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

UNDERGRADUATE PROGRAMME

TEACHING PLAN

ODD SEMESTER 2024– 2025

Department of Zoology

Vision

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

Mission

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

Class : I B. Sc. Zoology Core Course - 1
Title of the Course : Invertebrata
Semester : I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU231CC1	4	1	1	-	6	6	90	25	75	100

Pre-requisite
Students need to know the classification of invertebrates based on their morphology and Anatomy.

Learning Objectives:
1. To distinguish the characteristic features and function, evolutionary position, economic importance, and interaction with the environment of invertebrates.
2. To develop the skill of identification of invertebrates and to promote employability in museum, consultancy firms and educational institutions.

Course Outcome

COs	On completion of this course, students will;	Cognitive level
CO 1	understand the basic concepts of invertebrate animals and recall its structure and functions.	K1
CO 2	illustrate and examine the systemic and functional morphology of various groups of invertebrates.	K2
CO 3	differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	K3

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

Teaching plan
Total Hours: 90 (Including lectures, assignments, and tests)

Units	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment
I	**Protozoa (18 Hrs.)**					
	1.	Introduction to Classification, taxonomy, and nomenclature. General characters and classification of Phylum Protozoa up to classes.	2	K2 (U), K3 (Ap)	Lecture using Chalk and talk, Lecture using PPT	Oral Test, MCQ
	2.	Type study: *Paramecium* (Morphology and Reproduction) and *Plasmodium* (Lifecycle)	3	K1 (R) K2 (U)	Brainstorming, Lecture using PPT	Mind map, Oral test

	3.	Parasitic protozoans (*Entamoeba*, *Trypanasoma* & *Leishmania*) - Economic importance	3	K1 (R), K3 (Ap)	Lecture using PPT, Flipped learning	Slip test, Peer Discussion
	4.	Nutrition in protozoa - Host-parasitic interactions in *Entamoeba* and *Plasmodium*-Locomotion in protozoa	2	K1 (R), K3 (Ap)	Lecture using You Tube video, Group Discussion	Peer Discussion, Short Essay
	5.	**Porifera:** General characters and classification up to Classes. Type study: Sycon- Canal system in sponges.	4	K2 (U), K3 (Ap)	Peer tutoring, Lecture using PPT	Illustrative Diagrams, Class Test
	6.	Reproduction in sponges. Skeleton in sponges.	4	K1 (R)	Brain storming and Illustrative Lecture	Slip Test
II	**Coelenterata (18 Hrs.)**					
	1	General characters and classification up to classes – Type study: *Obelia* (Morphology and lifecycle)	4	K1 (R), K2 (U)	Blended learning, Mind map	Short test, Objective Type test
	2	Corals and coral reefs - Economic importance of corals and coral reefs	4	K1 (R), K3 (Ap)	Lecture using PPT, Group Discussion	Slip test, MCQ,
	3	Polymorphism in Hydrozoa.	2	K2 (U)	Review, Mind map	Illustrative Diagrams, Short essays,
	4	**Platyhelminthes:** General characters and classification of up to classes. Type study: *Fasciola hepatica* (Morphology and lifecycle),	4	K1 (R), K2 (U)	Lecture using chalk and talk, Lecture using PPT	Open book test, Class Test
	5	Parasitic adaptations. Host-parasitic interactions of Helminthine parasites	4	K1 (R)	Brainstorming, Group discussion	Slip Test, Oral test
III	**Aschelminths (18 Hrs.)**					
	1	General characters and classification of up to classes - Type study: *Ascaris lumbricoides* (Morphology and lifecycle)	5	K1 (R), K2 (U)	Group Discussion, Interactive PPT	Quiz, Class Test

	2	Nematode Parasites and diseases - *Wuchereria bancrofti*, *Enterobius vermicularis*, *Ancylostoma duodenale*. Parasitic adaptations.	4	K2 (U), K3 (Ap)	Interactive lecture, Cooperative learning	Oral Test, Group Discussion
	3	**Annelida:** General characters and classification up to Classes. Type study: *Nereis* (Morphology)	5	K1 (R), K2 (U)	Brainstorming, Inquiry based learning	Slip test, Illustrative Diagrams
	4	Metamerism- Modes of life in Annelids. Reproduction in polychaetes.	4	K1 (R)	Flipped classroom, Illustrative lecture	MCQ, Oral test
IV	**Arthropoda (18 Hrs.)**					
	1	General characters and classification of Phylum Arthropoda up to Classes. Type study: *Penaeus indicus* (Morphology and reproduction).	5	K1 (R), K2 (U)	Lecture using Chalk and talk, Group Discussion	Short test, Oral test
	2	Affinities of *Peripatus* – Larval forms in Crustacea. Economic importance of Insects	4	K2 (U), K3 (Ap)	Lecture using PPT	MCQ, Class Test
	3	Insect pests of Agricultural Importance- Pest of rice: Rice stem borer (*Scirpophaga incertulas*) – Pest of Sugarcane: The shoot borer (*Chilo infuscatellus*)	5	K2 (U), K3 (Ap)	Brainstorming, Inquiry based learning	Oral Test, Slip test
	4	Pest of coconut: The rhinoceros beetle (*Oryctes rhinoceros*). Principles of Integrated Pest Management.	4	K2 (U), K3 (Ap)	Review, Collaborative Teaching	Concept explanation
V	**Mollusca (18 Hrs.)**					
	1	General characters and classification of Phylum Mollusca up to Classes. Type study: *Pila globosa*. Foot and torsion in Mollusca.	5	K1 (R), K2 (U)	Blended learning, Collaborative teaching	MCQ, Short Test
	2	Economic importance- Cephalopods.	3	K3 (Ap)	Blended classroom	Slip Test, Oral Test
	3	**Echinodermata:** General characters and classification	5	K1 (R), K2 (U)	Lecture using PPT	Mind map, Class Test

		of Phylum Echinodermata up to Classes.				
	4	Type study: *Asterias.* Water Vascular system in Echinodermata – Larval forms of Echinoderms.	5	K1 (R), K2 (U)	Lecture using PPT, Group Discussion	Short Essays, Peer Discussion

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

Activities (Em/ En/SD): Album preparation - Insect pests of Agricultural

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

Activities related to Cross Cutting Issues: Group Discussion on Economic importance of Insects

Assignment: Economic importance of corals and coral reefs

Sample questions

Part A

1. Amoebiasis is caused by
   (a) Toxoplasma gondii
   (b) Entamoeba histolytica
   (c) Ascaris lumbricoides
2. Polyps asexually produce medusa. (**State True/False)**
3. Ascaris is the example of Phylum _____.
4. **Assertion (A):** Arthropods possess only true coelom.
   Reason (R): Haemocoel in Arthropod is not lined by the mesodermal epithelium.
   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
5. Water vascular system helps in
   a) Locomotion b) Food capture and transport c) Respiration d) All of these

Part B

1. List the general characters of Phylum Protozoa.
2. Explain the parasitic adaptations in Platyhelminthes
3. Identify the disease caused by *Wuchereria bancrofti.*
4. Outline the morphology of *Penaeus indicus*.
5. Describe the water vascular system in present in Echinoderms

Part C

1. Illustrate the canal system in sponges with suitable diagram.
2. Interpret the economic importance of corals and coral reefs
3. How do polychaetes reproduce?
4. Summarize the insect pests of agricultural importance.
5. Discuss the larval forms of Echinoderms.

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
Dr. P.T. Arokya Glory
Dr. A. Punitha
Dr. C. Josephine Priyatharshini

Class : I B. Sc. NME I
Title of the Course : Ornamental Fish farming and management
Semester : I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU231NM1	1	-	1	-	2	2	30	25	75	100

Pre- requisite
Introductory understanding of basic aquaculture principles and fish biology.

Learning Objectives

1. To identify various ornamental fish species, their habitat requirements, and the key factors influencing their health and well-being in captivity.
2. To gain skills on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.

Course Outcome:

COs	On completion of this course, students will;	Cognitive level
CO1	identify commercially important ornamental fishes, including indigenous and exotic varieties.	K1
CO2	explore food and feeding habits in ornamental fishes, including formulated feed and live feed.	K2
CO3	gain expertise in the maintenance of aquariums and water quality management.	K3

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

Teaching plan Modules
Total Hours: 30 (Incl. Assignment & Test)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Introduction to ornamental fish keeping. (6 Hrs)**					
	1	Introduction to ornamental fish keeping.	1	K1 (R)	Blended learning, Lecture,	MCQ, Oral test
	2	Scope and importance of ornamental fish culture.	1	K2 (U)	Flipped classroom, Peer tutoring	Short essays, objective test (Fill in the blanks)
	3	Domestic and global scenario of ornamental fish trade and export potential.	2	K3 (Ap)	Brainstorming, Lecture	Quizzes, slip test
	4	Commercially important ornamental fishes - Indigenous and exotic varieties.	2	K3 (Ap)	YouTube videos, Lecture	MCQ, Short essays,

II	**Biology of egg layers and live bearers. (6 Hrs)**					
	1	Biology of egg layers and live bearers.	1	K3 (Ap)	Interactive PPT, Discussion	Mind map, True/False (Objective test)
	2	Food and feeding in ornamental fishes.	1	K3 (Ap)	Lecture using videos, Group discussion	Assignment
	3	Formulated feed and Live feed; Live feed culture.	2	K3 (Ap)	Peer tutoring, PPT	Evaluation through short test, Oral test
	4	Breeding, hatchery and nursery management of egg layers (e.g. Goldfish) and live bearers (e.g. Guppy).	2	K3 (Ap)	Flipped classroom, Demonstration	Mind map, True/False (Objective test)
III	**Aquarium design and construction (6 Hrs.)**					
	1	Accessories - aerators, filters and lighting.	2	K1 (R)	Illustrative Lecture, Peer tutoring	
	2	Aquarium plants and their propagation.	1	K2 (U)	Cooperative Learning, Interactive Lecture	Class Test, Mind Map
	3	Maintenance of aquarium and water quality management.	1	K3 (Ap)	Brain Storming & Group Discussion	Group Discussion, Slip Test
	4	Ornamental fish diseases, their prevention, control and treatment methods.	2	K2 (U)	Lecture Method, teaching, Integrative learning	Rapid fire test, Flow Chart
IV	**Conditioning and Packing (6 Hrs.)**					
	1.	Conditioning, packing,	2	K1 (R) K2 (U)	Lecture Method, Integrative Teaching	Illustrative Diagrams, Online Assignment
	2.	Transport, and Quarantine methods.	1	K3 (Ap)	Flipped learning, Brainstorming	
	3.	Economics, Trade Regulations,	1	K1 (R) K2 (U)	Cooperative learning, Lecture method	Quiz, Multiple Choice Questions
	4.	Domestic and Export Marketing strategies.	2	K2 (U) K3 (Ap)	Reflective Thinking, Lecture using PPT	Concept explanations, Summary writing
V	**Practical (6 Hrs.)**					
	1.	Identification of locally available ornamental fishes	1	K2 (U) K3 (Ap)	Experiential learning,	Short test – Class test, Oral test

					Interactive Lecture Method.	
	2.	Egg Layers	2	K1 (R) K2 (U)	Inquiry based learning, Reflective Thinking	Illustrative Diagrams, Flow chart
	3.	Live Bearers	2	K1 (R) K3 (Ap)	Illustrative Lecture,	Surprise test, Illustrative assignment
	4.	Identification of locally available live feed organisms	1	K1 (R) K2 (U)	Exploratory learning, Demonstration	Summary writing, Oral test

1. Course Focussing on Employability/ Entrepreneurship/ Skill Development:
   Activities (Em/ En/SD): **Employability**
   1. Assignment: Food of ornamental fishes
   2. Debate: "Trade regulations: Boon or Bane?
2. **Course Focusing on Cross Cutting Issues (Professional Ethics/ Human** Values/ Environment Sustainability/ Gender Equity): **Environment Sustainability**
   Activities related to Cross Cutting Issues: Environment Sustainability
   1. Album: Commercially important fishes
   2. Flow Chart- Fish diseases: Symptoms, Diagnosis and Treatment methods

3. Sample questions

Part A

What are ornamental fish?

What is the primary difference between egg layers and live bearers in ornamental fish?

Match the following

A. Scrapper tool	- 1) Maintain water quality
B. Light	- 2) Water plant
C. Decorative hood	- 3) Remove algal growth
D. *Valliisneria*	- 4) Induce fish growth
E. Filter	- 5) Tank cover

	A	B	C	D	E
a)	1	2	5	4	3
b)	4	3	2	1	5
c)	3	4	5	2	1
d)	2	5	1	3	4

Which factor is crucial for the successful transportation of ornamental fish?

A) pH level of the water

B) Size of the transport container

C) Ambient temperature

D) Humidity level in the transport environment

Part B

1. Discuss the importance of ornamental fish culture.
2. Describe the importance and methods of feeding ornamental fish.
3. Explore the benefits of the Overhead Trickle Purification System while providing a concise explanation of its operation.
4. Detail the techniques involved in conditioning and packaging fishes.

Part C

1. Examine the domestic and global scenario of ornamental fish trade and its export potential.
2. Discuss the breeding, hatchery, and nursery management of egg layers (e.g., Goldfish) and live bearers (e.g., Guppy).
3. Outline the construction guidelines for ornamental fish tanks.
4. Brief upon the domestic and export marketing strategies adopted in ornamental fish trade.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. F. Brisca Renuga

Dr. Jeni Chandar Padua

Class : I B. Sc. Foundation Course
Title of the Course : Introduction to Zoology
Semester : I

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZU241FC1	1	1	-	-	2	2	30	25	75	100

Pre-requisite:
Students should know the basic concepts of biology such as systemic classification, Grades in organization, parts of the cell, role of environment, culture of different organisms.

Learning objectives

1. To provide the knowledge of fundamental principles in zoology that will be a foundation for their later advanced courses in more specific biological subjects.
2. Familiarize with animal classification schemes and diagnostic characteristics as well as developing an understanding of and ability to apply basic zoological principles.

Course Outcomes

COS	On the successful completion of the course, student will be able to**:**	Cognitive level
CO1	describe the basic concepts of taxonomy, organization, structure and role of cell, environmental issues, importance of culturing organisms.	K1
CO2	apply classification principles and identify animals, its organ system based on its function, environmental problems, benefits of culturing organisms.	K2
CO3	enhance leadership qualities, team spirit, participate in learning activities and communicate effectively among the peer.	K3
CO4	analyze the functional roles of different cell organelles and the integration of various organ systems.	K4
CO5	critically evaluate the interrelationships and functional significance of physiological systems, cellular structures, environmental factors, and applied zoological practices.	K5

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

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

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
	1.	**Systematic and binomial system of nomenclature**: Systematic, classification and nomenclature.	1	K2 (U)	Instructive learning	Slip test, MCQ
	2.	**Systematics:** Kingdom Protista- Salient features, examples; Kingdom Animalia	1	K1 (R)	Introductory session, Tabulation	Quizzes

	3.	**Introduction to different Phyla**: Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes,	2	K3 (Ap) K4 (An)	Probing, ppt	Oral test
	4	Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata and Chordata.	2	K3 (Ap)	Flipped classroom	Album
II	1	**Physiology and Biochemistry**: Introduction to organ systems- Digestive, Respiratory system.	2	K1 (R) K4 (An)	Blended learning, PPT video	Illustration with labels
	2	Circulatory system, Urinogenital system	3	K3 (Ap)	lecture using YouTube videos	Drawing test of urinogenital system
	3	, Reproductive system.	1	K3 (Ap)	PPT, group discussion	Slip test.
III	1	**General structure Cell**: Ultrastructure of prokaryotic and eukaryotic cells. Different cell organelles- endoplasmic reticulum, Golgi bodies	2	K2 (U) K4 (An)	Group Discussion, Interactive PPT	Objective test, word splash
	2	Mitochondria, lysosome,	2	K1(R)	Flipped Classroom	MCQ, mind map
	3	Nucleus, nucleolus.	2	K3 (Ap)	Peer tutoring, lecture using videos	Model making on structure of DNA
IV	1	**Environmental Biology:** Principal layers of atmosphere.	2	K3 (Ap) K4 (An)	Chalk and board, lecture, discussion	Oral test
	2	Ecosystem, Abiotic and biotic factors	2	K3 (Ap)	Brainstorming, Discussion	open book test
	3	Global warming, green house effects, acid rain.	2	K3 (Ap) K4 (An)	Group Discussion	Assignment on Acid rain
V	1	**Applied Zoology**: Aquaculture – Pisciculture.	2	K3 (Ap) K5 (E)	Group Discussion, Demonstration of aquarium	Slip test MCQ
	2	Pearl culture.	1	K3 (Ap) K5 (E)	Flipped classroom	Quizzes

	3	Sericulture, Apiculture.	3	K3 (Ap) K5 (E)	Peer tutoring, PPT	Mind map, Subjective test

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

Activities (Em/ En/SD): Illustration of organ system and Models of cell organelles.

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

Activities related to Cross Cutting Issues: Group Discussion on Global warming and Acid Rain

Assignment: Album on animals

Sample questions (minimum one question from each unit)

Part A

1. Define taxonomy and nomenclature.
2. What is Digestion?
3. How a prokaryotic cell is different from a eukaryotic cell?
4. Mention the principal layers of atmosphere.
5. What are the benefits of sericulture?

Part B

1. Comment on the salient features of Protozoa with examples.
2. Distinguish open and closed circulatory system with neat, labelled sketch.
3. Sketch the excretory organ of an animal of your choice.
4. Explain the structure of DNA proposed by Watson and Crick.
5. Give a short note on the economic importance of pearl culture.

Part C

1. Explain the Characteristic features of Chordata.
2. Explain the structure of human digestive system.
3. What is the powerhouse of a cell? Explain.
4. Define Greenhouse effect. Explain the causes of it and what precautions should be taken to reduce the greenhouse effect.
5. Honeybees are useful insects. – Justify.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. A. Shyla Suganthi

Dr. S. Prakash Shoba

Class : II B. Sc. **Core Course III**
Title of the Course : Cell Biology
Semester : III

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU233CC1	4	1	1		6	6	90	25	75	100

Pre-requisite

Basic knowledge on cells and its types.

Learning Objectives

1. To give a perception on the general structure and functions of cellular organelles.
2. To develop skills on microscopy and cytological techniques.

Course outcomes

On the successful completion of the course, student will be able to:		
1	identify the types of microscopes, cell, cell organelles and cell division.	**K1**
2	outline the role of cell organelles, nucleic acid and their interactions.	**K2**
3	differentiate cell types, chromosomes, cell stages, normal and abnormal cells.	**K3**
4	apply knowledge in cellular research using cytological and modern techniques.	**K4**
5	assess skills in cytological techniques, microscopy, and cell biology experiments.	**K5**

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

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	**Cell, Microscope and Micro technique (15 hours)**					
	1.	Cell theory. Prokaryotic and eukaryotic cells.	3	K1 (R) K2 (U) K3 (Ap)	Brainstorming, Inquiry based Teaching.	Short test
	2.	Cytological techniques - Fixation, sectioning, and staining.	4	K2 (U) K3 (Ap) K5 (E)	Experiential Learning (Demonstration)	Flow chart
	3.	Microscopy – Resolving power and uses of Compound microscope.	3	K1 (R) K4 (An) K5 (E)	Illustration, Demonstration	Assignment
	4.	Resolving power and uses of Phase contrast and electron microscope.	3	K1 (R) K3 (Ap) K4 (An)	Flipped classroom	Class test
	5.	Micrometry.	2	K1 (R)	Illustrative	MCQ

				K2 (U)	lecture, Demonstration	
II	**Plasma membrane & Cell organelles (15 hours)**					
	1.	Cell junctions.	2	K1 (R) K2 (U)	Flipped classroom	Quiz
	2.	Ultrastructure and functions of Plasma membrane.	4	K1 (R) K2 (U) K3 (Ap)	Integrative teaching	Illustration - Model Making
	3.	Cell organelles - Mitochondria, Ribosomes.	3	K2 (U) K4 (An)	Reflective thinking, Illustrative lecture	Model Making
	4.	Endoplasmic reticulum, Golgi complex.	3	K1 (R) K2 (U) K4 (An)	Collaborative Learning	Model Making
	5.	Lysosomes, Centrosomes.	3	K1 (R) K2 (U) K3 (Ap)	Illustrative lecture, Inquiry based learning	Model Making
III	**Nucleus and nucleic acids (15 hours)**					
	1.	Ultrastructure and functions of nucleus and nucleolus.	4	K2 (U) K3 (Ap)	Flipped classroom	Model Making
	2.	Chromosomes - types, structure, giant chromosomes.	3	K1 (R) K2 (U) K4 (An)	KWL, Inquiry based Learning	Comprehension
	3.	Nucleic acids – structure, types and functions.	4	K2 (U) K3 (Ap)	Index card, Illustration	Open book test Model Making
	4.	Nucleosomes. DNA replication in prokaryotes.	4	K1 (R) K2 (U)	Flipped classroom	Class test
IV	**Gene expression and regulation (15 hours)**					
	1.	Properties of Genetic code.	1	K2 (U) K4 (An)	Co-operative Learning	Assignment
	2.	Fine structure of gene.	2	K1 (R) K2 (U)	Collaborative Learning	Model making
	3.	Protein synthesis in prokaryotes - transcription and translation.	4	K2 (U) K4 (An)	Flipped classroom	Think-Pair-Share
	4.	Post translational modifications.	4	K2 (U)	Reflective Thinking, Illustrative lecture	MCQ, Summarisation
	5.	Regulation of gene expression -*Lac* operon.	4	K3 (Ap) K4 (An)	Blended Learning	Short test, Quiz
V	**Cell division and significance (15 hours)**					
	1.	Cell cycle, Mitosis, Meiosis	4	K1 (R) K2 (U) K5 (E)	Interactive Presentation, Demonstration	MCQ, Worksheet
	2.	Regulation of cell cycle	2	K3 (Ap)	Collaborative	Short test

		cdk dependent.		K4 (An)	Learning	
	3.	Cancer - properties, types, diagnosis and treatment.	3	K3 (Ap) K5 (E)	Problem based learning, Group Discussion	Think-Pair-Share, Oral test
	4.	Proto-oncogenes, oncogenes, tumour suppressor genes. Apoptosis.	3	K3 (Ap) K4 (An)	Interactive Presentation	Just a minute, Online Assignment
	5.	Cell signaling: signaling molecules and their receptors (types and functions).	3	K2 (U)	Flipped classroom	MCQ, Presentation

Course Focusing on **Employability and Skill Development**

Activities: **Assignment (Models Making)**

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

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

Assignment (Model Making) : Plasma membrane, Mitochondria, Ribosomes, Endoplasmic reticulum, Golgi complex, Lysosomes, Centrosomes, Cell cycle, Nucleic acids – DNA and RNA

Group Discussion: Cancer - properties, types, diagnosis and treatment.

Sample Questions

Part A

1. Which one of the following is a Prokaryotic cell?
   a) Neries b) Starfish c) Blue-green algae d) Sponges
2. **Match the column 'A' with column 'B' and give the correct answer**

A. De Duve	1. Plasma membrane
B. Porter	2. Mitochondria
C. Nageli	3. Endoplasmic reticulum
D. Benda	4. Lysosome

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

3. **Assertion (A):** Supernumerary chromosomes are extra chromosomes.
   Reason (R): They are genetically inert and produce little phenotypic effect.
   a) Assertion is true but reason is false.
   b) Assertion is false but reason is true.
   c) Assertion and reason are true.
   d) Both Assertion and reason are false
4. Which of the following is attached to the tRNA?
   a) DNA b) ribosome c) amino acid d) nucleic acid
5. Apoptosis is referred to as programmed cell death. (State **True** or **False)**

Part B

1. Explain the principle of Phase contrast microscope.
2. Distinguish eukaryotic ribosomes from prokaryotic ribosomes.
3. Explain the structure of polytene chromosome with suitable diagram.
4. Elucidate how the genes are switched on and off in prokaryotes.
5. Recall the characteristic features, diagnosis and treatment of cancer cells.

Part C

1. Illustrate the structure of a eukaryotic cell.
2. Why are ribosomes called the protein factories of the cell? Substantiate this statement.
3. What are giant chromosomes? Explain the characteristics and functions of Lamp brush chromosome.
4. Categorize and explain the stages of transcription and translation in prokaryotes.
5. What are oncogenes? How do they account for the development of cancer?

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

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Class : II B. Sc. Botany Elective Course III
Title of the Course : Animal Diversity
Semester : III

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZU233EC1	3	1	-	-	3	4	60	25	75	100

Pre-requisite:

Students should be common aware of living organisms and their basic morphological differentiations from biological studies.

Learning Objectives

1. To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterates, Helminthes, Annelida, Arthropoda, Mollusca and Echinodermata.
2. To comprehend the taxonomic position and diversity among Protochordata, Pisces, Amphibia, Reptilia, Aves and Mammalia.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	relate the characteristic features in invertebrates and chordates.	K1
2.	classify invertebrates up to class level and chordates up to order level.	K2
3.	identify the structural and functional organization of few invertebrates and chordates.	K3
4.	survey the adaptations and habits of animals to their habitat.	K4
5.	assess the taxonomic position of invertebrate and chordate animals.	K5

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Diversity of Invertebrates–I** (12 Hrs)					
	1	Principles of taxonomy.	2	K1 (R) K2 (U)	Blended Learning, Interactive Lectures	Mind Map, Short test
	2	Criteria for classification– Symmetry and Coelom	4	K1 (R) K2 (U)	Inquiry based learning, Illustrative lecture	Flow Chart, Hands-On Activity
	3	Binomial nomenclature.	1	K1 (R)	Group Discussion	Think-Pair-Share
	4	Classification characteristics, and ecological roles of Protozoa, Porifera, and Coelenterata up to classes with two examples.	3	K1 (R) K2 (U) K3 (Ap)	Flipped classroom, Problem-Based Learning	Graphic Organizer, Peer Assessment

	5	Classification characteristics, and ecological roles of Helminthes and Annelida up to classes with two examples.	2	K1 (R) K2 (U) K3 (Ap)	Brain Storming, Group Work, Cooperative Learning	Self-Assessment, MCQ
II	**Diversity of Invertebrates–II** (12 Hrs)					
	1	Arthropoda: Salient features, classification (up to classes with example) and Economic importance.	4	K1 (R) K2 (U) K3 (Ap)	Cooperative Learning, Direct Instruction	Quizzes, Open book test
	2	Mollusca (Mollusks): classification (up to classes with example) and ecological roles.	4	K1 (R) K2 (U) K3 (Ap)	Collaborative Learning, Project-Based Learning	Comprehension
	3	Echinodermata: classification (up to classes with example) and evolutionary significance.	4	K1 (R) K2 (U) K3 (Ap)	Experiential Learning, Gamification	Peer Review and Feedback
III	**Diversity of Chordates–I** (12 Hrs.)					
	1	Chordates: characteristics and evolutionary significance.	4	K1 (R) K2 (U) K3 (Ap)	Inquiry based learning, Flipped learning	Class test, Quiz
	2	Protochordates: Characteristic features, classification, feeding mechanisms. Pisces: Salient features, classification, adaptations of fishes to aquatic habitats.	4	K1 (R) K2 (U) K4 (An)	Cooperative Learning, Interactive Lecture	Class Test, Mind Map
	3	Amphibia: Salient features, classification up to orders with examples. Fertilization, metamorphosis, and parental care.	4	K3 (Ap) K5 (E)	Brain Storming & Group Discussion	Group Discussion, Slip Test
IV	**Diversity of Chordates–II** (12 Hrs.)					
	1.	Reptilia: classification, various forms of locomotion. Identification of Poisonous and non-poisonous snakes.	4	K1 (R) K2 (U) K5 (E)	Lecture Method, Integrative Teaching	Illustrative Diagrams, Online Assignment
	2.	Aves: Classification up to orders. Beaks and specialized respiratory systems.	4	K1 (R) K3 (Ap) K5 (E)	Cooperative learning, Lecture method	Quiz, Multiple Choice Questions
	3.	Mammalia: Classification up to orders. Mammalian hair/fur, mammary glands and specialized teeth.	4	K1 (R) K4 (An)	Reflective Thinking, Lecture using PPT	Concept explanations, Summary writing

V	**Animal Organization** (12 Hrs.)					
	1.	Earth worm: Structure and organization (digestive, excretory, and reproductive system).	2	K2 (U) K4 (An)	Peer tutoring, Group Discussion	Seminar, Short test – Class test, Oral test
	2.	Prawn: Structure and organization (Exoskeleton, excretory and reproductive system.	3	K1 (R) K5 (E)	Inquiry based learning, Flipped learning,	Illustrative Diagrams, Online Assignment
	3.	Rabbit: Structure and organization (digestive system, circulatory and endocrine system)	1	K1 (R) K3 (Ap)	Illustrative Lecture, Peer teaching	Surprise test, Seminar

1. Course Focussing on Employability/ Entrepreneurship/ Skill Development:
   Activities (Em/ En/SD): **Employability**
   1. Group discussion on Binomial Nomenclature
   2. Debate: "Classification of Aves- Is it based on evolution or genetics?

2. Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity): **Environment Sustainability**
Activities related to Cross Cutting Issues: Environment Sustainability
   1. Mind Map - Symmetry and Coelom.
   2. Flow Chart- Classification of Mammals

3. Sample questions

Part A (1 Mark)

1. Assertion (A): Annelids exhibit bilateral symmetry.
Reason (R): Bilateral symmetry allows for more efficient movement and the development of a head region (cephalization).

a) Both A and R are true, and R is the correct explanation for A.
b) Both A and R are true, but R is not the correct explanation for A.
c) A is true, but R is false.
d) A is false, but R is true.

2. Arthropoda is the largest phylum in the animal kingdom, including classes such as Insecta and Arachnida. **True or False.**
3. Which one of these is a Piscean animal?
a. Crow b. Snake c. Parrot d. Fish

4. Which of the following characteristics are commonly associated with reptiles?
A) Warm-blooded B) Lay eggs C) Have fur or feathers D) Live in water
5. The _____ of a rabbit is covered in dense fur, providing insulation and protection from the environment.

Part B (6 Marks)

1. Explain the significance of binomial nomenclature in the classification of invertebrates.
2. Describe the distinguishing features of the major class of the phyla Arthropoda.
3. Explain the major characteristics of Pisces.
4. Discuss the flight adaptations of birds?

5. Detail the anatomy of an earthworm, highlighting its structural features and their functions.

Part C (12 Marks)

1. Describe the differences in body symmetry and coelom types among Porifera. Coelenterata.
2. Discuss the unique characteristics and examples of Echinodermata.
3. Evaluate the characteristics of amphibians adding a note on their classification.
4. Analyse the distinguishing characteristics of marsupials and placental mammals.
5. Assess the variations in prawn appendages and their significance in the life cycle of Prawn.

Head of the Department

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Course Instructors

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Class : II B. Sc. Zoology SEC II
Title of the Course : Sea Food Processing
Semester : III

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZU233SE1	1		1		2	2	30	25	75	100

Prerequisite

Students should have a foundational understanding of seafood industry, including knowledge of different types of seafood, their seasons, quality standards, and market demands.

Learning Objectives

To develop a skill to recognize different types of seafood and their biological characteristics.
To apply the innovative approaches to improve seafood process.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall different types of seafood and their characteristics.	**K1**
2.	understand the importance of maintaining proper hygiene and sanitation in seafood processing	**K2**
3.	apply proper techniques for handling, filleting, and packaging different types of seafood	**K3**
4.	analyze the factors affecting seafood quality, such as freshness, texture, and taste	**K4**
5.	evaluate the sustainability of seafood processing practices and propose improvements for minimizing environmental impact.	**K5**

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

Teaching modules

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	**Introduction to Seafood (6 hours)**					
	1.	Importance of seafood, Classification of seafood products.	2	K1 (R)	Brain Storming, Inquiry based Teaching.	Flow chart
	2.	Common fish species, Shellfish varieties: mollusks and crustaceans.	2	K1 (R)	Blended Learning	Album making
	3.	Sustainable seafood management in Indian coastal communities.	2	K2 (U)	Collaborative Learning	Assignment
II	**Seafood Nutrition (6 hours)**					
	1.	Nutritional composition of seafood: protein,	2	K5 (E)	Flipped classroom	Class test

		omega-3 fatty acids, vitamins.				
	2.	Health benefits of seafood according to ayurvedic principles and dietary recommendations.	2	K1 (R) K3 (Ap)	Integrative teaching	Group Discussion
	3.	Risks associated with seafood consumption: allergies, contaminants.	2	K1 (R) K4 (An)	Reflective thinking	MCQ
III	**Seafood Processing (6 hours)**					
	1.	Methods of seafood preservation: freezing, canning, smoking.	2	K1 (R) K3 (Ap)	Experiential learning	Mind map
	2.	Integration of traditional and modern practices in seafood processing.	2	K5 (E)	Collaborative Learning	Discussion
	3.	Quality control and food safety regulations,	1	K4 (An)	PPT. Interactive teaching	Slip test
	4.	Innovation in seafood processing techniques. Market Trends.	1	K3 (Ap) K5 (E)	Group discussion, Flow chart	Recipe preparation
IV	**Cookery Techniques (6 hours)**					
	1.	Cooking methods for different seafood types: grilling, steaming, frying	2	K3 (Ap)	Experiential learning	Performance
	2.	Flavor pairing and seasoning for seafood dishes	2	K3 (Ap)	YouTube videos, Hands on learning	Performance
	3.	Texture and temperature control in seafood cooking	2	K4 (An)	PPT Demonstration	Quizzez
V	**Seafood Showcase (6 hours)**					
	1.	Cooking demonstrations with seafood	2	K3 (Ap) K4 (An)	Interactive learning	Performance
	2.	Recipe development and menu planning exercises	1	K3 (Ap) K4 (An)	Demonstration YouTube videos	Performance
	3.	Presentation of innovative seafood dishes.	3	K3 (Ap) K5 (E)	Collaborative learning	Display of prepared dishes

Course Focusing on **Entrepreneurial**

Activities: **Assignment, Group discussion, Album.**

Course Focusing on Cross Cutting Issues: Innovative processing techniques

Activities related to Cross Cutting Issues: Hands-on experience in sea food processing**.**

Assignment:

Sustainable seafood management in Indian coastal communities.

Album making

Common edible fish and shellfish species.

Group Discussion

Health benefits of seafood.

Sample questions

Part A

1. Which of the following is a common species of fish found in many diets around the world?
   a) Lobster b) Salmon c) Oyster d) Squid
2. Which of the following is not a type of freshwater fish?
   a) Catfish b) Trout c) Haddock d) Bass
3. Which fish is known for its high omega-3 fatty acid content?
   a) Trout b) Cod c) Tuna d) Clam
4. Which of the following is a health benefit of seafood consumption highlighted in Ayurvedic texts?
   a) Improves digestion b) Enhances cognitive function
   c) Promotes joint health d) All of the above
5. Which of the following is a common preservative used in canned seafood?
   a) Sugar b) Vinegar c) Salt d) Lemon juice

Part B

1. Name three common crustaceans found in seafood industry.
2. Classify the seafood products.
3. Tabulate the nutritional composition of seafood.
4. Explain the dietary requirements of seafood.
5. Differentiate canning and smoking.

Part C

1. Discuss the importance of seafood.
2. Describe the challenges faced by Indian coastal communities in maintaining sustainable seafood practices.
3. How would you incorporate seafood into a balanced diet plan?
4. How can someone with a seafood allergy avoid allergens in their diet?
5. How would you apply traditional processing methods to ensure the quality of different shellfish varieties?

Head of the Department

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Course Instructors

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Dr. A. Shyla Suganthi

Class : III B. Sc. **Major Core V**
Semester : V
Title of the Course : Physiology
Course Code : ZC2051

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	6	90	100

Learning Objectives

1. To enable the students to gain insight knowledge on the functional significanceof the different organs and organ systems.
2. To develop skills to relate the normal and abnormal functions of vital organs.
3. To train future researchers academically and intellectually in physiology.
4. Unable to perform, analyse and report on experiments and observations inphysiology

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	Cognitive level
CO - 1	recall the basic anatomy of digestive, respiratory, excretory, homeostatic, neuromuscular, endocrine and reproductive system.	PSO - 1	K1 (R)
CO - 2	describe the important physiological systems and internal regulation.	PSO - 1	K2 (U)
CO - 3	compare various organ systems and adaptations exhibitedby animals.	PSO - 2	K3 (Ap)
CO - 4	infer the integration of activities of different organ and organ system.	PSO - 3	K4 (An)
CO - 5	interrelate different organ systems to diseases for a holistic approach to human health.	PSO - 2	K5 (E)

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Nutrition and Digestion** (18 Hrs.)					
	1	Nutrition-types, Composition of food-importance of nutrients.	3	K2 (U) K3 (Ap)	Blended Learning, Illustrative lecture	Flow Chart, Hands-On Activity
	2	Balanced diet, Basal metabolic rate (BMR) and Body mass index (BMI).	3	K3 (Ap) K4 (An)	Inquiry based learning, Interactive Lectures	Think-Pair-Share, Quiz

	3	Malnutrition (Marasmus, Kwashiorkor, Obesity, epidemic dropsy).	3	K1 (R) K4 (An)	Group Discussion, Peer group Teaching	Graphic Organizer, Peer Assessment
	4	Mechanical & chemical digestion and absorption - Digestive system of man.	3	K3 (Ap) K5 (E)	Flipped classroom, Problem-Based Learning	Slip test, Assignment, Mind Map
	5	Digestion of carbohydrate, protein and fat. Absorption and assimilation of digested food materials.	4	K3 (Ap) K4 (An)	Brainstorming, Group Discussion.	MCQ, Oral test
	6	Physiology of ruminating stomach.	2	K4 (An)	Discussion, Brain storming	Flow chart, Oral test
II	**Respiration, Osmo- & thermoregulation** (18 Hrs.)					
	1	Respiration - Respiratory organs, Respiratory pigments.	3	K1 (R) K2 (U)	Cooperative Learning, Direct Instruction	Quizzes, Open book test
	2	Respiratory system of man - transport of O_2 and CO_2, oxygen dissociation curve, Bohr's effect.	5	K3 (Ap) K4 (An) K5 (E)	Collaborative Learning, Project-Based Learning	Comprehension
	3	Chloride shift, Anaerobiosis, Respiratory Quotient.	3	K2 (U) K5 (E)	Experiential Learning, Gamification	Peer Review and Feedback
	4	Osmoregulation: Osmoconformers, Osmoregulators, Osmoregulation in crustaceans, fishes and mammals.	4	K2 (U) K5 (E)	Lecture Group Discussion	Class Test, Mind Map
	5	Thermoregulation - poikilotherms and homeotherms, thermoregulatory Mechanisms.	3	K4 (An) K5 (E)	Peer group teaching, Group discussion	Group Discussion, Slip Test
III	**Circulation and Excretion** (18 Hrs.)					
	1	Circulation - composition blood and lymph, myogenic and neurogenic heart, structure of human heart.	4	K1 (R) K4 (An)	Brain Storming, Interactive class	Oral test Assignment
	2	Heart beat - origin and conduction, pace maker, cardiac cycle and ECG, blood pressure.	4	K1 (R) K2 (U) K5 (E)	Group Discussion, Lecture	Slip test, Quiz

	3	Heart diseases: arthrosclerosis, acute coronary occlusion, Myocardial infarction.	2	K1 (R) K5 (E)	Blended Learning, Interactive Lectures	Recall key terms short answers
	4	Excretion - patterns of excretion, excretory organs in invertebrates.	3	K1 (R) K4 (An)	Inquiry based learning, Illustrative lecture	Oral test, Class test
	5	Structure of kidney in man, nephron, counter current mechanism of urine formation.	3	K3 (Ap) K4 (An)	Flipped Learning, Interactive Lectures	MCQ, Summarization
	6	Composition of urine. Nephritis and Dialysis.	2	K1 (R) K4 (An) K5 (E)	Brainstorming, Group Discussion	Oral test, Flow chart
IV	**Muscle and Neurophysiology** (18 Hrs.)					
	1	Muscle physiology - types of muscles, ultrastructure and properties of skeletal muscle.	4	K1 (R) K2 (U)	Brainstorming, Interactive class	Slip test, Class test
	2	Mechanism of muscle contraction and Rigor mortis.	4	K2 (U) K3 (Ap) K5 (E)	Flipped classroom, Direct Instruction	Oral test, Short test
	3	Structure and types of neurons, neurotransmitters.	2	K3 (Ap) K4 (An)	Cooperative learning, Illustrative explanation	MCQ, Slip test
	4	Conduction of nerve impulse through myelinated and non-myelinated nerve and synapse.	3	K4 (An) K5 (E)	Interactive presentations, Cooperative Learning,	Oral test, Mind map
	5	Reflex action.	1	K3 (Ap) K4 (An)	Group Work, Cooperative Learning	True or False
	6	Receptors - types, physiology of phonoreception.	4	K4 (An) K5 (E)	Brainstorming, Group Discussion	Short answers
V	**Endocrine and Reproductive Physiology** (18 Hrs.)					
	1	Endocrine physiology - hormones and pheromones.	2	K1 (R) K3 (Ap)	Blended Learning, Interactive Lectures	Class test
	2	Hypothalamus and endocrine glands - pituitary, thyroid,	5	K3 (Ap) K5 (E)	Inquiry based learning, Illustrative lecture	Flow chart, short test

		parathyroid, adrenal, islets of Langerhans.				
	3	Biological clock and biological rhythms.	2	K3 (Ap) K4 (An)	Cooperative Learning, Direct Instruction	Slip test
	4	Reproductive physiology - male reproductive system. Female reproductive system, structure of graffian follicle.	4	K3 (Ap) K4 (An)	Flipped classroom, Problem-Based Learning	Anatomical Diagrams
	5	Menstrual cycles and menopause.	2	K3 (Ap) K4 (An) K5 (E)	Collaborative Learning, Project-Based Learning	Chart
	6	Hormonal regulation of menstruation, pregnancy and lactation.	3	K4 (An) K5 (E)	Reflective thinking, Illustrative lecture	Peer seminar

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

Activities for **Employability**

1. Peer Group Discussion: Endocrine Disorders
2. Group Discussion: Composition of food
3. Group Discussion: Blood pressure

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

Activities related to Cross Cutting Issues:

Assignment: 1. Malnutrition
2. Heart diseases
3. Anatomical diagrams of the male and female reproductive systems

Sample Questions

Part A (1 mark)

1. The process of swallowing the food into the stomach is called _____ (R) (CO-1)
a) Defecation b) Mastication c) Deglutition d) Digestion

2. A phenomenon where the animals undergo dormancy to escape from excessive cold is aestivation. **State True/ False**.

3. **Match the following** (U) (CO-2)

A.	Mesonephros	- 1. Calculi
B.	Diuresis	- 2. Advanced kidney
C.	Kidney stones	- 3. Increased urine flow
D.	Dialyser	- 4. Artificial kidney

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

4. The _____ are structures by which the animals respond to the changes in the external environment.

5. **Assertion (A):** Secretory phase is the second phase of menstrual cycle. (An) (CO-4)

Reason (R): The uterine glands secrete more mucous called uterine milk.

a) Statement A is correct and statement R is wrong
b) Statement A is wrong and statement R is correct
c) Both Statement A and R is wrong
d) Both Statement A and R is correct

Part B (4 marks)

1. Evaluate the importance of balanced diet.
2. Elucidate the various types of respiratory organs found in different animals.
3. How will you do dialysis to treat renal diseases?
4. Analyze Sliding Filament theory of muscle contraction.
5. Describe oestrus cycle and menstrual cycle.

Part C (8 Marks)

1. 'Adequate intake of proteins and vitamins is essential for a healthy life' - Justify.
2. Examine the mechanism of thermoregulation in poikilotherms and homeotherms.
3. Explain the structure of human heart with neat diagram.
4. Discuss the ultra-structure and properties of skeletal muscle.
5. Evaluate the role of hormones in the regulation of menstruation, pregnancy and lactation.

Head of the Department

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Course Instructor

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Dr. S. Mary Mettilda Bai

Dr. C. Anitha

Class : III B.Sc. Major Core VI
Title of the Course : Biotechnology
Semester : V
Course Code : ZC2052

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	6	90	100

Objectives

1. To inculcate the basic concepts and various techniques pertaining to biotechnology.
2. To provide interdisciplinary skills for research and employability in biotech industries.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	explain the basic concepts of biotechnology and nanotechnology.	PSO - 1	K1 (R)
CO - 2	Recite rDNA, hybridoma technology, tissue engineering andapplications of nanotechnology.	PSO - 1	K2 (U)
CO - 3	apply appropriate tools and techniques in biotechnological manipulation and problems ethically.	PSO - 2	K3 (Ap)
CO - 4	Examine the transgenic animals, microbial and biotechnological products.	PSO - 3	K4 (An)
CO - 5	Priorities biotechnological techniques for the welfare of environment and society.	PSO - 4	K5 (E)

Teaching plan

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

Unit	Module	Topic	Teaching Hrs	Cognitive level	Pedagogy	Assessment
I	1.	**Introduction to Biotechnology:** Scope of biotechnology, Genetic Engineering –-	2	K2 (U)	Lecture using Chalk and talk, review	short test, MCQ
	2.	Enzymes for cutting and joining DNAs, cloning vectors - pBR322, SV40, Ti plasmid.	3	K1 (R)	Introductory session, demonstration	Mind map, oral test
	3.	*In vitro* construction of rDNA, Introduction of rDNA into host cell	3	K3 (Ap)	Group Discussion, ppt	Word splash, objective test
	4.	selection of recombinants. DNA library.	2	K4 (An)	Mind mapping, chalk and Board, lecture	Differentiate between various ideas, Mind Map

	5.	Molecular markers - RAPD and RFLP. Polymerase Chain Reaction (PCR).	4	K5 (E)	Peer tutoring, jigsaw	Long essay test, oral test
	6.	Southern blotting. DNA sequencing - Maxam and Gilbert's method – Sanger's.	4	K3 (Ap)	Lecture using videos, peer tutoring	Discussion, Assignment
II	1	**Cell culture:** Culture media - cell culture technique -	3	K2 (U)	Blended learning, Lecture, Demonstration	short test, Objective test
	2	establishment of cell culture – primary andsub-culture - explant culture, callus culture,	3	K3 (Ap)	Demonstration , lecture using videos	MCQ, Assignments
	3	somatic hybridization and micro-propagation.	3	K3 (Ap)	PPT, group discussion	Slip test, MCQ,
	4	Celllines - large scale culture of cell lines -	3	K4 (An)	Review, mind map	Short essays, Quizziz
	5	organ culture - artificial skin and cartilage–3D culture –*Invitro* organ development - embryo culture.	3	K5 (E)	Chalk and Board, Lecture, you tube videos	Open book test
	6	Stem cells - characteristics, types and applications.	3	K2 (U)	group discussion, index card	Mind map, Oral test
III	1	**Transgenic animal technology:** Transgenesis – methods of transgenesis, knock out gene, applications of transgenic animals.	5	K3 (Ap)	Group Discussion, Interactive PPT	Objective test (Fill in the blanks), word splash
	2	Bioethics - ethical implications of transgenic animals	4	K1 (R)	Mind mapping, Debate	MCQ, mind map
	3	Hybridoma technology - production of hybridoma, monoclonal antibodies - production and applications	5	K4 (An)	Peer tutoring, lecture using videos	Slip test, poster making
	4	Bioreactors - stirred tank and air–lift bioreactor	4	K2 (U)	Flipped classroom, Peer tutoring	MCQ, Oral test

IV	1	**Metabolite production and Bioremediation**: Production - primary metabolite –L. glutamic acidand L. glutamine, secondary metabolite – penicillin, Biofuel-ethanol.	2	K3 (Ap)	Chalk and board, lecture, discussion	Evaluation through short test, Oral test
	2	Immobilization of enzymes and their applications. Biosensors – types and applications.	3	K4 (An)	Demonstration , Experimental practice	Practical test, open book test
	3	Bacterial SCP and its applications. Sewage and wastewater treatment.	3	K3 (Ap)	Discussion, simplified notes	Differentiat e between various ideas, MCQ,
	4	Bioremediation - types, degradation of xenobiotics (hydrocarbon, pesticide), super bug – construction and application.	4	K5 (E)	Review, Chalk and Board, lecture	Mind map, True/False (Objective test)
	5	Biomining and bioleaching**.** Biocontrol – *Bacillus thuringiensis.* Biosafety	3	K2 (U)	Chalk and board, lecture, Probing, Flipped cladss room	Essay, Concept explanation s
	6	Possible dangers of Genetically Engineered Organisms (GEOs) and biohazards of rDNA technology.	3	K1 (R)	Discussion, Debate	Evaluation through short test, Poster making
V	1	**DNA applications:** Disease diagnosis – DNA probes, disease treatment	3	K4 (An)	Group Discussion, peer tutoring	MCQ, Short essays,
	2	production of human insulin.	3	K3 (Ap)	Blended classroom, Demonstration	Quizzes, slip test
	3	Gene therapy – types and methods.	3	K2 (U)	Peer tutoring, PPT	Mind map, Subjective test
	4	Finger printing and its application in forensic medicine. Human Genome Project.	4	K4 (Ap)	Lecture using videos, Group discussion	Short essays, objective test (Fill in the blanks)

	5	Nanobiotechnology – Nano drug, Drug delivery system, DNA microarray, gene chip, Diagnosis and screening.	5	K5 (E)	Interactive PPT, Discussion	MCQ, Oral test

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability
Activities (Em/ En/SD): DNA Extraction
Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Professional Ethics
Activities related to Cross Cutting Issues : Debate on Bioethics in gene cloning and transgenic animals
Assignment : DNA library
Seminar Topic: (if applicable)
Sample questions (minimum one question from each unit)

Part A

1. Which technique is commonly used to create a DNA library?
   a) Polymerase chain reaction (PCR) b) Gel electrophoresis
   c) Southern blotting d) DNA microarray
2. Primary culture is usually performed in a sterile environment to prevent contamination. (**State True or False**)
3. Monoclonal antibodies are produced by _____ cells.
4. The term "superbug" is commonly associated with which group of bacteria?
   a) Gram-negative bacteria b) Gram-positive bacteria
   c) Fungal pathogens d) Parasitic organisms
5. The Human Genome Project was initiated in the 1990s and completed in 2003. (**State True or False)**

Part B

6. Outline the enzymes used in the cutting and joining of DNA segments.
7. Compare explant and callus culture.
8. Demonstrate stirred tank bioreactors.
9. Construction of superbugs is a boon. Justify.
10. Analyse the process of insulin production.

Part C

6. Define PCR and describe the process of the same.
7. Explain stem cells. Add a note on its Characteristics, types and applications.
8. Illustrate the production of monoclonal antibodies and applications.
9. Evaluate the immobilization of enzymes.
10. Classify the types and methods of gene therapy.

Head of the Department
Dr. A. Shyla Suganthi

Course Instructors
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Class : III B.Sc. Major Core VII
Title of the Course : Ecology and Toxicology
Semester : V
Course Code : ZC2053

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

Objectives

1. To develop a deep understanding on the interaction between the environment and the living organisms.
2. To develop skills to assess the toxicants and its impacts, environmental standards and apply that knowledge to current environmental issues for wise environmental management.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define abiotic, biotic and limiting factors, community structure, ecological succession, wild life conservation and toxicants.	PSO - 1	R
CO - 2	comprehend the physical and chemical properties of environment, biological effects, biogeochemical cycles, wild life conservation, environmental pollution and toxicology.	PSO - 1	U
CO - 3	identify the biotic factors, characteristics of communities, endangered species and causes for environmental problems.	PSO - 2	Ap
CO - 4	assess the structure and function of ecosystem, community, habitat for sustainable management of environmental system and for the remediation.	PSO - 3	An
CO - 5	evaluate the impact of environment changes on the biosphere.	PSO - 4	E
CO - 6	design and execute independent research in environmental science.	PSO - 4	C

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

Unit	Module	Topic	Teaching hrs	Cognitive level	Pedagogy	Assessment
	Introduction to ecology: 15 hrs					
I	1.	Scope-Branches of ecology. Autecology and synecology.	2	K1 (R)	Brain storming Lecture	Mind map on branches of ecology
		Environment –atmosphere, lithosphere, hydrosphere and biosphere.	2	K2 (U)	Video lecture	Assignment

	2.	Biological effects of temperature and light.	3	K3 (A)	Power point presentation -lecture	Case study on effect of temperature and light
		Concept of limiting factors - Liebig's law of minimum, Shellford's law of tolerance.	1	K1(R)	Lecture	Oral test
	3.	Interspecific relationship - mutualism, commensalism, antagonism - antibiosis, parasitism, predation and competition.	3	K3 (Ap)	Team teaching	Quiz by peers
	4.	Habitat ecology- adaptations of deep sea and desert living animals.	4	K4 (An)	Group discussion Video lecture	Mind map on adaptations
II	1.	Ecosystem –Structure, abiotic and biotic factors. Functions - Detritus and grazing food chains, food web,	2	K2 (U)	Brainstorming Seminar Power point presentation	Observe a food chain/food web in a terrestrial ecosystem and prepare a report.
		Trophic levels, energy flow.-Linear and Y-shaped, ecological pyramids.	2	K4 (An)	Lecture	Draw an ecological pyramid
	2.	Biogeochemical cycle – types, nitrogen and phosphorous cycle.	3	K2 (U)	Lecture-E content (video class)	Slip test
	3.	Population ecology - density, natality, mortality, age, distribution.	2	K2 (U)	Flipped class room Inquiry based learning	Assignment
		Population growth, population equilibrium, population fluctuations	2	K2 (U)		
		Biotic potential, population dispersal and dispersion,	2	K2 (U)		
		Regulation of population- density independent and density dependent factors, population interaction.	2	K4 (An)	Lecture Collaborative learning	Discussion

III	**Community Ecology: 15 hrs**					
		Concept of community, Community- structure, composition and stratification. Ecological niche, Ecotone and Edge effect, Ecotype, Ecological indicators.	4	K2 (U)	Lecture with PPT and field visit	Slip test
		Ecological succession - types, general process, Concepts of climax- theories of climax, patterns of succession.	3	K2 (U)	Lecture	Oral test - objective type
		Ecological effects of dams, hydroelectric projects. Animal distribution – continuous and discontinuous. Parallelism, Endemism. Zoogeographical regions of world.	6	K4 (An)	Case study-analysis lecture	Case study
		Remote sensing and its applications in agriculture, fisheries, forest management and food management.	2	K3 (Ap)	Lecture/ppt	Mind map
IV	**Toxicology**: 15 hrs					
	1	Scope and sub-divisions of toxicology. Toxicants – classification, toxicity - lethal, sublethal, LC_{50}, and LD_{50}.Toxic agents and their mode of action – toxicokinetics toxico-dynamics – toxic responses - ADME.	4	K2 (U) K3 (Ap) K4 (An)	Brainstor ming Flipped class room -Video Group discussion	Oral test Short test
	2	Toxic effects of heavy metals, pesticides, carcinogens, food additives, cosmetics, micro plastics and radiations. Factors affecting toxicity.	4	K2 (U) K3 (Ap)	Interactive PPT Roleplay	Oral test Quiz
	3	Dose-effect and dose-response relationship - acute toxicity, chronic toxicity reversible and irreversible effects.	3	K2 (U) K3 (Ap)	Collaborat ive learning- Peer group teaching, Jigsaw	Presentation Short test

	4	Toxicity bioassay – *in vivo* experiments – determination of LC_{50} and LD_{50}, *ex vivo* experiments – haematological and biochemical parameters. Application of toxicology.	4	K2 (U) K3 (Ap) K4 (An)	Flipped classroom Video Experiential learning	Slip test Quiz
V	**Ecotoxicology: 15 hrs**					
	1	Types – measurement of ecotoxicological effects. Pollution - pollutants, xenobiotics, greenhouse effect, ozone depletion, acid rain, photochemical smog	4	K1 (R) K2 (U) K6 (C)	Flipped class room-Group discussion Video	Assignment Peer Review
	2	Bhopal episode, Chernobyl disaster BOD, Eutrophication, Red tide, Minamata disease	3	K2 (U) K4 (An)	Inquiry based learning PPT	Assignments-Album creation
	3	Bioaccumulation, biomagnifications, biotransformation, biomonitoring.	4	K2 (U) K4 (An) K6 (C)	Flipped class room-Jigsaw, Video	Quiz Short test
	4	Waste water treatment and solid waste management. Environmental Auditing and Environmental Impact Assessment (EIA).	4	K2 (U) K3 (Ap) K4 (An)	Problem based learning-project	Model making

Course Focussing on Employability/ Entrepreneurship/ Skill Development :

Employability and Skill Development

Activities (Em/ En/SD): Solid waste management- vermicomposting

Water analysis

Course Focussing on Cross Cutting Issues

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

Environment Sustainability

Activities related to Cross Cutting Issues: Toxic effect on tadpole/observe a polluted area and prepare a report

Assignment:

Seminar Topic: (Food additives, cosmetics, micro plastics)

Assignment

Model making : Ecosystem structure and function, Community stratification, Pollution

Sample questions

Part A

1. Fishes living in cold waters are provided with a greater number of vertebrae than those living in warmer regions. This phenomenon is called_____ **(CO-5, E)**

   a) Allen's rule b) Jordan's rule

c) Rensch's rule d) Menkin's rule

2. The average number of new individuals produced by a population is _____. **(CO-1, R)**
a) Mortality b) Natality c) Death rate d) Growth rate

4. Assertion(A): The pyramid of energy in any ecosystem is upright. **(CO-4, An)**
Reason(B): At each tropic level 90% of energy is lost.
a. Statement 'A' and Statement B' are correct.
b. Statement 'A' and 'B' are wrong.
c. Statement' A' is correct and Statement 'B' is wrong.
d. Statement 'A' is wrong and Statement 'B' is correct.

5. Match the following and choose the correct answer (CO-1, R)

A. Ecotone	1. Effect of an abrupt transition between two communities
B. Edge effect	2. Region of transition between two communities.
C. Ecotype	3. A position occupied by a species in a community
D. Niche	4. A distinct species occupying a particular habitat.

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

4. Eutrophication is caused by the excessive enrichment of water bodies with nutrients, leading to algal blooms.**True/False.**

5. Which environmental disaster is associated with the release of methyl isocyanate gas?
a) Bhopal episode b) Chernobyl disaster c) Koodankulam d) Greenhouse effect

Part B

1. Discuss the interspecific relationship among animals.
2. Explain the types of food chain in an ecosystem. Differentiate a food chain from a food web.
3. Analyse the ecological effects of dams and hydroelectric projects.
4. Appraise the applications of remote sensing in agriculture, food and fisheries management.
5. Compare and contrast lethal and sublethal effects of toxicants.
6. Discuss the Role of Environmental Auditing in Sustainable Development

Part C

1. Summarize the adaptations exhibited by the deep-sea organisms.
2. Explain phosphorous cycle and its role in the environment.
3. Enumerate the types of animal distribution.
4. Highlight the differences between chemical, biological, and physical toxicants, and explain how each category impacts living organisms.
5. Discuss the strategies for Effective Solid Waste Management in Urban Areas

Course Instructors **Head of the Department**

Dr. F. Brisca Renuga Dr. A. Shyla Suganthi
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(Course-in charge)