

Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, Tamil Nadu.

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

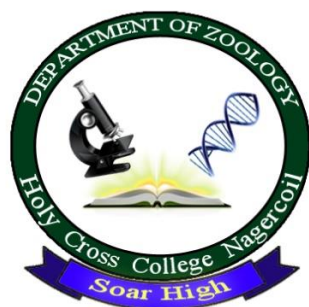
Affiliated to

Manonmaniam Sundaranar University, Tirunelveli



DEPARTMENT OF ZOOLOGY

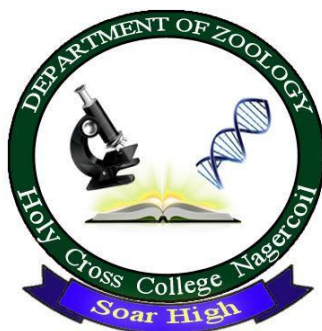
SYLLABUS FOR UNDERGRADUATE PROGRAMME



TEACHING PLAN

ODD 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

Class : I B. Sc. Zoology **Core Course - 1**
Title of the Course : Invertebrata
Semester : I
Course Code : ZU231CC1

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

Total Hours: 90 (Incl. Seminar & Test)

Unit	Module	Topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
Total Hrs: 12						
I	1	Protozoa: Introduction to Classification, taxonomy, and nomenclature. General characters and classification of Phylum Protozoa up to classes.	3	K1 (R) K2 (U)	Cooperative learning	Short test, MCQ Index card
	2	Type study: <i>Paramecium</i> and <i>Plasmodium</i> - Parasitic protozoans (<i>Entamoeba</i> , <i>Trypanosoma</i> & <i>Leishmania</i>) - Economic importance Nutrition in protozoa	3	K2 (U) K3 (Ap)	KWL	MCQ

	3	Host-parasitic interactions in <i>Entamoeba</i> and <i>Plasmodium</i> -Locomotion in protozoa	3	K4 (An)	Interactive presentations	Traffic lights. Short test
	4	Porifera: General characters and classification up to Classes. Type study: Sycon- Canal system in sponges. Reproduction in sponges	3	K2 (U)	Interactive presentation	Short test
II	Total Hrs: 12					
	1	Coelenterata: General characters and classification up to classes	3	K1 (R) K2 (U)	Interactive presentation	Short test
	2	Type study: <i>Obelia</i>	2	K2 (U) K3(Ap)	index card	Traffic lights. MCQ
	3	Corals and coral reefs - Economic importance of corals and coral reefs - Polymorphism in Hydrozoa.	3	K2 (U) K4 (An)	Role play interactive presentation	Mind mapping Short test
	4	Platyhelminthes: General characters and classification of up to classes. Type study: <i>Fasciola hepatica</i> . Parasitic adaptations. Host-parasitic interactions of Helminthine parasites	4	K2 (U) K5 (E)	Role play interactive presentation	Mind mapping Short test
III	Total Hrs: 12					
	1	Aschelminths: General characters and classification of up to classes	3	K3 (Ap)	Interactive presentation	Flow Chart MCQ
	2	Type study: <i>Ascaris lumbricoides</i>	3	K2 (U) K4 (An)	Interactive presentation	Flow Chart MCQ
	3	Nematode Parasites and diseases - <i>Wuchereria bancrofti</i> , <i>Enterobius vermicularis</i> , <i>Ancylostoma duodenale</i> . Parasitic adaptations.	2	K3 (Ap) K5 (E)	Interactive presentation	MCQ
	4	Annelida: General characters and classification up to Classes. Type study: <i>Nereis</i> , Metamerism-Modes of life in Annelids.	4	K1 (R) K2 (U)	Interactive presentation	Short test
IV	Total Hrs: 12					
	1	Arthropoda: General characters and classification of Phylum Arthropoda up to Classes. Type study: <i>Penaeus indicus</i> .	4	K2 (U) K4 (An)	Interactive presentation	Flow Chart
	2	Affinities of <i>Peripatus</i> – Larval forms in Crustacea. Economic importance of Insects.	2	K2 (U) K3 (Ap)	Interactive presentation	MCQ
	3	Insect pests of Agricultural Importance- Pest of rice: Rice stem borer (<i>Scirpophaga incertulas</i>) – Pest of Sugarcane: The shoot borer (<i>Chilo infuscatellus</i>)	3	K2 (U) K4 (An)	Interactive presentation	Flow Chart MCQ

	4	Pest of coconut: The rhinoceros beetle (<i>Oryctes rhinoceros</i>). Principles of Integrated Pest Management.	3	K2 (U) K3 (Ap)	Interactive presentation	Flow Chart MCQ
V	Total Hrs: 12					
	1	Mollusca: General characters and classification of Phylum Mollusca up to Classes.	2	K1 (R) K2 (U)	Interactive presentation	MCQ
	2	Type study: <i>Pila globosa</i> . Foot and torsion in Mollusca. Economic importance- Cephalopods	4	K2 (U) K4 (An)	Interactive presentation	Short test
	3	Echinodermata: General characters and classification of Phylum Echinodermata up to Classes. Type study: <i>Asterias</i> . Water Vascular system in Echinodermata – Larval forms of Echinoderms.	6	K2 (U) K4 (An)	Interactive presentation Interactive presentation	Short test

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

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

Activities (Em/ En/SD): **Report on observation of a waste water treatment plant**
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): **(Environmental sustainability)**

Activities related to Cross Cutting Issues: **Diversity and classification, Habitats and adaptations, Ecology and Behaviour**

Assignment: General characters of Phylum Protozoa)

Economic importance- Cephalopods

Sample questions

Part A

Choose the following

1. A. Unicellular - 1. Platyhelminthes
 B. Multicellular -2. Organ system
 C. Tissue grade - 3. Protozoa
 D. Organ grade - 4. Porifera
 -5. Coelenterata

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

2. Segmented worms are known as

- a. Nematodes b. Annelids c. Planarians. d. Arthropods.

3. Crustacean respiration takes place through_____.
4. The first multicellular animals are
 - a) Coelenterata
 - b) Porifera
 - c) Platyhelminthes
 - d) Annelida
5. The larval form of spongilla is
 - a) Rhagon
 - b) Planula
 - c) Coeloblastula
 - d) Parenchymula

Part B

1. Differentiate between invertebrates and vertebrates
2. Describe the structure of amoeba.
3. Comment on Spongilla
4. Classify and comment on Sea anemone. Discuss the colligative properties of water.
5. Classify phylum Arthropoda give two examples of each.
6. Discuss the competitive and uncompetitive inhibition

Part C

1. Write an essay on different types of classification and its significance
2. Describe the structure of polyp in Obelia. Compare it with blastostyle.
3. Explain the life history, pathology, and control measures of *Ascaris lumbricoids*.
4. Describe the external features of Prawn.
5. Describe the external features of Pila

Course-in charge
Department

Dr. A. Punitha

Dr. Venci Candida

Dr. Josephine Priyadharshin

Head of the

Dr. A. Shyla Suganthi

Class : I B. Sc. Botany
Title of the Course : Allied Zoology - I
Semester : I
Course Code : ZU231EC1

Elective Course I

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

COs	On completion of this course, students will;	Cognitive level
CO1	relate the characteristic features in invertebrates and chordates.	K1
CO2	classify invertebrates up to class level and chordates up to order level.	K2
CO3	identify the structural and functional organization of few invertebrates and chordates.	K3
CO4	survey the adaptations and habits of animals to their habitat.	K4
CO5	assess the taxonomic position of invertebrate and chordate animals.	K5

Teaching Modules

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 hours)					
	1	Principles of taxonomy. Criteria for classification– Symmetry and Coelom. Binomial nomenclature.	3	K1 (R)	Brainstorming, Interactive presentations	Recall key terms MCQ
	2	Classification of protozoa, up to classes with two examples.	2	K1 (R) K2 (U)	Chalk and Talk, PPT	Oral test MCQ Illustration
	3	Classification of Coelenterata, up to classes with two examples.	2	K1 (R) K2 (U)	Group Discussion, Lecture	Slip test Mind map Dictation

	4	Classification of Helminthes up to classes with two examples.	3	K1 (R) K2 (U) K3 (Ap)	Lecture using videos	Flow chart, MCQ
	5	Classification of Annelida up to classes with two examples.	2	K1 (R) K2 (U) K3(Ap)	Brainstorming, Group discussion, PPT	Mind map, MCQ, Oral test
II	Diversity of Invertebrates – II (12 hours)					
	1	Classification of Arthropoda, up to class level with examples.	4	K2 (U) K4 (An)	Brainstorming, Group Discussion	Flow chart, model making, Animal collection
	2	Classification of Mollusca up to class level with examples.	4	K1 (R) K3(Ap)	Lecture using PPT Interactive class	Oral test Assignment
	3	Classification of Echinodermata up to class level with examples.	4	K1 (R) K2 (U)	Chalk and Talk PPT	Mind map True or False
III	Diversity of Chordates – I (12hours)					
	1	Classification of Prochordata, up to orders giving two examples.	4	K1 (R) K2 (U)	Lecture using PPT, Interactive class	Oral test Assignment
	2	Classification of Pisces up to orders giving two examples.	4	K1 (R) K2 (U)	Group Discussion, Lecture	Slip test Assignment
	3	Classification of Amphibia up to orders giving two examples.	4	K1 (R) K2 (U)	Brainstorming Lecture	Recall examples, short answers
IV	Diversity of Chordates – II (12 hours)					
	1	Classification of Reptilia up to orders giving two examples.	4	K1 (R) K2 (U) K3 (Ap)	Brainstorming, Interactive class	Slip test, Animal Identification using Placards
	2	Classification of Aves up to orders giving two examples.	4	K1 (R) K2 (U) K3 (Ap)	Flipped classroom	MCQ, Class test Mind map
	3	Classification of Mammalia up to orders giving two examples.	4	K1 (R) K2 (U) K3 (Ap)	PPT Interactive class	Flow chart Oral test
V	Animal organization (12 hours)					

	1	Structure and organization of Earthworm	4	K1 (R) K3 (Ap)	Chalk and Talk, Demonstration Field visit	Practical Class test Illustration
	2	Structure and organization of Rabbit	4	K3 (Ap)	PPT, Chalk and Talk,	Practical Illustration
	3	Structure and organization of Prawn	4	K2 (U) K3 (Ap)	Chalk and Talk, Demonstration,	Practical, Illustration

Course Focussing on Skill Development

Activities: Seminar, Assignment, Group discussion, Practical, Animal collection

Course Focussing on Cross Cutting Issues: Environmental Sustainability

Activities related to Cross Cutting Issues: Assignment, Model making, Animal collection

Assignment: Identification of few invertebrates involves soil fertility

Sample questions

Part A

- The animals which lack notochord or back bone are called _____
- Assertion (A):** Water vascular system is present only in echinoderms.
Reason (R): The canals of this system are filled with sea water only.
 - Assertion is true but reason is false.
 - Assertion is false but reason is true.
 - Assertion and reason are true.
 - Both Assertion and reason are false
- Haemoglobin is absent in the RBCs of chordates. **True/False**
- The wings in birds are operated by _____ muscles.
- Kidney is the -----organ.

Part B

- Give the general characters of Invertebrates.
- Give the general characters of phylum Aschelminths
- How will you classify amphibians? Add suitable examples.
- Classify Aves up to order level with any two examples.
- Give the external characters of prawn.

Part C

- Give an account on the characteristic feature of phylum Protozoa.
- Explain the external characteristic feature of *Penaeus* with a suitable diagram.
- Classify prochordates up to orders with any two suitable examples
- Classify mammals up to orders with examples
- Explain the structure and organization of rabbit

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. A. Jeni Chandar Padua

Dr. A. Punitha

Class : I B. Sc. NME I
Title of the Course : Ornamental Fish farming and management
Semester : I
Course Code : ZU231NM1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
2	2	30	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: 90 (Incl. Seminar & Test)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1	Introduction to ornamental fish keeping. Scope and importance of ornamental fish culture.	2	K1 (R), K2 (U)	Peer group teaching	Recall key terms
	2	Domestic and global scenario of ornamental fish trade and export potential.	2	K1 (R), K2 (U)	Brainstorming, Interactive class	MCQ
	3	Commercially important ornamental fishes - Indigenous and exotic varieties.	2	K2 (U) K3 (Ap)	Flipped classroom	Recall key terms
II	1	Biology of egg layers and live bearers. Food	2	K2 (U) K3 (Ap)	Co-operative learning	

		and feeding in ornamental fishes.				
	2	Formulated feed and Live feed; Live feed culture.	2	K2 (U) K3 (Ap)	Brainstorming, Interactive class	Oral test
	3	Breeding, hatchery and nursery management of egg layers (e.g., Goldfish) and live bearers (e.g., Guppy).	2	K2 (U) K3 (Ap)	Blended learning	Slip test
III	1	Aquarium design and construction	1	K2 (U)	Flipped learning	Chart preparation
	2	Accessories - aerators, filters, and lighting. Aquarium plants and their propagation.	2	K3 (Ap)	Co-operative learning	Short test
	3	Maintenance of aquarium and water quality management	1	K2 (U)	Brainstorming, Interactive class	MCQ
	4	Ornamental fish diseases, their prevention, control and treatment methods.	2	K3 (Ap)	Blended learning	Assignment
IV	1	Conditioning, packing, transport and quarantine methods.	3	K2 (U)	Flipped learning	Short test
	2	Economics, trade regulations, domestic and export marketing strategies.	3	K3 (Ap)	Interactive class	MCQ
Practical						
V	1	Identification of locally available ornamental fishes - Egg layers and live bearers.	3	K3 (Ap)	Brainstorming,	Assignment
	2	Identification of locally available live feed organisms	3	K3 (Ap)	Interactive class	Assignment

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

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): Exotic varieties and their impacts on environment.

Activities related to Cross Cutting Issues: Commercially important ornamental fishes - Indigenous and exotic varieties

Assignment: Identification of locally available ornamental fishes

Seminar Topic: (if applicable) Nil

Sample Questions

Part A

1. Goldfish is the example for egg layer. **True/False**

Part B

3. Explain the aquarium plants and their propagation.
4. Comment on the diseases of ornamental fishes.

Part C

5. Discuss the Indigenous and exotic varieties of ornamental fishes.
6. How will you construct aquarium tank at your home?

Head of the Department

Dr, A. Shyla Suganthi

Course Instructor

Dr. S. Prakash Shoba

Dr. C. Josephine Priyadarshini

Class : I B. Sc. Foundation Course
Title of the Course : Introduction to Zoology
Semester : I
Course Code : ZU231FC1

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

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

Teaching Modules

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

Units	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
	1.	Systematic and binomial system of nomenclature: meaning of the terms taxonomy, Systematic, classification and nomenclature, Need of classification.	2	K2(U)	Lecture using Chalk and talk, review.	short test on writing biological names
	2.	Systematics: Kingdom Protista- Salient features, examples; Kingdom Animalia	2	K1(R)	Introductory session, Tabulation	Assignment on classification of Animal kingdom
	3.	Introduction to different Phyla: Protozoa, Porifera, Coelenterata,	2	K3(Ap)	Probing, ppt	Oral test

		Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata and Chordata.				
II	1	Physiology and Biochemistry: Introduction to organ systems- Digestive, Respiratory system.	2	K1(R)	Blended learning, Lecture	MCQ
	2	Endocrine and Circulatory system, Urinogenital system,	2	K3(Ap)	lecture using YouTube videos	Drawing test of urinogenital system
	3	Nervous system, Reproductive system.	2	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)	Group Discussion, Interactive PPT	Objective test, word splash
	2	Mitochondria, lysosome, nucleus, nucleolus.	2	K1(R)	Flipped Classroom	MCQ, mind map
	3	Modern concept of gene: DNA as genetic material, structure of DNA as given by Watson and Cricks model and RNA.	2	K3(Ap)	Peer tutoring, lecture using videos	Model making on structure of DNA
IV	1	Environmental Biology: Principal layers of atmosphere- Exosphere, Thermosphere.	2	K3(Ap)	Chalk and board, lecture, discussion	Oral test
	2	Mesosphere, Stratosphere, Troposphere. Lithosphere Hydrosphere,	2	K3(Ap)	Brainstorming, Discussion	open book test
	3	Environmental issues- Global warming, green house effects, acid rain.	2	K3(Ap)	Group Discussion	Assignment on Acid rain
V	1	Applied Zoology: Aquaculture – Pisciculture.	2	K3(Ap)	Group Discussion, Demonstration of aquarium	MCQ, Short essays,
	2	Prawn culture and Pearl culture.	2	K3(Ap)	Blended classroom	Quizziz
	3	Sericulture, Apiculture.	2	K3(Ap)	Peer tutoring, PPT	Mind map, Subjective test

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

Activities (Em/ En/SD): Model making (DNA Model)

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 : Acid Rain

Sample questions (minimum one question from each unit)

Part A

1. What do you mean by taxonomy and nomenclature.
2. Define Endocrine system.
3. List the organelles present in Eukaryotic cell.
4. Write short notes on acid rain.
5. Differentiate Aquaculture and Pisciculture.

Part B

1. Define Protista. Add a note on the salient features with examples.
2. Distinguish open and closed circulatory system with neat, labelled sketch.
3. Name the two systems involved in Urinogenital system. Explain.
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 different phyla of kingdom Animalia.
2. Explain the structure of human lungs.
3. Choose any two organelles and add a note on its structure and function.
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. X. Venci Candida

Dr. S. Prakash Shoba

Class : I B. Sc.
Title of the Course : Cell Biology
Semester : III
Course Code : ZC2031

Major core III

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

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

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the types of microscopes, cell, cell organelles and cell division.	PSO - 1	R
CO - 2	outline the role of cell organelles, nucleic acid and their interactions.	PSO - 4	U
CO - 3	apply knowledge in cellular research using cytological and modern techniques.	PSO - 3	Ap
CO - 4	differentiate cell types, chromosomes, cell stages, normal and abnormal cells.	PSO - 2	An

Teaching Modules

Total Hours: 60 (Including, Assignments. Seminar & Test)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Cell, Microscope and Micro technique (12 Hrs.)					
	1.	Cell theory. Prokaryotic and eukaryotic cells.	3	K1 (R)	Lecture using Chalk and talk, Introductory session	Evaluation through short test, MCQ
	2.	Cytological techniques - Fixation, sectioning and staining.	3	K4 (Ap)	Lecture using videos, Mind mapping	Simple definitions, Recall steps
	3.	Microscopy – Resolving power and uses of Compound microscope	3	K3(An)	Lecture using Chalk and talk, Experiential learning	Concept with examples

	4.	Phase contrast and electron microscope. Micrometry.	3	K4 (Ap)	PPT, Demonstration	Concept explanations, Differentiate between various ideas
II	Plasma membrane & Cell organelles (12 Hrs.)					
	1	Ultrastructure and functions of Plasma membrane,	3	K2 (U)	Lecture using Chalk and talk, PPT	Evaluation through short test
	2	Ultrastructure and functions of mitochondria, Ribosomes	3	K1 (R)	Lecture using videos, PPT	MCQ, Class Test
	3	Ultrastructure and functions of Endoplasmic reticulum, Golgi complex	3	K2 (U)	Lecture using Chalk and talk	Evaluation essay
	4	Ultrastructure and functions of lysosomes, centrosomes	3	K1 (R)	PPT, Peer tutoring	Group Discussion
III	Nucleus and nucleic acids (12 Hrs.)					
	1	Ultrastructure and functions of nucleus and nucleolus	3	K2 (U)	Lecture using Videos and chalk and talk	Evaluation essay
	2	Chromosomes - types, structure, giant chromosomes	3	K3(An)	Lecture using chalk and talk, Experiential learning	Group Discussion
	3	Nucleic acids – structure, types and functions	3	K3 (An)	Demonstration, Group Discussion	MCQ
	4	Nucleosomes, DNA replication in prokaryotes	3	K1 (R)	PPT, Mind mapping	Recall steps
IV	Gene expression and regulation (12 Hrs.)					
	1	Characteristics of Genetic code	3	K2 (U)	Lecture using chalk and talk	Group Discussion
	2	Fine structure of gene.	2	K1 (R)	Brainstorming, Lecture using chalk and talk	Evaluation essay
	3	Protein synthesis in prokaryotes -	4	K2 (U)	PPT, Mind mapping	Recall steps

		transcription and translation				
	4	Regulation of gene expression - <i>Lac</i> operon	3	K3 (An)	PPT, Lecture using Videos	Map knowledge
V	Cell division and significance (12 Hrs.)					
	1	Cell cycle, Mitosis	3	K3 (An)	Lecture using chalk and Talk, Flow chart	MCQ
	2	Meiosis, Regulation of cell cycle dependent	3	K2 (U)	Flow chart, Lecture using video	Recall steps
	3	Cancer - properties, types, diagnosis, and treatment. Proto-oncogenes	3	K4 (Ap)	Brainstorming, PPT	Check knowledge in specific or offbeat situations
	4	Oncogenes, tumour suppressor genes. Ageing and apoptosis	3	K3 (An)	Lecture using chalk and talk, Mind mapping	Justify with pros and cons

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

Activities (Em/ En/SD): Model making – Cell organelles.

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

Activities related to Cross Cutting Issues: Ethics to be followed by a professional lab Technician, Research on Emerging Technologies

Assignment: Meiosis

Sample questions (minimum one question from each unit)

Part A

1. Cell Theory was proposed by _____.
2. Ribosomes are assembly shops for protein synthesis. **State True/False**
3. **Assertion:** The nucleus is present in all eukaryotic cells.

Reason: It functions as the heart of the cell.

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

4. The termination codon is also called as _____.
5. During interphase the nucleus is small and not distinct. **State True/False**

Part B

1. Define cell theory.
2. Enumerate the functions of Plasma membrane.
3. How will you differentiate the different types of chromosomes.
4. Discuss the characteristics of genetic code.
5. Explain apoptosis with suitable diagram.

Part C

1. Describe the different steps involved in Cytological techniques.
2. Mitochondria is the power house of the cell. – Justify.
3. Explain how DNA replication takes place in prokaryotes.
4. Discuss the process of gene expression using Lac operon.
5. Elaborate the events taking place during meiosis.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. P.T. Arokya Glory

Dr. A. Shyla Suganthi

Semester : III Major Elective I (a)
Name of the Course : Biochemistry, Biophysics and Biostatistics
Course code : ZC2032

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

Objectives

1. To enrich the knowledge of students on the structure, classification and metabolism of biomolecules and to learn the principle and functions of specified bio-instruments.
2. To enlighten students on the nature of life and basic methods in statistics to be used in future biological research.

Course outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the structure of atoms, biomolecules, bio instruments, and biological data.	PSO - 1	R
CO - 2	describe the interactions of biomolecules; importance of buffer systems, enzymes, light, bioinstrumentation and collection of biological data.	PSO - 2	U
CO - 3	apply basic scientific methods and analysis in the fields of biochemistry, biophysics, and biostatistics.	PSO - 3	Ap
CO - 4	classify biological macromolecules, the techniques used in biological study, and analyse biological data using appropriate statistical methods.	PSO - 3	An
CO - 5	evaluate the significance of biomolecules, principle of bio instruments, statistical concepts.	PSO - 4	E

Teaching Modules

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Bonds, Buffers, and Protein (12hours)					
	1	Atoms - Isotopes- Chemical bonds	2	K1	Brainstorming Lecture	Recall key terms Short answers
	2	Hydrogen ion concentration – pH and its measurement	2	K1, K2	Chalk and Talk, Lecture	Oral test MCQ
	3	Acids and bases – Acidosis and alkalosis	2	K1, K2	Group Discussion, Lecture	Slip test Assignment
	4	Buffers - Biological buffer systems - Significance of buffers.	2	K3	Lecture using videos	MCQ

	5	Proteins –Classification, structure, and biological functions.	2	K1, K4	Brainstorming, Group Discussion, PPT	Mind map, MCQ, Oral test
	6	Enzymes - Classification and properties	2	K4	Discussion, Brain storming	Flow chart, Oral test
II	Carbohydrates and Lipids (12hours)					
	1	Carbohydrates classification, Monosaccharaides – glucose, Disaccharides - lactose	3	K1, K4	Brainstorming, Group Discussion	Flow chart/ mind map MCQ
	2	Polysaccharides - glycogen, biological functions of carbohydrates.	2	K1, K4	Lecture using PPT Interactive class	Oral test Assignment
	3	Lipids - classification, simple lipids - waxes	3	K2, K3	Chalk and Talk PPT	Mind map True or False
	4	Compound lipids – lecithin, Derived lipids - cholesterol, biological functions of lipids	4	K2, K4	Lecture Group Discussion	Short answers
III	Light and separation techniques (12hours)					
	1	Nature and properties- electromagnetic spectrum	2	K1, K4	Lecture using PPT, Interactive class	Oral test Assignment
	2	Absorption, emission, fluorescence, and phosphorescence	2	K1, K2	Group Discussion, Lecture	Slip test Assignment
	3	Colorimeter and spectrophotometer – Principle, instrumentation, and applications	3	K1	Brainstorming Lecture	Recall key terms short answers
	4	Centrifuge – principle, types, and applications	2	K1, K4	Brainstorming, Group Discussion	Oral test Assignment
	5	Chromatography- principle and applications of paper and column Chromatography	3	K3	Lecture using videos	MCQ
IV	Introduction to Biostatistics (12 hours)					
	1	Population, data, sample, and variables	3	K1, K2	Brainstorming, Interactive class	Slip test
	2	Collection of data- sampling methods	3	K2, K3	Flipped classroom	Practical
	3	Processing of data- classification and tabulation	3	K3, K4	Problem-based learning	Solve Problem

	4	Presentation of data-diagrams and graphs	3	K4, K5	Problem-based learning	Practical
V	Statistical Methods (12 hours)					
	1	Measures of central tendency - Mean, Median, Mode	3	K1, K3	Chalk and Talk, Problem solving, Demonstration	Differentiate, Recall steps, Solve problems
	2	Dispersion - standard deviation and standard error	3	K3	Chalk and Talk, Demonstration, Problem solving	Recall steps, Solve problems
	3	Probability - apriori and aposteriori	3	K3, K4	Chalk and Talk, Demonstration,	Practical, Solve problem
	4	Test of significance: Chi square test and Student's 't' - test	3	K3, K4	Problem solving	Practical, Solve problem

Course Focusing on: Skill Development

Activities: Seminar, Assignment, Group discussion, Solve problems

Course Focusing on Cross Cutting Issues: Professional ethics

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

Assignment:

- Acidosis and alkalosis
- Biological functions of carbohydrates
- Centrifuge – principle, types and applications
- Nature and properties of electromagnetic spectrum
- Collect data – using different sampling methods (Methods of sampling from a population)

Sample questions

Part A

1. Acidosis refers to an excess of blood in the _____.
a) Blood b) Urine c) Lymph d) Gastric juice
2. Isotopes occupy the same place in the periodic table. **True or False**
3. Polysaccharides are polymeric anhydrides of _____.
4. **Assertion (A):** Glycogen is an important energy reservoir.
Reason (R): When energy is required glycogen is broken down to glucose.
a) A is wrong and R is correct
b) Both A and R are wrong
c) A is correct and R is wrong
d) Both A and R are correct
5. Rf value is related to which of the following equipment?

Part B

1. Describe the types of primary bonds
2. Monosaccharides act as best reducing agents” – Justify.
3. List the salient features of Fluorescence

4. Classify data
5. Differentiate histogram from bar diagram

Part C

1. Define pH and state its importance
2. Discuss the biological functions of carbohydrates
3. Define centrifugation. Explain the principle and application of Centrifuge.
4. The weight of fish taken in a pond is given below. Calculate the mean and median.

S.No.	1	2	3	4	5	6	7
Weight of fish	18	19	22	20	16	20	26

5. Represent the data in a pie and bar diagram using the data of the following table:

Blood groups	Number of students
A	345
B	667
C	545
AB	201

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. S. Mary Mettilda Bai & Dr. C. Anitha

Class : **II B.Sc. Botany** **Allied Zoology**
Title of the Course : **General Zoology**
Semester : **III**
Course Code : **ZA2031**

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

Objectives

- To impart knowledge on Animal diversity, Cell Biology, Genetics, Developmental Biology, Evolution and Physiology.
- To instill interdisciplinary skills for availing employment opportunities.

Course outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	recall the classification of animals, cells, genetic disorders in man, development of frog, structure and function of vital organs.	PSO – 1	R
CO – 2	outline the diversity of animal forms and their cellular organization, genetic makeup, evolution and physiology.	PSO – 1	U
CO – 3	correlate the physiological processes of animals and relationship of organs system, inheritance of characters.	PSO - 3	Ap
CO – 4	recognize the major functions of organ systems in the human body and the role played by animals and evolution of animal life.	PSO – 2	An
CO – 5	evaluate the characters, functions and genetics of diverse animals.	PSO – 4	E

Teaching Modules

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
	Invertebrate Zoology: 12 hrs					
	1.	Invertebrate Zoology, General characters of Invertebrates - classification up to phylum with two examples for each	2	K2(U)	Lecture using Chalk and talk	Evaluation through short test, Quiz, MCQ
	2.	<i>Paramecium</i> – external features, conjugation	2	K1(R)	Group Discussion,	Mind Map, Recall, MCQ, True/False,
	3.	<i>Obelia</i> – external features, polymorphism.	2	K3(Ap)	Peer tutoring, Review	Short essays, Fill ups, Discussion

	4.	<i>Ascaris</i> - external features, parasitic adaptations.	2	K4(An)	Lecture using videos,	Concept explanations, Essay writing
	5.	<i>Penaeus</i> – external features.	2	K5(E)	Lecture with PPT	Longer essay/ Evaluation essay
	6.	Starfish – external features, water vascular system	2	K6(C)	Demonstration ,	Discussion, Debating or Presentations
II	Chordate Zoology: 12 hrs					
	1.	Chordate Zoology: General characters of chordates -	2	K2(U)	Lecture, audiovisual aids	Class participation, short quiz
	2.	outline classification up to classes with one example.	2	K1(R)	Interactive discussion, group activities	Group presentation, written assignment
	3.	Migration of fishes. Identification of poisonous and non-poisonous snakes,	2	K3(Ap)	Laboratory demonstration, microscopy	Practical assessment, observation records
	4.	first-aid for snake bite. Flight adaptations in birds.	2	K4(An)	Visual aids, case studies	Group discussion, case study analysis
	5.	Rabbit – external characters.	2	K5(E)	Role play, concept mapping	Role plays performance, concept map creation
	6.	Dentition in human.	2	K6(C)	Demonstration using models	Discussion, Debating or Presentations
III	Cytogenetics:12 hrs					
	1.	Cytogenetics: Difference between plant and animal cells.	2	K2(U)	Lecture using Chalk and talk,	Evaluation through short test, MCQ, True/False,
	2.	Chromosomes - structure - types and function.	2	K1(R)	Group Discussion	MCQ, Recall concepts, short essays, short summary or overview
	3.	Human - Simple Mendelian traits,	2	K3(Ap)	Demonstration , PPT	Explain, discussions, short tests.
	4.	Genetics of blood groups,	2	K4(An)	Mind mapping, Review	Differentiate between various concepts, Map knowledge

	5.	sex linked inheritance - colour blindness and hemophilia, Down's syndrome.	2	K5(E)	Peer tutoring, Discussion	Longer essay/ Evaluation essay, Critique or justify with pros and cons of the disease
	6.	Non-disjunction - Klinefelter's and Turner's syndrome	2	K6(C)	Lecture using videos, Discussion	Check knowledge in specific area, Discussion, Debating or Presentations
IV	Developmental Zoology and Evolution: 12 hrs					
	1.	Developmental Zoology and Evolution:	2	K2(U)	Lecture using PPT	Evaluation through short test, MCQ, True/False, Short essays
	2.	Frog - structure of sperm and ovum - fertilization.	2	K1(R)	Group Discussion	MCQ, Recall Concepts,
	3.	Early development in frog - cleavage, blastulation and gastrulation.	2	K3 (Ap)	Lecture using Videos	Evaluation through short test, MCQ, True/False
	4.	Biochemical origin of life	2	K4 (An)	Mind mapping, PPT	Differentiate between various ideas, Map knowledge
	5.	Urey Miller Experiment,	2	K5(E)	Peer tutoring, Demonstration	Longer essay/ Evaluation essay
	6.	Natural selection theory and Modern synthetic theory of evolution.	2		Lecture using videos,	Evaluation through short test, MCQ,
V	Human Physiology: 12 hrs					
	1.	Human Physiology: Introduction	2	K2(U)	Lecture using Chalk and talk	True/False, Short essays, short summary or overview
	2.	Digestion – structure and functions of the digestive system.	2	K1(R)	Group Discussion	MCQ, Recall Concept
	3.	Respiration - structure and functions of lungs.	3	K3(Ap)	Mind mapping, Peer tutoring	Explain, discussions, short tests.
	4.	Circulation - structure and function of the heart.	3	K4(An)	Lecture using videos	Short essays, short summary or overview
	5.	Excretion - structure and functions of kidney.	2	K5(E)	Demonstration using PPT	Longer essay/ Evaluation

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Course focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Indirectly addressing cross-cutting issues.

Activities related to Cross Cutting Issues:

- Prepare essays on ethical considerations in animal experimentation
- Case study on the impact of human activities on the environment and potential solutions for sustainable development
- Group discussions on the ethical issues surrounding the use of animals in medical research and the development of alternative methods

Assignment: Simple Mendelian Traits, Downs Syndrome, Klinefelter's syndrome

Seminar Topic: Not applicable

Sample questions

Part A

1. Give an example of a phylum in the classification of invertebrates
2. The class of chordates that exhibits flight adaptations is _____
3. The type of inheritance causing color blindness in humans is called _____
4. What is the first stage involved in the early development of a frog after fertilization?
5. Cleavage

Part B

1. Explain the migratory patterns of fishes.
2. Elaborate on the external features of Paramecium and its process of conjugation.
3. Differentiate between plant cells and animal cells.
4. Provide an overview of the natural selection theory
5. Elucidate the structure and functions of the digestive system

Part C

1. Describe the flight adaptations in birds and their significance.
2. Discuss the external features and the significance of the water vascular system in starfish.
3. Discuss the inheritance patterns of simple Mendelian traits.
4. Describe the structure of sperm and ovum in frogs
5. Give an outline on the structure and functions of lungs in the respiratory system

Dr. A. Shyla Suganthi

Head of the Department

Dr. Jeni Chandar Padua

Course Instructor

Class : **II B.Sc. Zoology** **Add on Course**
Title of the Course : **Professional English for Life Sciences**
Semester : **III**
Course Code : **ALS203**

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

Objectives

1. To enhance the creative and academic writing skills and workplace communication.
2. To develop competence and competitiveness and thereby improve the employability skills and life-long learning.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define concepts related to communicative and digital competence.	1	R
CO - 2	illustrate academic writing and creativity in digital media.	2	U
CO - 3	apply communicative skills with digital competence in the workplace.	3	Ap
CO - 4	analyse a variety of formats, including essays, research papers, reflective writing, and critical reviews of life sciences.	4	An
CO - 5	analyze lectures, scripts, blogs, e-content and short films related to biology.	4	An

Teaching Modules

Total Hours: 30 (Incl. Test)

Unit	Section	Topics	Hours	Cognitive levels	Pedagogy	Assessment
6 hrs						
I	1	Small Group Work	2	K1 (R)	Lecture Video on instructions Group work	Questions to test listening skill Asked to identify the difference between facts and opinions Vocabulary
	2	Comprehension- Difference between facts & opinions	2	K2 (U)	Model passages	
	3	Developing a short poem with pictures Vocabulary	2	K3 (Ap)	Students made to write short poem	
6 hrs.						
2	1	Listening to Process Description -Cartographic Process Speaking-Role play-sample2	2	K2 (U)	Role play Video	Speaking skill Reading

	2	Reading Passages on Equipment & gadgets	2	K3 (Ap)	PPT on equipments and gadgets	Write sentences and paragraphs Internal Assessment
	3	Paragraph: Sentence Definition & Extended Definition, Freewriting Vocabulary	2	K3 (Ap)	Video Lecture	
	6 hrs.					
3	1	Listening to interviews of inventors in fields Small Group Discussion – Specific	3	K4 (An)	Video Discuss in small groups	Test listening and group discussion Test Reading and writing skill
	2	Long rereading text–The Art of Loving Essay Writing–Solidarity Vocabulary	3	K4 (An)	Read passages and write essays	
	6 hrs.					
4	1	Short Talks –Poverty and the need to alleviate it	3	Ka (R)	Listen and comprehend lectures	Test listening skill Interpret visuals
	2	Reading comprehension - passage2 Interpreting Visual Inputs Vocabulary	3	K5 (E)	Comprehension passages and visuals	
	6 hrs.					
5	1	Listening for Information Making Presentation task 3&4	2	K4 (An)	Video Presentation task	Presentation of textual matter Discussion on importance of professional ethics Give a Internal Assessment
	2	Motivational Articles on Professional Competence, Professional Ethics & Life Skill	2	K4 (An)	PPT and video	
	3	Problem & Solution Essays, Summary Writing Vocabulary	2	K3 (AP)	Problem and solution	

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. F. Brisca Renuga & Dr. S. Prakash Shoba

Class : III B. Sc. Zoology
 Semester : V
 Title of the Course : Physiology
 Course Code : ZC2051

Major Core V

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 significance of 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. Enable to perform, analyse and report on experiments and observations in physiology;

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 exhibited by 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 Modules

Total Contact hours: 60 (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, K3	Brainstorming Lecture	Short answers
	2	Balanced diet, Basal metabolic rate (BMR) and Body mass index (BMI).	3	K3, K4	Brainstorming, Group Discussion	Quiz, Oral test, MCQ
	3	Malnutrition (Marasmus,	3	K1, K4	Group Discussion, Lecture	Slip test Assignment

		Kwashiorkor, Obesity, epidemic dropsy).				
	4	Mechanical & chemical digestion and absorption - Digestive system of man.	3	K3, K5	Lecture using videos	MCQ
	5	Digestion of carbohydrate, protein and fat. Absorption and assimilation of digested food materials.	4	K3, K4	Brainstorming, Group Discussion, PPT	Mind map, MCQ, Oral test
	6	Physiology of ruminating stomach.	2	K4	Discussion, Brain storming	Flow chart, Oral test
II	Respiration, Osmo- & thermoregulation (18 Hrs.)					
	1	Respiration - Respiratory organs, Respiratory pigments.	3	K1, K2	Brainstorming, Group Discussion	Flow chart/ mind map MCQ
	2	Respiratory system of man - transport of O ₂ and CO ₂ , oxygen dissociation curve, Bohr's effect.	5	K3, K4	Lecture using PPT Interactive class	Oral test Assignment
	3	Chloride shift, Anaerobiosis, Respiratory Quotient.	3	K2	Chalk and Talk PPT	Mind map True or False
	4	Osmoregulation: Osmo conformers, Osmo regulators, Osmoregulation in crustaceans, fishes and mammals.	4	K2, K3	Lecture Group Discussion	Short answers
	5	Thermoregulation - poikilotherms and homeotherms, thermoregulatory Mechanisms.	3	K4, K5	Peer group teaching Group discussion Tutorial	MCQ
III	Circulation and Excretion (18 Hrs.)					
	1	Circulation - composition blood and lymph, myogenic and neurogenic heart, structure of human heart.	4	K1, K4	Lecture using PPT, Interactive class	Oral test Assignment
	2	Heart beat - origin and conduction, pace maker, cardiac cycle and ECG, blood pressure.	4	K1, K2	Group Discussion, Lecture	Slip test Assignment

	3	Heart diseases: artherosclerosis, acute coronary occlusion, Myocardial infarction.	2	K1	Brainstorming Lecture	Recall key terms short answers
	4	Excretion - patterns of excretion, excretory organs in invertebrates.	3	K1, K4	Brainstorming, Group Discussion	Oral test Assignment
	5	Structure of kidney in man, nephron, counter current mechanism of urine formation.	3	K3	Lecture using videos	MCQ
	6	Composition of urine. Nephritis and Dialysis.	2	K1, K4	Brainstorming, Group Discussion	Oral test Assignment
IV	Muscle and Neurophysiology (18 Hrs.)					
	1	Muscle physiology - types of muscles, ultrastructure, and properties of skeletal muscle.	4	K1, K2	Brainstorming, Interactive class	Slip test
	2	Mechanism of muscle contraction and Rigor mortis.	4	K2, K3	Flipped classroom	Oral test Assignment
	3	Structure and types of neurons, neurotransmitters.	2	K3, K4	Cooperative learning	MCQ
	4	Conduction of nerve impulse through myelinated and non-myelinated nerve and synapse.	3	K4, K5	Interactive presentations	Oral test Assignment
	5	Reflex action.	1	K3, K4	Group Discussion	Mind map True or False
	6	Receptors - types, physiology of phonoreception.	4	K4, K5	Brainstorming, Group Discussion	Short answers
V	Endocrine and Reproductive Physiology (18 Hrs.)					
	1	Endocrine physiology - hormones and ppheromones.	2	K1, K3	Group discussion Lecture	Presentation using ppt by students-seminar
	2	Hypothalamus and endocrine glands - ppituitary, thyroid, parathyroid, adrenal, islets of Langerhans.	5	K3	Lecture –ppt Recall definitions	Oral test
	3	Biological clock and biological rhythms.	2	K3, K4	Chalk and Talk, Demonstration,	Practical, Solve problem

	4	Reproductive physiology - male reproductive system. Female reproductive system, structure of graafian follicle.	4	K3, K4	Group discussion Lecture - videos	Assignment
	5	Menstrual cycles and menopause.	2	K3, K4	Debate videos	Chart preparation
	6	Hormonal regulation of menstruation, pregnancy, and lactation.	3	K4, K5	Concept analysis, Lecture	Short test

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

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Skill Development Activities (Em/ En/SD): Observation of Blood pressure and Hemoglobin content.**

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

Activities related to Cross Cutting Issues: Interdisciplinary Collaboration, Clinical Applications

Assignment: ECG and Blood pressure

Seminar Topic: (if applicable) Nil

Sample questions (minimum one question from each unit)

Part A

- Which of the following is the primary function of the respiratory system?
 - Transportation of oxygen
 - Digestion of food
 - Pumping blood
 - Temperature regulation
- What is the hormone responsible for regulating blood sugar levels in the body?
 - Insulin
 - Testosterone
 - Adrenaline
 - Estrogen
- Red blood cells are primarily responsible for carrying which gas in the bloodstream?
 - Oxygen
 - Carbon dioxide
 - Nitrogen
 - Hydrogen
- Which organ filters and detoxifies blood in the human body?
 - Liver
 - Heart
 - Lungs
 - Stomach

Part B

- Define homeostasis.
- Explain the process of muscle contraction.
- What is the function of the digestive system?
- Describe the importance of the circulatory system.
- What is the role of the endocrine system in maintaining body functions?

Part C

- Discuss the mechanisms of temperature regulation in the human body.
- Explain the process of cellular respiration and its significance.
- Compare and contrast the functions of arteries and veins in the circulatory system.
- Describe the role of the kidneys in maintaining fluid and electrolyte balance.
- Discuss the physiological response to stress and its impact on the body.

Head of the Department
Dr. A. Shyla Suganthi

Course Instructor
Dr. S. Prakash Shob & Dr. S. Mary Mettilda Bai

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

No. of Hours/ Week	No. of Credits	Total Hours	Marks
15	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 Modules

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Introduction to ecology: 15 hrs					
	1	Scope- Branches of ecology. Autecology and synecology.	2	K2 (R)	Interactive presentations You tube video	Short test, MCQ, True/False
	2	Environment –atmosphere, lithosphere, hydrosphere and biosphere.	2	K3 (U)	Group discussion Jig saw	Mind map Recall steps
	3	Biological effects of temperature and light.	3	K3 (A)	Peer group teaching Group discussion Tutorial worksheet	Short test

	4	Concept of limiting factors - Liebig's law of minimum, Shelford's law of tolerance.	1	K1 (U)	Peer group teaching	Recall Simple definitions
	5	Inter specific relationship - mutualism, commensalism, antagonism - antibiosis, parasitism, predation, and competition.	3	K3 (Ap)	Exhibition Co-operative learning	MCQ
	6	Habitat ecology- adaptations of deep sea and desert living animals.	4	K4 (An)	Interactive presentations Jigsaw	Assignment Short test
II	Ecosystem and Population ecology: 15 hrs					
	1	Ecosystem –Structure, abiotic and biotic factors. Functions - Detritus and grazing food chains, food web	2	K1 (U)	Peer group teaching Group Discussion	Mind map MCQ
	2	Trophic levels, energy flow - Linear and Y-shaped, ecological pyramids.	2	K4 (An)	Interactive presentations	Short test
	3	Biogeochemical cycle – types, nitrogen, and phosphorous cycle.	3	K6 (C)	Role plays and Exhibition	MCQ Short test
	4	Population ecology - density, natality, mortality, age, distribution.	2	K2 (U)	Co-operative learning Interactive presentations	Short test Seminar
	5	Population growth, population equilibrium, population fluctuations	2	K2 (U)	Q & A method	Short test Seminar
	6	Biotic potential, population dispersal and dispersion,	2	K2 (U)	Peer group teaching Index card	Short test
	7	Regulation of population - density independent and density dependent factors, population interaction.	2	K2 (U)	Jig saw Cooperative learning	MCQ, Short test
III	Community Ecology: 15 hrs					
	1	Concept of community, Community- structure, composition, and stratification.	2	K2 (U) K3 (Ap)	Brainstorming Lecture ppt	Short answers True or False
	2	Ecological niche, Ecotone and Edge effect, Ecotype, Ecological indicators.	2	K3 (Ap) K4 (An)	Brainstorming Lecture ppt	Short answers True or False
	3	Ecological succession - types, general process,	3	K1 (R) K2 (U)	Chalk and Talk Lecture ppt	Oral test MCQ

		Concepts of climax-theories of climax, patterns of succession.				
	4	Ecological effects of dams, hydroelectric projects.	3	K3 (Ap) K4 (An)	Group Discussion Lecture using videos	Slip test Recall key terms Assignment
	5	Animal distribution – continuous and discontinuous. Parallelism, Endemism. Zoogeographical regions of world.	3	K3 (Ap) K4 (An)	Group Discussion Lecture using videos	Slip test Recall key terms Assignment
	6	Remote sensing and its applications in agriculture, fisheries, forest management and food management.	2	K2 (U)	Lecture using videos	Short answers
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 – toxicodynamics – toxic responses - ADME.	4	K1 (R) K2 (U) K3 (Ap) K4 (An)	Brainstorming on Toxicology Chalk and talk	Concept analysis Recall key terms Differentiate concepts
	2	Toxic effects of heavy metals, pesticides, carcinogens, food additives, cosmetics, micro plastics and radiations. Factors affecting toxicity.	4	K2 (U) K3 (Ap)	Group discussion Lecture	Presentation using ppt by students-seminar
	3	Dose-effect and dose-response relationship - acute toxicity, chronic toxicity reversible and irreversible effects.	3	K2 (U) K3 (Ap)	Lecture –ppt Recall definitions	Oral test
	4	Toxicity bioassay – <i>in vivo</i> experiments – determination of LC ₅₀ and LD ₅₀ , <i>Ex vivo</i> experiments – hematological and biochemical parameters. Application of toxicology.	4	K2 (U) K2 (U) K3 (Ap)	Lecture –ppt Experiential learning	Slip test
V	Ecotoxicology: 15 hrs					
	1	Types – measurement of ecotoxicological effects. Pollution - pollutants,	4	K1 (R) K3 (Ap) K4 (An)	Group discussion	Assignment

		xenobiotics, greenhouse effect, ozone depletion, acid rain, photochemical smog			Lecture - videos	
	2	Bhopal episode, Chernobyl disaster BOD, Eutrophication, Red tide, Minamata disease	3	K2 (U) K3 (Ap) K4 (An)	Debate Lecture-videos	Chart preparation
	3	Bioaccumulation, biomagnifications, biotransformation, biomonitoring.	4	K2 (U)	Concept analysis Lecture	Short test
	4	Waste water treatment and solid waste management. Environmental Auditing and Environmental Impact Assessment (EIA).	4	K2 (U) K3 (Ap) K4 (An)	Observe waste water treatment plant Discussion	Model preparation

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

Course focusing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em/ En/SD): **Report on observation of a waste water treatment plant**

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

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

Assignment: **(Greenhouse effect- Data collection from previous reports)**

Seminar Topic: **(Toxic effects of food additives, cosmetics, micro plastics)**

Sample Questions

Part A

- Lithosphere is the _____.
 - The rigid outer part of the earth, consisting of the crust and upper mantle
 - Outer part of the earth's surface including the ocean.
 - The earth's surface including the flora and fauna.
 - The part of the atmosphere above the hydrosphere.
- Fishes living in cold waters are provided with a greater number of vertebrae than those living in warmer regions. This phenomenon is called _____.
 - Allen's rule
 - Jordan's rule
 - Rensch's rule
 - Menkin's rule
- The average number of new individuals produced by a population is _____.
 - Mortality
 - Natality
 - Death rate
 - Growth rate
- Assertion(A):** The pyramid of energy in any ecosystem is upright.
Reason(B): At each trophic level 90% of energy is lost.
 - Statement 'A' and Statement 'B' are correct.
 - Statement 'A' and 'B' are wrong.
 - Statement 'A' is correct and Statement 'B' is wrong.
 - Statement 'A' is wrong and Statement 'B' is correct.

4. Match the following and choose the correct answer

- | | |
|----------------|---|
| 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

Part B

- 11.a. Explain Liebig's law of minimum and Shelford's law of tolerance.
12. a. Explain population growth and regulation.
13. a. Define:
i. Ecological niche ii. Ecotone iii. Edge effect iv. Ecotype
14. Distinguish between:
i. LC₅₀ and LD₅₀ ii. *invivo* and *exvivo* toxic experiments
15. Summarize the effect of xenobiotics on living organisms.

Part C

16. Discuss the biological effects of light.
17. Explain the types of food chain in an ecosystem. Differentiate a food chain from a food web.
18. Analyse the ecological effects of dams and hydroelectric projects.
19. Assess the toxic effects of cosmetics, food additives and micro plastics.
20. Explain the effect of pollutants on the environment with reference to greenhouse effect and ozone depletion

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