Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, Tamil Nadu.

Nationally Re-Accredited with A+ by NAAC IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF ZOOLOGY

POST-GRADUATE PROGRAMME

TEACHING PLAN

ODD SEMESTER 2024 – 2025

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

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

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

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, student will be able to:		
1.	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	**K1**
2.	Understand the evolutionary process. All are linked in a sequence of life patterns.	**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**

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I						
	1.	Structure and function in invertebrates: Principles of Animal taxonomy	5	K2 (U)	Brain storming, Cooperative learning	Quiz
	2.	Species concept;	4	K1 (R)	PPT video, Interactive teaching	Socratic questioning
	3.	International code of zoological nomenclature	3	K2 (U)	PPT Group discussion	formative questioning
	4.	Taxonomic procedures	5	K4 (An)	Seminar Interactive PPT	Interactive questioning, class test

	5.	New trends in taxonomy	4	K3 (Ap)	PPT, chalk and talk, You Tube Video	Exit tickets Oral questioning
II	1	Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates	4	K2 (U)	PPT, Animated video, Flipped classroom	Interactive questioning Assignment
	2	Protostomia and Deuterostomes	4	K3 (Ap)	Seminar Cooperative learning	Interactive questioning
	3	Locomotion: Flagella and ciliary movement in Protozoa	4	K3 (Ap)	Chalk and talk. You Tube Video	formative questioning, MCQ
	4	Hydrostatic movement in Coelenterata	3	K2 (U)	Integrative teaching	MCQ, Slip test
	5	Hydrostatic movement in Annelida	3	K2 (U)	PPT, Experiential learning	Assignment Poster making
	6	Hydrostatic movement in Echinodermata	3	K2 (U)	Inquiry based learning	Assignment Oral test
III	1	Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan	4	K3 (Ap)	Inquiry based learning	Objective test (Fill in the blanks), word splash
	2	Filter feeding in Polychaeta	3	K4 (An)	Group Discussion	MCQ, mind map
	3	Mollusca and Echinodermata.	4	K3 (Ap)	Case study (various organisms of Mollusca and Echinodermata)	Slip test, MCQ
	3	Respiration: Organs of respiration: Gills, lungs and trachea	6	K4 (An)	Brainstorming, Debate	Slip test, poster making
	4	Respiratory pigments	2	K2 (U)	Team Teaching	MCQ, Oral test
	5	Mechanism of respiration	2	K3 (Ap)	PPT, Lecture	Model making, seminar
IV	1	excretion: Organs of excretion:	2	K1 (R) K2 (U)	You tube videos, Chalk and board	Nearpod Collaborative

		coelom, coelomoducts				
	2	Nephridia and Malpighian tubules	2	K4 (An)	Library Reference	Oral test
	2	Mechanisms of excretion	2	K3 (Ap)	PPT & lecture, visual images	Traffic light and Mind mapping
	3	Excretion and osmoregulation	2	K3 (Ap)	Brainstorming, Interactive PPT	Four corner and Mind mapping
	4	Nervous system: Primitive nervous system: Coelenterata and Echinodermata	4	K4 (An)	Seminar, Peer group teaching, Group discussion.	Quizzes, Summarisation, Oral test
	5	Advanced nervous system: Annelida	2	K4 (An)	KWL, Interactive PPT	Think and pair, Oral test
	6	Arthropoda (Crustacea and lnsecta)	3	K1 (R)	Group discussion, Jigsaw method	Class test, just a minute
	7	Mollusca (Cephalopoda)	2	K3 (Ap)	Mind mapping, chalk and Board, lecture	Word splash, objective test
	8	Trends in neural evolution	2	K2 (U)	Blended learning, Lecture,	Oral test, Mind Map
V	1	invertebrate larvae: Larval forms of free-living invertebrates -	5	K2 (U)	Seminar, Collaborative learning	Ticket out the door method, Nearpod Collaborative
	2	Larval forms of parasites;	4	K4 (An)	Seminar, Jigsaw, Group Discussion	Quizzes, Oral test, Summarisation
	3	Strategies and Evolutionary significance of larval forms.	4	K2 (U)	Seminar, Interactive PPT, Index card	Short test with open ended question
	4	Minor Phyla: Concept and significance;	4	K4 (An)	Interactive PPT, Jigsaw	Think and pair, Oral test
	5	Organization and general characters	4	K4 (An)	Seminar & Index card, Chunking method	Four corner and Mind mapping, Quizzes

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability
Activities (Em/ En/SD): Structure of different excretory organs (Model making)
Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):

Activities related to Cross Cutting Issues :

Assignment : 1. Hydrostatic movement in Annelida and Arthropoda
Assignment : 2 . Model making: Excretory organs

Seminar Topics:

1. Principles of Animal taxonomy
2. ICZN
3. Taxonomic Procedures
4. New trends in taxonomy
5. Coelom and its types
6. Protostomia and Deuterostomes
7. Patterns of feeding and digestion in lower metazoan
8. Filter feeding in Mollusca
9. Respiratory pigments
10. Organs of excretion: coelom, coelomoducts
11. Mechanisms of excretion
12. Excretion and osmoregulation
13. Larval forms of free-living invertebrates
14. Strategies and Evolutionary significance of larval forms.
15. Organization and general characters of invertebrate.

Sample questions

Part A

1. Which of the following is a characteristic feature of Protostomia?
   A) The mouth develops from the blastopore.
   B) The anus develops from the blastopore.
   C) They exhibit radial cleavage during embryonic development.
   D) They have a notochord.
2. Coelomates have a body cavity completely lined with mesoderm. (**State True or False**)
3. The International Code of Zoological Nomenclature is essential for ensuring that each species has a unique and universally accepted _____.
4 **Assertion:** Annelida exhibits hydrostatic movement.
   Reason: Hydrostatic movement in Annelida is facilitated by the presence of a fluid-filled coelom that acts as a hydrostatic skeleton.
   A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
   B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
   C) Assertion is true, but Reason is false.
   D) Assertion is false, but Reason is true.
5. Expand ICZN.

Part B

1. Discuss the concept of species in animal taxonomy. How does the biological species concept differ from the morphological species concept?
2. Compare and contrast the embryonic development of Protostomia and Deuterostomia.
3. Explain the mechanisms of hydrostatic movement in Annelida. How does this mode of locomotion benefit these organisms in their natural habitats?
4. Describe the patterns of feeding and digestion in sponges (Phylum Porifera).
5. Outline the various organs of respiration found in invertebrates, including gills, lungs, and tracheae.

Part C

1. Describe the various taxonomic procedures used in classifying invertebrates. Discuss the significance of molecular techniques in modern taxonomy.
2. Compare and contrast the organization of the coelom in acoelomates, pseudocoelomates, and coelomates. Include in your answer a detailed description of the structural differences, functional implications, and evolutionary significance of each type.
3. Discuss the mechanisms of flagellar and ciliary movement in protozoans, including the structural basis and functional outcomes of these movements. Compare these mechanisms to the hydrostatic movement observed in coelenterates, annelids, and echinoderms.
4. Describe the diversity of respiratory and excretory systems in invertebrates. Include in your discussion the structure and function of gills, lungs, tracheae, nephridia, and Malpighian tubules.
5. Examine the evolution of the nervous system in invertebrates, from primitive to advanced forms. Describe the nervous systems of coelenterates, echinoderms, annelids, arthropods (crustacea and Insecta), and molluscs (Cephalopoda).

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. X. Venci Candida

Dr. A. Shyla Suganthi

Dr. C. Josephine Priyatharshini

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

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

Pre-requisite:

Students with knowledge and comprehension on Zoology.

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	analyze 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** - Analyze; **K5** - Evaluate

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment
I	**Origin of vertebrates** (21 Hrs.)					
	1.	Concept of Protochordata.	3	K1 (R) K2 (U)	Brainstorming & Group Discussion	Quiz, Slip Test, Oral Test
	2.	The nature of vertebrate morphology.	4	K2	Lecture method-using Chalk and talk	Rapid fire Test, Oral Test
	3.	Vertebrate Morphology: Definition.	3	K1 (R) K2 (U)	Problem solving, Integrative Teaching	Concept explanations, Summary writing
	4.	Scope of vertebrate morphology.	3	K2 (U) K3 (Ap)	Reflective Thinking, Lecture method, Flipped learning.	Class Test, Mind Map
	5.	Relation of vertebrate morphology to other disciplines,	4	K2 (U) K4 (An) K5 (E)	Review, Brainstorming and Lecture	Summary Writing, Peer Discussion

	6.	Importance of the study of vertebrate morphology.	4	K2 (U) K4 (An)	Peer tutoring, Lecture using PPT	Short test, Class Test
II	**Origin and classification of vertebrates** (21 Hrs.)					
	1.	Vertebrate integument and its derivatives.	3	K1 (R) K2 (U)	Group Discussion, Reflective Thinking	Surprise Test, Rapid Fire Test
	2.	Development of skin and its derivatives.	4	K1 (R) K2 (U)	Lecture using Chalk and talk, Group Discussion	Quiz, Short Essay, Concept explanations
	3.	General structure of skin and its derivatives.	4	K2 (U) K3 (Ap)	Lecture using videos, Collaborative Teaching	Illustrative Diagrams, Evaluation Essay
	4.	Functions of skin and its derivatives.	4	K1 (R) K4 (An)	Debate, Brainstorming and Illustrative Lecture	Short summary Class Test
	5.	Glands, scales, horns, claws.	3	K2 (U) K5 (E)	Demonstration, Interactive lecture using video links	Group Discussion, Slip Test
	6.	Nails, hoofs, feathers and hairs.	3	K2 (U) K4 (An)	Group Discussion, Review	Rapid fire test, Class Test
III	**General plan of circulation in various groups** (21 Hrs.)					
	1.	Blood.	3	K1 (R) K4 (An)	Brainstorming, Inquiry based learning	Oral Test, Group Discussion
	2.	Evolution of the heart.	3	K1 (R) K5 (E)	Lecture using videos, Illustrative lecture	Seminar, Album preparation
	3.	Evolution of aortic arches and portal systems.	4	K2 (U) K5 (E)	Lecture using PPT	Mind Map, Slip test,
	4.	Respiratory system: Characters of respiratory tissue.	3	K1 (R) K2 (U)	Blended learning, Group discussion	Seminar, MCQ
	5.	Internal and external respiration.	4	K1 (R) K5 (E)	Peer tutoring, Review	Open Book Test, Online assignment
	6.	Comparative account of respiratory organs.	4	K1 (R) K5 (E)	Brainstorming and Illustrative Lecture	Seminar, Class Test
IV	**Skeletal system** (21 Hrs.)					
	1.	Skeletal system: Form, function, body size.	3	K1 (R) K2 (U)	Collaborative teaching, Lecture using PPT	Seminar, Oral test
	2.	Skeletal elements of the body.	3	K1 (R) K4 (An)	Peer tutoring, Group discussion	Mind map, Open Book Test
	3.	Comparative account of jaw suspensorium.	4	K2 (U) K3 (Ap) K5 (E)	Cooperative learning, Lecture using PPT	Seminar, Illustrative diagram
	4.	Vertebral column.	3	K1 (R) K2 (U) K4 (An)	Reflective thinking - KWL	Home assignment
	5.	Limbs and girdles.	4	K1 (R) K5 (E)	Brainstorming, Context based	Peer review - MCQ

	6.	Evolution of Urinogenital system in vertebrate series.	4	K3 (Ap) K5 (E)	Demonstrative lecture & Cooperative learning	Seminar, Quiz questioning in the classroom
V	**Sense organs** (21 Hrs.)					
	1.	Simple receptors.	3	K1 (R) K2 (U) K4 (An)	Integrative Teaching	Seminar, Short test – Class test, Oral test
	2.	Organs of Olfaction and taste.	4	K1 (R) K2 (U) K5 (E)	Interactive lecture, Cooperative learning	Illustrative Diagrams - Online Assignment
	3.	Lateral line system; Electroreception.	3	K1 (R) K3 (Ap)	Illustrative Lecture, Prezi video, Peer teaching	Quiz, Seminar
	4.	Nervous system: Comparative anatomy of the brain in relation to its functions	4	K1 (R) K4 (An) K5 (E)	Brainstorming, Inquiry based learning	Mind map, Slip test
	5.	Comparative anatomy of spinal cord.	3	K1 (R) K4 (An) K5 (E)	Collaborative teaching using pictures/ charts	Diagram, Open Book Test
	6.	Nerves - Cranial, Peripheral and Autonomous nervous systems.	4	K1 (R) K4 (An) K5 (E)	Illustrative lecture, Group Discussion	Seminar, Preparation of study materials

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities for Employability

A. Debate on "Spines and Spikes on the skin of animals: Is it primarily for defense against predators or for territorial disputes?

B. Mind map on skeletal elements of the body.

C. **Group Discussion** on Peripheral nervous system.

D. Assignment & Seminar Topics:

1. The nature of vertebrate morphology.
2. Scope of vertebrate morphology.
3. Importance of the study of vertebrate morphology.
4. Development of skin in mammals.
5. Comparative Anatomy of the exocrine glands in vertebrates.
6. Comparative study of Nails in Vertebrates.
7. Comparative study of Hoofs in ungulates.
8. Comparative anatomy of feathers in birds.
9. Anatomy of the Hearts of birds and mammals.
10. Characters of respiratory tissue.
11. Lungs in vertebrates.
12. Accessory respiratory organs.
13. Locomotion and skeletal adaptation in vertebrates.
14. Jaw suspension in different vertebrates.
15. Anatomy of the vertebral column of a mammal (Rabbit).

16. Anatomy of the Limbs and Girdles of an amphibian (Frog).
17. Simple receptors in fishes.
18. Organs of olfaction and taste in reptiles.
19. Anatomy of the brain of a mammal (Man).
20. General account of the Autonomous nervous system.

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

Activities related to Environment Sustainability – Biodiversity

1. Flow Chart - Vertebrate integument and its derivatives.

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

3. Puzzles – Vertebrates & identification (clues)

Sample questions

Unit I

Part A (1 Mark)

Identify the Phylum to which Protochordata belongs.

a) Chordata b) Arthropoda c) Mollusca d) Protozoa

Part B (6 Marks)

Evaluate the scope of vertebrate morphology in comparison to other scientific fields.

Part C (12 Marks)

Analyze the significance of studying vertebrate morphology within the context of modern biology through the composition of an essay.

Unit II

Part A (1 mark)

Vertebrate integument includes feathers, scales, hoofs, and horns.

(State True or False)

Part B (6 Marks)

Describe the importance of vertebrate integument in protection, thermoregulation, and sensory perception.

Part C (12 Marks)

Explain the roles and adaptations of nails and hoofs in vertebrates.

Unit III

Part A (1 mark)

The coronary arteries

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.

Part B (6 Marks)

Enumerate the difference between internal and external respiration in vertebrates.

Part C (12 Marks)

Give a comparative account of respiratory organs in vertebrates.

Unit IV

Part A (1 mark)

Craniostylic jaw suspension is found in mammals. (State True/False)

Part B (6 Marks)

State the skeletal elements present in the body of a vertebrate.

Part C (12 Marks)

Evaluate the evolution of the urinogenital system in vertebrates.

Unit V

Part A (1 mark)

Cerebral hemispheres in Eutherians are connected internally by _____.

a) Corpus callosum b) Corpus luteum c) Corpus albicans d) Corpus aqueduct

Part B (6 Marks)

How do electroreceptors work in different vertebrates?

Part C (12 Marks)

Compare the anatomy of the spinal cord of different vertebrate groups.

Course Instructors

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Dr. Jeni Chandar Padua

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Head of the Department

Dr. A. Shyla Suganthi

Class : I M. Sc. **Elective – II (a)**

Title of the Course : Biomolecules and their Interaction

Semester : I

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP241EC1	3	1	-	1	3	5	75	25	75	100

Pre-requisite:

Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism, and functions of biomolecules.

Learning Objectives

1. Students should know the fundamentals of biochemistry.
2. To develop analytical and communicative skills to conduct experiments and interpret 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	Cognitive Level	Pedagogy	Assessment/ Evaluation
	Basics of biophysical chemistry and biochemistry:					
I	**1**	Structure of atoms, molecules and chemical bonds -	2	K1(R) K2(U)	Seminar PPT	Presentation
	2	Stabilizing interactions in biomolecules: stability of protein and nucleic acid structures	3	K1(R) K2(U)	Brain storming Interactive PPT	Traffic light Class test
	3	Hydrogen bonding, covalent bonding, hydrophobic interactions, and disulfide linkage.	2	K1(R) K2(U)	Making Models	Peer review Presentation Oral test

	4	pH and Hydrogen ion concentration - buffers - 'Henderson-Hasselbalch' equation - buffer systems in blood - acidosis and alkalosis	3	K2(U) K3(Ap)	Inquiry-Based Learning - KWL. Experiments	MCQ Assessing Experiments
	5	Water – colligative properties - water turnover and balance - electrolyte balance - dehydration and water intoxication.	3	K4 (An)	Interactive presentations PPT	Traffic lights. Short test
	6	Thermodynamics - Enzyme kinetics	2	K2 (U)	Interactive PPT , Video	Four corner Short test
II	**Carbohydrates**					
	1	Classification, structure, properties of mono, oligo and polysaccharides and biological role of carbohydrates.	3	K1(R) K2 (U)	Seminar Video Creative projects - Models	Short test Presentation
	2	Carbohydrate metabolism - glycogenesis, glycogenolysis, glycolysis, Krebs cycle,	3	K2 (U) K3(Ap)	Flipped classroom - Index card You Tube video	Traffic lights. MCQ Mind mapping
	3	Electron transport and Oxidative phosphorylation, Energetics of glucose metabolism	3	K2 (U) K4 (An)	Role play interactive presentation You Tube video	Mind mapping Short test, Naming the molecules in a flow chart
	4	Pasteur effect– HMP shunt - gluconeogenesis - glyoxylate pathway - Cori cycle.	3	K2 (U) K5 (E)	Collaborative learning – Jigsaw You Tube video	Mind mapping Short test, Quiz
	5	Regulation and hormonal control of carbohydrate metabolism.	3	K1(R) K2(U) K5(E)	Collaborative learning - Peer group teaching.	Mind mapping MCQ
III	**Proteins:**					
		Classification, structure, Ramachandran plot, properties and biological role.	3	K1(R) K2(U)	Seminar Interactive presentation, PPT , Video	Presentation Flow Chart MCQ

	2	Amino acids - classification, structure and properties	3	K1(R) K2(U)	Seminar Drawing molecular structure	Presentation
	3	Metabolism of proteins - deamination, transamination - transmethylation and decarboxylation of amino acids	4	K2 (U) K3(Ap)	Collaborative learning - Roleplay	MCQ, Mind mapping Naming molecules
	4	Glycogenic and ketogenic amino acids - formation and transport of ammonia -	3	K2 (U) K4 (An)	Inquiry based learning. Video Seminar	Short test Quiz Presentation
	5	Glucose-alanine cycle - Ornithine cycle.	2	K1(R) K2(U)	Seminar Index card	Presentation
IV	**Lipids**					
	1	Classification, structure and biological role - chylomicrons,	3	K2(U) K4(An)	Interactive presentations PPT	Traffic lights. MCQ Mind mapping
	2	VLDL, LDL, HDL - Lipid metabolism - theories of oxidation of fatty acids	4	K2(U) K3(Ap)	Seminar, Collaborative learning - Roleplay	Presentation
	3	Oxidation of any one fatty acid and its bioenergetics (palmitic acid) -ketogenesis - biosynthesis of palmitic acid	3	K2(U) K4(An)	Seminar, Collaborative learning - Peer group teaching.	MCQ, Mind mapping Naming molecules
	4	metabolism of cholesterol. Integration of carbohydrate, protein and lipid metabolism	2	K2 (U) K3 (Ap)	Collaborative learning – Jigsaw You Tube video	Mind mapping MCQ
V	**Nucleotide, Enzymes and Vitamins:**					
	1	Biosynthesis and degradation of purines and pyrimidines. Enzymes: classification, nomenclature,	4	K1 (R) K2(U)	Flipped classroom - Index card You Tube video	MCQ, Mind mapping Naming molecules
	2	Michaelis - Menten constant, enzyme inhibition, mechanism of enzyme action, factors affecting	4	K2(U) K4 (An)	Seminar, Collaborative learning - Roleplay	Mind mapping MCQ

		enzyme activity, isozymes, coenzymes.				
	3	Vitamins: Classification and structure of fat soluble and water soluble, biochemical role of vitamins. Biosynthesis of vitamin C.	4	K2(U) K4(An)	Seminar, Interactive presentations PPT	Traffic lights. MCQ Mind mapping

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

Activities (Em/ En/SD): Analysing biochemicals of a solution

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

Activities related to Cross Cutting Issues:

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. Classification, structure and properties of mono, oligo, and polysaccharides
6. Biological role of carbohydrates.
7. Carbohydrate metabolism – glycogenesis and glycogenolysis
8. Classification, structure and properties of proteins
9. Classification, structure and properties of Amino acids.
10. Glycogenic and ketogenic amino acids.
11. Glucose-alanine cycle and Ornithine cycle.
12. LDL
13. HDL
14. Biosynthesis of palmitic acid
15. Integration of protein metabolism
16. Integration of lipid metabolism
17. Mechanism of enzyme action
18. Isozymes, coenzymes.
19. Factors affecting enzyme activity
20. Fat soluble vitamins
21. Water soluble vitamins
22. Biochemical role of vitamins

Sample questions

Part A

1. Which of the following colligative properties not is correctly associated with an aqueous solution of water?

a) Elevation of boiling point b) Reduction of vapor pressure c) Depression of freezing point d) Specific gravity

2. Catalyzing biochemical reactions is the biochemical role of carbohydrates **True / False**

3. **Assertion (A)**: Amino acids are amphoteric compounds
   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

4.The molecule which acts directly on an enzyme to lower its catalytic rate is _____
a) Repressor b) Inhibitor c) Modulator d) Regulator

6. Which of the following represents the two-dimensional structure of proteins?
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.

2. Discuss the role of pH in enzyme activity, metabolic processes, and homeostasis

3. Explain different types of carbohydrates

4. Differentiate VLDL, HDL, LDL and its clinical significance

5. Evaluate the competitive inhibition.

Part C

1. Analyze the concept of pH and its importance in biological systems

2. Discuss the structure of carbohydrates and their various functions in living organisms

3. Additionally, discuss how the presence of amino groups affects the chemical properties and biological functions of molecules.

4. Analyse the Michaelis Menten Hypothesis in enzyme kinetics.

5. Evaluate the fat-soluble vitamins.

Course In charge **Head of the Department**

Dr. A. Punitha Dr. F. Brisca Renuga **Dr. A. Shyla Suganthi**

Class : I M. Sc. **Elective – II (a)**
Title of the Course : Biostatistics
Semester : I

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC4	3	1	-	1	3	5	75	25	75	100

Pre-requisite:
Students should be aware of the importance of analysis of quantitative and qualitative information from biological studies

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

Cos	Upon completion of this course the students will be able to:	CL
CO1	recall different biological data, methods of collection and analysis of data.	K1
CO2	comprehend the design and application of biostatistics relevant to experimental and population studies.	K2
CO3	acquire skills to perform various statistical analyses using modern statistical techniques and software.	K3
CO4	analyze the data and interpret the results manually or by using software	K4
CO5	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 Modules
Total Contact hours: 75 (Including lectures, assignments, and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**12 hrs**					
	1.	Definition, scope and application of statistics; Primary and secondary data: Source and implications;	3	K1 (R)	Introductory session, Group Discussion	Concept explanations, short summary or overview
	2.	Classification and tabulation of biological data: Types and applications. Variables: Definition and types.	3	K2 (U)	Mind mapping, Peer tutoring, Review	Simple definitions, MCQ, Concept definitions

	3.	Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve;	3	K2 (U) K3 (Ap)	Lecture using ppt, Problem solving,	Solve problems, Explain
	4.	Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.	3	K4 (An)	Lecture using ppt, Problem solving	Problem-solving questions, Analysis, and diagrammatic representation of data
II	**15 hrs**					
	1.	Measures of central tendency: Mean, median and mode for continuous and discontinuous variables.	6	K2 (U) K3 (Ap) K4 (An)	Problem solving Demonstration	Suggest formulae Recall steps
	2.	Measures of dispersion: Range, variation	2	K2 (U) K3 (Ap)	Problem solving	Discussion, Presentations
	3.	Standard deviation, standard error, and coefficient of variation.	4	K2 (U) K3 (Ap) K4 (An)	Problem solving, Applying experimental data	Evaluation through short test
III	**12 hrs**					
	1.	Probability: Theories and rules	2	K1 (R) K2 (U)	PPT & problem-based approach	Simple definitions – short questions
	2.	Probability - Addition and multiplication theorem	4	K2 (U) K3 (Ap) K4 (An)	Gamification and problem solving	Giving exercises and solve problems
	3.	Probability distribution: Properties and application of Normal distribution	3	K2 (U) K3 (Ap)	Lecture & Thinking-based learning,	Discussion, problem solving
	4.	Binomial and Poisson distributions.	3	K3 (Ap) K4 (An)	Lecture, Thinking-based learning,	Short test, MCQ
IV	12 hrs					
	1.	Hypothesis testing: Student '*t*' test - paired sample and mean difference '*t*' tests.	4	K4 (An) K5 (E)	Problem-based approach, flipped classroom	Analyze and interpret problems

	2.	Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients.	4	K3 (Ap) K4 (An) K5 (E)	Lecture, PPT, Analyzing problems and visualizations	Simple test on formulae and Problem solving
	3.	Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.	4	K3 (Ap) K4 (An) K5 (E) K6 (C)	PPT & Analyzing visualizations	Identification of the apt method to solve the problem
V	**12 hrs**					
	1.	Analysis of variance: one way classification	4	K2 (U) K4 (An)	Lecture – ppt Problem solving	Problem solving
	2.	two-way classification.	3	K2 (U) K4 (An)	Lecture – ppt Problem solving	Problem solving
	3.	Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).	4	K2 (U) K3 (Ap) K4 (An)	Tutorial video, usage of software	Short test

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 and Human values.

Activities related to Cross Cutting Issues: Statistical analysis of a data, role in environmental sustainability and public health research

Assignment: Perform an experiment and analyze data

Seminar topics

1. Primary data
2. Secondary data
3. Classification of biological data
4. Variables -Types
5. Tabulation.
6. Graphical Presentation of data
7. Diagrammatic Presentation of data
8. Measures of central tendency: Mean
9. Measures of central tendency: Median
10. Measures of dispersion: SD
11. Hypothesis testing
12. Probability - theorems
13. Normal distribution
14. Binomial Distribution
15. Poisson Distribution
16. Correlation
17. Regression
18. Student 't' test
19. ANOVA (2 students)
20. SPSS (2 students)

Sample questions

Part A

1. Choose the correct answer

A. Exhaustive event - 1) Same chances of occurrence
B. Complementary event – 2) Not at a same time
C. Mutually Exclusive - 3) A group of events
D. Equally likely – 4) More than one sample space

	A	B	C	D
a)	1	3	2	4
b)	2	3	4	1
c)	4	1	3	2
d)	3	4	2	1

2. Suppose that you have the following set of numbers: 8, 2, 5, 3, 6, 7, 4, 5. What is the mean value?

a. 5 b. 4.25 c. 4 d. 6

3. When the difference between expected and observed frequencies is not significant the hypothesis is ----------.

a) Accepted b) Rejected c) Significant d) Zero

4. Evaluate: (i) ${}_7C_4$

5. In conducting One way ANOVA, which of the following test statistics would be used?

a. Z b. t c. X^2 d. F

Part B

1. Following are the number of students undergoing different courses in a college. Represent it as a pie diagram.

Courses	B. Sc	B. A	B. Com	M.Sc.	M.A	M. Com
N0: of students	505	540	220	260	240	50

2. What is median? Give its formula and applications.
3. Discuss the biological applications of chi-square analysis.
4. Calculate the correlation co-efficient 'r' between protein density in the diet (x) and food consumption of a fish (y).

X	25	30	34	40	45	50
Y	40	34	30	28	26	25

5. Discuss the features of SPSS.

Part C

1. What is Data? Explain the types and the methods of collection.
2. Find the standard deviation for the following data.

Height (cm) x	152	164	154	162	156	160	158
No of students	5	2	9	16	13	20	15

3. Calculate Spearman's rank correlation for the following data of marks obtained by 10 PG students in evolution and biostatistics.

Evolution	80	38	95	30	74	84	91	60	66	40
Biostatistics	85	50	92	58	70	65	88	56	52	46

4. The data given below are the weight of the fish (X) and weight of liver (Y). Compute regression equation on weight of the fish and weight of the liver.

X	16	22	24	32	34	38	45
Y	2	2.5	3.0	4.0	4.5	5.0	6

5. The following data represents the length of one month old Catla grown with three different food formulations. Analyze these data for the difference among food formulations in terms of fish growth using ANOVA.

Formulation A	**Formulation B**	**Formulation C**
16	14	18
13	17	14
11	21	10
15	15	12
19	17	15

Head of the Department **Course Instructor**

Dr. A. Shyla Suganthi Dr. Vinoliya Josephine Mary

Dr. A. Shyla Suganthi

Class : II M.Sc. Core Course V
Title of the Course : Genetics and Evolution
Semester : III

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP233CC1	5	-	-	1	5	6	90	25	75	100

Pre-requisite:
Students should have a foundational understanding of basic biological concepts.
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

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Mendelian Genetics (**18 Hrs.)					
	1	Mendelian principles. Gene interactions – complementary, Supplementary and epistatic.	6	K1 (R) K2 (U) K5 (E)	Blended Learning, Illustrative lecture	Flow Chart, Hands-On Activity with beads
	2	Multiple allelism.	1	K1 (R) K2 (U) K3 (Ap)	Inquiry based learning, Interactive Lectures	Think-Pair-Share, Quiz
	3	Linkage and crossing over – types – mechanism – theories.	3	K1 (R) K4 (An) K5 (E)	Peer group Teaching	Seminar, Peer Assessment
	4	Chromosome mapping - Linkage maps, tetrad analysis Mapping with molecular markers and somatic cell hybrids.	4	K1 (R) K2 (U) K5 (E)	Flipped classroom, Problem-Based Learning	Slip test, Assignment
	5	Polygenic inheritance. Heritability and its measurements.	4	K2 (U) K3 (Ap) K4 (An)	Brainstorming, Group Discussion.	Oral test, Class notes

II	**Molecular and Human Genetics** (18 Hrs.)					
	1	Gene concept. Mutation - types and effects of gene mutation. Mutagens – chromosomal mutation.	4	K2 (U) K3 (Ap) K5 (E)	Cooperative Learning, Direct Instruction	Quiz
	2	DNA damage and repair.	2	K1 (R) K2 (U)	Collaborative Learning	Seminar
	3	Human chromosomes, Karyotyping, Chromosomal banding and painting Pedigree analysis.	4	K3 (Ap) K4 (An)	Illustrative lecture	Open book Test
	4	Genetic Disorders - Phenylketonuria, Alkaptonuria, albinism, Gout, ADA deficiency,	4	K2 (U) K3 (Ap) K4 (An)	Brainstorming, Group Discussion	Seminar, Flow Chart
	5	Genetic Disorders - Von Gierke's disease, G6PD deficiency, Tay Sach's disease, Gaucher's disease, sickle cell anemia, thalassemia. Genetic counseling.	4	K2 (U) K3 (Ap) K5 (E)	Cooperative learning, Group discussion	Seminar, Slip Test
III	**Population Genetics and Evolution** (18 Hrs.)					
	1	Mendelian populations Hardy Weinberg law and genetic equilibrium.	3	K1 (R) K3 (Ap)	Brain Storming, Interactive class	Seminar Assignment
	2	Calculation of gene frequencies: for autosomal - dominant and recessive alleles	3	K1 (R) K2 (U)	Group Discussion, Lecture	Slip test, Quiz
	3	Calculation of gene frequencies: for Codominant alleles, Multiple alleles.	3	K1 (R) K2 (U)	Group Discussion, Lecture	Seminar Oral test
	4	Elementary evolutionary forces. Genetic load and death	3	K1 (R) K3 (Ap) K4 (An)	Blended Learning, Interactive Lectures	Recall key terms short answers
	5	Elementary evolutionary forces neutralist hypothesis, genetic polymorphism.	3	K1 (R) K3 (Ap) K4 (An)	Blended Learning, Interactive Lectures	Seminar Oral test
IV	**Molecular evolution** (18 Hrs.)					
	1	Origin of life. Principles of molecular evolution studies.	3	K1 (R) K5 (E)	Brainstorming, Interactive class	Slip test, Class test
	2	Molecular clock.	3	K2 (U) K5 (E)	Interactive class	Oral test

	3	Phylogenetic tree - Distance Matrix and Parsimony based approach	3	K2 (U) K4 (An) K5 (E)	Flipped classroom, Direct Instruction	Oral test, Short test
	4	Kinds of molecular phylogenies – Universal Tree of Life.	3	K2 (U) K4 (An) K5 (E)	Flipped classroom, Direct Instruction	Oral test, Short test
	5	Phylogenetic and biological concept of species.	3	K3 (Ap) K4 (An) K5 (E)	Cooperative learning, Illustrative explanation	MCQ, Slip test
	6	Speciation - allopatric and sympatry. Adaptive radiation	3	K3 (Ap) K4 (An) K5 (E)	Illustrative explanation	Seminar Oral test
V	**Origin of higher categories** (18 Hrs.)					
	1	Major trends in the origin of higher categories. Microevolution, macroevolution, Mega-evolution and Co-evolution.	4	K1 (R) K4 (An) K5 (E)	Blended Learning, Interactive Lectures	Graphic Organizer, Peer Assessment
	2	Evolution rates, Phyletic gradualism, Punctuated equilibrium.	3	K1 (R) K4 (An) K5 (E)	Inquiry based learning, Illustrative lecture	Mind Map, Short test
	3	Origin and Evolution of Primates. Evolution of Anthropoid Primates The First hominids.	4	K3 (Ap) K4 (An) K5 (E)	Cooperative Learning, Direct Instruction	Flow Chart
	4	Australopithecines and origin of modern man – Bipedalism –	3	K3 (Ap) K5 (E)	Flipped classroom, Problem-Based Learning	Mind map
	5	Communication - Speech – language - Altruism and morality.	4	K3 (Ap) K5 (E)	Collaborative Learning, Project-Based Learning	Comprehension

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

Activities for **Skill Development**

1. Problem-Based Learning of Mendelian principles
2. Problem based learning on Hardy Weinberg law
3. Album on evolution of man

Activities related to Cross Cutting Issues: Pedigree analysis

Seminar / Home assignment Topics

1. Monohybrid Cross
2. Dihybrid cross

3. Complementary and supplementary Gene interactions
4. Multiple allelism.
5. DNA damage and repair
6. Disorders of amino acid metabolism (phenylketonuria, alkaptonuria, and albinism).
7. Human Chromosomes
8. Haemoglobin disorders (sickle cell anomia, thalassemia).
9. Hardy Weinberg law
10. Pedigree analysis.
11. Calculation of gene frequencies: for autosomal - dominant and recessive alleles
12. Calculation of gene frequencies: for dominant and recessive alleles
13. Origin of life
14. Molecular Clock
15. Phylogenetic tree - Distance Matrix and Parsimony based approach.
16. Universal tree life
17. Microevolution
18. Macroevolution and Mega-evolution
19. Origin of modern man
20. Altruism and morality.

Sample Questions

Part A (1 mark)

1. **Assertion (A)**: Mendel's experiment had a small sampling size. **(CO2; U)**
   Reason (R): It gave greater credibility to the data that he collected.
   a) Both assertion and reason are true.
   b) Assertion is false but reason is true.
   c) Assertion is true but reason is false.
   d) Both assertion and reason are false.
2. **Match the following (CO4; An)**

Deletion	-	1) Reverse order of chromosome
Duplication	-	2) Repeat of chromosome
Inversion	-	3) Exchange of chromosome
Translocation	-	4) Lose of chromosome

3. What is the formula to calculate gene frequency?

4. **Assertion (A):** Adaptive radiation results in the diversification of a single ancestral species into multiple distinct species. (An) (CO-4)
Reason (R): Adaptive radiation occurs because different populations of the ancestral species adapt to distinct ecological niches
   a) Statement A is correct and statement R is wrong
   b) Statement A is wrong and statement R is correct
   c) Both Statement A and R is wrong
   d) Both Statement A and R is correct

5. Which of the following best characterizes situations in which the evolution of two or more species is mutually influenced?

a) Microevolution b) Macroevolution c) Mega evolution d) Coevolution

Part B

1. Illustrate the mechanism of linkage. **(CO3; Ap)**
2. Appraise Gene concept. **(CO5; E)**
3. How will you do dialysis to treat renal diseases? **(CO1; R)**
4. Differentiate allopatry and sympatry with an example each. **(CO5; E)**
5. What are the key differences between micro and megaevolution. **(CO1; R)**

Part C

1. Demonstrate Laws of Mendelian inheritance. **(CO2; U)**
2. Examine the disorders of amino acid metabolism. **(CO4; An)**
3. Evaluate Hardy-Weinberg principle used in evolutionary biology studies? **(CO5; E)**
4. Discuss the kinds of molecular phylogenies with an example each. **(CO6; C)**
5. How did bipedalism impact human evolution? **(CO1; R)**

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

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

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

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

Pre-requisite:

Students should have fundamentals of different organ system.

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 system 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

Teaching Plan

Total Hours: 90 (Incl. Seminar & Test)

Unit	Module	Topic	Teaching Hrs	Cognitive Level	Pedagogy	Assessment/ Evaluation
	Nutrition					
I	1.	Types of nutrition and feeding mechanisms in animals.	3	K1(R)	Brain Storming, Inquiry based Teaching	Mind map, Seminar
	2.	Functional anatomy of the digestive system of man.	4	K1(R)	Blended Learning	Illustration
	3.	Movements of gastrointestinal tract.	4	K2(U)	Collaborative Learning	Assignment
	4.	Secretory functions of the alimentary tract and glands, digestion and absorption.	3	K4(An)	Flipped classroom, Reflective thinking	Class test, Seminar
	5.	Gastrointestinal disorders - Gallstones, liver cirrhosis, gastritis,	4	K5(E)	Integrative teaching	Seminar, Group Discussion

		peptic ulcer and appendicitis.				
II	**Respiration and Homeostasis**					
	1	Functional anatomy of the respiratory system of man, transport of respiratory gases.	**3**	K1(R) K2(U)	Seminar Interactive presentation	Short test
	2	Regulation of respiration, respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis.	**3**	K2(U) K3(Ap)	Index card Cooperative learning	MCQ
	3	Homeostasis- Osmoregulation - types and mechanism	**2**	K2(U) K4(An)	Problem based learning	Exhibition
	4	Thermoregulation – classification and mechanism.	**2**	K2(U) K5(E)	Seminar Interactive presentation	Exhibition
	5	Deep sea physiology, High altitude and space physiology	**3**	K5(E)	Interactive presentation	Exhibition
	6	Bioluminescence - physiology and functions.	**2**	K1(R) K2(U)	Seminar	Oral test, Mind Map
III	**Circulation**:					
	1	Haemopoiesis, Blood clotting. Myogenic and neurogenic heart.	**3**	K1(R) K2(U)	Seminar & Index card, Chunking method	Word splash, objective test
	2	Functional anatomy of the human heart.	**3**	K1(R) K2(U)	Interactive PPT, Jigsaw	Class test, just a minute
	3	Cardiac cycle, pacemaker, heart rate, regulation of cardio-vascular system.	**4**	K3(Ap)	Seminar, Interactive PPT, Index card	Think and pair, Oral test
	4	Heart diseases - atherosclerosis, coronary thrombosis and angina pectoris, Angiogram and Angioplasty	**4**	K2(U) K4(An)	Seminar, Jigsaw, Group Discussion	Quizzes, Summarisation , Oral test
	5	Lymphatic system - organization, composition and functions.	**4**	K1(R) K2(U)	Seminar, Collaborative learning	Four corner and Mind mapping
IV	**Neuro-muscular system**					
	1	Structure neuron & neurotransmitters,	**4**	K1 (R) K2 (U)	Collaborative learning -	Quiz Short test

		synapse, nerve impulse conduction.			Peer group teaching. Roleplaying of nerve conduction	Presentation
	2	reflex activity, electroencephalogram (EEG), MRI	4	K2 (U) K3 (Ap)	Flipped classroom You tube video Drawing activities	Labelling the parts Oral test Short test
	3	Neural disorders - meningitis and epilepsy	1	K2 (U) K3(Ap)	Seminar Interactive PPT Video	Presentation
	4	Types of muscle, structure, Properties of skeletal muscle.	3	K1 (R) K2 (U)	Seminar Interactive PPT Video	Presentation
	5	Neuromuscular junction and mechanism of muscle contraction, neuromuscular junction.	4	K2 (U) K3 (Ap)	Flipped classroom You tube video Inquiry Based learning Interactive PPT	Exit tickets Short test Viva voce
	6	Sense organs - structure and functions of skin and eye.	**2**	K1 (R) K2 (U)	Collaborative learning - Jigsaw Seminar - Interactive PPT Video	Model making Presentation
V	**Excretion and Reproduction**					
	1	Patterns of excretion, structure and function of kidney of man, nephron,	**3**	K1 (R) K2 (U)	Brain storming- Inquiry Based learning- Interactive PPT	Quiz Oral test Presentation
	2	Formation of urine – counter current mechanism, micturition,	**4**	K1 (R) K2 (U)	Flipped classroom You tube video Drawing activities	Four corner Class test

	3	renal disorders – nephritis, renal calculi, dialysis	**1**	K1 (R) K2 (U)	Problem based learning – real life scenario. Model making	Presentation Traffic light Quiz
	4	Structure of human testis and ovary .	**3**	K1 (R) K2 (U)	Collaborative learning – Jigsaw Flipped class room - video	Drawing and labelling parts
	5	Oestrus and menstrual cycle, ovulation.	**3**	K1 (R) K3 (Ap)	Problem based learning – real life scenario	Short test and class test
	6	pregnancy, parturition and lactation, hormonal regulation of reproduction	**4**	K1 (R) K3 (Ap)	Inquiry Based learning Interactive PPT	Presentation Four corners Exit tickets

Course Focussing on Employability/ Entrepreneurship/ Skill Development:

Employability and Skill Development

Activities (Em/ En/SD): Models 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:

Assignment: Model making - Gastrointestinal disorders, respiratory problems, heart diseases, skin and eye, nephritis, renal calculi, dialysis.

Seminar Topics

1. Feeding mechanisms in animals.
2. Secretory functions of the alimentary tract.
3. Gastrointestinal disorders - Gallstones, liver cirrhosis.
4. Gastrointestinal disorders - gastritis, peptic ulcer and appendicitis.
5. Structure and function human respiratory organ
6. Transport of respiratory gases.
7. Respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis.
8. Functional Anatomy of Human Heart
9. Heart diseases - atherosclerosis, coronary thrombosis and angina pectoris
10. Composition and function of lymphatic system
11. Cardiac Cycle
12. Types and structure of muscle.
13. Properties of skeletal muscle.
14. Structure and functions of skin
15. Structure and functions eye.
16. Neural disorders - meningitis and epilepsy.

17. Patterns of excretion.
18. Structure and function of kidney.
19. Renal disorders – nephritis, renal calculi, dialysis.
20. Structure and functions of testes.

Sample questions

Part A

1. Match the following and choose the correct answer

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?
a) Trachea b) Larynx c) Bronchi d) Pharynx

.

3. Vitamin B12 and folic acid are necessary for the maturation of RBCs. **True or False**

4. .**Assertion (A**): Botulinum Toxin is a neuromuscular blocker
Reason (R): It prevent transmission of impulses from nerve fiber to the muscle fiber.
e) Statement A is correct, but B is wrong
f) Statement A is wrong and B is correct
g) Statement A and B are wrong
h) Statement A and B are correct

5. Expand FSH.

Part B

6. How do villi and microvilli contribute to the efficiency of nutrient absorption in the small intestine?
7. Examine how factors such as pH and temperature influence the binding and release of oxygen by hemoglobin.
8. . Describe the causes and symptoms for Angina pectoralis
9. Explain the mechanism of muscle contraction.
10. Discuss the different patterns of excretion in animals.

Part C

6. Discuss the significance of enzyme specificity in the breakdown of different types of nutrients.
7. Discuss the role of the hypothalamus in thermoregulation, including its thermoregulatory set point and feedback mechanisms.
8. Describe the process of blood clotting.
9. Write about the structure of the eye and explain the physiology of vision.
10. What is tubular reabsorption? Evaluate the mechanism of tubular reabsorption.

Head of the Department **Course In charge**

Dr. A. Shyla Suganthi Dr. F. Brisca Renuga
Dr. X.Venci Candida
Dr. C. Anitha

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

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

Pre-requisite
Students should have the basic understanding of animal biology, strong observational and analytical skills.

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

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/
I	**Understanding Animal Behaviour** (12 Hrs.)					
	1	Significance and need for studying animal behavior,	1	K1 (R), K2 (U)	Brain Storming & Group Discussion	Quiz, Slip Test, Oral Test
	2	Approaches to behavioural studies, Genetic basis of behavior,	2	K2 (U)	Lecture method-using Chalk and talk	Rapid fire Test, Oral Test

	3	Heritability of behaviour,	2	K1 (R) K4 (An)	Problem solving, Integrative Teaching	Concept explanations, Summary writing
	4	Habitat and its impact on influencing behavior,	3	K2 (U)	Reflective Thinking, Lecture method, Flipped learning.	Class Test, Mind Map
	5	Social interactions and their role in shaping behavior,	2	K2 (U), K5 (E)	Review, Brain storming and Lecture	Summary Writing, Peer Discussion
	6	Ethology and recording animal behaviour.	2	K2 (U) K3 (Ap)	Peer tutoring, Lecture using PPT	Short test, Class Test
II	**Evolution and Social Behavior:** (12 Hrs.)					
	1	**I**mpact of natural selection on social behavior,	1	K1 (R) K2 (U)	Group Discussion, Reflective Thinking	Surprise Test, Rapid Fire Test
	2	sexual selection, altruism,	3	K1 (R) K2 (U)	Lecture using Chalk and talk, Group Discussion	Quiz, Short Essay, Concept explanations
	3	mating systems, sexual strategies.	2	K2 (U), K3 (Ap)	Lecture using videos, Collaborative Teaching	Illustrative Diagrams, Evaluation Essay
	4	Exploring social organization and animal perception,	1	K1 (R) K4 (An)	Debate, Brain storming and Illustrative Lecture	Short summary Class Test
	5	communication within social animals, group living dynamics	2	K2 (U) K5 (E)	Demonstration, Interactive lecture using video links	Group Discussion, Slip Test
	6	parental care, visual adaptations in challenging environments.	3	K2 (U) ,K4 (An)	Group Discussion, Review	Rapid fire test, Class Test
III	**Animal and the Environment** (12 Hrs.)					
	1	Habitat selection, Coordination and Orientation,	2	K1 (R), K2 (U)	Reflective Thinking, Lecture method, Flipped learning.	Rapid fire Test, Oral Test
	2	Homeostasis and Behaviour,	2	K2 (U)	Review, Brain storming and Lecture	Concept explanations, Summary writing
	3	Physiology and Behaviour in changing environments,	2	K1 (R) K3 (Ap)	Peer tutoring, Lecture using PPT	Class Test, Mind Map
	4	Conditioning and Learning, Biological aspects of learning,	2	K2 (U)	Brain Storming & Group Discussion	Group Discussion, Slip Test

	5	Cognitive aspects of learning. Foraging behaviour,	2	K2 (U), K4 (Ap)	Interactive Lecture method, Cooperative learning	Rapid fire test, Class Test
	6	Competition, Environmental challenges and stressors.	2	K1 (R) K5 €	Problem solving, Integrative Teaching	Class Test, Mind Map
IV	**Understanding Complex Behaviour** (12 Hrs.)					
	1.	Instinct, learning, Cognition and Memory,	3	K1 R) K2 (U)	Problem solving, Integrative Teaching	Illustrative Diagrams, Online Assignment
	2.	Decision making behaviour in Animals, Mechanism of Decision making,	3	K1 (R) K3 (Ap)	Reflective Thinking, Flipped learning, Lecture method	Quiz, Concept explanations, Seminar
	3.	Complex reproductive behaviours,	1	K2 (U), K4 (An)	Review, Brain storming and Lecture	Concept explanations, Summary writing
	4.	Complex behaviour of honey bees,	2	K2 (U), K5 €	Reflective thinking , Group Discussion	Home assignment
	5.	Languages and mental representation,	1	K1 (R), K2 (U)	Brainstorming, Context based	Peer review - MCQ
	6.	Animal awareness and Emotion	2	K2 (U), K3 (Ap)	Demonstrative lecture & Cooperative learning	Seminar, Quiz questioning in the classroom
V	**Chronobiology** (12 Hrs.)					
	1.	Circadian Rhythm, Biological Clock,	2	K1 (R) K2 (U)	Integrative Teaching, Debate	Seminar, Short test – Class test, Oral test
	2.	Concept of central and peripheral clock system; Circadian pacemaker system;	3	K1 (R), K3 (Ap)	Interactive lecture, Cooperative learning	Illustrative Diagrams, Online Assignment
	3.	Photoperiodism, Influence of circadian rhythms on mating, feeding, and other behaviors,	1	K2 (U), K4 (An)	Illustrative Lecture, Prezi video, Peer teaching	Quiz, Seminar
	4.	Ultradian and Infradian Rhythms,	2	K1 (R) K2 (U)	Brainstorming, Inquiry based learning	Mind map, Slip test
	5.	Chronobiology and Aging, Chrono pharmacology,	3	K1 (R), K5 E	Collaborative teaching using pictures/ charts	Diagram, Open Book Test
	6.	chrono medicine, chronotherapy.	1	K1 R) K2 (U)	Illustrative lecture, Group Discussion	Seminar, Preparation of study materials

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em/ En/SD): **Employability**

1. Debate on Heritability of behaviour.
2. Group Discussion on the Conditioning and Learning

Assignment & Seminar Topics:

1. Significance and need for studying animal behavior,
2. Approaches to behavioural studies,
3. Genetic basis of behavior,
4. Heritability of behaviour,
5. Habitat and its impact on influencing behavior,
6. Social interactions and their role in shaping behavior,
7. Ethology and recording animal behaviour.
8. Impact of natural selection on social behavior,
9. Communication within social animals
10. Visual adaptations in challenging environments.
11. Physiology and Behaviour in changing environments,
12. Biological aspects of learning
13. Foraging behaviour
14. Environmental challenges and stressors.
15. Complex behaviour of honey bees,
16. Languages and mental representation,
17. Animal awareness and Emotion.
18. Influence of circadian rhythms on mating, feeding, and other behaviors,
19. Chronobiology and Aging,
20. Chrono pharmacology, chrono medicine,

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

Activities related to Cross Cutting Issues: Environment Sustainability

1. Mind Map – Conditioning and Learning
2. Flow Chart- Ultradian and Infradian Rhythms.

3. Sample questions

Unit I

Part A (1 Mark)

'Behavior' is a trait associated with heritability. (State True or False)

Part B (6 Marks)

Explain the genetic basis of behavior.

Part C (12 Marks)

Evaluate the significance of social interactions and their role in shaping behavior.

Unit II

Part A (1 Mark)

Identify the male bird species that constructs nests.

a. Weaver bird b. Sun bird c. Tailor bird d. Dove

Part B (6 Marks)
Analyze the influence of natural selection on social behavior.

Part C (12 Marks)
Elaborate on sexual behavior and the methods of sexual selection.

Unit III
Part A (1 Mark)
Name the competition for mates between species members of the same sex.
a.Intersexual selection b. Mate choice c. Intrasexual selection d. Female choice

Part B (6 Marks)
Define Homeostasis. Illustrate its impact on animal behavior.

Part C (12 Marks)
Compare classical conditioning with operant conditioning in terms of their influence on learning and behavior.

Unit IV
Part A (1 Mark)
Fill in the Blank:
The type of rhythm followed by our sleep-wake cycle is called _____.

Part B (6 Marks)
Define Cognition and describe how cognition interacts with memory to shape human behavior and decision-making processes.

Part C (12 Marks)
Evaluate the complex behavior of honey bees adding notes on their foraging behaviour.

Unit V
Part A (1 mark)
Our sleep-wake cycle follows the Circadian rhythm (State True or False).

Part B (6 Marks)
Define Biological Clock and explain its adaptive significance.

Part C (12 Marks)
Elaborate on photoperiodism and explain its significance in the regulation of seasonal reproduction in vertebrates.

Course Instructors
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Class : II M.Sc. Skill Enhancement Course II
Title of the Course : Dairy Farming
Semester : III

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**

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Introduction to Dairy Farming (9 Hrs.)**					
	1	Advantages of dairying - Classification of breeds of cattle	3	K1 (R), K5 (E)	Lecture method, Lecture using PPT	Oral Test, Seminar
	2	Indigenous and exotic breeds - Selection of dairy cattle	2	K1 (R)	Lecture using PPT	Seminar, Album preparation
	3	Breeding - artificial insemination	1	K3 (Ap)	Blended learning, Inquiry based learning,	Class Test, MCQ
	4	Dairy cattle management - General Anatomy.	3	K1 (R), K2 (U)	Group discussion, Flipped Class room	Slip Test, Seminar
II	**Construction of Model Dairy House (9 Hrs.)**					
	1	Types of Housing (open housing, shed) - layout planning, ventilation, drainage, and waste management.	3	K2 (U), K3 (Ap)	Collaborative learning, Group Discussion	Summarization , Seminar
	2	Different Managemental Parameters	2	K2 (U), K3 (Ap)	Interactive Class, Flipped Class room	Short Test, Mind map

	3	Winter Management	2	K2 (U), K3 (Ap)	Brain storming, Lecture using videos	Oral Test, Seminar
	4	Summer Management	2	K2 (U), K3 (Ap)	Brain storming, Lecture using videos	Peer Review, Seminar
III	**Feedstuffs available for livestock (9 Hrs.)**					
	1	Roughages -Concentrates - Energy rich concentrates - Protein rich concentrates	3	K1 (R), K2 (U)	Co-operative learning, Mind map	Quiz, Seminar
	2	Mineral Supplements - Vitamin Supplements - Feed additives	2	K1 (R), K2 (U)	Lecture using PPT, Mind map	Mind map, Slip Test, Seminar
	3	Feeding management - Calves Feeding - Feeding of adults	2	K1 (R), K2 (U)	Brainstorming, Lecture using You Tube videos	Oral Test, Open Book Test
	4	Feeding of pregnant dairy animals - Feeding pregnant heifer.	2	K1 (R), K2 (U)	Brainstorming, Lecture using You Tube videos	Online Assignment
IV	**Milk (9 Hrs.)**					
	1.	composition of milk - milk spoilage - pasteurization	2	K4 (An)	Mind map, Flow chart	Slip test, Seminar
	2.	role of milk and milk products in human nutrition	3	K5 (E)	Brainstorming, Lecture using PPT	MCQ, Oral test, Seminar
	3.	Dairy products	2	K5 (E)	Mind map	Class Test, Seminar
	4.	Dairying as a source of additional income and employment.	2	K5 (E)	Brainstorming, Inquiry based	Brainstorming, Group Discussion
V	**Contagious disease (9 Hrs.)**					
	1.	Common Bacterial (Mastitis; Johne's Disease) – Protozoal (Coccidiosis; Theileriosis)	3	K2 (U), K3 (Ap)	Lecture using PPT, Group Discussion	Oral Test, Assignment, Seminar
	2.	Helminth (Tapeworm Infections; lung fluke)	2	K2 (U), K3 (Ap)	Brainstorming, Lecture using You Tube videos	MCQ, Assignment, Seminar
	3.	Viral Diseases (Foot and Mouth Disease; Infectious Bovine Rhinotracheitis)	2	K2 (U), K3 (Ap)	Collaborative learning, Group Discussion	Slip Test, Assignment, Seminar
	4.	Parasitic Infestation (Trypanosomiasis) - Vaccination - Biosecurity.	2	K2 (U), K3 (Ap)	Interactive Class, Flipped Class room	Assignment, Seminar

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): Professional Ethics
Activities related to Cross Cutting Issues: Album preparation – Indigenous and exotic breeds of dairy cattle
Assignment: Common bacterial, viral diseases and Helminth and parasitic infection in cattle

Seminar Topic:
1. Classification of breeds of cattle
2. Indigenous and exotic breeds
3. Selection of dairy cattle
4. General anatomy of dairy cattle
5. Types of Housing (open housing, shed)
6. Different Managemental Parameters
7. Winter Management
8. Summer Management
9. Roughages and Concentrates
10. Energy rich concentrates and Protein rich concentrates
11. Mineral Supplements - Vitamin Supplements
12. Feed additives
13. Composition of milk - milk spoilage
14. Pasteurization
15. Role of milk and milk products in human nutrition
16. Dairy products
17. Common Bacterial (Mastitis; Johne's Disease)
18. Protozoal (Coccidiosis; Theileriosis) - Helminth (Tapeworm Infections; lung fluke)
19. Viral Diseases (Foot and Mouth Disease; Infectious Bovine Rhinotracheitis) - Parasitic Infestation (Trypanosomiasis)
20. Vaccination of dairy cattle.

Sample questions

Part A

1. Which of the following is an indigenous dairy breed of cattle?
   a) Red Sindhi
   b) Chippiparai
   c) Kanni
   d) Kombai
2. Which of the following statements are correct?
   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.
   C. Animals get fresh 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**

4. The time and temperature used for the pasteurization of milk is _____.
5. **Assertion (A):** Foot and mouthy disease causes ulceration in mouth and hoof clefts.
   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.
2. What are the key components of a dairy farm's infrastructure?
3. Enumerate the feed additives for dairy cattle.
4. Summarise the composition of milk.
5. Recall the vaccination schedule for dairy cattle.

Part C

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

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