

Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, Tamil Nadu.

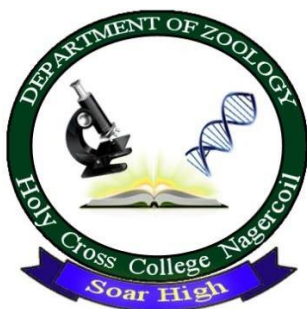
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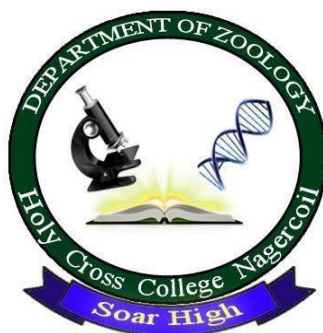


**DEPARTMENT OF ZOOLOGY
UNDERGRADUATE PROGRAMME**



**TEACHING PLAN
EVEN 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)

PEOs	Upon completion of B.A/B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO 1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1& M2
PEO 2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	M3, M4, M5 & M6

PROGRAMME OUTCOMES (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	PEOs Addressed
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	PEO 1
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	PEO2
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	PEO 2
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	PEO 1&PEO 3
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	PEO 2&PEO 3
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	PEO 2&PEO 3
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to develop knowledge and skills.	PEO 1 &PEO 3

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO	Upon completion, B.Sc. Zoology graduates will be able to:	PO addressed
PSO 1	deep understanding of the key concepts of Zoology in the areas of Taxonomy, Physiology, Cell Biology, Genetics, Applied Zoology, Aquaculture Ecology and Toxicology, Biochemistry, Biophysics, Biostatistics, Biotechnology, Immunology, Microbiology and Evolution.	PO1, PO3
PSO 2	perform laboratories experiments with suitable techniques at cellular, molecular, biochemical, physiological, and systematic levels.	PO2, PO3
PSO 3	apply biological methods to formulate hypothesis, collect, analyze, and evaluate the data to address the problem effectively.	PO4, PO5
PSO -4	plan their career goals and pursue higher studies in different Zoological disciplines and develop entrepreneurship skills by applying the knowledge gained from courses like Aquaculture, Sericulture, Apiculture, Poultry, Vermi technology and Clinical Laboratory Technology.	PO1, PO4, PO 6
PSO 5	to identify societal and environmental problems and solve them with innovative ideas and technologies, which can be patented.	PO3, PO6, PO7

Class : I B. Sc. Zoology

Core Course - II

Title of the Course : Chordata

Semester : II

Course Code : ZU232CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU232CC1	4	1	1	-	6	6	90	25	75	100

Pre-requisite

Students should know the taxonomical classification of chordates in relation to their functional morphology.

Learning objectives

1. To develop an in-depth knowledge on the structures and distinct features of Phylum Chordata.
2. To identify the animals of each subphylum and class based on their characteristic features.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall the name and distinct features of different sub phylum belonging to phylum Chordata.	K1
2	explain the structural organization, function and evolutionary aspects of chordates.	K2
3	interpret the biological significance and the conservation of chordates.	K3

K1- Remember; **K2-** Understand; **K3-** Apply

Teaching Plan with Modules

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

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
Unit I: General Characters and Classification of Phylum Chordata:					
1.	General Characters and Classification of Phylum Chordata: origin of Chordata	4	K1(U)	Group discussion, PPT	Oral Test, MCQ
2.	Differences between non-chordates and chordates	4	K1(R)	Blended learning, Lecture	Mind map, Oral test
3.	General characters, affinities and systematic position of Hemichordata (<i>Balanoglossus</i>)	4	K1(Ap)	Brainstorming, Discussion	Slip test, Peer Discussion
4.	Urochordata (<i>Ascidia</i>),	3	K1(R)	Mind mapping, chalk and Board, lecture	Peer Discussion, Short Essay

5.	Cephalo-chordata (<i>Amphioxus</i>).	3	K1(R)	Mind map, Chalk and board	Illustrative Diagrams, Class Test
Unit II: Agnatha:					
1	Agnatha: Characteristics of subphylum vertebrata. General characters	3	K1(R)	Brainstorming, Discussion	Quizziz, Panel discussion
2	Classification up to class level, Agnatha (<i>Petromyzon</i>)	3	K1(R)	Group discussion, PPT	MCQ, Oral test
3	Pisces (<i>Scoliodon sorrakowah</i>), circulatory system	3	K2 (U)	PPT, Chalk and board	Slip test
4	Sense organs. - types of scales and fins	3	K2 (U)	Mind mapping, chalk and Board, lecture	MCQ, Mind map
5	Accessory respiratory organs - air bladder - parental care	3	K2 (U)	Peer tutoring, Lecture method	Objective test, Online assignment
6	Migration - economic importance.	3	K3 (Ap)	Blended learning, Lecture	Open book test
Unit III: Amphibia:					
1	Amphibia: General characters and classification up to orders with names of the examples only.	4	K2 (U)	PPT, Chalk and board	MCQ, Mind map
2	Type study – <i>Rana hexadactyla</i> Morphology, Digestive system, respiratory system, Urinogenital system,	4	K1 (R)	Peer tutoring, Flow diagram	Open book test
3	Endoskeleton: Skull, typical vertebra, atlas, girdles and limbs	4	K3 (Ap)	Mind mapping, chalk and Board, lecture	Slip test
4	Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela	4	K2 (U)	Blended learning, Lecture	Objective test
5	Parental care in Amphibia.	2	K3 (Ap)	Group discussion, Lecture method	MCQ, Mind map
Unit IV: Reptilia:					
1	Reptilia: General characters and classification -:	3	K1 (R)	Chalk and board, lecture using videos	Short essays, Quizzes
2	Type study – (<i>Calotes versicolor</i> - Morphology, endoskeleton of <i>Varanus</i>).	4	K2 (U)	PPT, group discussion	MCQ, Group discussion
3	Extinct reptiles. Snakes of South India	3	K2 (U)	Team teaching, mind map	Peer review

4	Poisonous snakes - <i>Naja naja</i> , King cobra and Viper, Non-poisonous snakes - Python, Rat snake (<i>Ptyas mucosa</i>) and Wolf snake (<i>Lycodon aulicus</i>).	4	K3 (Ap)	Chalk and Board, Lecture, you tube videos	preparation of one word question
5	Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification	4	K3 (Ap)	Group Discussion, Interactive PPT	Long essay test, oral test
Unit V: Aves and Mammalia:					
1	Aves and Mammalia: Aves: general characters and classification – type study - <i>Columba livia</i> – exoskeleton.	5	K2 (U)	Peer tutoring, lecture using videos	Class test
2	Flight adaptations, Migration.	4	K3 (Ap)	Flipped classroom, Peer tutoring	Class test
3	Mammalia: general characters and classification - type study - Rabbit	3	K1 (R)	Mind mapping, PPT	Oral test, Mind Map
4	Nervous system. Adaptations of aquatic mammals, egg laying mammals	3	K2 (U)	Peer tutoring, lecture using videos	Objective question test
5	Marsupials, flying mammals. Dentition in mammals.	3	K3 (Ap)	Flipped classroom, Peer tutoring	Class test

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

Activities (Em/ En/SD): Osteology in frog (Practical), Parental care in Amphibia (Mind map)

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues:

Assignment:

1. Assignment on Accessory respiratory organs in Fishes
2. Album preparation on Poisonous snakes of south India

Sample questions

Part A

1. In higher chordates notochord is surrounded or replaced by a _____.
2. *Scoliodon* belongs to the class Chondrichthyes. **(State True or False)**
3. The heart of amphibians are _____chambered.
4. **Assertion (A):** The skull in reptiles serves as the basis for their classification.

Reason (R): Variations in skull morphology are reflective of the diverse feeding habits and ecological niches occupied by reptilian species.

- a. Both assertion and reason are correct
 - b. Assertion is correct and reason is wrong
 - c. Both assertion and reason are wrong
 - d. Assertion is wrong and the reason is correct.
5. The technique which provides information about movement of birds
- a) Migration b) Bird ringing c) Navigation d) Emigration

Part B

1. List out the general characters of chordates.
2. Explain the types of migration in fishes.
3. Give the general characters of amphibians.
4. Provide an overview of the poisonous and non-poisonous snakes found in South India.
5. Compare and contrast the dentition in mammals.

Part C

1. Give the general characters of Prochordates and classify them up to classes.
2. Explore the structure and function of sense organs in *Scoliodon sorrakowah*.
3. Describe the parental care in amphibians.
4. Explain the detailed morphological features of *Calotes versicolor*.
5. Write an essay on flight adaptation in birds.

Course Instructor	Head of the Department
Dr. P.T. Arokya Glory Dr. A. Punitha	Dr. A. Shyla Suganthi

Class: : I B.Sc. Zoology **Core Lab Course II**
Title of the Course : Lab on Chordata
Semester II
Course Code : ZU232CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								Internal	External	Total
ZU232CP1	-	-	2	-	2	2	30	25	75	100

Pre-requisite

Students should know the taxonomical classification of chordates in relation to their functional morphology.

Learning objectives:

1. To identify the structures and distinct features of phylum Chordata
2. To distinguish the characteristic features of each subphylum and class

Course Outcomes

On the successful completion of the course, student will be able to:		
1	identify and recall the name and distinct external and internal features of animals belonging to phylum Chordata.	K1
2	explain the structural organization of various organs and systems in different classes of vertebrates.	K2
3	analyze, compare, and distinguish the morphological features and developmental stages of chordates	K3

K1 - Remember; **K2** - Understand; **K3** – Apply

Teaching plan with Modules

Total Hours 30 (Including lectures, assignments and tests)

Modules	Topics	Hours	Cognitive Level	Pedagogy	Assessment
Dissection					
1	Frog: External features & Digestive system (Demo)	2	CO 1 (R) CO 2 (U)	Demonstration	Continuous performance-based assessment
2	Frog: Arterial system (Demo)	2	CO 1 (R) CO 2 (U)	Demonstration	
3	Frog: Cranial nerve 5 th , 9 th and 10 th (Demo)	2	CO 2 (U) CO 3 (Ap)	Demonstration	
Mounting					
1	Fish: Placoid and Ctenoid scales	2	CO 2 (U) CO 3 (Ap)	Demonstration & practical	Internal assessment
2	Frog: hyoid apparatus and Brain (Demo)	2	CO 1 (R) CO 2 (U)		
Osteology					
1	Frog: Skull, vertebral column	2	CO 2 (U) CO 3 (Ap)	Observation of Specimens	

2	Frog: pectoral girdle, pelvic girdle, forelimb and hindlimb	2	CO 2 (U) CO 3 (Ap)	Observation of Specimens
3	Chelonia - anapsid skull. Pigeon – skull, synsacrum.	2	CO 2 (U) CO 3 (Ap)	Observation of Specimens
Specimen and Slides				
1	Balanoglossus, Tornaria larva, Amphioxus, Petromyzon, Ammocoetus larva. Pisces: <i>Torpedo</i> , <i>Channa</i> , <i>Hippocampus</i> , <i>Exocoetus</i> , <i>Echieneis</i> , <i>Catla</i> , <i>Clarius</i> . Scales: placoid, cycloid, ctenoid Amphibia: Ichthyophis, <i>Bufo</i> , Axolotl larva Reptilia : <i>Draco</i> , <i>Chamaeleon</i> , <i>Gecko</i> , <i>Uromastix</i> , <i>Vipera russelli</i> , <i>Naja</i> , <i>Enhydrina</i> , <i>Typhlops</i> , <i>Trionyx</i> , <i>Crocodylus</i> , Aves: <i>Psittacula</i> , <i>Bubo</i> , <i>Corvus</i> , <i>Pavo</i> ; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down Mammalia: Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Loris, Hedgehog	12	CO 1 (R) CO 2 (U) CO 3 (Ap)	Observation of Specimens/ slides/ charts
Embryology				
	Life cycle of Frog, Placenta in mammals	2	CO 2 (U) CO 3 (Ap)	Observation of Specimens

Course Instructor	Head of the Department
Dr. P.T. Arokya Glory Dr. A. Punitha	Dr. A. Shyla Suganthi

Class: : I B.Sc. **Non-Major Elective NME II**
Title of the Course : **Biocomposting for Entrepreneurship**
Semester : **II**
Course Code : **ZU232NM1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU232NM1	-	1	1	-	2	2	30	25	75	100

Pre-requisite

Students should aware about the effect of chemical pollution and the importance of organic farming.

Learning Objectives:

1. To highlight the importance of Bio composting for entrepreneurship in waste management.
2. To enable students for setting up Bio compost units and bins for waste reduction.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	define the process of bio composting by earthworms and explain the economic cost of establishing small Biocompost units as a cottage industry.	K1
2.	demonstrate composting techniques for various applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc	K2
3.	establish a small Biocompost units as a cottage industry.	K3

K1- Remember; **K2-** Understand; **K3-** Apply

Teaching plan with Modules

Total Hours 30 (Including lectures, assignments and tests)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Unit I (6Hrs)					
1	Bio composting – Definition, types; home composting, vermicomposting,	2	K1 (R) & K2 (U)	Brainstorming, Lecture, interactive PPT	Summarization on, Flow chart
2	Aerobic composting, anaerobic composting.	2	K2 (U),	Group Discussion, interactive PPT	Group presentation
3	Compost Ingredients - ecological importance.	2	K1 (R),	Flipped learning, Illustration	Home assignment, Open book test.
Unit II (6Hrs)					
1	Bio composting technology -Field pits - ground heaps – tank	2	K1 (R)	Collaborative teaching, Peer teaching	Mind map, Oral test,

	- large-scale - batch and continuous methods –				
2	biology of the composting process.	2	K1 (R), K3(Ap)	Interactive lecture, Group discussion, Illustration	Diagrams, Online Assignment, Seminar, MCQ
3	Humification of organic material. Compost enrichment.	2	K2 (U,	Illustration, Peer teaching	Illustration, Assignment
Unit III (6Hrs)					
1	Methods of composing Preparation of Biocompost pit and bed for Bangalore method,	3	K3(Ap)	Interactive PPT, Experiential learning, Group work	Group Presentation, Assignment
2	Indore method, Coimbatore method,	2	K2(U)	Experiential learning, Group work	Assignment
3	NADEP method.	1	K2(U)	Experiential learning, Group work	Assignment
Unit IV (6Hrs)					
1	Applications of Biocompost in soil fertility maintenance	2	K1(R) &	Flipped class room Group discussion	Oral test
2	Promotion of plant growth, value added products, waste reduction, etc..	3	K2(U)	Inquiry based,	Quiz
3	Drawbacks of using composts	1	K2(U)	Peer teaching	Open book test
Unit V (6Hrs)					
1	Economics of establishment of a small biocompost unit.	3	K2(U)	Interactive PPT	Class test
	Project report proposal for Self Help Group (Income and employment generation).	3	K3 (Ap)	Group work	Presentation

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Employability Activities for Employability**

1. Preparation of bio compost pit
2. Project report proposal for Self Help Group

Course Focusing on Cross Cutting Issues: **Environmental sustainability& Human value**
Activities related to Cross Cutting Issues:

Assignment: 1. Preparation of different types of Bio compost pit

Sample Questions

Part A (1 mark)

1. Which of the following is a key ingredient in composting?
a) Plastic waste b) Organic waste c) Metal scraps d) Synthetic fibers
2. Anaerobic composting requires constant aeration for effective decomposition **True/ False**
a) What is the primary ecological importance of composting?
a) Soil erosion b) Reduction of plastic waste c) Nutrient recycling d) Water conservation
4. **Assertion (A):** Large-scale composting methods require less management effort than small-scale composting.

Reason (R): Large-scale composting uses advanced machinery for operations.

- 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, but R is false.
- d) A is false, but R is true.

5. Establishing a small biocompost unit is a non-viable income generation method for Self-Help Groups. **True/ False**

Part B (6 marks)

1. Discuss the differences between aerobic and anaerobic composting.
2. Explain the ecological importance of composting ingredients.
3. Compare the Bangalore and Coimbatore methods of composting, focusing on their preparation techniques.
4. Analyse the biology of the composting process, with special reference to humification of organic material.
5. Discuss the applications of biocompost in promoting soil fertility and its contribution to sustainable agriculture.

Part C (12 Marks)

1. Explain vermicomposting and home composting types of biocomposting and add its advantages and disadvantages.
2. Describe the field methods of biocomposting such as field pits, ground heaps, and tanks large-scale batch and biological processes involved in composting.
3. Compare the Indore and NADEP methods of biocomposting. Discuss the preparation and maintenance of compost pits for each method.
4. Evaluate the applications of biocompost in plant growth promotion, and waste reduction. Discuss potential drawbacks and limitations of compost use.
5. Propose a project for establishing a small biocomposting unit for a Self-Help Group, detailing its economic viability, income potential, and employment generation

Course Instructor	Head of the Department
Dr. F. Brisca Renuga Dr. Jeni Chandar Padua	Dr. A. Shyla Suganthi

Class : I B.Sc. Zoology Skill Enhancement Course Sec-1
Title of the Course : Beekeeping
Semester II
Course Code : ZU242SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU242SE1	1	1	-	-	2	2	30	25	75	100

Prerequisite

Students should have the basic understanding of honey bees and their economic importance.

Learning Objectives

1. To train the students to learn the techniques of honey bee rearing, optimization of techniques based on climate and geographical regions, and various measures to be taken to maximize the benefits.
2. To help the student to become familiar with the significance of beekeeping as an economically viable industry.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	gain a comprehensive understanding of the key concepts related to the beekeeping.	K1
2	impart thorough knowledge about the techniques involved in bee keeping and honey production.	K2
3	develop entrepreneurial skills necessary for self-employment in beekeeping sector.	K3
4	analyze the damage caused by pest and diseases.	K4
5	asses the economic viability, and employment opportunities in small and large-scale beekeeping industries.	K5

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

Teaching plan with Modules

Total Hours 30 (Including lectures, assignments and tests)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit I : Biology of Bees: (6 Hrs.)					
1	Historical background of apiculture.	1	K2 (U)	Brainstorming, Group Discussion	Short Q&A Session, Flow Chart
2	Classification and biology of honey bees.	2	K3 (Ap) K5 (E)	Experiential Learning, Hands-On Activity	Group Presentation, Think-Pair-Share
3	Social organization of bee colony.	1	K2 (U) K4 (An)	Interactive PPT, Group Discussion	Mind Map, Assignment
4	Behavioural patterns (bee dance, swarming).	2	K2 (U) K4 (An)	Collaborative Learning, Demonstration	Short Test, Role Play
Unit II: Rearing of Bees (6 Hrs)					

1	Artificial Bee rearing (Apiary).	1	K1 (R) K2 (U)	Demonstration, Model-Based Teaching	Debate
2	Beehives – Newton and Langstroth.	1	K3 (Ap) K4 (An) K5 (E)	Collaborative Learning, Video Session	Model Making.
3	Bee Pasturage; Selection of bee species for apiculture – <i>Apis cerana indica</i> , <i>Apis mellifera</i> .	1	K2 (U) K5 (E)	Inquiry-Based Learning	Album Making, Group Discussion
4	Beekeeping equipment.	1	K2 (U)	Video-Based Lecture, Hands-On Activity	Class Test, Mind Map
5	Methods of extraction of honey (Indigenous and Modern) & processing	1	K3 (Ap)	Peer Teaching, Demonstration	Practical Demo, Group Discussion
6	Apiary management - Honey flow period and lean period, effects of pollutants on honeybees.	1	K4 (An) K5 (E)	Peer Learning, Case Studies	Group Analysis
Unit III: Pests and Diseases (6 Hrs)					
1.	Wax moths, Ants, Wasps, Wax beetles, Birds, Mites.	1	K1 (R) K4 (An)	Brain Storming, Model-based learning	Model Making, Assignment
2	Bacterial diseases – American foulbrood disease, European foulbrood disease,	2	K1 (R) K2 (U) K5 (E)	Visual Learning, Illustrative Lecture	Model Making, Flow Charts
3	Viral diseases – Sac brood disease, Thai sac brood disease.	1	K1 (R) K5 (E)	Blended Learning, Videos	Recall key terms, Flow chart
4	Fungal diseases – Chalkbrood disease, Stonebrood disease.	2	K1 (R) K4 (An)	Inquiry-Based Teaching, Discussion	Case Study, Quiz
Unit IV: Bee Economy (6 Hrs)					
1	Products of apiculture industry - Honey, Bees Wax.	2	K1 (R) K2 (U) K5 (E)	Brainstorming, Interactive PPT	Mind map, Slip test
2	Products of apiculture industry - Propolis, Royal jelly, Pollen etc. and their uses.	2	K2 (U) K4 (An)	Flipped classroom, Video-based Learning	Oral test
3	Modern methods in employing artificial Beehives for cross pollination in horticultural gardens- stationary and migratory bee keeping.	2	K3 (Ap) K4 (An)	Illustrative Explanation, Cooperative Learning.	Model Making, Drawing

Unit V: Entrepreneurship in Apiculture (6 Hrs)					
1	Bee keeping Industries.	1	K1 (R) K3 (Ap)	Video-based Learning, Group Discussion	Concept Recall Test
2	Recent advancements, employment opportunities.	1	K2 (U) K4 (An)	Video-Based learning.	Model Presentation
3	Economics in small and largescale beekeeping.	1	K3 (Ap) K5 (E)	Inquiry based learning, Brainstorming	Assignment, Short test
4	Scope for women entrepreneurs in beekeeping sector.	1	K3 (Ap) K4 (An) K5 (E)	Problem-Based Learning, Case Study.	Report Writing
5	Study of development programs and organizations involved in beekeeping in India.	2	K3 (Ap) K4 (An)	Flipped Classroom, Interactive Discussion	Assignment

Course Focusing on Entrepreneurship and Skill Development

Activities for Entrepreneurship and Skill Development

1. Case Study: Scope for women entrepreneurs in beekeeping sector.
2. Debate: Rearing of bees (Traditional Vs Artificial).
3. Model Making: Bee hive, Pests of bees.

Course Focusing on Cross Cutting Issues: Environment Sustainability

Activities related to Cross Cutting Issues:

Assignment: 1. Social organization of bee colony.

2. Economics in small and largescale beekeeping.

Sample Questions

Part A

1. Which of the following is the main goal of apiculture?
 - a) Producing silk
 - b) Harvesting honey and bee products
 - c) Growing flowers
 - d) Breeding butterflies
2. **Assertion (A):** Artificial bee rearing (apiaries) helps in higher honey production.
Reason (R): Apiaries provide controlled environments for bee colonies.
 - 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, but R is false.
 - d) Both A and R are false.
3. Viral diseases like sac brood can be easily treated with antibiotics. **State True or False.**
4. Which of the following is not a product of the apiculture industry?
 - a) Honey
 - b) Beeswax
 - c) Silk
 - d) Propolis
5. **Assertion (A):** Small-scale beekeeping can be economically viable for rural communities.
Reason (R): Beekeeping requires minimal land resources and has multiple revenue streams.
 - 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, but R is false.
 - d) Both A and R are false.

Part B

1. Explain the classification and biological characteristics of honey bees, emphasizing their roles and contributions to the ecosystem.
2. Explain the various types of beekeeping equipment and their functions in effective apiary management.
3. Identify and explain the major pests affecting bee colonies and the impact they have on apiculture productivity.
4. Explore the various products of the apiculture industry, including honey and beeswax, and their uses in different sectors.
5. Discuss recent advancements in the apiculture industry. Add notes on the employment opportunities.

Part C

1. Describe the social organization of a bee colony and how it influences their daily activities and survival.
2. Discuss the structure, advantages, and usage of Newton and Langstroth beehives in modern apiculture.
3. Discuss bacterial diseases affecting honey bee colonies, focusing on the causes, symptoms, and control measures of American and European foulbrood diseases.
4. Evaluate the modern methods used in artificial beehives for cross-pollination in horticultural gardens, emphasizing stationary and migratory beekeeping.
5. Evaluate the scope and challenges faced by women entrepreneurs in the beekeeping sector.

Course Instructor	Head of the Department
Dr. C. Anitha Dr. A. Punitha	Dr. A. Shyla Suganthi

Class : II B.Sc. Zoology
Title of the Course : Animal Physiology
Semester IV
Course Code : ZU234CC1

Core Course IV

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU234CC1	4	1	-	-	5	5	75	25	75	100

Pre-requisite:

Students should have the basic knowledge of structure and function of different organ system

Learning Objectives:

1. To enable the students to comprehend the functional significance of various organs and organ systems.
2. To train future researchers in the field of physiology both academically and intellectually as well as the ability to assess and report experiments and observations in physiology.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall the basic anatomy of digestive, respiratory, excretory, homeostatic, neuromuscular, endocrine and reproductive system	K1
2.	describe the important physiological systems and internal regulation.	K2
3.	compare various organ systems and adaptations exhibited by animals.	K3
4.	infer the integration of activities of different organ and organ system.	K4
5.	interrelate different organ systems to diseases for a holistic approach to human health.	K5

Teaching plan with Modules

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

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit I: Nutrition and Digestion (15 Hrs.)					
1	Nutrition-types of food and feeding mechanisms, composition of food.	3	K2 (U) K3 (Ap)	Interactive Lecture, Group Discussion	Flow Chart
2	Balanced diet. Basal Metabolic Rate (BMR) and Body Mass Index (BMI).	3	K3 (Ap) K5 (E)	Debate, Experimental Learning, Case Study.	Think-Pair-Share
3	Digestive enzymes and their role in digestion of carbohydrate.	3	K2 (U) K4 (An)	Interactive Q&A, Brainstorming.	Mind Map
4	Digestive enzymes and their role in digestion of protein and fat.	3	K2 (U) K4 (An)	Collaborative Learning,	Short test

4	Absorption and assimilation of carbohydrate, protein and fat.	3	K1 (R) K4 (An)	Video-based Learning, Group Discussion.	Class Test
Unit II: Respiration & Circulation (15 Hrs.)					
1	Respiratory organs, Respiratory pigments and functions.	3	K1 (R) K2 (U)	Explanation with models, Instructional based learning	Labelling, Model Making, Assignment.
2	Transport of gases (CO ₂ and O ₂) - Chloride Shift, Haldane and Bohr's effect.	3	K3 (Ap) K4 (An) K5 (E)	Collaborative Learning, Video-Based Learning	Comprehension
3	Types of heart, Structure and function of heart.	3	K2 (U) K5 (E)	Model-based teaching, Inquiry-based Learning	Model Making, Labelling
4	Double circulation – Origin and conduction, pacemaker, cardiac cycle and ECG, blood pressure.	3	K2 (U) K5 (E)	Video-based lecture, Demonstration, Hands-on Activity	Class Test, Mind Map
5	Heart diseases – atherosclerosis, acute coronary occlusion, myocardial infarction.	3	K4 (An) K5 (E)	Peer group teaching, Role Play	Group Discussion, Case Study
Unit III: Excretion (15 Hrs.)					
1.	Patterns of excretion, excretory organs in vertebrates.	3	K1 (R) K4 (An)	Brain Storming, Model-based learning	Model Making, Assignment
2	Structure of kidney in man, nephron.	2	K1 (R) K2 (U) K5 (E)	Illustrative Lecture, Visual Aids based Learning	Model Making.
3	Counter current mechanism of urine formation.	2	K1 (R) K5 (E)	Blended Learning, Video-based Lectures	Recall key terms, Flow chart
4	Nephritis and dialysis	3	K1 (R) K4 (An)	Inquiry based learning, Illustrative lecture	Group Discussion, Case Study
5	Osmoregulation - Osmo conformers and osmoregulatory, osmoregulation in crustaceans, fishes and mammals.	3	K3 (Ap) K4 (An)	Flipped Learning, Interactive Lectures	MCQ, Summarization
6	Thermoregulation - poikilotherms and	2	K1 (R)	Brainstorming, Group Discussion	Oral test

	homeotherms, thermoregulatory mechanisms.		K4 (An) K5 (E)		
Unit IV: Muscle Physiology (15 Hrs.)					
1	Types of muscles, ultrastructure and properties of skeletal muscle.	4	K1 (R) K2 (U)	Brainstorming, Interactive PPT	Mind map, Slip test
2	Mechanism of muscle contraction and Rigormortis.	4	K2 (U) K3 (Ap)	Flipped classroom, Video-based Learning	Oral test, Roleplay
3	Structure and types of neurons.	3	K3 (Ap) K4 (An)	Illustrative explanation, Cooperative learning.	Model Making, Drawing
4	Conduction of nerve impulse through non-myelinated, myelinated nerve and synapse.	4	K4 (An) K3 (Ap)	Interactive presentations, Video-based Learning.	Class Test
Unit V: Endocrine and Reproductive Physiology (15 Hrs.)					
1	Endocrine organs- hypothalamus and endocrine glands- pituitary.	3	K1 (R) K3 (Ap)	Visual Aids-based Teaching Collaborative learning- group discussion	Recall Terms,
2	Endocrine glands- thyroid, parathyroid, adrenal, islets of Langerhans.	3	K2 (U) K4 (An)	Interactive video, Model based learning.	Model Making
3	Biological clock and rhythms.	2	K3 (Ap) K5 (E)	Inquiry based learning, Brainstorming	Flow chart, short test
4	Photoreceptor – Structure of a mammalian eye, physiology of vision.	4	K3 (Ap) K4 (An)	Cooperative Learning, Problem-Based Learning	Slip test
5	Phonoreceptor – Structure of mammalian ear, Physiology of hearing, equilibrium.	3	K3 (Ap) K4 (An)	Flipped classroom, Problem-Based Learning	Anatomical Diagrams

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Employability Activities for Employability**

1. Case Study: Heart Diseases
2. Debate: Balanced Diet
3. Model Making: Kidney, Heart, Nephron, Neuron, Lungs, Eye, Ear.

Course Focusing on Cross Cutting Issues: **Human Values**

Activities related to Cross Cutting Issues:

- Assignment:** 1. Excretory organs in vertebrates
2. Respiratory pigments and functions

Sample Questions

Part A

- Which enzyme is responsible for the digestion of starch in the mouth?
a) Pepsin b) Amylase c) Lipase d) Trypsin
- During the chloride shift, what ion is exchanged with chloride ions in red blood cells?
a) Potassium b) Calcium c) Bicarbonate d) Hydrogen
- Which process primarily drives the counter-current mechanism in the loop of Henle?
a) Active transport b) Osmosis c) Diffusion d) Filtration
- Assertion (A):** Rigor mortis occurs after death due to the absence of ATP in muscles.
Reason (R): ATP is necessary for the detachment of myosin heads from actin filaments during muscle relaxation.
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, but R is false.
d) A is false, but R is true.
- The islets of Langerhans are located in the adrenal glands. **State True or False**

Part B

- Describe the various types of food and their significance in human nutrition.
- Illustrate the enzymatic breakdown of carbohydrates during digestion.
- Discuss nephritis and the impact of impaired renal function on homeostasis.
- Analyze Sliding Filament theory of muscle contraction.
- Explain the physiological mechanisms involved in photoreception and how light influences circadian rhythms.

Part C

- Compare the feeding mechanisms of herbivores, carnivores, and omnivores.
- Evaluate the effects of heart diseases such as myocardial infarction on cardiovascular physiology
- Explain the counter-current mechanism of urine formation and its significance in osmoregulation.
- Describe the process of muscle contraction from action potential initiation to muscle relaxation.
- Explain the physiology of hearing and how the ear maintains equilibrium in humans.

Course Instructor	Head of the Department
Dr. C. Anitha Dr. C. Josephine Priyatharshini Dr. F. Brisca Renuga	Dr. A. Shyla Suganthi

Class : II B.Sc. Zoology **Core Lab Course IV**
Title of the Course : Lab on Animal Physiology
Semester : IV
Course Code : ZU234CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU234CP1	-	-	2	-	2	2	30	25	75	100

Pre-requisite:

Students should have knowledge relevant to genetics, evolution and physiology.

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.	choose appropriate methods to analyse physiological functions and food adulterants.	K1
2.	describe the principles of analytical methods and instruments and its uses in physiology.	K2
3.	prepare balanced diet for different age group, calculate BMI, identify food adulterants.	K3
4.	analyse the effect of physical factors on the rate of activity physiological process.	K4
5.	estimate the variation in rate of physiological activity, BMI, blood cells, oxygen consumption and excretory products under varying environmental condition.	K5

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

Teaching plan

Total Contact hours: 30 (Including Experiments and tests)

Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Activity of salivary amylase in relation to pH.	2	K4 (An)	Demonstration, Experiential Learning	Performance, Calculation Internal test
Activity of salivary amylase in relation to temperature.	2	K4 (An)	Demonstration, Experiential Learning	
Oxygen consumption of fresh water fish with reference to body weight	2	K4 (An)	Demonstration, Experiential Learning	
Detection of nitrogenous waste products (Ammonia, urea and uric acid).	2	K4 (An)	Demonstration, Experiential Learning	
Preparation of a balance diet for different age groups using standard diet chart	2	K3 (Ap)	Demonstration, Experiential Learning	

Estimation of carbohydrate, protein and lipid	2	K4 (An)	Demonstration, Experiential Learning	
Experiment on BMI calculation	2	K4 (An)	Demonstration, Experiential Learning	
Analysis of common food adulterants by simple methods	2	K4 (An)	Demonstration, Experiential Learning	
Estimation of Haemoglobin.	2	K4 (An)	Demonstration, Experiential Learning	
Measurement of Blood pressure	2	K4 (An)	Demonstration, Experiential Learning	
Haemoglobin	1	K1 (R) K2 (U) K3 (Ap) K4 (An) K5 (E)	Model based Learning, Explanation with Visual Aids and Instruments, Pictures.	Drawing, Identification, Labelling
ECG	1			
Cardiac muscle	1			
Skeletal muscle	1			
Smooth muscle	1			
Simple muscle curve	1			
Kymograph	1			
Mammalian eye	1			
Mammalian ear	1			
Thyroid gland	1			

Course Instructor	Head of the Department
Dr. C. Anitha Dr. C. Josephine Priyatharshini	Dr. A. Shyla Suganthi

Class : II B. Sc. Botany **Elective Course IV**
Title of the Course : Economic Zoology
Semester :IV
Course Code : ZA2041

Course Code	L	T	P	S	Credits	Inst. Hrs	Total Hrs	Marks		
								CIA	External	Total
ZU234EC1	3	-	1	-	3	4	60	25	75	100

Pre-requisite:

Students should have fundamentals of culture practices of economically important animals.

Learning Objectives:

1. To empower the students with the culture practices of economically important animals.
2. To enable the students to become an entrepreneur.

Course Outcome

On the successful completion of the course, students will be able to:		
1	recall the principles of api-, seri-, and aquaculture, poultry and dairy farming.	K1
2	explain the tools and techniques used in rearing practices.	K2
3	practice the fundamental concepts of applied zoology in research and animal farms.	K3
4	inspect the quality of honey, silk, egg, milk and fish.	K4
5	evaluate the profitability of animal farms.	K5

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

Teaching Plan with Modules

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

Modules	Topics	Hours	Cognitive Level	Pedagogy	Assessment
Unit I: Aquaculture (12 Hrs)					
1	Aquaculture in India.	1	K1 (R)	Collaborative Learning, Interactive PPT, Lecture	Mind map, MCQ, Diagram
2	Important cultivable organisms and their qualities.	3	K3 (Ap)	Brainstorming and Lecture, Blended learning	Quiz, Online test, Open book Assignment
3	Culture of Indian major carps.	2	K2 (U)	Inquiry based learning, Group discussion	Interactive PPT, Short test
4	Marine prawn culture, Pearl culture.	3	K4 (An)	Cooperative teaching, Lecture, Videos	Slip test, Rapid fire, Diagram

5	Integrated fish culture (paddy cum fish culture).	3	K2 (U)	Flipped learning, Lecture, Interactive PPT	Online test, Open book test, Quizzes
Unit II: Apiculture (12 Hrs)					
1	Classification and kinds of bees,	2	K1 (R)	Demonstration using Specimens, Lecture, Review	MCQ, Rapid fire Test
2	Bees and their society.	2	K2 (U)	Inquiry based teaching, Video, PPT	Summary Writing, Oral Quiz
3	Caste distinction and their functions.	3	K3 (Ap)	Blended learning, Lecture, Chalk and Talk	Mentimeter – quiz, short test
4	Methods of Bee keeping (primitive and modern).	2	K3 (Ap)	Lecture, Group Discussion	Mind Map, Online test, Slip Test
5	Honey Bee products: honey, bee wax, bee venom.	3	K2 (U) K4 (An)	Interactive PPT, Lecture, Video	Assignment, Surprise Test, Class test
Unit III: Sericulture (12 Hrs)					
1	Moriculture – methods of propagation.	3	K2 (U)	Brain storming, Lecture, Interactive PPT	Interactive PPT, Short test, Quiz
2	Common species of Silkworm, Life cycle of mulberry silkworm - egg, larva, pupa and adult.	3	K3 (Ap)	Flipped Class room, Lecture, Video	Mind map, MCQ, Online test, Open book test
3	Rearing of silkworm, mounting, spinning and harvesting of cocoons.	3	K2 (U) K3 (Ap)	Lecture, blended class room	Slip test, Illustrative Diagram, Flow Chart
4	Silk Reeling and Marketing.	3	K2 (U) K4 (An)	Lecture, Video	Quiz, Online test, Open book Assignment
Unit IV: Poultry Farming (12 Hrs)					
1	Poultry housing, Types of poultry houses.	3	K4 (An)	Mind map, Lecture, PPT, YouTube videos	Mind map, MCQ, Diagram
2	Management of chick, growers.	2	K3 (Ap)	Lecture, Chalk and Talk, Interactive PPT	Slip test, Summary Writing, Short test,
3	Management of layers and broilers.	2	K3 (Ap)	Inquiry based teaching, Video, PPT	Quizzes, Rapid fire,

					Illustrative diagram
4	Sexing in chicks. Nutritive value of egg.	2	K2 (U) K4 (An)	Lecture, Chalk and Talk, Tutorial	Oral Test, Summary Writing
5	Diseases of poultry– Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis.	3	K2 (U)	Collaborative Learning, Lecture, PPT	Short test, Mind map, flow chart
Unit V: Dairy Farming (12 Hrs)					
1	Breeds of Dairy animals -Establishment of a typical Dairy farm.	2	K1 (R) K2 (U)	Lecture, video lesson Interactive PPT, YouTube Videos	Mind map, MCQ, Diagram
2	Management of cow - New born, calf, Heifer, milking cow.	3	K2 (U)	Lecture, Group Discussion	Quiz, Online test, Open book Assignment
3	Diseases - Mastitis, Rinder Pest, Foot and Mouth Disease.	3	K2 (U)	Lecture, Tabulation, Peer tutoring	Interactive PPT, Short test
4	Dairy products - Standard milk, skimmed milk, toned milk	2	K4(An) K5 (E)	Chalk and Talk, Lecture Method Problem-based learning, Lecture, Interactive PPT	Slip test, Illustrative Diagram, Flow Chart
5	Fermented milk -curd, ghee, cheese, Pasteurization	2	K3(Ap)	Lecture, video lessons, Index card	Summary Writing, Oral Quiz

Course Focusing on Employability/ Entrepreneurship/ Skill Development:

Entrepreneurship & Employability

Activities (Em/ En/SD): Debate (Invitation, Report and photos with reference)

Topic: Egg or Milk : Which is highly nutritive ?

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues:

ii) Assignment 1:

Flow Chart: Life Cycle of Silk Worm

ii) Assignment 1:

Mind Map: Diseases of Poultry

Seminar Topic: Not Applicable

Sample questions

Section A

1. The house of the honey bee is called chamber (**State True or False**)

2. Match the following

- | | | |
|----------------|---|------------------------------|
| A. Italian bee | - | 1. <i>Apis dorsata</i> |
| B. Little bee | - | 2. <i>Apis cerana indica</i> |
| C. Rock bee | - | 3. <i>Apis florea</i> |
| D. Indian bee | - | 4. <i>Apis mellifera</i> |

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

3. The appliance used for mounting the spinning larva is _____.

- a) Rectangular tray b) Circular tray c) Chandrika d) Rubber strips

4. **Assertion (A):** Sun drying is a method of stifling.

Reason (R): Stifling is to kill the pupa living inside the cocoon.

- a. Both A and R are correct b) Both A and R are wrong
b. A is correct and R is wrong d) A is wrong and R is correct

5. Culture of marine organisms is called _____

- a) Mariculture b) Sericulture c) Apiculture d) Aquaculture

6. Indian major carp include

- a) Catla b) Prawns c) Crabs d) Oysters

7. **Assertion (A):** Egg is the poor man's food.

Reason (R): The egg is cheap and nutritious.

- a) Statement 'A' and 'B' are wrong. b) Statement 'A' and 'B' are correct.
c) Statement 'A' is correct, but 'B' is wrong. d) Statement 'A' is wrong and 'B' is correct.

8. Identification of female chicks by seeing the cloaca is called _____.

- a) Colour sexing b) Feather sexing c) Vent sexing d) Size sexing

9. **Match the following and choose the correct one:**

- | | | |
|----------------------------|---|---------------------------------|
| A) Mastitis | - | 1) Cattle plague bovine typhus |
| B) Rinderpest | - | 2) Madu veekam |
| C) Foot and mouth diseases | - | 3) <i>Staphylococcus aureus</i> |
| D) Bacteria | - | 4) Aphthous |

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

10. The other name of skimmed milk is _____.

Section B (5 x 4 = 20 marks)

1. Explain the diagnostic features of honey bees.
2. Describe the food of honey bees.
3. Illustrate the life cycle of silkworm.
4. Differentiate pebrine and muscardine.
5. Explain the important cultivable organisms of aquaculture.
6. Write notes on pearl culture.

7. Explain the types of poultry houses.
8. Analyze the nutritive value of egg and flesh.
9. List the different breeds of dairy animals.
10. Distinguish skimmed milk and fermented milk.

Section C (5 x 8 = 40 marks)

1. Explain the modern method of bee keeping.
2. Discuss the common diseases of honey bee and their management.
3. Explain the different methods of propagation in moriculture.
4. Discuss the steps involved in silk reeling.
5. Explain aquaculture in India.
6. Give an account of ornamental fish culture.
7. What are the principles to be followed the construction of poultry house? Explain.
8. Discuss the diseases of poultry.
9. Explain the establishment of a typical dairy farm.
10. Discuss the different products of dairy.

Course Instructor	Head of the Department
Dr. Jeni Chandar Dr. Prakash Shobha	Dr. A. Shyla Suganthi

Class : III B. Sc. Zoology

Major Core VIII

Semester : VI

Title of the Course : Developmental Biology

Course Code : ZC2061

Credits	Inst. Hours	Total Hours	Marks
6	90	90	100

Learning Objectives

1. To impart knowledge on the sequential changes during the embryonic development of animals and human reproductive health.
2. To develop skills on observation of developmental stages, regeneration, and nuclear transplantation.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	Cognitive level
CO - 1	define the concepts of reproduction, embryonic development, nucleo-cytoplasmic interaction and birth control.	PSO – 1	K1 (R)
CO - 2	outline the patterns of cleavage, morphogenetic movements, fate map, the reproductive disorders and treatment.	PSO - 1	K2 (U)
CO - 3	execute the principles of embryology in applied sciences and birth control measures.	PSO – 3	K3 (Ap)
CO - 4	analyze clinical implications of the development, gender based reproductive disorders and intervening mechanism.	PSO - 3	K4 (An)

Teaching Plan with Modules

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

Module	Topics	Hours	Cognitive level	Pedagogy	Assessment
Unit I: Reproduction (18 Hrs.)					
1	Sexual reproduction Spermatogenesis, Structure, and types of sperm.	4	K1 (R) K2 (U)	Interactive PPT, Lecture Method, Flipped Class room, Group discussion	MCQ, Short test
2	Oogenesis, types of egg, egg membranes, Structure of egg- frog, chick, and human.	5	K1 (R) K2 (U)	Peer teaching, YouTube links, PPT, Lecture Method	Slip test Assignment
3	Fertilization -types, chemical and cytological factors involved in fertilization, physiological changes in fertilization,	5	K1 (R) K4 (An)	Interactive PPT, Blended learning, Lecture method, Group discussion	MCQ, Flow chart

	significance, Prevention of polyspermy				
4	Asexual reproduction. Parthenogenesis - types and significance.	4	K1 (R) K4 (An)	Interactive PPT, Inquiry based learning, Lecture method	Mind map, MCQ, Oral test
Unit II: Cleavage and Gastrulation (18 Hrs.)					
1	Cleavage: Planes and patterns of cleavage, factors controlling cleavage, cleavage and blastulation in frog.	4	K1 (R) K2 (U)	Blended learning, Lecture method, Group discussion, Interactive PPT	Quiz, Identification of stages of embryo
2	Fate map of frog. Morphogenetic movements.	3	K1 (R) K2 (U)	Interactive PPT, Lecture Method, Flipped Class room, Group discussion	Mind map on development of organ system
3	Gastrulation in frog.	2	K1 (R) K2 (U)	Interactive PPT, Inquiry based learning, Lecture method	Flow chart
4	Organizer – Spemann’s experiments - organizer in amphibian embryo, embryonic induction - neural induction.	6	K1 (R) K3 (Ap)	PPT, YouTube Video, Collaborative learning.	Oral test, Preparation of MCQ
5	Competence. Gradient theory - gradient system - types, experimental evidences, mechanism.	3	K3 (Ap)	Interactive PPT, Cooperative learning	Quiz, Slip test
Unit III: Organogenesis (18 Hrs.)					
1	Development of eye, heart, digestive system in frog	4	K1 (R) K3 (Ap)	Video links and interactive PPT,	MCQ, Flow chart,
2	Extra embryonic membrane, development of fetal membranes.	3	K2 (R) K3 (Ap)	Illustrative diagrams	Illustrative diagrams test
3	Placenta in mammals - classification, functions	2	K2 (R) K3 (Ap)	Interactive PPT, Specimens	Mind map, Short Answer Test,
4	Development Stem cells, Preservation of cord blood stem cells.	6	K2 (R) K4 (An)	YouTube, Group Discussion	MCQ, Slip test
5	Principles of collections of Umbilical cord, gametes and embryos.	3	K2 (R) K3 (Ap)	Interactive lecture, YouTube videos	Seminar, Slip test

Unit IV: Metamorphosis and Regeneration (18 Hrs.)					
1	Metamorphosis: Types, Insect and Amphibian metamorphosis.	3	K2 (R) K3 (Ap)	Flow Chart using PPT, Seminar by student Video link	Quiz, Online assignments
2	Hormonal control of metamorphosis in Insect and Amphibian.	4	K2 (R) K3 (Ap)	Lecture with Interactive PPT.	Flow chart of metamorphosis
3	Regeneration: types, regeneration in Planaria, Amphibia and human liver.	3	K1 (R), K3 (Ap)	Seminar by student Interactive PPT.	Oral test, Quiz
4	Factors influencing regeneration, physiological changes involved in regeneration.	3	K3 (Ap) K2 (U), K4 (An)	Flow Chart using PPT, Seminar by student Video link	Quiz, Online assignments
5	Nucleo-cytoplasmic interaction - Acetabularia. Ageing- concepts and theories	3	K1 (R), K3 (Ap)	Illustrative lecture, YouTube videos, Panel Discussion	Slip test
6	Synthetic biology – synthetic life.	2	K1 (R), K3 (Ap) K4 (An)	KWL, Peer Discussion	Peer teaching & assessment
Unit V: Embryological Techniques (18 Hrs.)					
1	Infertility – causes and diagnostic parameters – hormonal imbalance, Polycystic Ovarian Diseases (PCOD). Rh factors and incompatibility	2	K1 (R) K2 (U) K3 (Ap) K4 (An)	Brainstorming, YouTube videos, Discussion	Open book test
2	<i>In vitro</i> fertilization, artificial insemination, cryopreservation of sperm and ovum - test tube babies – amniocentesis.	4	K1 (R) K2 (U) K3 (Ap) K4 (An)	KWL, Ms-PPT, YouTube videos	Mind map
3	Teratogenesis- agents and their effects.	4	K2 (U), K3 (Ap) K4 (An)	Illustrative Lecture, Ms- PPT.	Slip test
4	Cryopreservation of sperm and ovum - test tube babies – amniocentesis.	3	K1 (R) K2 (U) K3 (Ap)	Cooperative learning – Jigsaw	Peer discussion & assessment
5	Birth control - physical barriers - contraceptive devices - IUCD, surgical method.	2	K1 (R), K3 (Ap) K4 (An)	Interactive lecture, Object based learning, YouTube Videos	Mind map
6	Hormonal and therapeutic methods of birth control	3	K2 (U) K3 (Ap) K4 (An)	Inquiry based Lecture, Group discussion	MCQ

Course Focusing on Employability/ Entrepreneurship/ Skill Development:

Skill Development

Activities (Em/ En/SD): Gender based reproductive disorders and intervening mechanism.

Activities related to Cross Cutting Issues:

Assignment: Development of heart in frog. Birth control

Peer Group Discussion: Infertility

Online Assignment: Mind map/Flow chart: Insect metamorphosis

Sample questions

Part A

1. **Assertion:** Spermatogenesis results in the formation of haploid sperm cells.

Reason: During spermatogenesis, diploid spermatogonia undergo meiosis, producing haploid spermatids.

- a) Both assertion and reason are correct. b) Both assertion and reason are wrong.
c) Assertion is correct but reason is wrong. d) Assertion is wrong but reason is correct.

2. Identify the primary morphogenetic movement during gastrulation in frog embryos.

- a) Epiboly b) Invagination c) Ingression d) Proliferation

3. The placenta in mammals serves primarily as a respiratory organ for the developing fetus. **State True or False**

4. Which of the following best describes the role of nucleo-cytoplasmic interaction in the model organism *Acetabularia*? (CO-1)

- a) The nucleus controls the formation of the cytoskeletal structure.
b) The cytoplasm directs the synthesis of ribosomal RNA in the nucleus.
c) The nucleus and cytoplasm interact to regulate the growth and development of the *Acetabularia* cell.
d) The cytoplasm influences the function of the Golgi apparatus, while the nucleus maintains the cell wall.

5. Cryopreservation of gametes is used to: (CO-3)

- a) Preserve gametes or embryos for future fertilization.
b) Induce ovulation
c) Increase reproductive rates
d) Prevent genetic defects

Part B

1. Describe the types of egg membranes and their functions during fertilization.
2. Explain the concept of competence in the context of embryonic development.
3. Briefly describe the development of the digestive system in frog embryos.
4. Describe the hormonal control of metamorphosis in insects, emphasizing the role of juvenile hormone and ecdysone.
5. Explain the diagnostic parameters for infertility, with a focus on hormonal imbalance and Poly Cystic Ovarian Disease (PCOD).

Part C

1. Compare and contrast the structures of eggs in frogs, chicks, and humans. Discuss the specific adaptations and features that make each egg suitable for its respective reproductive strategy.

2. Discuss Spemann's experiments and their significance in understanding embryonic induction.
3. Discuss the principles of the collection of umbilical cord blood. Highlight the significance of preserving cord blood stem cells and the potential applications of stem cell development.
4. Analyse the regenerative ability of animals and discuss the histological process behind the regeneration.. (CO-4)
5. Imagine you are a healthcare consultant at a family planning clinic. A couple approaches you seeking information about various birth control methods. Explain in detail the hormonal and therapeutic birth control options available, highlighting the key features, benefits and potential risks of each method. (CO-3)

Course Instructor	Head of the Department
Dr. S. Prakash Shoba Dr. S. Mary Metilda Bai Dr. C. Josephine Priyatharshini	Dr. A. Shyla Suganthi

Class : III B.Sc. Zoology **Major Core IX**
Title of the Course : Immunology and Microbiology
Semester : VI
Course Code : ZC2062

No. of hours/week	No. of credits	Total number of hours	Marks
6	6	90	100

Objectives

1. To enable the students to know about the immune system and the microbes around us.
2. To develop the analytical skill on invading microbes and immune response.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	Cognitive level
CO - 1	define the components of the immune system, mechanisms of immune response, microbial diversity, infectious diseases and microbial application.	PSO - 1	K1 (R)
CO - 2	discuss the types of immune cells, immune response, taxonomic classification of microbes and their role in industries.	PSO - 1	K2 (U)
CO - 3	apply the concepts of Immunology and Microbiology for interdisciplinary research and life-long learning.	PSO - 3	K3 (Ap)
CO - 4	analyze the role of microbes in food, air, water, soil and immune response to infection.	PSO - 4	K4 (An)

Teaching Plan with Modules

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

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
Unit I: Immunity and Lymphoid organs ((18 hrs)					
1	History and scope. Types of immunity - Innate, acquired, passive and active.	4	K1 (R) & K2 (U)	KWL, Interactive PPT	Quick Write Flow chart
2	Cells of immune system (T cells)	2	K1 (R),	Inquiry based learning, Interactive PPT	Oral test, Mind mapping,
3	B cells, macrophages	2	K1 (R)	Fish bowl discussion	Quiz
4	Primary and Secondary lymphoid organs - Thymus, Bone marrow, Bursa of Fabricius,	4	K1 (R), K2 (U)	Flipped learning, Hot Potato	Illustration, Assignment - model making

5	Spleen, Lymph node, Mucosa Associated Lymphoid Tissue.	3	K1 (R), K2 (U)	Concept Mapping, Interactive PPT	Open book test, short test, Assignment - model making
6	Lymphoid and myeloid lineage.	3	K1 (R), K2 (U)	Video class, Collaborative learning	Quiz – slido, Mind mapping
Unit II: Antigen and Antibodies (18 hrs)					
1.	Haemopoietic stem cells and haemopoiesis.	4	K1(R), K2 (U)	Interactive PPT, Jigsaw	Mind map, Oral test
2.	Antigen, immunogens, hapten and adjuvants.	4	K1(R), K2 (U)	Peer teaching, Blended learning	Slido - Quiz
3.	Immunoglobulin - types, structure, and functions of IgG.	4	K1(R), K2 (U)	Group Discussion, Flipped classroom	Assignment, class test
4.	Antigen - Antibody reactions.	3	K1(R), K2 (U)	Inquiry based learning, KWL method	Mind mapping Class test, Quizzes
5.	Secondary antibody, purification of antibody.	3	K1(R), K2 (U)	Peer teaching, Video class	Open book test
Unit III: Immune Response (18 hrs)					
1	Primary and secondary immune response	3	K2 (U), K4 (An)	Interactive PPT, You tube video, Story boarding.	Mind mapping, Quick quizzes
2	Immunity to bacterial infections (humoral and cell-mediated immune response).	4	K2 (U), K4 (An)	Role play, Interactive PPT, You Tube Videos	Assignment (Flowchart) model making
3	Hypersensitivity - Allergens and types of hypersensitivity.	3	K2 (U)	Expository Teaching Interactive PPT	Peer Discussion, MCQ
4	Autoimmunity– Rheumatoid arthritis.	3	K2 (U)	Think – pair share, Inquiry-Based Learning	Four corners, Test using Padlet
5	Immunobiotics– definition, respiratory and digestive ailments.	3	K2 (U)	Peer teaching, Role play	Oral test, Summarization
6	Vaccines and Immunization schedule.	2	K2 (U)	Flipped classroom, Think-Pair-Share	MCQ, case study

Unit IV: General Microbiology (18 hrs)					
1	History and scope. Whittaker's and Bergy's classification of microbes.	4	K2 (U)	Brain storming, Cooperative learning	Class test, Rapid fire test
2	Bacteria - structure of <i>E. coli</i> , bacterial growth kinetics, culture media,	4	K4 (An)	Flipped classroom	MCQ, Slip test
3	culture techniques – batch culture. and continuous culture (chemostat and turbidostat).	4	K3 (Ap)	Blended learning	Summary Writing, Oral Quiz
4	Virus: structure (SARS and T4 phage)	2	K1(R)	PPT & Lecture	Short test with open ended questions, Flow Chart
5	reproduction of T4 phage (lysogenic and lytic).	2	K2 (U)	lecture using videos	Oral test, Summarization
6	Synthetic Biology.	2	K4 (An)	PPT & Lecture	Oral presentation, Quiz
Unit V: Applied Microbiology (18 hrs)					
1	Food poisoning, Food spoilage and preservation.	2	K3 (Ap)	Collaborative learning	Mind mapping, MCQ
2	Industrial microbiology - Scope and applications – Fermentation process – Fermenter -Wine and Vinegar production.	4	K4 (An)	Interactive Lecture, PPT	Summarization, Slip test
3	Medical microbiology - Bacterial diseases – Leptospirosis, Syphilis, Pneumonia,	4	K2 (U)	Peer teaching, Inquiry based	Oral quiz, Short test, MCQ
4	Viral diseases – COVID -19, Herpes, Hepatitis B, Rabies	4	K1(R)	Lecture, Group discussion	MCQ, mind mapping
5	Fungal diseases – Tineacorporis, Mucormycosis - Mycotoxicosis and Aspergillosis.	4	K2 (U)	Collaborative learning	Oral test, Summarization

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

Activities (Em/ En/SD): Flow chart/ Mind map

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

Activities related to Cross Cutting Issues: Create posters to raise awareness about the importance of vaccines and immunization schedules.

Assignment: Causes, Symptoms, Diagnosis and treatment of Viral Diseases

Sample questions

Part A

- 1. Who is considered the father of microbiology?**
a) Louis Pasteur b) Robert Koch c) Edward Jenner d) Antonie van Leeuwenhoek
- 2. Active immunity is acquired when antibodies are transferred from an immune individual to a non-immune individual. True or False**
- 3. The white blood cells that are responsible for producing antibodies in the immune response are**
-----.
- 4. Assertion (A): Antibodies are proteins that specifically recognize and bind to antigens.**
Reason (R): Antigens are substances that stimulate the production of antibodies in the body.
a) Both A and R are correct and R is the correct explanation of A.
b) Both A and R are correct but R is not the correct explanation of A.
c) A is correct and R is incorrect.
d) A is incorrect and R is correct.
- 5. Which of the following is a characteristic of the secondary immune response?**
a) It is slower and weaker than the primary response.
b) It involves memory cells and is quicker and stronger.
c) It only involves T cells.
d) It occurs only after the first exposure to an antigen.
Answer: b) It involves memory cells and is quicker and stronger.
- 6. Which of the following vaccines is included in the recommended immunization schedule for children in India?**
a) BCG (Bacillus Calmette-Guérin)
b) Hepatitis C
c) Malaria vaccine
d) Dengue vaccine
- 7. True or False: Whittaker's classification system divides organisms into five kingdoms: Monera, Protista, Fungi, Plantae, and Animalia.**
- 8. The structure of the E. coli bacterium includes a single _____ chromosome and a cell wall made of peptidoglycan.**

9. Which of the following is true regarding T4 phage reproduction?

- a) It only undergoes a lytic cycle
- b) It can undergo both lysogenic and lytic cycles
- c) It infects bacterial cells by injecting RNA
- d) It has a double-stranded RNA genome

10. Which of the following is a fungal disease associated with mycotoxicosis?

- a) Aspergillosis
- b) Pneumonia
- c) Syphilis
- d) Hepatitis B

Part B

1. Explain the types of immunity (innate, acquired, passive, and active) with examples.
2. What is the difference between active and passive immunity?
3. Compare primary and secondary immune responses in terms of speed, magnitude, and duration.
4. Summarize Whittaker's and Bergy's classification systems and their importance in microbiology.
5. Discuss the causes of food spoilage and the methods used for food preservation.

Part C

1. Explain the structure, functions, and significance of primary and secondary lymphoid organs
2. Describe the structure, types, and functions of immunoglobulins, focusing on IgG.
3. Compare and contrast the primary and secondary immune responses with examples.
4. Explain the structure of bacteria and viruses, highlighting *E. coli*, SARS-CoV, and T4 phage.
5. Discuss the scope and applications of industrial microbiology.

Course Instructor	Head of the Department
Dr. A. Shyla Suganthi Dr. Jeni Chandar Padua Dr. X. Venci Candida	Dr. A. Shyla Suganthi

Class : III B.Sc. Zoology **Major Core X**
Title of the Course : Organic Evolution
Semester : VI
Course Code : ZC2063

No. of hours/week	No. of credits	Total number of hours	Marks
6	5	90	100

Objectives

1. To discern the evolutionary significance of animals and origin of species.
2. To provide skills for tracing fossil records, interpreting animal evolution and analysing phylogenetic tree.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the concepts of evolution, origin of life, geological time scale, natural selection, speciation and evidences of evolution.	PSO - 1	R
CO - 2	discuss on the theories of evolution, isolation, variation, speciation, fossils and phylogram.	PSO - 2	U
CO - 3	generalise experimental and natural evidences in support of evolution, genetic equilibrium, speciation and rate of evolution.	PSO - 3	Ap
CO - 4	analyse the major transitions in evolution and phylogeny of animals.	PSO - 3	An
CO - 5	assess and report the evidences in support of natural selection, speciation and evolution.	PSO - 4	E

Teaching Plan with Modules

Total Hours 90 (Incl. Assignments & Test)

Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit I: Concepts and Evidences of Evolution (18 Hrs.)					
1	Origin of life - Theories and experiments.	5	K1 (R)	Flipped learning, YouTube videos	MCQ, Class Test
2	Evidences in support of evolution – morphology and comparative anatomy, embryology.	5	K2 (U)	Blended learning, PPT	Mind map, Assignment
3	Evidences in support of evolution – Physiology and biochemistry, palaeontology.	4	K4 An)	PPT, You Tube Videos	Quiz making, Seminar, Oral test
4	Geological time scale.	4	K4 n)	Peer teaching	
Unit II: Theories of Evolution (18 Hrs.)					
1	Evolution: Lamarckism, Neo-Lamarckism.	3	K1 (R)	Debate, Discussion	Short answer test, Recall terms
2	Darwinism, Neo-Darwinism.	3	K2 (U)	Peer teaching	Recall terms, Assignment

3	Mutation theory of De Vries. Modern synthetic theory. Variation – types, sources	4	K3 (Ap)	KWL(Know, Want to Know, Learned	Seminar, slip test, Flow chart
4	Hardy-Weinberg law and elemental forces of evolution - mutation, combination, hybridization, genetic drift, Founder's principle, polyploidy.	4	K4 (An)	PPT, Index card method	Quiz, Short answer test, Recall terms
5	Natural selection – Stabilizing, directional and disruptive selection.	4	K4 (An)	Inquiry based learning, Jigsaw	Class test, MCQ
Unit III: Isolating mechanisms, Species Concept and Speciation (18 Hrs.)					
1	Isolating mechanisms: Types, origin and evolution of isolating mechanisms, role of isolation in speciation.	4	K2 (U)	Flipped learning, PPT Presentation,	Short test, Mind map, MCQ
2	Species concept - morphological, genetic and biological. Salient features of species.	4	K2 (U)	KWL, PPT presentation	Class test Assignment
3	Sibling species, sub species, demes. Speciation - Phyletic and true speciation, mechanism of speciation.	5	K2 (U)	Brainstorming, Index card, Inquiry based	Oral test, Splash card, Seminar, Panel discussion
5	Adaptive radiation (Darwin finches) - Convergent and divergent evolution.	5	K3 (Ap)	Brainstorming, Q&A method	Model making, test
Unit IV: Phylogenetic analysis (18 Hrs.)					
1	Phylogenetic analysis: Tools for sequence alignment–BLAST, FASTA.	6	K1 (R)	Blended learning, PPT presentation	Open ended questions
2	Methods of phylogenetic analysis - phenetic and cladistic; phylogenetic trees.	6	K3 (Ap)	Blended learning, Jigsaw	Assignment, Short answer test
3	Methods for determining evolutionary trees – maximum parsimony, distance and maximum likelihood.	6	K4 (An)	Flipped learning, PPT presentation	Essay test, Recall terms
Unit V: Trends in Evolution, Mimicry and Colouration (15 Hrs.)					
1	Trends in Evolution: Modes of evolution–micro, macro and mega-evolution.	3	K5 (E)	Group discussion, Index card	Think and pair, Mind map

2	Heterochrony - Paedomorphosis and Peramorphosis.	2	K2 (U)	Flipped learning	Oral test, MCQ
3	Rate of evolution. Human Evolution – organic, cultural and future evolution.	5	K5 (E)	Peer group teaching	Seminar, Assignment
4	Mimicry and colouration.	4	K5 (E)	Group discussion	Quiz, Think and pair
5	Extinction - types, causes and significance.	4	K2 (U)	Peer group teaching	Mind map, Slip test, MCQ

Course Focusing on **Employability**

Activities: **Seminar, Assignment, Group discussion, Model making**

Course Focusing on Cross Cutting Issues: **Human Values**

Activities related to Cross Cutting Issues: **Assignment, Group Discussion**

Assignment: Evidences in support of evolution, Geological time scale.

Seminar: Phylogenetic tree. Mimicry and colouration

Model making Adaptive Radiation

Sample Questions

Part A

- The first experiment regarding the evolution of life was performed by _____
a) Watson and Crick b) Oparin and Haldane
c) Urey and Miller d) Meselson and Stahl
- What does p^2 in the Hardy-Weinberg equation $(p+q)^2 = p^2 + 2pq + q^2$ indicate?
a) individuals that are heterozygous dominant b) individuals having a lethal allele
c) individuals that are homozygous dominant d) individuals that are homozygous recessive
- Which of the following structures are formed due to adaptive radiation?
a) Homologous structure b) Analogous structure c) Vestigial structure d) All of these.
- On the basis of cladistics, this eukaryotic kingdom is polyphyletic and hence unacceptable
a) Monera b) Protista c) Animalia d) Fungi
- The extinct representative of the present-day living man is _____
a) Cro magnon man b) erect man c) java man d) neanderthal man

Part B

- Explain the theories of origin of life.
- Discuss the mutation theory of DeVries.
- Explain the role of isolation in speciation.
- List the tools used for sequence alignment.
- List the trends in evolution.

Part C

- Explain the evidences in support of evolution on Physiology and biochemistry.
- Elaborate the Hardy-Weinberg law and elemental forces of evolution.
- What is Adaptive radiation? Explain with suitable examples.
- Discuss the methods for determining evolutionary trees.
- Explain the origin of human.

Course Instructor	Head of the Department
Dr. J. Vinoliya Josephine Mary Dr. C. Anitha	Dr. A. Shyla Suganthi

Class : III B.Sc. Zoology
Title of the Course : Economic Zoology
Semester : VI
Course Code : ZC2064

Major Elective III – (a)

No. of hours/week	No. of credits	Total number of hours	Marks
4	3	60	100

Objectives

1. To acquaint the students with the applied aspects of Zoology.
2. To develop entrepreneurial skills in the area of applied zoological sciences.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	recall the importance of applied area of biological sciences.	PSO - 3	R
CO - 2	explain the rearing techniques of economically important animals.	PSO -3	U
CO - 3	apply the different strategies adopted in rearing of honey bee, lac insect, silkworm, fishes, fowls and dairy animals.	PSO -4	Ap
CO - 4	choose the profitable culture practices.	PSO -4	An
CO - 5	evaluate the profitability of animal farms.	PSO - 4	E
CO - 6	extend the entrepreneurial skills in establishing animal farms.	PSO - 4	C

Teaching plan with modules

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

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1.	Apiculture - scope, varieties of honey bees, bees and their society, communication in honey bees.	2	K1(R)	Inquiry based learning, Group discussion	Slip test, peer review
	2.	Bee pasturage, food of honey bees, relationship between plants and bees	2	K1(R)	Blended learning, Lecture method	MCQ, Question bank
	3.	Methods of bee keeping - primitive and modern	2	K3(Ap)	Flipped class learning	Flow chart, Slip test,
	4.	Economic importance of honey bee products- honey, bee wax, bee venom, pollen, royal jelly, and propolis	2	K4(An)	PPT, group discussion	Mind map, Flow chart
	5.	Enemies and diseases of honey bees. Honey extraction and processing. Steps involved in starting	2	K4(An)	Inquiry based learning, Brain storming	seminar, preparation of question bank, Flow chart

		apiary. Funding sources for beekeeping projects				
	6	Lac culture – scope – lac insect – cultivation of lac – processing of lac. composition of lac. Economic importance of lac.	2	K1(R) &K 5(E)	PPT, Blended learning, Group discussion	Peer review
II	1	Scope, Silk Road, CSB. Moriculture - varieties of mulberry, methods of propagation, harvesting of leaves	3	K1(R)	Blended learning, Lecture method, Group discussion, PPT	seminar, preparation of question bank
	2	Types of silk and silkworms. <i>Bombyx mori</i> - life cycle, rearing, mounting, spinning, harvesting of cocoons,	3	K3(Ap)	You tube links, PPT, Lecture Method	online Assignments, peer review
	3	Silk reeling techniques, and marketing	2	K4(An)	PPT, Lecture Method, Flipped Class room, Group discussion	MCQ, Group discussion
	4	Diseases of silkworm - pebrine, grasserie, Flacherie, sotto diseases, muscardine. Insect pest of silkworm Uzifly. Economic importance of sericulture.	4	K3(Ap)	PPT, YouTube Video, Collaborative learning	Short essays, Quizzes
III	1	Scope, Poultry industry in India, commercial layers and broilers	2	K1(R)	Brainstorming, Discussion	Mind mapping, Quizzes
	2	Poultry housing - types. Management of chick, growers, layers and broilers.	2	K3(Ap)	Group discussion, Jigsaw method	Oral test, Flow chart
	3	Sexing in chicks, debeaking	2	K3(Ap)	Mind map, Index card, Lecture	Short test with open ended question
	4	Diseases of poultry – Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis, vaccination.	2	K2(U)	Mind mapping, chalk and board, lecture	Oral test, Summarizationn
	5	Duck farming- introduction- duck breeds – housing - feed management	2	K6(C)	Peer tutoring, Jigsaw	Quizzes, slip test
	6	breeding – disease management – marketing. Economic importance of poultry farming.	2	K2(U)	Blended learning, Lecture	Quizzes, panel discussion

IV	1	Dairy Farming: Scope, indigenous and exotic breeds, establishment of a typical dairy farm.	2	K1(R)	KWL, Inquiry based & PPT	Nearpod Collaborative
	2	Management of cow - New born, calf, Heifer, milking cow.	2	K3(Ap)	YouTube videos, lecture	Oral test
	2	Diseases -Mastitis, Rinder Pest, FMD.	2	K2(U)	PPT & lecture	Mind mapping
	3	Nutritive value of milk, dairy products - standard milk, skimmed milk, toned milk and fermented milk - curd, ghee, cheese. Dairy Farming: Pasteurization	3	K2(U)	PPT, group discussion	Seminar, group discussion
	4	Goat farming – common breeds - construction and maintenance of sheds. Economic importance of dairy farming.	3	K4(An)	Seminar, Peer group teaching, mind map	Model making, slip test
V	1	Aquaculture: Aquaculture in India, important cultivable organisms and their qualities.	2	K1(R)	PPT, Lecture Method, Flipped Class room	Slip test Assignment
	2	Culture –types, Indian major carps, marine prawn and pearl oyster.	2	K3(Ap)	PPT, Inquiry based learning, Lecture method	MCQ, Flow chart
	3	Diseases of fishes – bacterial gill rot, viral hemorrhagic septicemia, saprolegniasis. Fish parasites – Argulus and <i>Ichthyophthirius</i>	2	K5(E)	PPT, Lecture Method, Flipped Class room, Group discussion	Mind map,
	4	Integrated fish culture - paddy cum fish culture (Pokkali), fish cum poultry farming, fish cum dairy farming, fish cum pig farming.	3	K5(E)	Chalk and Board, Lecture, you tube videos	Slip test, MCQ
	5	Ornamental fish culture – setting an aquarium, aquarium fishes. Economic importance of aquaculture.	3	K6©	Group Discussion, Interactive PPT	Word splash, objective test

Course Focussing on Employability/ Entrepreneurship/ Skill Development :

Entrepreneurship

Activities (Em/ En/SD): Construction of sheds for goat (Model making)

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

Activities related to Cross Cutting Issues:

Assignment : 1. Fish cum poultry farming.

Seminar Topics:

Sample questions (minimum one question from each unit)

Part A

1. The fertile female of the bee colony is _____bee.
2. The blue revolution occurs in aquaculture (State True / False).
3. What is the purpose of debeaking in poultry farming?
 - a) To enhance egg production
 - b) To prevent cannibalism and feather pecking
 - c) To improve meat quality
 - d) To control diseases
- 4 In goat farming, the construction and maintenance of a _____are crucial for providing a conducive environment for the well-being of the animals.
5. **Assertion (A):** Fish cum pig farming can pose environmental challenges.

Reasoning (R): The integration of fish and pig farming may lead to water pollution and increased nutrient load in the fish ponds, as pig waste contains high levels of nutrients that can adversely affect water quality and fish health.

- 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

6. Describe the member of bee colony with a neat, labeled sketch.
7. Illustrate the lifecycle of *Bombyx mori*.
8. Explain the significance of poultry farming and add a note on the economic importance of the same.
9. Compare and contrast goat farming with dairy farming. Discuss common goat breeds used in dairy production, shed construction, and maintenance practices.
10. What are the qualities of a cultivable organism in Aquaculture practices?

Part C

6. Explain the various methods of bee keeping.
7. Explain the different types of mountages used in silkworm rearing.
8. Outline a comprehensive disease surveillance and control strategy for a poultry farm. Discuss the importance of biosecurity measures, routine health checks and early detection of diseases.
9. Explain the importance of breeding in dairy farming for improving milk production and quality. Discuss the characteristics of indigenous and exotic dairy breeds.
10. Provide a detailed guide on setting up an aquarium for ornamental fish. Discuss the essential components, such as tank size, filtration, lighting, and substrate. Explain the considerations for selecting and maintaining aquarium fishes.

Course Instructor	Head of the Department
Dr. X. Venci Candida Dr. S. Prakash Shoba	Dr. A. Shyla Suganthi

Class : III B.Sc. Major Practical IV
Title of the Course : Ecology and Toxicology & Organic Evolution
Semester : V & VI
Course Code : ZC20P4

No. of hours/week	No. of credits	Total number of hours	Marks
4	2	60	100

Objectives

1. To investigate the relationship between the organisms and their environment.
2. To develop skill to identify variation, speciation and phylogeny.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the protocols to analyze water quality and variation in fingerprints.	PSO - 1	R
CO - 2	identify the zooplankton, serial homology, mutant forms of <i>Drosophila</i> , mimicking animals and fossils.	PSO - 2	U
CO - 3	interpret the evolutionary concepts, natural selection, variations, gene frequency and prodigality of nature through experiments.	PSO - 3	Ap
CO - 4	analyze physical and chemical factors of the natural ecosystem and lethal concentration of pesticide.	PSO - 4	An

Teaching plan with Module

Total Hours 60 (Incl. Demonstration, Observation & Test)

Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
Ecology and Toxicology (30 Hrs.) V semester					
1	Detection of transparency of water by Secchi disc.	3	Measure transparency of water. (CO-1)	Demonstration & Observation	Continuous Performance based assessment.
2	Quantitative estimation of oxygen in water samples.	3	Estimate oxygen content in water samples. (CO-1)	Demonstration & Observation	
3	Estimation of salinity of water samples.	3	Estimate salinity of water samples. (CO-1)	Demonstration & Observation	
4	Estimation of CO ₂ in water samples.		Estimate the CO ₂ in water samples. (CO-1)	Demonstration & Observation	Internal Assessment.
5	Mounting of planktons	3	Identify planktons and prepare temporary slides. (CO-2)	Demonstration & Observation	
6	Study of food chain and food web in a terrestrial ecosystem.	3	Identify the producers and consumers in an ecosystem and how they interact. (CO-4)	Field visit	

7	Estimate insect population using quadrat method.		Estimate insect population of a study area using the quadrat method. (CO-4)	Field visit
8	Preparation of different concentrations of toxicants (percentage, ppt, ppm).		Prepare different concentrations of toxicants (CO-4)	Demonstration & Observation
9	Determination of LC ₅₀ of a pesticide (toxicity curve method).	3	Determine LC ₅₀ of a pesticide. (CO-4)	Demonstration & Observation
10	Study of pond ecosystem and field report of the visit (compulsory).	3	Document the field trip. (CO-4)	Field Trip/ virtual visit
11	Museum specimens/ Slides/ Models/ Charts: Water sampler, Water cycle, Ecological Pyramids, Energy Flow, Edge effect, Mutualism - Hermit crab and Sea anemone, Commensalism - <i>Echeneis</i> and Shark, Parasitism - <i>Sacculina</i> on Crab, Competition – prey and predator, Cyclomorphosis - <i>Daphnia</i> .	9	Identify and Explain water sampler, ecological pyramids, Mutualism, Commensalism, Competition, Cyclomorphosis. (CO-2,4)	Observation of the spotters and specimen

Course Instructor	Head of the Department
Dr. Vinoliya Josephine Mary Dr. F. Brisca Renuga	Dr. A. Shyla Suganthi

Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
Organic Evolution (30 Hrs.) VI semester					
1	Observation of Serial homology in prawn.	3	Analyze the homologous organs. (CO-2)	Experiment & Observation	Continuous Performance based assessment.
2	Study of Analogy – wings of animals (charts/ models/ specimen).	3	Analyze the analogous organs. (CO-2)	Observation	
3	Observation of prodigality of nature - Frog.	3	Interpret the prodigality of nature. (CO-3)	Observation	
4	Observation of mutant forms in <i>Drosophila</i> .		Identify mutants and discuss its importance in evolution. (CO-2)	Culture & Observation	

5	Observation of variation in finger prints.	3	Identify the uniqueness of each individual person. (CO-1)	Experiment & Observation	Internal Assessment.
6	Variations in the markings of Umbonium shells.	3	Identify the difference between shells and its importance in speciation. (CO-3)	Experiment	
7	Demonstration of the effect of natural selection on gene frequency using beads.		Evaluate the role of natural selection in a population. (CO-3)	Experiment	
8	Demonstration of the effect of genetic drift on gene frequency using beads.		Evaluate the role of genetic drift in a population (CO-3)	Experiment	
9	Demonstration of sequence alignment by BLAST and construction of cladogram.	3	Interpret the evolutionary concepts through blast and cladogram analysis (CO-3)	Demonstration	
10	Identification of types of fossils.	3	Document the identified fossils. (CO-2)	Museum/ Virtual	
11	Models / Charts / Specimen Homology - fore limbs of vertebrates, Vestigial organs, Nautiloid fossil, <i>Limulus</i> , <i>Peripatus</i> , <i>Archaeopteryx</i> , Darwin finches, Industrial melanism, Ancon sheep, Monarch and Viceroy butterfly, Stick insect, Krait and <i>Lycodon</i> , Phylogenetic tree.	9	Identification and description of the spotters (CO-2)	Observation of the spotters and specimen	

Course Instructor	Head of the Department
Dr. J. Vinoliya Josephine Mary Dr. C. Anitha	Dr. A. Shyla Suganthi

Class : III B. Sc. Zoology
Semester : VI
Title of the Course : Vermitechnology
Course Code : ZSK206

SBC

No. of hours/week	No. of credits	Total number of hours	Marks
2	2	30	100

Learning Objectives

1. To impart knowledge on the production of vermicompost, a nutrient rich fertilizer.
2. To enable the students to generate and promote employment and organic farming.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the classification and categories of earthworms.	PSO - 1	K1 (R)
CO - 2	explain the biology of earthworms.	PSO - 1	K2 (U)
CO - 3	assess the importance of earthworms in soil fertility, medicine and pharmaceuticals.	PSO - 5	K3 (Ap)
CO - 4	design the methodology for vermiculture and for the production of vermicompost and vermishash.	PSO - 3	K4 (An)
CO - 5	prepare and market the vermicompost.	PSO - 4	K5 (E)

Teaching Plan with Modules

Total Contact hours: 30 (Including lectures, assignments and tests)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
Unit I: Vermitechnology (6 Hrs.)					
1	Definition and importance. Earthworm–Systematic position and salient features.	2	K1 (R)	PPT, video	Slip test
2	Categories of earthworm – Anecic, Endogeic, Epigeic species.	1	K1 (R)	PPT, Online Video	Liter collection
3	Biology of <i>Eisenia fetida</i> , <i>Lumbricus terrestris</i> , <i>Eudrilus eugenia</i> , <i>Megascolex mauritii</i> .	3	K2 (U)	Interactive PPT, Group Discussion	MCQ
Unit II: Role of earthworms (6 Hrs.)					
1	Soil fertility and productivity	1	K3 (Ap)	Interactive PPT	Mind map
2	Earthworm and microorganisms	1	K2 (U)	PPT, Screen Captured e-content	Slip test
3	Pest and diseases of earthworm	2	K2 (U)	PPT video	Quizzes

4	Economic and medicinal importance	2	K3 (Ap)	PPT, Online video, Group Discussion	Vermi bed preparation
Unit III: Vermiculture (6 Hrs.)					
1	Collection and preservation	2	K4 (An)	PPT, Video	Poll
2	Vermiculture techniques -Types (monoculture and polyculture)	1	K4 (An)	PPT, E-content	Flow chart
3	Vermicast - formation, shape, composition and importance.	1	K4 (An)	PPT, online class	Slip test
4	Vermiwash – preparation, composition and applications.	2	K4 (An)	PPT, Video lesson.	Online Quiz
Unit IV: Vermicomposting (6 Hrs.)					
1	Requirements–earthworm, site, bed, feed, moisture and oxygen	1	K4 (An) K5 (E)	PPT, Discussion	MCQ
2	Steps of vermicomposting - selection of site, containers, species, food, preparation of vermibed, inoculation of worms, feeding, watering the wormbed	3	K4 (An)	Recorded PPT, Video	Vermibed preparation
3	Methods of vermicomposting	2	K4 (An)	PPT, Discussion, You Tube Video	Mind Map
Unit V: Harvesting and marketing (6 Hrs.)					
1	Harvesting of earthworms and vermicompost	1	K4 (An)	PPT, Online video	Flow chart
2	Packaging, storing, and marketing of vermicompost Economic viability of vermicomposting	1	K4 (An)	PPT, Video, Screen Captured e-content	Slip test
3	Vermi-remediation	2	K4 (An)	Interactive PPT, Video	Vermi bed preparation
4	Financial Support by Government and Non-Government funding agencies.	2	K5 (E)	PPT, Discussion, Online Video	Flow chart

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

Activities (Em/ En/SD): Vermi bed preparation, harvesting of vermicompost

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

Activities related to Cross Cutting Issues:

Assignments:

1. Album preparation on Categories of earthworm
2. Mind map on steps involved in vermicomposting

Sample questions

Part A

1. Vermicomposting is the compost produced by worms. **State True or False**
2. Which of the following methods helps to maintain soil humidity in verimitechnology?
Slant method b. Heap method c. Surface method d. Light method
3. What is monoculture in earthworm farming?
 - a) Cultivation of a single species of earthworm
 - b) Cultivation of multiple species of earthworms
 - c) Avoiding the use of earthworms in agriculture
 - d) Cultivation of earthworms and fish together
4. **Assertion:** Vermiwash promotes plant growth.
Reason: Vermiwash contains growth promoting hormones.
 - a) Both assertion and reason are correct
 - b) b) Assertion is correct and reason is wrong
 - c) Both assertion and reason are wrong
 - d) d) Assertion is wrong and the reason is correct.
5. Earthworms can completely break down non-biodegradable materials like plastics in vermiremediation. **State True or False**

Part B

1. Differentiate Categories of earthworm with suitable example.
2. Analyse Economic and medicinal importance of vermicomposting.
3. Differentiate monoculture with poly culture.
4. Discuss methods of vermicomposting.
5. Vermicompost promotes employability - Justify

Part C

1. Illustrate the Biology of *Eisenia fetida*,
2. Discuss the Pest and diseases of earthworms.
3. Vermiwash promotes plant growth – Justify
4. Explain vermibed preparation with suitable diagram.
5. Explain the steps involved in the harvesting and marketing of vermicomposting.

Course Instructor	Head of the Department
Dr. P.T. Arokya Glory Dr. C. Josephine Priyatharshini	Dr. A. Shyla Suganthi

Class: III B.Sc. **Major Practical V**
Title of the Course : Developmental Zoology & Immunology and
Microbiology
Semester VI
Course Code : ZC20P5

No. of hours/week	No. of credits	Total number of hours	Marks
4	2	60	100

Objectives

1. To investigate the relationship between the organisms and their environment.
2. To develop skill to identify variation, speciation and phylogeny.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the protocols to analyze water quality and variation in finger prints.	PSO - 1	R
CO - 2	identify the zooplankton, serial homology, mutant forms of <i>Drosophila</i> , mimicking animals and fossils.	PSO - 2	U
CO - 3	interpret the evolutionary concepts, natural selection, variations, gene frequency and prodigality of nature through experiments.	PSO - 3	Ap
CO - 4	analyze physical and chemical factors of natural ecosystem and lethal concentration of pesticide.	PSO - 4	An

Teaching plan with Module

Total Hours 60 (Incl. Demonstration, Observation & Test)

Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
Ecology and Toxicology (30 Hrs.) V semester					
1	Detection of transparency of water by Secchi disc.	3	Measure transparency of water. (CO-1)	Demonstration & Observation	CIA Internal Assessment.
2	Quantitative estimation of oxygen in water samples.	3	Estimate oxygen content in water samples. (CO-1)	Demonstration & Observation	
3	Estimation of salinity of water samples.	3	Estimate salinity of water samples. (CO-1)	Demonstration & Observation	
4	Estimation of CO ₂ in water samples.		Estimate the CO ₂ in water samples. (CO-1)	Demonstration & Observation	
5	Mounting of planktons	3	Identify planktons and prepare temporary slides. (CO-2)	Demonstration & Observation	

6	Study of food chain and food web in a terrestrial ecosystem.	3	Identify the producers and consumers in an ecosystem and how they interact. (CO-4)	Field visit
7	Estimate insect population using quadrat method.		Estimate insect population of a study area using quadrat method. (CO-4)	Field visit
8	Preparation of different concentrations of toxicants (percentage, ppt, ppm).		Prepare different concentrations of toxicants (CO-4)	Demonstration & Observation
9	Determination of LC ₅₀ of a pesticide (toxicity curve method).	3	Determine LC ₅₀ of a pesticide. (CO-4)	Demonstration & Observation
10	Study of pond ecosystem and field report of the visit (compulsory).	3	Document the field trip. (CO-4)	Field Trip/ virtual visit
11	Museum specimens/ Slides/ Models/ Charts: Water sampler, Water cycle, Ecological Pyramids, Energy Flow, Edge effect, Mutualism - Hermit crab and Sea anemone, Commensalism - <i>Echeneis</i> and Shark, Parasitism - <i>Sacculina</i> on Crab, Competition – prey and predator, Cyclomorphosis - <i>Daphnia</i> .	9	Identify and Explain water sampler, ecological pyramids, Mutualism, Commensalism, Competition, Cyclomorphosis. (CO-2,4)	Observation of the spotters and specimen

Course Instructor	Head of the Department
Dr. S. Prakash Shoba Dr. A. Ms. Mary Mettilda Bai	Dr. A. Shyla Suganthi

Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Immunology and Microbiology (30 Hrs.)					
1	Dissection of Lymphoid organs of Rat - (Virtual demonstration).	2	Identify immune organs and its role. (CO-4)	Demonstration through virtual lab	Pre-assessment.
2.	Radial immuno diffusion	4	Recall antigen antibody reactions. (CO-3, 4)	Practical	Performance-based Assessment.

3	Demonstration of Hemagglutination.	4	Realize the process of hemagglutination (CO-3, 4)		Self-assessment, Model examination
4	Observation of immune cells – Blood smear preparation		Differentiate different types of blood cells based on their morphology (CO-3, 4)		
5	Preparation of culture media for bacteria and fungi.	4	Select appropriate culture media to grow bacteria and fungus (CO-3, 4)	Practical	
6	Serial dilution technique.	2	Recall serial dilution. (CO-2, 3,4)	Practical	
7	Examination of bacterial motility by Hanging drop technique.	2	Devise the hanging drop technique. (CO-2, 3, 4)	Practical	
8	Identification of bacteria by simple staining.		Identify bacilli and coccus positive and negative bacteria. (CO-2, 3, 4)		
9	Identification of bacteria by Gram staining.	4	Recognize and differentiate Gram positive and negative bacteria. (CO-2, 3, 4)	Practical	
10	Study of the effect of pH on growth of bacteria based on turbidity.	2	Analyze the growth growth of bacteria based on turbidity. (CO-2, 3, 4)		
11	<i>Charts/ Models/ Instruments</i> <i>Escherichia coli</i> , T4phage, Zika virus, Bacterial growth curve, Chemostat, Autoclave, Hotair oven, Inoculation loop	4	Apply the culture technique of bacteria. (CO-2, 3, 4)		
12	Haemocytometer, Stage and Ocular micrometer.	4	Recall the application of haemocyto meter and ocular micrometer. (CO-2, 3)	Demonstration (virtual)	

Course Instructor	Head of the Department
Dr. A. Shyla Suganthi Dr. X. Venci Candida	Dr. A. Shyla Suganthi