Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, Tamil Nadu.

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

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF ZOOLOGY

SYLLABUS FOR UNDERGRADUATE PROGRAMME

TEACHING PLAN

EVEN SEMESTER 2023 – 2024

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, Ecology and Toxicology, Biochemistry, Biophysics, Biostatistics, Biotechnology, Immunology, Microbiology and Evolution.	PO1, PO3
PSO - 2	perform laboratory 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, Vermitechnology 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

TEACHING PLAN

Class : I B. Sc. Zoology Core Course - II
Title of the Course : Chordata
Semester : II
Course Code : ZU232CC1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	4	90	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)

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1.	General Characters and Classification of Phylum Chordata: origin of Chordata	4	K1(U)	Group discussion, Jigsaw method	MCQ, Mind map
	2.	Differences between non-chordates and chordates	4	K1(R)	Blended learning, Lecture	MCQ, Mind map
	3.	General characters, affinities and systematic position of Hemichordata (*Balanoglossus*)	4	K1(Ap)	Brainstorming, Discussion	Slip test
	4.	Urochordata (*Ascidia*),	3	K1(R)	Mind mapping, chalk and Board, lecture	MCQ, Mind map

	5.	Cephalochordata (*Amphioxus*).	3	K1(R)	Index cards, Chalk and board	MCQ, Mind map
II	1	Agnatha: Characteristics of subphylum vertebrata. General characters	3	K1(R)	Brainstorming, Discussion	Quizziz, Panel discussion
	2	Classification up to class level, Agnatha (*Petromyzon*)	3	K1(R)	Group discussion, Jigsaw method	MCQ, Oral test
	3	Pisces (*Scoliodon sorrakowah*), circulatory system	3	K2 (U)	Index cards, 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, jigsaw	Objective test, word splash
	6	Migration - economic importance.	3	K3 (Ap)	Blended learning, Lecture	Open book test, assignment
III	1	Amphibia: General characters and classification up to orders with names of the examples only.	4	K2 (U)	Index cards, Chalk and board	MCQ, Mind map
	2	Type study –*Rana hexadactyla* Morphology, Digestive system, respiratory system, Urinogenital system,	4	K1 (R)	Peer tutoring, jigsaw	Open book test, assignment
	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, word splash
	5	Parental care in Amphibia.	2	K3 (Ap)	Group discussion, Jigsaw method	MCQ, Mind map
IV	1	Reptilia: General characters and classification -:	3	K1 (R)	Chalk and board, lecture using videos	Short essays, Quizzes
	2	Type study – (*Calotes versicolor* - Morphology, endoskeleton of *Varanus*).	4	K2 (U)	PPT, group discussion	MCQ, Group discussion
	3	Extinct reptiles. Snakes of South India	3	K2 (U)	Team teaching, mind map	online Assignment peer review
	4	Poisonous snakes - *Naja naja*, King cobra and Viper, Non-poisonous snakes - Python, Rat snake (*Ptyas mucosa*) and Wolf snake (*Lycodon aulicus*).	4	K3 (Ap)	Chalk and Board, Lecture, you tube videos	preparation of question bank

	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
V	1	Aves and Mammalia**:** Aves: general characters and classification – type study - *Columba livia* – exoskeleton.	5	K2 (U)	Peer tutoring, lecture using videos	Class test, Just a minute
	2	Flight adaptations, Migration.	4	K3 (Ap)	Flipped classroom, Peer tutoring	Class test, Just a minute
	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	Word splash, objective test
	5	Marsupials, flying mammals. Dentition in mammals.	3	K3 (Ap)	Flipped classroom, Peer tutoring	Class test, Just a minute

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

Activities (Em/ En/SD): 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 : Debate on "**Environment Sustainability"**

Assignment :

1. Accessory respiratory organs
2. Album on "Poisonous and non-poisonous snakes.

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 of 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. Distinguish between the types of scales and fins found in Pisces.
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. Discuss the different types of teeth found in mammalian dentition, their functions, and how variations in tooth structure are related to the dietary habits of different mammalian species.

Part C

1. Give the general characters of Prochordates and classify them up to classes.
2. Explore the structure and function of their sense organs, emphasizing how these adaptations contribute to their survival, feeding, and reproductive behaviours.
3. Describe the parental care in amphibians.
4. Write an essay on flight adaptation of birds.
5. Explain the detailed morphological study of *Calotes versicolor*. Describe the external features and adaptations that contribute to its survival and reproduction.

Head of the Department **Course Instructors**

Dr. A. Shyla Suganthi Dr. A. Punitha

Dr. X. Venci Candida

Class : B. Sc./ B.A./ B.Com NME II
Semester : II
Title of the Course : Biocomposting for Entrepreneurship
Course Code : ZU232NM1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
2	2	30	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 Contact hours: 90 (Including lectures, assignments, and tests)

Units	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	**Biocomposting (6 Hrs.)**					
	1	Definition, types; home composting, vermicomposting	2	K1 (R)	Flipped learning	Slip test
	2	Aerobic composting, anaerobic composting	2	K2 (U)	Blended learning	MCQ class test
	3	Compost Ingredients - ecological importance	2	K1 (R)	Group discussion	Dictation
II	**Biocomposting technology (6 Hrs.)**					
	1	Field pits - ground heaps – tank - large-scale	2	K1 (R) K3 (Ap)	PPT, Peer teaching	Mind map
	2	Batch and continuous methods	1	K2 (U) K3 (Ap	Collaborative Learning	Slip test

	3	Biology of the composting process	1	K2 (U) K3 (Ap	Hands on training	Quizzes
	4	Humification of organic material. Compost enrichment	2	K2 (U) K3 (Ap	Hands on training	Flow chart
III	**Methods of composing (6 Hrs.)**					
	1	Preparation of Biocompost pit and bed for Bangalore method	2	K2 (U) K3 (Ap)	Hands on training	Flow chart
	2	Preparation of Biocompost pit and bed for, Indore method	1	K2 (U) K3 (Ap)	Hands on training	Flow chart
	3	Preparation of Biocompost pit and bed for Coimbatore method.	1	K2 (U) K3 (Ap)	Hands on training	Flow chart
	4	Preparation of Biocompost pit and bed for, NADEP method .	2	K2 (U) K3 (Ap)	Hands on training	Flow chart
IV	**Applications of Biocompost in soil fertility (6 Hrs.)**					
	1	Maintenance, promotion of plant growth	2	K2 (U)	Hands on training	Oral test
	2	Value added products, waste reduction, etc	2	K3 (Ap)	Hands on training	Mind map
	3	Drawbacks of using composts.	2	K2 (U)	Group discussion	Oral test
V	**Economics of establishment of a small biocompost unit (6 Hrs.)**					
	P	Project report proposal for Self Help Group	3	K3 (Ap) K4(An) K5 (E)	Hands on training	Report preparation
	2	Income and employment generation).	3	K3 (Ap)	Hands on training	Amount of purchase

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

Activities (Em/ En/SD): Preparation of Biocompost pit, Compost enrichment, Hands on training for Self Help Group

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

Activities related to Cross Cutting Issues: Organize workshops to educate communities about the importance of biocomposting, Implement composting initiatives in schools.

Assignment: Preparation of Biocompost pit and bed

Seminar Topic: (if applicable) Nil

Sample questions

Part A

1. Vermicomposting is the compost produced by worms. **State True or False**
2. The method which maintains humidity is the
   a. Slant method b. Heap method c. Surface method d. Light method
3. Expand NADP
4. **Assertion :** Vermiwash promotes plant growth.
   Reason : Vermiwash contains growth promoting hormones.
   e. Both assertion and reason are correct
   f. Assertion is correct and reason is wrong
   g. Both assertion and reason are wrong
   h. Assertion is wrong and the reason is correct.
5. Vermicompost are the _____ industries.

Part B

1. Differentiate aerobic and anaerobic composting.
2. Analyse batch and continuous methods of vermicomposting.
3. Discuss Bangalore method of vermi pits.
4. Vermicompost promotes waste reduction – Justify
5. Vermicompost promotes employability - Justify

Part C

1. Discuss the types of Biocomposting.
2. Describe the biology of composting process
3. Differentiate Indore and Coimbatore method of biocomposting.
4. Explain the value-added products of vermicomposting.
5. Prepare a sample project report proposal for Self Help Group.

Head of the Department **Course Instructor**

Dr, A. Shyla Suganthi Dr. C. Josephine Priyatharshini

Dr. S. Prakash Shoba

Class : I B.Sc. Zoology SEC 1
Title of the Course : Animal Behaviour
Semester : II
Course Code : ZU232SE1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
2	2	30	100

Prerequisite

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

Learning Objectives

- To understand the biological properties of animal behavior, with an evolutionary and ecological emphasis
- To develop practical skills related to studying and analyzing animal behavior.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	Cognitive level
CO - 1	Gain a comprehensive understanding of the key concepts related to the genetics, evolution, perception, learning, decision making and chronobiology of animal behaviour.	K1
CO - 2	explain the evolutionary and ecological factors influencing social behaviour, the complexity of decision-making process in animals and the concepts of biological clocks.	K2
CO - 3	interpret animal behaviour patterns, social behaviour dynamics, predict and manage animal physiology and behaviour, solve behavioural problems, optimise human health and well-being.	K3

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

Teaching Plan with Modules

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

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Basics of Animal Behaviour (6 Hrs.)**					
	1.	**Basics of Animal Behaviour** : Defining animal behaviour, Importance, and significance of studying animal behaviour	2	K1 (R) K2 (U)	Brain storming, Cooperative learning	MCQ, Slip test

	2.	Approaches to behavioural studies, Genetic basis of behaviour	1	K2 (U), K3 (Ap)	Lecture, Group discussion	Summarisation, Class test
	3.	Heritability of behaviour, Habitat, and its impact on influencing behaviour	1	K1 (R), K2 (U)	PPT & Lecture	Oral test, Flow chart
	4	Social interactions and their role in shaping behaviour, Ethology and recording animal behaviour	2	K1 (R), K2 (U)	Interactive lecture, Group Discussion	Slip test, Flow chart
II	**Evolution and Social Behaviour (6 Hrs.)**					
	1	Natural selection and Social Behaviour, Sexual selection	1	K2 (U)K3 (Ap)	Flipped classroom, Inquiry based learning	Quiz using Mentee metre
	2	Altruism, Mating systems and Sexual strategy and social organisation	2	K1 (R), K3 (Ap)	Peer tutoring, lecture using videos	Class test, Mind mapping
	3	Animal perception, Communication in Social animals, Group living	1	K1 (R), K2 (U)	Video class, Collaborative learning	Slip test, Slido - MCQ
	4	Parental Care, Visual adaptations to unfavourable environments.	2	K1 (R), K2 (U)	Lecture using videos	Group Discussion
III	**Animal and the Environment (6 Hrs.)**					
	1	Habitat selection, Coordination and Orientation	1	K1 (R), K2 (U)	Collaborative learning	Oral presentation
	2	Homeostasis and Behaviour, Physiology and Behaviour in changing environments	1	K1 (R), K3 (Ap)	Mind mapping, Debate	MCQ, mind mapping
	3	Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning	2	K1 (R), K2 (U)	Peer tutoring, lecture using videos	Oral test, Summarization
	4	Foraging behaviour, Competition, Environmental challenges and stressors.	2	K2 (U), K3 (Ap)	Simulation, Lecture method	Slip test, Open Book test
IV	**Understanding Complex Behaviour (6 Hrs.)**					
	1	Instinct, learning, Cognition and Memory, Complex reproductive behaviours	2	K1 (R), K2 (U)	KWL, Inquiry based	Quiz, Question bank by students
	2	Decision making behaviour in Animals, Mechanism of Decision making	2	K2 (U), K3 (Ap)	Flipped classroom, Collaborative learning	Oral test, Slido - MCQ
	3	Complex behaviour of honey bees, Languages and mental representation	1	K1 (R), K2 (U)	PPT & lecture	Mind mapping

	4	Animal awareness and Emotion.	1	K2 (U), K3 (Ap)	Inquiry-based; context based	Class test, Quiz
V	**Chronobiology (6 Hrs.)**					
	1	Circadian rhythm, Biological Clock, concept of central and peripheral clock system	2	K1 (R), K2 (U)	Collaborative learning, Discussion	Assignment, Open Book test
	2	circadian pacemaker system; photoperiodism	1	K2 (U), K3 (Ap)	Jigsaw, Group Discussion	Oral test , Summarisation
	3	Influence of circadian rhythms on mating, feeding, and other behaviours	1	K1 (R), K2 (U)	Interactive PPT, Index card	Short test with open ended question
	4	Ultradian and Infradian Rhythms, Chronobiology and Aging, Chrono pharmacology, chrono medicine, chronotherapy.	2	K1 (R), K3 (Ap)	Lecture method, Flipped classroom	Oral test, Flow chart

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

Activities (Em/ En/SD): Complex behaviour of honey bees. (Video making)

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

Activities related to Cross Cutting Issues: Debate on "Chrono medicine and Chronotherapy.

Assignment: Circadian rhythm

Sample questions

Part A

1. Which term refers to the study of how genes contribute to individual differences in behaviour?
   a) Ethology b) Behavioural genetics c) Sociobiology d) Cognitive neuroscience
2. Altruism is a behaviour in which an individual exhibits selfless concern for the well-being of others, often at a cost to itself. **State True/False**
3. Homeostasis is the physiological process that maintains _____ internal conditions in animals.
4. What happens when an organism experiences disruptions in its circadian rhythms?
   a) No significant effects on health and behaviour.
   b) Enhanced cognitive function.
   c) Potential negative impacts on physical and mental well-being.
   d) Improved adaptability to environmental changes.

5. **Assertion:** Decision-making behaviour in animals is a complex process influenced by combination of genetic, environmental, and cognitive factors.
   Reason: Animals rely solely on instinct and do not possess the cognitive capacity for decision-making based on diverse factors.
   a) Both A and R are correct b) Both A and R are wrong
   c) A is correct and R is wrong d) A is wrong and R is correct

Part B

1. How does habitat influence animal behaviour, and what factors within a habitat can impact the behavioural patterns of animals?
2. Explain the concept of parental care in the animal kingdom and discuss the adaptive advantages it provides to both parents and offspring.
3. Discuss the biological factors that contribute to the process of learning in animals.
4. Describe the mechanism of exhibiting complex reproductive behaviours by animals.
5. Differentiate between ultradian and infradian rhythms in biological systems, providing examples of each.

Part C

1. Elaborate the fundamental principles of ethology and the methodologies used for recording and analyzing animal behaviour.
2. List the various forms of communication observed in social animal groups.
3. Discuss the factors influencing foraging decisions, the various strategies employed by different species, and the adaptive significance of foraging behaviour.
4. Illustrate the roles of different castes within the bee hive.
5. Describe the field of chronopharmacology, exploring how the timing of drug administration influences its efficacy and potential side effects.

Head of the Department **Course Instructors**

Dr. A. Shyla Suganthi Dr. P.T. Arokya Glory
Dr. S. Prakash Shobha

Class : II B. Sc. Zoology **Major Core IV**
Title of the Course : Genetics
Semester : IV
Course Code : ZC2041

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	4	60	100

Objectives

1. To enable the students to understand the basic principles of inheritance and population genetics.
2. To enhance skills to interpret hereditary, mutation and syndromes and extend genetic counselling to society.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the key concepts of heredity, population genetics, karyotyping and genetic counselling.	PSO - 1	K1(R)
CO - 2	describe Mendelian, polygenic, and cytoplasmic inheritance, chromosome mapping, nondisjunction, gene frequency and eugenics.	PSO - 1	K2 (U)
CO - 3	apply the principles of heredity to real life situations.	PSO - 2	K3 (Ap)
CO - 4	execute and analyze the results of genetic experimentation in animal and plant models.	PSO - 3	K4 (An)
CO - 5	evaluate the genetic data of a population.	PSO - 4	K5 (E)

Teaching Plan with Modules

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

Unit	Module	Topic	Hours	K - level	Pedagogy	Assessment/ Evaluation
I	**Mendelian inheritance** (12 Hrs.)					
	1	Monohybrid and dihybrid - back cross and test cross. Complete, incomplete and codominance.	3	K1 (R) K2 (U) K3 (Ap)	Brainstorming, Lecture, Checker board practice	Class test, Mind map, Class Exercises, MCQ
	2	Interactions of genes: Complementary genes – flower colour in sweet pea, Supplementary genes – inheritance of comb in fowl, Epistasis – inheritance of colour pattern in poultry and coat colour in mice.	5	K1 (R) K2 (U) K5 (E)	PPT, Illustrative lecture, Group Discussion, Checker board practice.	Assignment, Checker board, Flow chart, recall terms, short answers,

	3	Lethal genes – sickle cell anaemia. Polygenic inheritance - Skin colour in man.	2	K1 (R) K2 (U) K3 (Ap)	Inquiry based learning, Peer teaching, Reasoning.	Home assignment, Slip test, Flow chart
	4	Multiple alleles: ABO blood group in man, Rh factor in man, coat colour in rabbit.	2	K1 (R) K2 (U) K4 (An)	Interactive lecture, Group Discussion	Class notes, case study
II	**Chromosome mapping and Syndromes** (12 Hrs.)					
	1	Linkage – types, groups and theories. Crossing over - mechanism, theories, cytological evidence - Stern's experiment and Tetrad analysis, significance.	4	K1 (R) K2 (U) K3 (Ap)	Collaborative teaching, Peer teaching (Seminar), PPT	Mind map, Oral test, Seminar, Preparation of study materials
	2	Chromosome map - two point and three-point cross, construction of chromosome map.	3	K1 (R) K2 (U)	Problem-based learning, Interactive lecture, Group discussion	Diagrams, Online Assignment
	3	Sex determination in man and Drosophila.	2	K1 (R) K4(An)	Lecture, PPT, Mind map	Diagrams, Demonstration
	4	Nondisjunction - Primary and secondary nondisjunction in *Drosophila*. Syndromes in man: Turner's, Klinefelter's and Down syndrome.	3	K2 (U) K3(Ap) K5 (E)	Brainstorming, Reasoning, Case study-based learning.	Class test, Vocabulary test, Recall terms
III	**Cytoplasmic inheritance and Mutation** (12 Hrs.)					
	1	Cytoplasmic inheritance - Kappa particles in *Paramecium*, milk factor in mice, shell coiling in *Limnaea*.	3	K1 (R) K2 (U) K3 Ap)	Brainstorming, Inquiry based teaching, Reflective thinking, PPT presentation	Assignment, Online test, slip test.
	2	DNA as genetic material - Bacterial transformation, conjugation, F- factor and transduction.	3	K1 (R) K3 (Ap) K4(An)	Illustration, Lecture, Interactive Class, video,	Oral test, MCQ, Notes.
	3	Mutation: Chromosomal mutation - changes in structure and number, aneuploidy and euploidy.	3	K1 (R) K3 (Ap) K4(An)	Illustrative Lecture, Interactive PPT	Interactive PPT (Online assignment – GC)
	4	Gene mutation – mutagens. DNA repair mechanisms.	3	K2 (U) K3 (Ap) K4(An)	Inquiry based Learning, Collaborative learning	Mind Map
	Human chromosomes and genetic diseases (12 Hrs.)					

IV	1	Autosomes and allosomes – Karyotype and idiogram.	2	K1 (R) K3(Ap) K4(An)	Brainstorming, Explicit Instruction,	Oral test, Notes.
	2	Simple Mendelian traits in man. Twins - types, development and application.	2	K1 (R) K3 (Ap) K4(An)	Illustrative lecture, Case Study based discussion	Quizlet
	3	Inborn errors of metabolism - Phenylketonuria, Alkaptonuria, Albinism.	5	K1 (R) K3 (Ap) K4(An)	Interactive Lecture, Reasoning, Case study – sharing.	Open Book Test - Quiz
	4	Sex-linked genes and their inheritance - X-linked genes - Colour blindness and Haemophilia, Y-linked genes - holandric genes.	3	K1 (R) K3 (Ap) K4(An)	Demonstrative Lecture, PPT (GC),	Home Assignment - Diagram
V	**Population genetics** (12 Hrs.)					
	1	Hardy Weinberg equilibrium – calculation of gene frequency.	3	K3 (Ap) K4(An) K5 (E)	Brainstorming, PPT (GC)	Discussion
	2	Factors affecting gene frequency – selection, mutation, genetic drift and migration.	3	K3 (Ap) K4(An) K5 (E)	Illustrative Lecture, Prezi presentation PPT-Video (GC)	Quizlet
	3	Inbreeding, out breeding and heterosis. Eugenics, Euthenics and Euphenics.	3	K3 (Ap) K4(An) K5 (E)	Brainstorming Interactive Lecture, Ms-PPT (GC)	Class Note
	4	Pedigree analysis. Genetic prognosis - Genetic counselling.	3	K3 (Ap) K4(An) K5 (E)	Illustrative lecture, Group Discussion	Discussion

Course Focussing on Employability/ Entrepreneurship/ Skill Development:

Employability

Activities: **Seminar, Assignment, Group discussion, Case study**

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

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

Assignment:

- Gene interaction
- Polygenic inheritance
- Chromosome map
- Cytoplasmic inheritance

- Mutation
- Sex-linked genes and their inheritance
- Calculation
- of gene frequency

Seminar:

- Linkages – types, groups, and theories
- Crossing over
- Changes in structure and number of chromosomes
- Simple Mendelian traits in man.
- Factors affecting gene frequency

Sample questions

Part A

1. Genetics is branch of science deals with _____
   a. Development b. Embryo c. Heredity d. Evolution
2. **Assertion:** Crossing F1 hybrid with the recessive parent is dominant back cross.
   Reason: Recessive back cross helps to identify the heterozygosity of the parent.
   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.
3. Match the following and choose the correct one:

A) Linkage	- 1) Bivalent are relationally coiled
B) Chiasma type theory	- 2) Recombinants
C) Crossing over	- 3) tetrad formation
D) Torsion theory	- 4) remain together

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

6. Point Mutation leads to alteration in the purines and pyrimidines of DNA.
   (State **True** or **False**)
9. If the gene frequency of a dominant allele of an autosomal character is 0.5, what will be the gene frequency of its recessive allele?
   a) 0.25 b) 0.1 c) 0.5 d) 0.75

Part B

1. Illustrate monohybrid cross with an example.
2. What is nondisjunction? Explain its effect in Klinefelter's syndrome.
3. Analyse the different structural changes in the chromosomes.
4. Evaluate the mechanism of formation of twins.
5. Analyse the factors affecting gene frequency.
6. Discuss Genetic counselling.

Part C

1. A pure tall (T) red (R) coloured garden pea plant is crossed with a dwarf white coloured plant. Give the genotypes of the parents and the phenotypic ratio of the F2 generation.
2. Discuss the mechanism of crossing over and prove the same using Stern's experiment.
3. What is chromosome map? How will you construct a chromosome map?
4. Explain cytoplasmic inheritance with a suitable example.
5. Explain the calculation of gene frequency using Hardy Weinberg equilibrium.
6. What is Pedigree Analysis? Explain the diagrammatic representation of a pedigree chart.

Head of the Department **Course instructors**

Dr. A. Shyla Suganthi Dr. C. Anitha

Dr. S. Mary Mettilda Bai

Class : III B. Sc. Zoology Major Elective II
Semester : IV
Title of the Course : (a) Clinical Laboratory Technology
Course Code : ZC2042

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	4	60	100

Objectives

1. To impart knowledge on the laboratory techniques adopted in clinical laboratories.
2. To develop skills for gaining employability in hospitals and research laboratories.

Course outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	Cognitive level
CO - 1	describe the laboratory principles applied in diagnosis of disease.	PSO - 1	K1(R)
CO - 2	classify the clinical specimens and use appropriate laboratory protocol.	PSO - 2	K2(U)
CO - 3	prepare reagents, handle instruments, perform clinical analysis and validate the results.	PSO - 3	K3(Ap)
CO - 4	develop skills necessary for higher studies or placement in clinical laboratories.	PSO - 4	K4(An)

Teaching Plan with Modules

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

Unit	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Essential pre-requisites of a clinical laboratory (12 Hrs)**					
	1	Safety measures in the laboratory, first aid in the laboratory.	4	K1 (R) K3 (Ap)	Lecture Method, Group Discussion	Short answers
	2	Sterilization – physical and chemical methods.	3	K3 (Ap) K4 (An)	Lecture, Peer Group teaching	Quiz, Oral test
	3	Preparation of Normal, Molar and Percentage solution.	3	K2 (U) K3 (Ap)	Blended Learning, Chalk and Talk	Flow chart mind map MCQ
	4	Biomedical waste management.	2	K2 (U)	PPT, Chalk and Talk	MCQ
II	**Laboratory Instruments and their applications (12 Hrs)**					
	1	Microscope, Balance, pH meter,	3	K1 (R) K2 (U)	Brainstorming, Interactive class	Slip test Assignment

	2	Colorimeter, Autoanalyzer, Centrifuge	3	K2 (U) K3 (Ap)	Flipped classroom	Oral test
	3	Incubator, Water bath	3	K2 (U) K3 (Ap)	Cooperative learning	Mind map, True or False
	4	Hemocytometers, Sahli's haemoglobinometer	3	K2 (U) K3 (Ap)	Demonstration, PPT	Short answers
III	**Clinical Haematology (12 Hrs)**					
	1	Collection of blood - Venous and capillary, Blood grouping,	3	K2 (U) K3 (Ap) K4 (An)	Peer group teaching, Lecture method	Mind map, MCQ, Open book test
	2	Separation of plasma and serum, Blood cell count – Total count and differential count,	3	K2 (U) K3 (Ap) K4 (An)	Didactive teaching, Experiential learning: Demo.	Short test Flow Chart Quiz
	3	Haemoglobin estimation by Sahli's method, Erythrocyte sedimentation rate (ESR).	3	K1 (R) K3 (Ap)	Didactive teaching , Demonstration	Quiz, , Laboratory Tests
	4	Analysis of blood glucose Analysis of serum creatinine. Analysis of alkaline phosphatase and cholesterol	3	K1 (R) K3 (Ap)	PPT, You tube video,	Learner Verification, open book test
IV	**Examination of sputum and body fluids (12 Hrs)**					
	1	Collection, physical, chemical, and microscopic examination of cerebrospinal fluid.	3	K3 (Ap) K4 (An)	Lecture-Based Instruction, PPT, Mind map	MCQ, Diagram test, Performance Assessment
	2	Collection, physical, chemical and microscopic examination of sputum	3	K3 (Ap) K4 (An)	Lecture, Chalk and Talk	One-Minute Paper, Subjective Tests
	3	Serous fluid – pleural fluid, and pericardial fluid,	3	K2 (U) K3 (Ap) K4(An)	PPT, Video	Performance Assessment, Cloze Tests
	4	Serous fluid - peritoneal fluid and Synovial fluid.	3	K2 (U) K3 (Ap) K4(An)	Lecture, Chalk and Talk	Pre-tests, Quizzes
V	**Urine and Stool Analysis (12 Hrs)**					
	1	Urine – collection, composition, volume, colour and transparency, Analysis of urine for glucose, albumin, bilirubin, urobilinogen and ketone.	3	K2 (U) K3 (Ap) K4 (An)	Lecture, video lesson	Assignment, performance test

	2	Microscopic examination for bacteria, organized and unorganized deposits and blood.	3	K2 (U) K3 (Ap)	Chalk and Talk	Online quizzes,
	3	Pregnancy test, Stool - collection, types, microscopic examination	3	K2 (U) K3 (Ap)	Lecture, PPT	Think-Pair-Share, Slip test
	4	Identification of intestinal parasites using saline wet mount - faecal occult blood.	3	K2 (U) K3 (Ap) K4(An)	Lecture, PPT	Performance Assessment, Cloze Tests

Course Focusing on Employability/ Entrepreneurship/ Skill Development:
Employability

Activities (Em/ En/SD): Prepare reagents, handle instruments, clinical analysis of results**.**

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

Activities related to Cross Cutting Issues: Role of the laboratory in public health initiatives.

Assignment: First aid in the laboratory.

Seminar Topic: (if applicable) Nil

Sample questions

Part A

1. What are the essential pre-requisites of a Clinical Laboratory?
   a. Safety measures and first aid in the laboratory. b. Sterilization methods.
   c. Biomedical waste management. d. All of the above
2. Which instrument is used to view objects at the cellular level?
   a. Microscope b . Balance c. pH meter d. Colorimeter
3. **Match the following and choose the correct option**

   A. Glucose - 1. Friedewald method
   B. Creatinine - 2. Foster and Dunn method
   C. Triglycerides - 3. Folin Wu method
   D. HDL - 4. Picrate method

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

4. Which body fluid is collected from the pleural, pericardial, and peritoneal cavities?
   a. Synovial fluid b. Blood c. Serous fluid d. Urine
5. Stool analysis includes the identification of intestinal parasites using a saline wet mount. **State True/False**.

Part B

1. Why is safety important in a laboratory?
2. What is the application of a microscope in a laboratory?
3. How is haemoglobin estimation done according to Sahli's method?
4. What are the different methods used to collect sputum and body fluids?
5. What aspects of stool are analyzed in a stool test?

Part C

1. How do physical and chemical methods differ in sterilization?
2. What is the function of a colorimeter in a laboratory
3. What does ESR stand for and what does it measure?
4. What is the significance of microscopic examination in the analysis of sputum and body fluids?
5. How are intestinal parasites identified in a stool test?

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. S. Prakash Shoba

Dr. A. Shyla Suganthi

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

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	3	60	100

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

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	recall the principles of api-, seri-, and aquaculture, poultry and dairy farming.	PSO - 1	R
CO - 2	explain the tools and techniques used in rearing practices.	PSO - 3	U
CO - 3	practice the fundamental concepts of applied zoology in research and animal farms.	PSO - 3	Ap
CO - 4	inspect the quality of honey, silk, egg, milk and fish.	PSO - 2	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)

Unit	Modules	Topics	Hours	Cognitive Level	Pedagogy	Assessment
I	**Apiculture (12 Hrs)**					
	1	Classification and kinds of bees, Bees and their society.	2	K1 (R)	Lecture, PPT	Slido test, Evaluation through MCQ,
	2	Caste distinction and their functions.	2	K3 (Ap)	Lecture, Chalk and Talk	Mentimeter – quiz, short test
	3	Food of honey bees	1	K1 (R) K3 (Ap)	Lecture, Mind map	Mind Map, Online test
	4	Bee keeping methods (primitive and modern).	3	K2 (U) K3 (Ap)	Lecture, Mind map	
	5	Honey Bee products: honey, bee wax, bee venom.	2	K2 (U) K4 (An)	Lecture, Group Discussion Video	Assignment, Formative

	6	Common diseases – nosemosis, acariasis, bee septicemia and management.	2	K1 (R) K3 (Ap)	Lecture, Mind map	Class test Quiz
II	**Sericulture (12 Hrs)**					
	1	Moriculture – methods of propagation.	2	K2 (U)	Lecture, PPT	Interactive PPT, Short test
	2	Common species of Silkworm, Life cycle of mulberry silkworm - egg, larva, pupa and adult.	2	K3 (Ap)	Lecture, Video	Mind map, MCQ, Online test, Open book
	3	Rearing of silkworm, mounting, spinning and harvesting of cocoons.	3	K2 (U) K3 (Ap)	Lecture, blended class room	Class test, open book test
	4	Silk Reeling, Silk Marketing.	3	K2 (U) K4 (An)	Lecture, Video	Quiz I Formative
	5	Common diseases – pebrine, grasserie, muscardine, flacherie and management.	2	K1 (R) K4 (An)	Lecture, Mind map	Assessment II (3, 4, 5), Quiz II
III	**Aquaculture (12 Hrs)**					
	1	Aquaculture in India.	1	K1 (R)	Youtube links, Mind map, Lecture	Mind map, MCQ, Diagram
	2	Important cultivable organisms and their qualities.	2	K3 (Ap)	Lecture, pictures	Quizzes, Online test, Open book Assignment
		Culture of Indian major carps.	2	K2 (U)	Chalk and Talk, Video	
	4	Marine prawn culture, Pearl culture.	2	K4 (An)	Lecture, Mind map, Video	
	5	Integrated fish culture - paddy cum fish culture.	2	K2 (U)	Lecture, PPT	
	6	Ornamental fish culture.	1	K2 (U)	Chalk and Talk, Video	
	7	Common diseases – Ichtyophthirius, Dropsy, Fin Rot soft shell syndrome and management	2	K2 (U)	Lecture, PPT	
IV	**Poultry Farming (12 Hrs)**					
	1	Poultry housing, Types of poultry houses.	2	K4 (An)	Lecture, PPT, Mind map	Mind map, MCQ, Diagram
	2	Management of chick, growers.	2	K3 (Ap)	Lecture, Chalk and Talk	Slip test, Online test, Open book test,

	3	Management of layers and broilers.	2	K3 (Ap)	PPT, Video	Formative Assessment I (1, 2, 3), Quiz I (1, 2, 3) Formative Assessment II (4, 5), Quiz II (4, 5)
	4	Sexing in chicks.	1	K2 (U)	Lecture, Chalk and Talk	
		Nutritive value of egg and flesh.	2	K4 (An)		
	5	Diseases of poultry– Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis and management.	3	K2 (U)	Lecture, PPT	
V	**Dairy Farming (12 Hrs)**					
	1	Breeds of Dairy animals	2	K1 (R)	Lecture, video lesson	Diagram test, Open book test, short answer test, Online test, MCQ, Assignment, Formative Assessment II Quiz II
	2	Establishment of a typical Dairy farm.	2	K2 (U)	PPT, Video	
	2	Management of cow - New born, calf, Heifer, milking cow.	2	K2 (U)	Lecture, You tube video	
	3	Diseases - Mastitis, Rinder Pest, Foot and Mouth Disease and management.	2	K2 (U)	Lecture, Tabulation	
	4	Nutritive value of milk	1	K4(An)	Chalk and Talk	
	5	Pasteurization	1	K3(Ap)	Lecture, video lesson	
	6	Dairy products - Standard milk, skimmed milk, toned milk and fermented milk - curd, ghee, cheese.	2	K5 (E)	Lecture, PPT	

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

Activities (Em/ En/SD): Peer teaching, Assignment, Quiz **(**Invitation, Study material with reference)

Topics:

1. Honey Bee products
2. Common diseases
3. Ornamental fish culture.
4. Nutritive value of egg
5. Nutritive value of milk
6. Dairy products

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

i) Identification of pest and diseases in mulberry plants, Preparation of dairy products

ii) Assignment Topics and Type:

Flow Chart: Classification of bees

Mind Map: Pasteurisation process

iii) Quizlet Topic:

Bees and Diseases

Seminar Topic: (if applicable) Nil

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. *Apis dorsata*
B. Little bee - 2. *Apis cerana indica*
C. Rock bee - 3. *Apis florea*
D. Indian bee - 4. *Apis mellifera*

	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) *Staphylococcus aureus*
D) Bacteria - 4) Apthous

	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.

Head of the Department **Course Instructor**

Dr, A. Shyla Suganthi Dr. Jeni Chandar Padua

Dr. A. Punitha

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)

Units	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	**Reproduction** (18 Hrs.)					
	1	Sexual reproduction Spermatogenesis, Structure, and types of sperm.	4	K1 (R) K2 (U)	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, You tube links, PPT, Lecture Method	Slip test Assignment
	3	Fertilization -types, chemical and cytological factors involved in fertilization, physiological changes	5	K1 (R) K4 (An)	PPT, Blended learning, Lecture method, Group discussion	MCQ, Flow chart

		in fertilization, significance, Prevention of polyspermy				
	4	Asexual reproduction. Parthenogenesis - types and significance.	4	K1 (R) K4 (An)	PPT, Inquiry based learning, Lecture method	Mind map, MCQ, Oral test
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, PPT	Quiz, Identification of stages of embryo
	2	Fate map of frog. Morphogenetic movements.	3	K1 (R) K2 (U)	PPT, Lecture Method, Flipped Class room, Group discussion	Mind map on development of organ system
	3	Gastrulation in frog.	2	K1 (R) K2 (U)	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.	Quiz, Group discussion
	5	Competence. Gradient theory - gradient system - types, experimental evidences, mechanism.	3	K2 (U) K3 (Ap)	Lecture using PPT, Cooperative learning	MCQ, Flow chart
III	**Organogenesis** (18 Hrs.)					
	1	Development of eye, heart, digestive system in frog	4	K2 (U) K3 (Ap)	Video links and PPT, Lecture method	MCQ, Flow chart
	2	Extra embryonic membrane, development of fetal membranes.	3	K2 (U) K3 (Ap)	Video, Lecture using PPT	Mind map, Short Answer Test
	3	Placenta in mammals - classification, functions	2	K2 (U)	Didactive teaching, PPT.	Quiz Online Debate
	4	Development Stem cells, Preservation of cord blood stem cells.	6	K2 (U) K3 (Ap) K4 (An)	Narrative PPT – Screen capture using Camtasia	Slip test MCQ
	5	Principles of collections of Umbilical cord, gametes and embryos.	3	K2 (U) K3 (Ap)	Lecture using PPT	
IV	**Metamorphosis and Regeneration** (18 Hrs.)					

	1	Metamorphosis: Types, Insect and Amphibian metamorphosis.	3	K2 (U)	Flow Chart using PPT, Seminar by student. Video link	Quiz through quizzes, Mind map
	2	Hormonal control of metamorphosis in Insect and Amphibian.	4	K2 (U) K3 (Ap)	Lecture with PPT.	Quiz through mentee.com Flow chart
	3	Regeneration: types, regeneration in Planaria, Amphibia and human liver.	3	K2 (U) K4 (An)	PPT recorded Team-Based Learning Lecture-Discussion	Team-Based Learning Online quizzes
	4	Factors influencing regeneration, physiological changes involved in regeneration.	3	K2 (U) K3 (Ap) K4(An)	Lecture with PPT online video lesson.	
	5	Nucleo-cytoplasmic interaction - Acetabularia. Ageing- concepts and theories	3	K2 (U) K4 (An)	Flipped Classroom Mind Mapping	Classroom Polling Online quizzes
	6	Synthetic biology – synthetic life.	2	K2 (U)	Lecture, PPT	Class test
V	**Embryological Techniques** (18 Hrs.)					
	1	Infertility – causes and diagnostic parameters – hormonal imbalance, Poly Cystic Ovarian Diseases (PCOD). Rh factors and incompatibility	2	K2 (U) K3 (Ap)	Open board, Animation videos	Quiz through google classroom, Flow Chart
	2	*Invitro* fertilization, artificial insemination, cryopreservation of sperm and ovum - test tube babies – amniocentesis.	4	K1(R) K3 (Ap)	PPT Inquiry-based	Online assignment, Debate
	3	Teratogenesis- agents and their effects.	4	K1 (R) K2 (U)	Online diagrams and open board	Open book test
	4	Cryopreservation of sperm and ovum - test tube babies – amniocentesis.	3	K2 (U) K3 (Ap)	Expository Teaching, PPT.	Peer assessment
	5	Birth control - physical barriers - contraceptive devices - IUCD, surgical method.	2	K2 (U) K3 (Ap)	Video lesson Real-World Applications	Quizzez
	6	Hormonal and therapeutic methods of birth control	3	K4(An)	Flipped Classroom	Class test

Course Focusing on Employability/ Entrepreneurship/ Skill Development:

Skill Development

Activities (Em/ En/SD): Clinical implications of the development, gender based reproductive disorders and intervening mechanism.

Activities related to Cross Cutting Issues: presentations on the societal impact of developmental biology advancements.

Assignment: Development of eye, heart, digestive system in frog.

Debate: Invitro fertilization

Online Assignment: Mind map/Flow chart: Insect metamorphosis

Seminar Topic: Amphibian 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 of False**
4. In insects, metamorphosis involves the transformation of a larva into an ----------.
5. **Pick Up the Odd One:**
   a) Poly Cystic Ovarian Disease (PCOD) b) Rh factors and incompatibility
   c) Artificial Insemination d) Teratogenesis

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. Explain the concept of nucleo-cytoplasmic interaction in Acetabularia. How does the positioning of the nucleus influence the morphology and growth of this unicellular organism?
5. Discuss the various methods of birth control, covering physical barriers, contraceptive devices (with a specific focus on IUCD), and surgical and hormonal methods.

Head of the Department

Dr, A. Shyla Suganthi

Course Instructor

Dr. S. Prakash Shoba

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 forinterdisciplinary 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)

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
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	Class test, Flow chart
	2	Cells of immune system (T cells and B cells, macrophages)	4	K1 (R),	Inquiry based learning, Interactive PPT	Oral test, Mind mapping, Traffic light
	3	Primary and Secondary lymphoid organs - Thymus, Bone marrow, Bursa of Fabricius,	4	K1 (R), K2 (U)	Flipped learning, Think – pair share	Four corner Slip test, Illustration, Assignment -

						model making
	4	Spleen, Lymph node, Mucosa Associated Lymphoid Tissue.	3	K1 (R), K2 (U)	Interactive lecture, Group Discussion,	Open book test, short test, Assignment - model making
	5	Lymphoid and myeloid lineage. .	3	K1 (R), K2 (U)	Video class, Collaborative learning	Quiz – slido, Mind mapping
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, Reciprocal teaching.	Slido - Quiz
	3.	Immunoglobulin - types, structure, and functions of IgG.	4	K1(R), K2 (U)	Group Discussion, Flipped classroom	Traffic light, class test
	4.	Antigen - Antibody reactions.	3	K1(R), K2 (U)	Interactive PPT, Collaborative learning	Mind mapping Class test,
	5.	Secondary antibody, purification of antibody.	3	K1(R), K2 (U)	Peer teaching, Reciprocal teaching.	Four corner, Open book test
III	**Immune Response (18 hrs)**					
	1	Primary and secondary immune response	3	K2 (U), K4 (An)	You tube video, Group Discussion,	Mind mapping, Portfolio review.
	2	Immunity to bacterial infections (humoral and cell-mediated immune response).	4	K2 (U), K4 (An)	Role play, Interactive PPT	Assignment model making
	3	Hypersensitivity - Allergens and types of hypersensitivity.	3	K2 (U)	Role reversal, Interactive PPT	Slido - MCQ, Oral test
	4	Autoimmunity– Rheumatoid arthritis.	3	K2 (U)	Think – pair share, Jigsaw	Four corners, Test using Padlet
	5	Immunobiotics– definition, respiratory and digestive ailments.	3	K2 (U)	Reciprocal teaching & Peer teaching	Oral test, Summarization

	6	Vaccines and Immunization schedule.	2	K2 (U)	Flipped classroom.	Thumps up / down, Listing out important steps
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
	2	Bacteria - structure of *E. coli*, bacterial growth kinetics, culture media,	4	K4 (An)	Flipped classroom	MCQ, Slip test
	2	culture techniques – batch culture. and continuous culture (chemostat and turbidostat).	4	K3 (Ap)	Blended learning	Socrative, Collaborative
	3	Virus: structure(SARS and T4 phage)	2	K1(R)	PPT & Lecture	Short test with open ended question
	4	reproduction of T4 phage (lysogenic and lytic).	2	K2 (U)	lecture using videos	Oral test, Summarization
	5	Synthetic Biology.	2	K4 (An)	PPT & Lecture	Oral presentation
V	**Applied Microbiology (18 hrs)**					
	1	Food poisoning, Food spoilage and preservation.	2	K3 (Ap)	Collaborative learning	Mind mapping, MCQ
	2	Industrialmicrobiology - Scope and applications – Fermentation process – Fermenter -Wine and Vinegarproduction.	4	K4 (An)	Mind mapping	Summarization Slip test
	3	Medical microbiology - Bacterial diseases – Leptospirosis, Syphilis, Pneumonia,	4	K2 (U)	Peer teaching, Inquiry based	Slip test, Slido - 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

C**ourse Focusing on Employability/ Entrepreneurship/ Skill Development:** Skill Development

Activities (Em/ En/SD): Wine and Vinegar production (Mind Map)

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

Activities related to Cross Cutting Issues: Debate on "Professional Ethics of a Microbiologist".

Assignment: Reproduction of T4 phage (lysogenic and lytic).

Sample questions

Part A

1. The primary lymphoid organs are large at birth and they atrophy with age. **(State True/False)**
2. **Assertion (A):** Ig G offers a passive protection to the newborn babies for about 6 – 9 months.

   Reason (R): Ig G is the only immunoglobulin that crosses the human placenta.

   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

3. The Antigen Presenting Cells internalizes the antigen by _____.
4. Who among the following is the father of Immunology?

a) Louis Pasteur b) Robert Koch c) Edward Jenner d) Alexander Fleming

5. The disease Tineacorporis is caused by _____.

Part B

1. Distinguish between active and passive immunity.
2. Enumerate the structure of Immunoglobulin G.
3. What is hypersensitivity? Explain its types.
4. How will you classify microbes based on Bergy's system of classification?
5. Identify the process involved in Wine production.

Part C

1. Describe the structure and function of spleen.
2. Explain the steps involved in the purification of antibody.
3. What are vaccines? Provide the Immunization schedule for newborns.
4. Elaborate the structure of *E. coli*
5. Summarize the causative organism, symptoms, treatment and preventive measures of some viral diseases in man.

Head of the Department
Dr. A. Shyla Suganthi

Course Instructor
Dr. P.T. Arokya Glory

Dr. F. Brisca Renuga

Class : III B. Sc. Zoology **Major Core X**
Semester : VI
Title of the Course : Organic Evolution
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 75 (Incl. Assignments & Test)

Unit	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment/
I	**Concepts and Evidences of Evolution (15 Hrs.)**					
	1	Origin of life - Theories and experiments.	4	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, paleontology.	4	K4 (An)	PPT, You Tube Videos	Quiz making, Seminar, Oral test

	4	Geological time scale.	2	K4 (An)	Peer teaching	
II	**Theories of Evolution (15 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.	3	K4 (An)	PPT, Index card method	Quiz, Short answer test, Recall terms
	5	Natural selection – Stabilizing, directional and disruptive selection.	2	K4 (An)	Inquiry based learning, Jigsaw	Class test, MCQ
III	**Isolating mechanisms, Species Concept and Speciation (15 Hrs.)**					
	1	Isolating mechanisms: Types, origin and evolution of isolating mechanisms, role of isolation in speciation.	3	K2 (U)	Flipped learning, PPT Presentation,	Short test, Mind map, MCQ
	2	Species concept - morphological, genetic, and biological. Salient features of species.	3	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, discussion
	5	Adaptive radiation (Darwin finches) - Convergent and divergent evolution.	4	K3 (Ap)	Brainstorming, Q&A method	Model making, Essay answer test
IV	**Phylogenetic analysis (15 Hrs.)**					
	1	Phylogenetic analysis**:** Tools for sequence alignment–BLAST, FASTA.	4	K1 (R)	Blended learning, PPT presentation	Open ended questions

	2	Methods of phylogenetic analysis - phenetic and cladistic; phylogenetic trees.	5	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
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.	2	K5 (E)	Group discussion	Quiz, Think and pair
	5	Extinction - types, causes and significance.	3	K2 (U)	Peer group teaching	Mind map, Slip test, MCQ

Course Focusing on Employability/ Entrepreneurship/ Skill Development: 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 – morphology and comparative anatomy, embryology.
- Darwinism, Neo-Darwinism.
- Species concept
- Human Evolution – organic, cultural and future evolution.

Seminar

- Evidences in support of evolution – Physiology and biochemistry, palaeontology.
- Modern synthetic theory
- Speciation
- Phylogenetic tree
- Rate of evolution

Model making

- Adaptive Radiation

Sample Questions

Part A

1. 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
2. What does p^2 in the Hardy-Weinberg equation (p+q)2 = p2 + 2pq + q2 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
3. Which of the following structures are formed due to adaptive radiation?
   a) Homologous structure b) Analogous structure
   c) Vestigial structure d) All of these.
4. On the basis of cladistics, this eukaryotic kingdom is polyphyletic and hence unacceptable
   a) Monera b) Protista c) Animalia d) Fungi
5. 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

1. Explain the theories of origin of life.
2. Discuss the mutation theory of DeVries.
3. Explain the role of isolation in speciation.
4. List the tools used for sequence alignment.
5. List the trends in evolution.

Part C

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

Head of the Department **Course instructors**

Dr. A. Shyla Suganthi Dr. J. Vinoliya Josephine Mary
Dr. C. Anitha

Class : III B.Sc. Zoology Major Elective III
Title of the Course : (a) Economic Zoology
Semester : VI
Course Code : ZC2064

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 importantanimals.	PSO -3	U
CO - 3	apply the different strategies adopted in rearing of honey bee, lacinsect, 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
Total Contact hours: 60 (Including lectures, assignments, and tests)

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	1.	Apiculture - scope, varieties of honey bees, bees and their society, communication in honey bees.	2	K1(R)	Group discussion	Slip test, peer review
	2.	Bee pasturage, food of honey bees, relationship between plants and bees	2	K1(R)	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, andpropolis	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 apiary. Funding sources for beekeeping projects	2	K4(An)	Inquiry based learning	seminar, preparation of question bank, Flow chart
	6	**Lac culture** – scope – lac insect – cultivation of lac – processing of lac. composition of lac. Economic importance of lac.	2	K1(R)K5 (E)	PPT, Blended learning	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. *Bombyxmori*- 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	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, You tube Video, Collaborative learning	Short essays, Quizzes
III	1	Scope, Poultry industry in India, commercial layers and broilers	2	K1(R)	Brainstormin g, Discussion	Mind mapping, Quizzes
	2	Poultry housing - types. Management of chick, growers, layers and broilers.	2	K3(Ap)	Group discussion, Jigsaw method	Oral test
	3	Sexing in chicks, debeaking	2	K3(Ap)	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, Summarisation
	5	Duck farming- introduction- duck breeds – housing - feed management	2	K6 (C)	Peer tutoring, Jigsaw	Nearpod Collaborative
	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 Group discussion
	2	Culture –types, Indian major carps, marine prawn and pearl oyster.	2	K3 (Ap)	PPT, Inquiry based learning	MCQ, Flow chart
	3	Diseases of fishes – bacterial gill rot, viral hemorrhagic septicemia, saprolegniasis. Fish parasites – Argulus and *Ichthyophthirius*	2	K5 (E)	PPT, Lecture Method, Flipped Class room,	Mind map, Group discussion

	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 (C)	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): Environment Sustainability

Activities related to Cross Cutting Issues: Setting an aquarium, silkworm rearing

Assignment : 1. Fish cum poultry farming.

Seminar Topics: Nil

Sample questions

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 orrect 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 pracices?.

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.

Head of the Department **Course Instructors**

Dr. A. Shyla Suganthi Dr. X. Venci Candida

Dr. C. Josephine Priyatharshini

Class : III B. Sc. Zoology **SBC**
Semester : VI
Title of the Course : Vermitechnology
Course Code : ZSK175

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	U
CO - 2	explain the biology of earthworms.	PSO - 1	U
CO - 3	assess the importance of earthworms in soil fertility, medicine and pharmaceutics.	PSO - 5	E
CO - 4	design the methodology for vermiculture and for the production of vermicompost and vermiwash.	PSO - 8	Ap
CO - 5	prepare and market the vermicompost.	PSO - 7	Ap

Teaching Plan with Modules
Total Contact hours: 90 (Including lectures, assignments and tests)

Units	Modules	Topic	Hours	Cognitive level	Pedagogy	Assessment
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	MCQ
	3	Biology of *Eisenia fetida, Lumbricus terrestris, Eudrilus eugenia, Megascolex mauritii.*	3	K2 (U)	Interactive PPT, Group Discussion	Dictation
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	Nearpod
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
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	, , Flow Chart
	3	Methods of vermicomposting	2	K4 (An)	PPT, Discussion, You Tube Video	Mind Map
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	Poll
	4	Financial Support by Government and Non-	2	K5 (E)	PPT, Discussion, Online Video	Flow chart

		Government funding agencies.				

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

Activities (Em/ En/SD): Construction of Vermi pit, Harvesting of earthworms and vermicompost

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

Activities related to Cross Cutting Issues:

Assignment :

1. Vermiculture techniques 2. Vermi-remediation

Seminar Topics: Nil

Sample questions

Part A

1. Vermicomposting is the compost produced by worms. **State True or False**
2. The method which maintains humidity is the
   Slant method b. Heap method c. Surface method d. Light method
2. What is monoculture?
3. **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.
4. Vermicompost are the _____ industries.

Part B

6. Differentiate Categories of earthworm with an example each.
7. Analyse Economic and medicinal importance of vermicomposting.
8. Differentiate monoculture with poly culture.
9. Discuss methods of vermicomposting.
10. Vermicompost promotes employability - Justify

Part C

6. Illustrate the Biology of *Eisenia fetida*,
7. Discuss the Pest and diseases of earthworms.
8. Vermiwash promotes plant growth – Justify
9. Explain vermibed preparation with suitable diagram.
10. Explain the steps involved in the harvesting and marketing of vermicomposting.

Head of the Department **Course Instructor**

Dr, A. Shyla Suganthi Dr. C. Josephine Priyatharshini