndromes (Down's syndrome, Klinefelter's syndrome and Turner's syndrome), Chromosomal banding, Fossils (Ammonite, Trilobite, Nautiloid fossil), Geographical isolation (Indian and African Elephants), Seasonal Isolation (Sea Urchin), Phylogram, Universal Tree of Life	5	2	CO-1 (R) CO-2 (U) CO-3 (Ap)	VAK learning	Illustrative method	YouTube, Virtual Lab	Models, Pictorial representations Genetic cross

Head of the Department **Course Instructors**

Dr. A. Shyla Suganthi **Dr. J. Vinoliya Josephine Mary** **Dr. C. Josephine Priyatharshini**

ADVANCED ANIMAL PHYSIOLOGY (45 hrs)								
1	Effect of temperature on heart rate of Freshwater Mussel	3	1	K2& K3	Demonstration Inquiry based learning	Experimental learning Peer Learning through group tasks. Inquiry based learning	Videos	Rubric-Based Evaluation-, concept explanation, teamwork, Observation and record Regularity Model Exam
2	Effect of temperature on salivary amylase activity and calculation of Q10	3	1	K2& K3			Videos	
3	Effect of pH on salivary amylase activity.	3	1	K2& K3				
4	Salt loss and salt gain in a freshwater fish.	3	1	K2& K3	Demonstration		Videos	
5	Examine the relative activity of enzymes in the fore, mid, and hindgut of a typical insect.	3		K2, K3 & K4	Demonstration Inquiry-Based Pedagogy		Videos	
6	Examination of excretory products of fish, bird and mammals	3	1		Project-Based Learning,	Group brainstorming & presentation Think-Pair-Share	Videos	Performance-based, Reularity-based
7	Counting of blood cells using a hemocytometer	3	2	K2, K3 & K4	Demonstration Inquiry based learning	Experimental learning Peer Learning through group tasks	Videos	Performance-based, Analysis report
8	Haemolysis of blood – Demonstration	3						
9	Observation of haemin crystals in blood.	3						

10	Estimation of haemoglobin.	3						
11	Charts/ Slides/ Models/ Bookplates/ Instruments: EEG, ECG, Conditional reflex, Skeletal muscle, Kymograph, Sphygmomanometer, Intestine, Nervous tissue, Liver, Lungs, Heart, Kidney.	5	3	K1	Peer teaching	Peer Learning through group tasks	-	Short test, Diagram

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on training, problem Solving

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Gender equity

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Demonstrate dihybrid cross using beads. Write down the phenotypic and genotypic ratio using Punnet square.
2. Demonstrate the effect of Natural selection. Write down the procedure and discusson your result.
3. Design an experiment to explain the salt loss and salt gain in a freshwater fish. Write down the procedure and discuss your result.
4. Analyze the effect of pH on the salivary amylase activity. Write down the procedure and discuss on your result.
5. Identify the types of excretory products in the given samples A, B, C and D.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. C. Josephine Priyatharshini
Dr. C. Anitha

Teaching Plan

Department : Zoology
Class : I M.Sc. Zoology
Title of the Course : Elective Course V: a) Animal Behaviour and Chronobiology
Semester : III
Course Code : ZP233EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233EC1	2	1	-	1	3	4	60	25	75	100

Learning Objectives

1. To understand the biological aspects of animal behaviour, focusing on evolution and ecology.
2. To develop hands-on skills essential for studying and analyzing animal behaviour.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	attain a thorough comprehension of the fundamental principles concerning genetics, evolution, perception, learning, decision-making, and chronobiology in animal behaviour.	K1
2	elucidate the evolutionary and ecological elements impacting social behaviour, the interplay between animal physiology and behaviour, the intricacies of decision-making processes in animals, and the principles underlying biological clocks.	K2
3	interpret animal behaviour patterns, social behaviour dynamics, predict and manage animal physiology and behaviour, solve behavioural problems, optimise human health and well-being.	K3
4	critically analyse and assess the impact of environmental changes on physiology and behaviour, evaluate the decision-making processes in complex behavioural scenarios and role of biological clocks in human health and disease management.	K4 & K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**UNDERSTANDING ANIMAL BEHAVIOUR (12 Hours)**								
	1.	Significance and need for studying animal behaviour,	1	1	CO-1 (R) CO-2 (U)	Lecture method-using Chalk and talk	Inquiry-Based Learning, Peer Teaching.	PPT, Video Lectures	Short Test, Rapid fire test, Written notes I CIA
	2.	Approaches to behavioural studies, Genetic basis of behaviour,	2		CO-2 (U)	Brainstorming & Group Discussion	Collaborative Learning, Inquiry based learning	Video Lecture,	Seminar, Peer review – MCQ I CIA
	3.	Heritability of behaviour,	2	1	CO-1 (R) CO-4 (An)	Reflective Thinking, Lecture method, Flipped learning.	Interactive Class notes	PPTs	Seminar, Oral test, Quiz Surprise test I CIA
	4.	Habitat and its impact on influencing behaviour,	3		CO-2 (U)	Problem solving, Integrative Teaching	*Group Presentations, Peer Teaching.*	Video Lectures, PPT	Oral Question Summary Writing, I CIA
	5.	Social interactions and their role in shaping behaviour,	2	1	CO-2 (U) CO-5 (E)	Review, Brainstorming and Lecture	Inquiry based learning, Case-Based Learning	Video Lecture, E-notes	Short Test – MCQ I CIA

	6.	Ethology and recording animal behaviour.	2		CO-2 (U) CO-5 (E)	Peer tutoring, Lecture using PPT	Collaborative Learning, Interactive Class notes	E-Content, Videos	Quiz Concept Explanation I CIA
II	**EVOLUTION AND SOCIAL BEHAVIOR:** (12 **Hours**)								
	1.	**I**mpact of natural selection on social behavior,	1	1	CO-1 (R) CO-2 (U)	Group Discussion, Reflective Thinking	Verbal Quiz, Think-Pair-Share	Youtube Videos, PPT	Seminar, Summary Writing Written Notes, II CIA
	2.	sexual selection, altruism,	3		CO-1 (R) CO-2 (U)	Lecture using Lecture with Visual Aids (Specimen/ Charts/ Pictures/ PPT), Collaborative Teaching	Group Discussions, Peer=teaching	Video Lecture,	Oral Test MCQ II CIA
	3.	mating systems, sexual strategies.	2		K2, K3	Lecture using Chalk and talk, Group Discussion	Collaborative Learning, Interactive Class notes	PPT, Videos	Quiz questioning in the classroom II CIA
	4.	Exploring social organization and animal perception,	1	1	K1, K4	Debate, Brainstormin g and Illustrative Lecture	Inquiry-Based Learning, Peer Teaching.	Video Lectures, PPTs	Group Discussion– Written Notes, II CIA
	5.	communication within social animals, group living dynamics	2		K2, K5	Group Discussion, Review	Inquiry based learning, Role Play	PPTs, Video Lecture,	Seminar, Class Test Peer review – MCQ

									II CIA
	6.	parental care, visual adaptations in challenging environments.	3	1	K2,K4	Demonstration, Interactive lecture using video links	Collaborative Learning, Interactive Class notes	PPT, Videos	Quiz Illustrative Diagrams, Essay Writing II CIA
III	**ANIMAL AND THE ENVIRONMENT (12 Hours)**								
	1	Habitat selection, Coordination and Orientation,	2	1	CO-1 (R) CO-2 (U)	Peer teaching, Collaborative learning,	Explaining concept, Answering questions from peer	E-Notes, PPT	Quiz, Group Discussion I CIA
	2	Homeostasis and Behaviour,	2		CO-2 (U)	Experiential learning,Differentiated instruction	Peer review, Group reflection	PPT, YouTube Video	Seminar, Peer review , Rapid fire test
	3	Physiology and Behaviour in changing environments,	2	1	CO-1 (R) CO-3 (Ap)	Lecture using PPT	Reflective thinking, Formulating questions,	PPT, Video Lecture	Seminar, Mind Map, Class test I CIA
	4	Conditioning and Learning, Biological aspects of learning,	2		CO-2 (U)	Experiential learning, Inquiry-Based Learning	Simulation, Group discussion	PPT, E-Notes	Quiz,Peer review – MCQ I CIA
	5	Cognitive aspects of learning. Foraging behaviour,	2	1	CO-2 (U) CO-4 (An)	Flipped classroom, Lecture using PPT	In Class discussion, Discussion on material referred	PPT, E-Notes	Seminar, Open book test, Quiz I CIA
	6	Competition, Environmental	2		CO-1 (R) CO-5 (E)	Brainstorming and	Guided Inquiry based learning	PPT, E-Notes	Class Test, MCQ I CIA

		challenges and stressors.				Illustrative Lecture			
IV	**UNDERSTANDING COMPLEX BEHAVIOUR** (12 **Hours**)								
	1	Instinct, learning, Cognition and Memory,	3		CO-1 (R) CO-2 (U)	Collaborative learning, Lecture using PPT	Simulation, Peer review	E-Notes, YouTube Video	Class test,Open Book Test I CIA
	2	Decision making behaviour in Animals, Mechanism of Decision making,	3	1	CO-2 (U) CO-3 (Ap)	Lecturing, Active learning	Think-pair-share, Peer tutoring	E- Notes	Mind map, Open Book Test I CIA
	3	Complex reproductive behaviours,	1		CO-2 (U) CO-4 (An)	Lecture with Visual Aids (PPT, Pictures), Cooperative learning	Group discussion, Peer feedback	PPT	Seminar, Illustrative diagram I CIA
	4	Complex behaviour of honey bees,	2	1	CO-2 (U) CO-5 (E)	Reflective thinking, Group Discussion	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching.	Video Lectures, PPT	Home assignment – Written Notes, I CIA
	5	Languages and mental representation,	1		CO-1 (R) CO-2 (U)	Brainstorming, Lecture with Visual Aids (Specimen/ Charts/ Pictures/ PPT)	Guided Inquiry based learning	Video Lecture,	Seminar, Peer review – MCQ II CIA
	6	Animal awareness and Emotion	2	1	CO-2 (U) CO-3 (Ap)	Demonstrative lecture & Cooperative learning	Collaborative Learning, Interactive Class notes	PPT, Videos	Seminar, Quiz questioning in the classroom II CIA

V	**CHRONOBIOLOGY** (12 **Hours**.)								
	1.	Circadian Rhythm, Biological Clock,	2	1	CO-1 (R) CO-2 (U)	Integrative Teaching, Concept-based discussion	Think-Pair-Share, Inquiry-Based Learning, Peer Teaching	Video Lectures, Notes/ PPT	Short test – Class test, Oral test II CIA
	2.	Concept of central and peripheral clock system; Circadian pacemaker system;	3		CO-1 (R) CO-3 (Ap)	Interactive lecture with Visual Aids such as Charts, Drawings, Pictures & PPT etc., Cooperative learning	Peer group discussion	YouTube Video, PPT	Illustrative Diagrams - Online Assignment II CIA
	3.	Photoperiodism, Influence of circadian rhythms on mating, feeding, and other behaviours,	1	1	CO-2 (U) CO-4 (An)	Illustrative Lecture, Video, Peer teaching	Collaborative Learning, Peer teaching	PPT, E-Notes	Quiz, Seminar II CIA
	4.	Ultradian and Infradian Rhythms,	2		CO-1 (R) CO-2 (U),	Brainstorming, Inquiry based learning	Memory Game, Peer teaching	Youtube Videos	Mind map, Slip test II CIA
	5.	Chronobiology and Aging, Chrono pharmacology,	3	1	CO-1 (R) CO-5 (E)	Collaborative teaching using pictures/ charts	Peer Learning, Interaction in the class	E-Notes, Ms-PPT	Seminar, Diagram, Open Book Test II CIA
	6.	chrono medicine, chronotherapy.	1		CO-1 (R) CO-2 (U)	Illustrative lecture with Visual Aids such as Charts, Drawings,	Collaborative Learning, Group Discussion	YouTube Videos, Ms-PPT	Preparation of study materials II CIA

I. Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities for Employability

A. Mind map on Habitat Selection

B. Debate on "Chronomedicine - Effective vs Ineffective."

C. Assignment & Seminar Topics

1. Approaches to behavioural studies,
2. Heritability of behaviour,
3. Impact of natural selection on social behaviour,
4. Communication within social animals
5. Homeostasis and Behaviour
6. Physiology and Behaviour in changing environments,
7. Foraging behaviour
8. Complex behaviour of honey bees,
9. Languages and mental representation,
10. Animal awareness and Emotion.
11. Influence of circadian rhythms on mating, feeding, and other behaviours,
12. Chronobiology and Aging,
13. Chrono pharmacology, chrono medicine

II. Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity): Environment Sustainability –Biodiversity

1. Flow Chart - Circadian Rhythm

2. Group Discussion – Chronotherapy

Sample questions

Part A (1 Mark)

1. 'Behavior' is a trait associated with heritability. (**State True or False**) **CO 4 (An)**
2. Identify the male bird species that constructs nests. **CO 2 (U)**
   a. Weaver bird b. Sun bird c. Tailor bird d. Dove
3. Name the competition for mates between species members of the same sex. **CO 3 (Ap)**

a. Intersexual selection b. Mate choice c. Intrasexual selection d. Female choice

4. **Fill in the Blank:** The type of rhythm followed by our sleep-wake cycle is called _____. **CO 2 (U)**
5. Our sleep-wake cycle follows the Circadian rhythm (**State True or False**). **CO 3 (Ap)**

Part B

1. Explain the genetic basis of behaviour. **CO 2 (U)**
2. Analyze the influence of natural selection on social behaviour. **CO 3 (Ap)**
3. Define Homeostasis. Illustrate its impact on animal behaviour. **CO 2 (U)**
4. Describe how cognition interacts with memory to shape human behaviour and decision-making processes. **CO 2 (U)**
5. Define Biological Clock and explain its adaptive significance. **CO 3 (Ap)**

Part C

1. Evaluate the significance of social interactions and their role in shaping behaviour. **CO 5 (E)**
2. Elaborate on sexual behaviour and the methods of sexual selection. **CO 2 (U)**
3. Compare classical conditioning with operant conditioning in terms of their influence on learning and behaviour. **CO 4 (An)**
4. Evaluate the complex behavior of honey bees adding notes on their foraging behaviour. **CO 5 (E)**
6. Elaborate on photoperiodism and explain its significance in the regulation of seasonal reproduction in vertebrates. **CO 3 (Ap)**

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. Jeni Chandar Padua
Dr. A. Shyla Suganthi

Teaching Plan

Department : Zoology
Class : II M.Sc. Zoology
Title of the Course : Skill Enhancement Course II – Dairy Farming
Semester : III
Course Code : ZP233SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233SE1	2	-	1	-	2	3	45	25	75	100

Learning Objectives:

1. To impart conceptual knowledge about the animal life in the air and their behaviours.
2. To understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	categorize cattle breeds and the diverse feed options for livestock.	**K1**
2.	understand the various housing options and the nutritional needs of dairy animals at different life stages.	**K2**
3.	apply breeding techniques and implement managerial parameters to uphold optimal conditions in dairy housing.	**K3**
4.	analyze and explore milk composition and factors leading to spoilage.	**K4**
5.	prepare and asses new variety of dairy products and their nutritional values.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; K5 – Evaluate

Teaching plan

Total Contact hours: 45 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation
I	**INTRODUCTION TO DAIRY FARMING**								
	1	Advantages of dairying - Classification of breeds of cattle	2	1	K1 (R), K5 (E)	Inquiry based Learning	Flow Chart Making	PPT, e-book	Oral Test, Seminar
	2	Indigenous and exotic breeds - Selection of dairy cattle	2		K1 (R)	Collaborative Learning	Think Pair Share, Mind Map	e-books, YouTube Videos	Seminar, Album preparation
	3	Breeding - artificial insemination	1	1	K3 (Ap)	Video based Learning	Peer Teaching	PPT, e-notes	Class Test, MCQ
	4	Dairy cattle management - General Anatomy.	2		K1 (R), K2 (U)	Inquiry based Learning, Video based Learning	Group Discussion	YouTube Videos	Slip Test, Seminar
II	**CONSTRUCTION OF MODEL DAIRY HOUSE**								
	1	Types of Housing (open housing, shed) - layout planning, ventilation, drainage, and waste management.	3	1	K2 (U), K3 (Ap)	Inquiry based Learning	Flow Chart Activity, Field visit	Flow Chart, e-notes	Summarization, Seminar
	2	Different Managemental Parameters	2		K2 (U), K3 (Ap)	Lecture using PPT, Blended learning	Students review	PPT, YouTube	Short Test, Mind map, CIA I

								videos, Notes	
	3	Winter Management	1	1	K2 (U), K3 (Ap)	Inquiry based learning	Peer interaction and Discussion	PPT, Notes	Oral Test, Seminar, CIA I
	4	Summer Management	1		K2 (U), K3 (Ap)	Flipped classroom	Group discussion	PPT, YouTube videos, Notes	Peer Review, Seminar, CIA I
III	**FEEDSTUFFS AVAILABLE FOR LIVESTOCK**								
	1	Roughages - Concentrates - Energy rich concentrates - Protein rich concentrates	2	1	K1 (R), K2 (U)	Jigsaw, Mind map	Co-operative learning	PPT, Notes	Quiz, Seminar, CIA I
	2	Mineral Supplements -Vitamin Supplements - Feed additives	2		K1 (R), K2 (U)	Collaborative learning, Inquiry based learning	Think – pair share	Notes	Mind map, Slip Test, Seminar, CIA I
	3	Feeding management - Calves Feeding - Feeding of adults	1	1	K1 (R), K2 (U)	Lecture using PPT, Blended learning	Students review	PPT, Notes	Oral Test, Open Book Test, CIA I
	4	Feeding of pregnant dairy animals - Feeding pregnant heifer.	2		K1 (R), K2 (U)	Lecture using PPT, Blended learning	Students review	PPT, YouTube videos, Notes	Online Assignment, CIA I
IV	**Milk**								
	1.	composition of milk - milk spoilage - pasteurization	2	1	K4 (An)	Mind map	Creative thinking	PPT, Notes	Slip test, Seminar, CIA I

	2.	role of milk and milk products in human nutrition	2		K5 (E)	Peer teaching	Group discussion	Notes	MCQ, Oral test, Seminar
	3.	Dairy products	1	1	K5 (E)	Experiential learning	Real life experience	YouTube videos, Notes	Class Test, Seminar, CIA II
	4.	Dairying as a source of additional income and employment.	2		K5 (E)	Chalk and board	Brainstorming	Notes	Brainstorming, Group Discussion, CIA II
V	**CONTAGIOUS DISEASE**								
	1.	Common Bacterial (Mastitis; Johne's Disease) – Protozoal (Coccidiosis; Theileriosis)	2	1	K2 (U), K3 (Ap)	Lecture using PPT	Group Discussion	PPT, YouTube videos, Notes	Oral Test, Assignment, Seminar, CIA II
	2.	Helminth (Tapeworm Infections; lung fluke)	1		K2 (U), K3 (Ap)	Blended learning	Students review	PPT, YouTube videos, Notes	MCQ, Assignment, Seminar, CIA II
	3.	Viral Diseases (Foot and Mouth Disease; Infectious Bovine Rhinotracheitis)	2	1	K2 (U), K3 (Ap)	Flipped classroom	Group Discussion	PPT, YouTube videos, Notes	Slip Test, Seminar, CIA II
	4.	Parasitic Infestation (Trypanosomiasis) - Vaccination - Biosecurity.	2		K2 (U), K3 (Ap)	Inquiry based learning	Peer interaction and Discussion	PPT, YouTube videos, Notes	Seminar, CIA II

CO-1 (R)**Course Focusing on Employability/ Entrepreneurship/ Skill Development:** Entrepreneurship

Activities (Em/ En/SD): Field visit

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues: Album preparation – Indigenous and exotic breeds of dairy cattle

Assignment: Helminth and parasitic infection in cattle

Seminar Topic:

1. Classification of breeds of cattle.
2. Indigenous and exotic breeds.
3. Artificial Insemination.
4. Selection of dairy cattle, Types of Housing (open housing, shed).
5. Roughages and Concentrates.
6. Energy rich concentrates and Protein rich concentrates.
7. Mineral Supplements, Vitamin Supplements.
8. Feed additives.
9. Composition of milk, milk spoilage.
10. Pasteurization of milk.
11. Role of milk and milk products in human nutrition.
12. Dairy products.
13. Vaccination schedule for different stages of Dairy Cow.

Sample questions

Part A

1. Which of the following is an indigenous dairy breed of cattle? **CO 1 (R)**
   a) Red Sindhi b) Chippiparai c) Kanni d) Kombai
2. Which of the following statements are correct? **CO-2 (U)**
   A. In double row housing, either the cattle face out from each other or face in towards each other.
   B. When the number of animals doesn't exceed 10, the double row system is desirable.

CO-4 (R) C. Animals get fresg air directly and the milking process can be effectively supervised in tail to tail system.

D. Sun rays reach the gutter and provide sanitation in head-to-head system.

a) All are correct b) 1, 3 and 4 are correct c) 2 and 3 are correct d) 1 is correct

3. Cattle feed includes roughage and concentrates. **State True/False** **CO 4 (An)**
4. The time and temperature used for the pasteurization of milk is _____. **CO 1 (R)**
5. **Assertion (A):** Foot and mouthy disease causes ulceration in mouth and hoof clefts. **CO 3 (Ap)**
   Reason (R): Foot and mouth disease is highly contagious.

a) Both A and R are correct

b) Both A and R are wrong

c) A is correct and R is wrong

d) A is wrong and R is correct

Part B

1. List the advantages of dairy farming. **CO 1 (R)**
2. What are the key components of a dairy farm's infrastructure? **CO 4 (An)**
3. Enumerate the feed additives for dairy cattle. **CO 1 (R)**
4. Summarise the composition of milk. **CO 2 (U)**
5. Recall the vaccination schedule for dairy cattle. **CO 1 (R)**

Part C

1. Describe artificial insemination in dairy cattle. **CO 3 (Ap)**
2. Discuss the key strategies and practices involved in the winter management of dairy cattle to ensure their health and productivity. **CO 3 (Ap)**
3. Examine the principles and practices of feeding adult dairy cattle to optimize milk Production. **CO 4 (An)**
4. Evaluate the multifaceted role of dairy products in contemporary society, considering their nutritional and economic dimension. **CO 5 (E)**
5. Explain the causative organism, symptoms and treatment for viral diseases in dairy cattle. **CO 2 (U)**

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