

**Holy Cross College (Autonomous), Nagercoil-629004**

**Kanyakumari District, Tamil Nadu.**

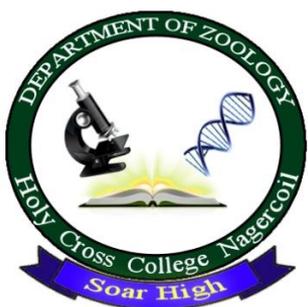
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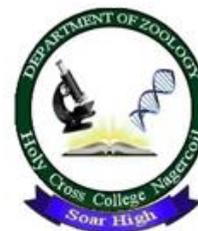
**Manonmaniam Sundaranar University, Tirunelveli**



**DEPARTMENT OF ZOOLOGY  
POST-GRADUATE 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)**

<b>POs</b>	<b>Upon completion of M.A./ M. Sc. /MSW Degree Programme, the graduates will be able to:</b>	<b>Mapping with Mission</b>
PEO1	apply scientific and computational technology to solve socio ecological issues and pursue research.	M1, M2
PEO2	continue to learn and advance their career in industry both in private and public sectors	M4 & M5
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	M2, M5 & M6

### PROGRAMME OUTCOMES (POS)

<b>PO</b>	<b>Upon completion of M.Sc. Degree Programme, the graduates will be able to:</b>	<b>Mapping with PEOs</b>
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	<b>PEO1 &amp; PEO2</b>
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	<b>PEO1, PEO 2 &amp; PEO3</b>
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	<b>PEO 2</b>
PO4	develop innovative initiatives to sustain ecofriendly environment	<b>PEO1, PEO 2</b>
PO5	pursue active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	<b>PEO 2</b>
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	<b>PEO1, PEO 2 &amp; PEO3</b>
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	<b>PEO3</b>

### PROGRAMME SPECIFIC OUTCOMES (PSOs)

<b>PSO</b>	<b>Upon completion of M.Sc. Programme, the graduates will be able to:</b>	<b>PO addressed</b>
PSO1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO1, PO2
PSO2	carryout experimental techniques, analyze statistically, draw conclusions, write report, present effectively and publish in indexed journals effectively	PO2, PO4, PO5, PO6
PSO 3	develop personal and key transferable skills and entrepreneurial skills through industrial / field visits and internships.	PO2, PO3
PSO 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO1, PO2, PO3, PO4, PO6
PSO 5	discriminate societal and environmental problems, adopt relevant technology, synthesis solution and claim for IPR	PO4, PO5, PO7

**Class** : I M.Sc., Zoology **Core Course I**  
**Title of the Course** : **Structure and Function of Invertebrates**  
**Semester** : I  
**Course Code** : ZP231CC1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
7	5	105	100

**Pre-requisite:**

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

**Learning Objectives:**

1. To realize the range of diversification of invertebrate animals.
2. To understand the concept of classification and their characteristic features of major group of invertebrates.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
<b>CO1</b>	remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	<b>K1</b>
<b>CO2</b>	understand the evolutionary process and its linkage in a sequence of life pattern	<b>K2</b>
<b>CO3</b>	apply for pre-professional work in agriculture and conservation of life forms.	<b>K3</b>
<b>CO4</b>	analyze areas beyond current understandings of life process.	<b>K4</b>
<b>CO5</b>	evaluate and to create the perfect phylogenetic relationship in classification.	<b>K5</b>

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

**Teaching Modules**

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Structure and function in invertebrates: 18 hrs						
I	1	<b>Principles of Animal taxonomy:</b> Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy	2	K1 & K2	Heutagogy, Andragogy, Partnering	Class test, Slip test,
II	2	<b>Organization of coelom:</b> <b>Acoelomates;</b> <b>Pseudocoelomates;</b> <b>Coelomates:</b> Protostomia and	2	K2 & K4	Z-A approach VAK method	Quizzes Socratic Class test

		Deuterostomes; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata			Flipped Class	
III	3	<b>Nutrition and Digestion:</b> Patterns of feeding and digestion in lower metazoan; Filter feeding in Polychaeta, Mollusca, and Echinodermata. Respiration: Organs of respiration: Gills, lungs, and trachea; <b>Respiratory pigments;</b> Mechanism of respiration		K3 & K5	Naitalism Xenography Spaced learning	Class test Question naire
IV	4	<b>Excretion:</b> Organs of excretion: <b>coelom, coelomoducts, Nephridia and Malpighian tubules;</b> Mechanisms of excretion; Excretion and osmoregulation. <b>Nervous system:</b> Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda); Trends in neural evolution		K4 & K6	Team technology Virtual Dual code	Class test Mind map
V	5	<b>Invertebrate larvae:</b> Larval forms of free-living invertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Concept and significance; Organization and general characters		K5 & K6	Reflective Online	Class test Open book test

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

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

**Course focusing on Cross Cutting Issues (Professional Ethics/ Human**

**Values/Environment Sustainability/ Gender Equity):** Professional Ethics, Interdisciplinary studies.

Activities related to Cross Cutting Issues: Adaptations to the Environment, Conservation and Biodiversity, Human Health and Disease.

**Assignment:** Organs of excretion - Online

**Seminar Topic:** Larval forms of free-living invertebrates

**Sample questions (minimum one question from each unit)**

**Part A**

1. What is the primary function of an invertebrate's exoskeleton?  
a) Support and protection b) Gas exchange c) Sensory perception d) Reproduction
2. Which invertebrate phylum includes animals with jointed appendages and a hard exoskeleton?  
a) Annelida b) Mollusca c) Arthropoda d) Cnidaria
3. What is the primary function of the water vascular system in echinoderms?  
a) Circulation b) Respiration c) Locomotion d) Digestion
4. In invertebrates, what is the main role of the coelom?  
a) Sensory perception b) Reproduction c) Digestion d) Fluid-filled body cavity
5. Which invertebrate group includes animals that are filter feeders and have a notochord in their larval stage?  
a) Porifera b) Ctenophora c) Echinodermata d) Urochordata

**Part B -**

1. Describe the role of IUZN.
2. Explain the difference between Ciliary and pseudopodial movement.
3. Discuss the process of excretion in starfish.
4. What are the key characteristics of the phylum Mollusca?
5. Comment on the salient features of Mesozoa.

**Part C**

1. Discuss the significance of taxonomy in the classification and understanding of invertebrate diversity.
2. Explore the diverse feeding strategies and mechanisms found in different invertebrate phyla.
3. Discuss the role of ganglia, nerve nets, and centralization in the nervous systems of different phyla.
4. Describe the mechanisms of waste elimination and osmoregulation in invertebrates.
5. Analyze the significance of larval forms in the life cycles of invertebrates. Provide examples of different larval types

**Head of the Department**

Dr. A. Shyla Suganthi

**Course Instructor**

**C. Josephine Priyatharshini**

P.T. Arokya Glory

**Class** : I M.Sc. Zoology **Core Course: II**  
**Title of the Course** : Comparative Anatomy of Vertebrates  
**Semester** : I  
**Course Code** : ZP231CC2

No. of Hours/ Week	No. of Credits	Total Hours	Marks
5	4	105	100

**Pre-requisite:**

Students with knowledge and comprehension on zoology

**Learning Objectives:**

1. To impart conceptual knowledge about the animal life in the air and their behaviours.
2. To understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

**Course Outcomes**

On successful completion of the course, the student will be able to:		
<b>CO1</b>	remember the general concepts and major groups in animal classification, origin, structure, functions, and distribution of life in all its forms.	<b>K1</b>
<b>CO2</b>	understand the evolutionary process and its linkage in a sequence of life patterns.	<b>K2</b>
<b>CO3</b>	apply this for pre-professional work in agriculture and conservation of life forms.	<b>K3</b>
<b>CO4</b>	analyze what lies beyond our present knowledge of life process.	<b>K4</b>
<b>CO5</b>	evaluate and to create the perfect phylogenetic relationship in classification.	<b>K5</b>

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

**Teaching Modules**

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1.	Concept of Protochordata: Intdn	2	K1 (R)	Introductory session, Group Discussion,	Evaluation through short test, MCQ, True/False,
	2.	The nature of vertebrate morphology;	2	K2 (U)	Lecture using Chalk and talk	MCQ, Recall Short essays,
	3.	Definition and scope of vertebrate morphology	3	K2 (U)	Lecture using videos,	Concept explanations, Short summary or overview

	4.	relation of vertebrate morphology to other disciplines;	3	K3 (Ap) K4 (An)	Mind mapping, Peer tutoring,	Differentiate between various ideas, Map knowledge
	5.	Importance of the study of vertebrate morphology.	2	K5(E)	Demonstration, PPT, Review	Longer essay/ Evaluation essay
<b>II</b>						
	1.	Origin and classification of Vertebrates - Intdn	2	K1(R)	Introductory session, Group Discussion,	Evaluation through short test, True/False,
	2.	Vertebrate integument and its derivatives.	2	K2 (U)	Lecture using Chalk and talk	Simple definitions, MCQ
	3.	Development of skin and its derivatives	2	K3(An)	Lecture using videos,	Short essays, Concept explanations,
	4.	general structure of skin and its derivatives	2	K4 (Ap)	Mind mapping, Peer tutoring,	Short summary or overview
	5.	functions of skin and its derivatives	2	K5 (E)	Demonstration, PPT	Longer essay/ Evaluation essay
	6.	Glands, scales, horns, claws, nails, hoofs, feathers and hairs.	2	K6 (Cr)	Video links, Group Discussion, Review	
<b>III</b>						
	1.	General plan of circulation in various groups: Blood;	2	K1 (R)	Group Discussion, Lecture	Short test, MCQ,
	2.	Evolution of heart	2	K2 (U)	Lecture using Chalk and talk	MCQ, Recall steps, Concept definitions
	3.	Evolution of aortic arches and portal systems.	2	K3 (An)	Lecture using videos, discussion	True/False, Short essays,
	4.	Respiratory system: Characters of respiratory tissue	2	K5 (E)	Peer tutoring	Concept explanations, Short summary or overview
	5.	Internal and external respiration;	2	K4(Ap)	Demonstration, PPT, Review	Longer essay/ Evaluation essay
	6.	Comparative account of respiratory organs	2	K4 (Ap)	Lecture using videos,	Short summary or overview

					Group Discussion	
<b>IV</b>						
	1.	Skeletal system: Form, function,	2	K2 (U)	Group Discussion	Evaluation through short test, MCQ
	2.	body size and skeletal elements of the body	2	K1 (R)	Lecture using Chalk and talk	Simple definitions, MCQ,
	3.	Comparative account of jaw suspensorium,	2	K3 (An)	Lecture using videos	True/False, Short essays, Concept explanations,
	4.	Comparative account of Vertebral column;	2	K5 (E)	Group discussion	Differentiate between various ideas, MCQ
	5.	Comparative account of Limbs and girdles;	2	K5 (E)	PPT, Review	Longer essay/ Evaluation essay
	6.	Evolution of Urinogenital system in vertebrate series.	2	K5 (E)	Group discussion	Evaluation through short test, MCQ
<b>V</b>						
	1.	Sense organs: Simple receptors	2	K2 (U)	Lecture with PPT	Short test, MCQ,
	2.	Organs of Olfaction and taste	2	K1 (R)	Lecture using Chalk and talk	MCQ, Recall steps, Concept definitions
	3.	Lateral line system; Electroreception.	2	K3 (An)	Lecture using videos	True/False, Short essays,
	4.	Nervous system: Comparative anatomy of the brain in relation to its functions;	2	K4 (Ap)	Mind mapping, Peer tutoring	Concept explanations, Short summary or overview
	5.	Comparative anatomy of spinal cord	2	K5 (E)	Demonstration, PPT, Review	Longer essay/ Evaluation essay
	6.	Nerves-Cranial, Peripheral and Autonomous nervous systems.	2	K5 (E)	Group Discussion	Short summary or overview

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability Activities (Em/ En/SD): Em

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

Activities related to Cross Cutting Issues:

- **Professional Ethics:** Prepare case studies on ethical dilemmas in vertebrate research

- **Human Values:** Group discussion on the ethical treatment of animals in research, addressing the balance between scientific advancements and animal welfare.
- **Environment Sustainability:** Analyse the impact of human activities on vertebrate habitats and ecosystems, and propose sustainable practices to mitigate these effects.
- **Gender Equity:** Explore and highlight the contributions of women scientists in the field of vertebrate research.

**Assignment:** Seminar Papers

**Seminar Topics:** Vertebrate integument, functions of skin, Endocrine Glands, Placoid scales, horns, claws, nails, hoofs, feathers hairs, Sense organs, Simple receptors, olfaction, lateral line, electroreception, vertebral column.

**Sample questions**

### Part A

1. Which of the following best describes the concept of Protochordata?
  - a. Primitive chordates lacking a vertebral column
  - b. Advanced chordates with a well-developed brain
  - c. Invertebrates with segmented bodies
  - d. Fish-like vertebrates with jaws and paired limbs
2. Which of the following is NOT a derivative of the vertebrate integument?
  - a. Glands
  - b. Scales
  - c. Feathers
  - d. Fins
3. Which of the following is NOT a characteristic of respiratory tissue?
  - a. High surface area for gas exchange
  - b. Presence of cilia for particle removal
  - c. Rich blood supply for oxygen uptake
  - d. Production of mucus for lubrication
4. Which of the following is NOT a component of the skeletal system in vertebrates?
  - A) Skull
  - B) Vertebral column
  - C) Muscles
  - D) Limbs
5. The \_\_\_\_\_ system in vertebrates is responsible for detecting and processing sensory information.

### Part B

1. Explain the nature of vertebrate morphology and its relation to other disciplines.
2. Describe the general structure and functions of the skin and its derivatives in vertebrates.
3. Discuss the evolution of the heart and the significance of aortic arches in different vertebrate groups.
4. Describe the characteristics of respiratory tissue and its role in internal and external respiration.
5. Discuss the form, function, body size, and skeletal elements of the vertebrate skeletal system. Provide examples of different skeletal components and their respective functions.

## **Part C**

1. Discuss the importance of studying vertebrate morphology. Explain how it contributes to our understanding of evolution, taxonomy, and medical research.
2. Explain the role of glands, scales and horns in different vertebrate groups. Illustrate your answer with specific examples.
3. Provide a comparative account of the respiratory organs in different groups of vertebrates.
4. Discuss the adaptations of respiratory organs for efficient gas exchange in various vertebrate taxa
5. Provide a comparative account of the skeletal elements in different vertebrate groups. Describe the structure and function of the jaw suspensorium
6. Explain the evolutionary changes in the urinogenital system across the vertebrate series, highlighting the adaptations and modifications that have occurred.
7. Compare and contrast the organs of olfaction in vertebrates. Explain their structure, function, and the mechanisms involved in detecting and perceiving odours.

### **Head of the Department**

Dr. A. Shyla Suganthi

### **Course Instructor**

Dr. Jeni Chandar Padua

**Class** : I M. Sc. **Elective – II (a)**  
**Title of the Course** : **Molecules and their interaction relevant to Biology**  
**Semester** : **I**  
**Course Code** : **ZP231EC4**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	3	75	100

**Pre-requisite:**

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

**Learning Objectives**

1. Students should know the fundamentals of biochemistry.
2. To develop analytical and communicative skills to conduct experiments and interpret the results

**Course Outcome**

On the successful completion of the course, student will be able to:		
<b>CO1</b>	gain comprehensive knowledge the structure, properties, metabolism, and bioenergetics of biomolecules	<b>K1</b>
<b>CO2</b>	acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation	<b>K2</b>
<b>CO3</b>	comprehend the fundamentals of biophysical chemistry and biochemistry, importance, and applications of methods in conforming the structure of biopolymers	<b>K3</b>
<b>CO4</b>	analyze the structural organization of and proteins, carbohydrates, nucleic acids and lipids	<b>K4</b>
<b>CO5</b>	familiarize the use of methods for the identification, characterization, and conformation of biopolymer structures	<b>K5</b>

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

**Teaching Modules**

**Total Hours: 90(Incl. Seminar & Test)**

Unit	Module	Topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
<b>Basics of biophysical chemistry and biochemistry:</b>						
I	1	Structure of atoms, molecules and chemical bonds -	4	K1 (R) K2 (U)	Seminar Cooperative learning	Short test, MCQ Index card
	2	Principles of biophysical chemistry pH, buffer, reaction	4	K2 (U) K3 (Ap)	Seminar KWL	MCQ

	3	Kinetics, thermodynamics, Colligative properties	4	K4 (An)	Interactive presentations	Traffic lights. Short test
II	Biomolecular interactions and their properties					
	1	Biomolecular interactions and their properties: Stabilizing interactions - Vander Waals, electrostatic,	1	K1 (R) K2 (U)	Seminar Interactive presentation	Short test
	2	Hydrogen bonding, hydrophobic interaction etc. - Composition, structure.	1	K2 (U) K3 (Ap)	I Seminar index card	Traffic lights. MCQ
	3	Composition, structure Metabolism, and function of biomolecules carbohydrates,	3	K2 (U) K4 (An)	Role play interactive presentation	Mind mapping Short test
	4	Composition, structure Metabolism, and function of biomolecules lipids	3	K2 (U) K5 (E)	Role play interactive presentation	Mind mapping Short test
	5	Composition, structure metabolism, and function of biomolecules-proteins	2	K5 (E)	I Role plays interactive presentation	Mind mapping MCQ
	6	Composition, structure metabolism, and function of biomolecules- nucleic acids and vitamins.	2	K1 (R) K2 (U)	Seminar	Mind mapping MCQ
III	Bioenergetics and enzymology:					
	1	Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction,	3	K3(Ap)	Interactive presentation	Flow Chart MCQ
	2	Group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics,	4	K2 (U) K4 (An)	Seminar Interactive presentation	Flow Chart MCQ
	3	Enzyme regulation, mechanism of enzyme catalysis, isoenzymes	4	K3 (Ap) K5 (E)	Interactive presentation	MCQ
IV	Structural conformation of proteins and nucleic acids:					
	1	Conformation of proteins (Ramachandran plot, secondary-	3	K2 (U) K4 (An)	Interactive presentation	Flow Chart
	2	Tertiary and quaternary structure; domains; motifs and folds)	4	K2 (U) K3 (Ap)	Interactive presentation	MCQ

	3	Conformation of nucleic acids (A-, B-, Z-DNA),	3	K2 (U) K4 (An)	Seminar	Flow Chart MCQ
	4	t-RNA, micro-RNA.	2	K2 (U) K3 (Ap)	Seminar Interactive presentation	Flow Chart MCQ
V	Stabilizing interactions in biomolecules:					
	1	Stability of protein	4	K1 (R) K2 (U)	Interactive presentation	MCQ
	2	Stability of nucleic acid structures.	4	K2 (U) K4 (An)	Interactive presentation	Short test
	3	Hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.	4	K2 (U) K4 (An)	Seminar Interactive presentation	Short test

Course Focussing on Employability/  
Entrepreneurship/ Skill Development:

Activities (Em/ En/SD):

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

**Employability, Entrepreneurship and  
Skill Development**

**Analysing biochemicals of a solution**

**Professional Ethics**

Human Values, Environment Sustainability,

### Seminar Topics

- 1) Structure of atoms, molecules
- 2) Chemical bonds
- 3) Colligative properties
- 4) Stabilizing interactions: Vander Waals, electrostatic,
- 5) Hydrogen bonding,
- 6) Hydrophobic interaction
- 7) Composition, structure, metabolism, and function of biomolecules: carbohydrates,
- 8) Lipids,
- 9) Proteins,
- 10) Nucleic acids and
- 11) Vitamins
- 12) Principles of catalysis
- 13) Mechanism of enzyme catalysis
- 14) Isoenzymes
- 15) Structural conformation of proteins and nucleic acids
- 16) Conformation of nucleic acids (A-, B-, Z-DNA)
- 17) t-RNA
- 18) Micro-RNA
- 19) Stability of protein and nucleic acid structures
- 20) Hydrogen bonding
- 21) Hydrophobic interactions and disulfide linkage.

### Assignment:

1. Topic: Chemical bonds (Mention Topic and Type)
2. Topic: Enzyme kinetics and protein structure

## Sample questions

### Part A

1. Name the type of the bond present between the nitrogen bases of the nucleic acid.  
a) Covalent bond b) Co-ordinate bond c) Hydrogen bond d) Electrostatic bond

2. Match the following:

- |                    |   |
|--------------------|---|
| A. Glycogenesis    | 1. breakdown of glucose by enzymes                              |
| B. Glycogenolysis  | 2.formation of glycogen from sugar                              |
| C. Glycolysis      | 3.generation of glucose from non-carbohydrate carbon substrates |
| D. Gluconeogenesis | 4. Break down of glycogen into glucose                          |

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

3. Which one of the following structures of protein exhibit pleated sheet structure?  
a) Primary b) Secondary c) Tertiary d) Quaternary
4. Who proposed the hypothesis for enzyme action?  
a) Michaelis and Menton b) Embden and Meyerhof c) Watson and Crick d) Kuhne

5. **Assertion :** Nucleic acids form secondary or higher-order structures such as duplexes , triplexes and G-quadruplexes

**Reason :** Because of the specific interactions among the bases

- a) Both assertion and reason are true.  
b) Both assertion and reason are false.  
c) Assertion is true but reason is false.  
d) Assertion is false but reason is true

### Part B

1. Discuss the colligative properties of water.
2. Classify carbohydrates. Add a note on their biological role.
3. Discuss the structure and properties of protein.
4. Elucidate the enzyme kinetics.
5. Discuss the competitive and uncompetitive inhibition

### Part C

1. How is acid base regulation carried out in the biological system?
2. Elucidate the catabolism of carbohydrates.
3. Explain the integration of carbohydrate, protein and lipid metabolism

Course In charge

Dr. A. Punitha

Dr. F. Brisca Renuga

Head of the Department

Dr. A. Shyla Suganthi

**Class** : I M. Sc.  
**Title of the Course** : Biostatistics  
**Semester** : I  
**Course Code** : ZP231EC1

**Elective – I (a)**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
5	4	75	100

**Pre-requisite:**

Students should be aware of the importance of analysis of quantitative and qualitative information from biological studies

**Learning Objectives:**

1. To enable the students to understand the basic concepts in Biostatistics and analyse the data to derive inferences in various biological experiments.
2. To develop analytical skills of statistics and draw valid conclusions in research.

**Course outcomes**

COs	Upon completion of this course the students will be able to:	CL
CO1	recall different biological data, methods of collection and analysis of data.	K1
CO2	comprehend the design and application of biostatistics relevant to experimental and population studies.	K2
CO3	acquire skills to perform various statistical analyses using modern statistical techniques and software.	K3
CO4	analyze the data and interpret the results manually or by using software	K4
CO5	evaluate on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	K5

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

**Teaching Modules**

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

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

	3.	Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve;	3	K2 (U) K3 (Ap)	Lecture using ppt, Problem solving,	Solve problems, Explain
	4.	Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.	3	K4 (An)	Lecture using ppt, Problem solving	Problem-solving questions, Analysis, and diagrammatic representation of data
<b>II</b>	<b>15 hrs</b>					
	1.	Measures of central tendency: Mean, median and mode for continuous and discontinuous variables.	6	K2 (U) K3 (Ap) K4 (An)	Problem solving Demonstration	Suggest formulae Recall steps
	2.	Measures of dispersion: Range, variation	2	K2 (U) K3 (Ap)	Problem solving	Discussion, Presentations
	3.	Standard deviation, standard error, and coefficient of variation.	4	K2 (U) K3 (Ap) K4 (An)	Problem solving, Applying experimental data	Evaluation through short test
<b>III</b>	<b>12 hrs</b>					
	1.	Probability: Theories and rules	2	K1 (R) K2 (U)	PPT & problem-based approach	Simple definitions – short questions
	2.	Probability - Addition and multiplication theorem	4	K2 (U) K3 (Ap) K4 (An)	Gamification and problem solving	Giving exercises and solve problems
	3.	Probability distribution: Properties and application of Normal distribution	3	K2 (U) K3 (Ap)	Lecture & Thinking-based learning,	Discussion, problem solving
	4.	Binomial and Poisson distributions.	3	K3 (Ap) K4 (An)	Lecture, Thinking-based learning,	Short test, MCQ
<b>IV</b>	<b>12 hrs</b>					
	1.	Hypothesis testing: Student 't' test - paired sample and mean difference 't' tests.	4	K4 (An) K5 (E) K6 (C)	Problem-based approach, flipped classroom	Analyze and interpret problems
	2.	Correlation: Types - Karl Pearsons Co-efficient, Rank	4	K3 (Ap) K4 (An) K5 (E)	Lecture, PPT,	

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

**Course Focussing** : Employability/ Skill Development

**Activities:** Prepare a chart on Presentation of data

**Course Focussing on Cross Cutting Issues (Professional Ethics/ Human**

**Values/Environment Sustainability/ Gender Equity):** Professional Ethics and Human values.

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

**Assignment:** Perform an experiment and analyze data

**Seminar topics**

- |   |                                    |
|---|------------------------------------|
| 1. Primary data                         | 12. Probability - theorems         |
| 2. Secondary data                       | 13. Normal distribution            |
| 3. Classification of biological data    | 14. Binomial Distribution          |
| 4. Variables -Types                     | 15. Poisson Distribution           |
| 5. Tabulation.                          | 16. Correlation                    |
| 6. Graphical Presentation of data       | 17. Regression                     |
| 7. Diagrammatic Presentation of data    | 18. Student 't' test               |
| 8. Measures of central tendency: Mean   | 19. ANOVA (2 students)             |
| 9. Measures of central tendency: Median | 20. SPSS (2 students)              |
| 10. Measures of dispersion: SD          | 21. Characteristics of probability |
| 11. Hypothesis testing                  |                                    |

**Sample questions**

**Part A**

**Choose the correct answer**

- A. Exhaustive event - 1) Same chances of occurrence  
 B. Complementary event - 2) Not at a same time

- C. Mutually Exclusive - 3) A group of event  
 D. Equally likely - 4) More than one sample space
- |    |   |   |   |   |
|----|---|---|---|---|
|    | A | B | C | D |
| a) | 1 | 3 | 2 | 4 |
| b) | 2 | 3 | 4 | 1 |
| c) | 4 | 1 | 3 | 2 |
| d) | 3 | 4 | 2 | 1 |

**Part B**

The length of fishes is given in the following frequency distribution. Calculate the quartile deviation.

Length (cm)	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	3	3	6	9	14	7	5

**Part C**

A clinical psychologist has run an experiment comparing two treatments for depression (**cognitive-behavioral therapy** (CBT) and **Client-centered therapy** (CCT) against a control condition. Subjects were randomly assigned to the experimental condition. After 12 weeks, the subject's depression scores were measured using the CESD depression scale. Find significance of the treatment Use a oneway ANOVA with  $\alpha=.01$  for the test. The data are summarized as follows:

Control	CBT	CCT
5	4	5
6	10	7
9	3	8

**Head of the Department**

Dr. A. Shyla Suganthi

**Course Instructor**

Dr. Vinoliya Josephine Mary

Dr. A. Shyla Suganthi

**Class : II M. Sc.**  
**Title of the Course : Physiology**  
**Semester : III**  
**Course Code : PZ2031**

**Core IX**

Hours/ Week	Credits	Total Hours	Marks
6	4	90	100

**Objectives**

1. To impart knowledge on the structure and functions of various organs, organ systems and associated disorders.
2. To develop skills relevant for pursuing higher education and apply the knowledge in their life.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the structure and functions of organ systems.	PSO - 1	R
CO - 2	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	U
CO - 3	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 2	Ap
CO - 4	analyze the physiological changes in relation to environmental conditions.	PSO - 3	An
CO - 5	evaluate the physiological functioning of different organs.	PSO - 4	E

**Teaching Modules**

**Total Hours: 90 (Incl. Seminar & Test)**

Unit	Module	topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
	<b>Nutrition</b>					
<b>I</b>	<b>1</b>	Types of nutrition and feeding mechanisms in animals.	<b>2</b>	K1 (R) K2 (U)	Seminar & Index card	Short test, MCQ
	<b>2</b>	Digestion - functional anatomy of the digestive system of man.	<b>2</b>	K2 (U) K3 (Ap)	Seminar Group discussion	Essay
	<b>3</b>	Movements of gastrointestinal tract	<b>2</b>	K4 (An)	Interactive presentations	Traffic lights. Short test
	<b>4</b>	Secretory functions of the alimentary tract and glands,	<b>2</b>	K5 (E)	Group discussion, Cooperative learning,	Assignment – Mapping Traffic light

	5	digestion and absorption	2	K5 (E)	Tutorial & Jigsaw, Index card	Mind mapping
	6	Metabolism of protein, carbohydrate and lipid.	3	K5 (E)	Role play KWL	Oral test Four squares
	7	Gastrointestinal disorders - Gallstones, liver cirrhosis, gastritis, peptic ulcer, and appendicitis.	2	K4 (An)	Index card	MCQ
	<b>Respiration and Homeostasis</b>					
	1	Functional anatomy of the respiratory system of man, transport of respiratory gases.	3	K1 (R) K2 (U)	Seminar Interactive presentation	Short test
	2	Regulation of respiration, respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis.	3	K2 (U) K3 (Ap)	Index card Cooperative learning	Traffic lights. MCQ
II	3	Homeostasis- Osmoregulation - types and mechanism	2	K2 (U) K4 (An)	Jigsaw	Exhibition
	4	Thermoregulation – classification and mechanism.	2	K2 (U) K5 (E)	Jigsaw	Exhibition
	5	Deep sea physiology, High altitude and space physiology	3	K5 (E)	Interactive presentation	Exhibition
	6	Bioluminescence - physiology and functions.	2	K1 (R) K2 (U)	Seminar	Four corners
III	<b>Circulation:</b>					
		Haemopoiesis, Blood clotting. Myogenic and neurogenic heart. Functional anatomy of the human heart.	3	K2 (U)	Interactive presentation Seminar	MCQ
		Cardiac cycle, pacemaker, heart rate, regulation of cardio-vascular system.	3	K3 (Ap)	Interactive presentation	Short test
		Blood pressure, sphygmomanometer, electrocardiogram (ECG),	2	K2 (U) K4 (An)	Interactive presentation	MCQ Short test
		Heart diseases - atherosclerosis, coronary thrombosis and angina pectoris	1	K3 (Ap)	Cooperative learning	Viva voce

		Lymphatic system - organization, composition and functions.	2	K2 (U)	Interactive presentation	Oral questioning	
IV	<b>. Neuro-muscular system</b>						
	1	Structure of the brain and neuron, neurotransmitters, synapse, nerve impulse conduction,	4	K2 (R)	Introductory session, Seminar, Lecture	Short test, MCQ	
	2	reflex activity, electroencephalogram (EEG). Neural disorders - meningitis and epilepsy.	4	K3 (Ap) K4 (An)	Blended learning, Group Discussion	Oral test, Essay test	
	3	Types of muscle, structure and properties of skeletal muscle,	3	K2 (R)	Seminar, Interactive PPT	Open book test, MCQ	
	4	mechanism of muscle contraction, neuromuscular junction.	4	K3 (Ap)	Video class, Discussion	Assignment - Poster	
	5	Sense organs - structure and functions of skin and eye	3	K3 (Ap) K4 (An)	Interactive PPT, seminar	Mind map, Draw the organ test	
V	<b>Excretion and Reproduction:</b>						
	1	Patterns of excretion, structure and function of kidney of man, nephron	3	K1(U) K2(R)	Flipped classroom, Group discussion	Short quiz, draw the organ test	
	2	formation of urine – counter current mechanism, micturition,	3	K3(Ap)	Jigsaw,	Mind map, slip test	
	3	renal disorders – nephritis, renal calculi, dialysis.	2	K4(An)	Chalk and board, lecture	Flow chart, Quizziz	
	4	Structure of testis and ovary (human), oestrus and menstrual cycle	4	K2(R)	Seminar, PPT	MCQ, Poster making	
	5	ovulation, pregnancy, parturition and lactation,	4	K3(Ap)	Video class, Group Discussion	Subjective test	
	6	hormonal regulation of reproduction.	2	K4(An)	Blended classroom	Flow chart, oral test	

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

**Activities (Em/ En/SD):** Observation Physiological activities

**Course Focussingon Cross Cutting Issues Professional Ethics/ Human Values/**

**Environment Sustainability/ Gender Equity):** Human Values

**Activities related to Cross Cutting Issues:** Model making and Exhibit about diseases

**Assignment:**

1. Topic: Secretory functions of the alimentary tract and glands, and absorption – Mapping.
2. Topic: Mechanism of muscle contraction, neuromuscular junction- Poster

### Seminar topics

- |  |                                      |
|--|--------------------------------------|
| 1. Menstrual & Estrus cycle              | functions                            |
| 2. Thermal regulation                    | 11. Coronary diseases                |
| 3. Structure and function of ovary       | 12. Structure of testes              |
| 4. Structure of Respiratory system       | 13. Structure and types of neurons   |
| 5. Myogenic and neurogenic heart         | 14. Gastro intestinal disorder       |
| 6. Structure and types of muscle         | 15. Types of nutrition               |
| 7. Structure and functions of eye.       | 16. Structure and function of Kidney |
| 8. Functional anatomy of the human heart | 17. Respiratory disorder             |
| 9. Structure and function of skin        | 18. Digestive glands                 |
| 10. Bioluminescence - physiology and     | 19. Structure of Digestive system    |
|  | 20. Sample questions                 |

### Part A

1. Inflammation of stomach is
  - a) Gastritis
  - b) Hepatitis
  - c) Gingivitis
  - d) Meningitis
2. Pneumonia is the inflammation of the lung tissues followed by accumulation of blood cells, fibrin and exudates in the alveoli. **State True or False**
3.
 

A. Atherosclerosis -	1. Plaques in arteries
B. Coronary Thrombosis-	2. Sphygmomanometer
C. Blood Pressure-	3. Chest pain
D. Angina Pectoralis-	4. Hardening of arteries

	A	B	C	D
a)	2	1	4	3
b)	1	2	3	4
c)	2	4	1	3
d)	4	1	2	3
3. Assertion (A): Botulinum Toxin is a neuromuscular blocker  
**Reason (R):** It prevent transmission of impulses from nerve fiber to the muscle fiber.
  - a) Statement A is correct, but B is wrong
  - b) Statement A is wrong and B is correct
  - c) Statement A and B are wrong
  - d) Statement A and B are correct

### Part B

1. Discuss the types of nutrition adopted by animals.
2. Explain the regulation of respiration in man.
3. How do animals adapt to extreme temperature conditions?
4. Explain the mechanism of muscle contraction.
5. Discuss the different patterns of excretion in animals.

### Part C

4. Discuss the different phases of gastrointestinal secretion and its regulation.
5. Recall the different osmoregulatory mechanisms operated in aquatic animals
6. Describe the process of blood clotting.
7. What is acetylcholine? How it's formed and mentions the types of acetylcholine receptors
8. What is tubular reabsorption? Evaluate the mechanism of tubular reabsorption.

Course In charge

Dr. Venci Candida & Dr. Brisca Renuga

Head of the Department

Dr. A. Shyla Suganthi

**Class : II M. Sc. Zoology**  
**Title of the Course : Genetics and Evolution**  
**Semester : III**  
**Course Code : PZ2032**

**Core X**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	4	90	100

**Objectives**

1. To enrich the knowledge on the principles of heredity at molecular level and to discern the evolutionary significance.
2. To develop skills for assessing heritability, identifying genetic disorders and constructing phylogenetic trees.

**Course outcomes**

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	recall the principles of inheritance, mutation, genetic disorders, genetic equilibrium and patterns of evolution.	PSO - 1	K1 (R)
CO - 2	describe Linkage and crossing over, Gene concept, Hardy Weinberg law and gene frequency, principles and methods of molecular evolutionary studies.	PSO - 1	K2 (U)
CO - 3	interpret the heritability and its measurements, molecular and biochemical basis of genetic diseases, gene frequencies of population, Universal Tree of Life, cultural evolution of man.	PSO - 2	K3 (Ap)
CO - 4	analyse the expressivity of genes, chromosome mapping, inheritance of particular character through Pedigree chart, Factors affecting Hardy Weinberg equilibrium and phylogenetic relationship.	PSO - 3	K4 (An)
CO - 5	evaluate allelic and non-allelic interactions, effects of mutation, selection, migration, adaptation on Mendelian population.	PSO - 4	K5 (E)

**Teaching Modules**

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	<b>Mendelian genetics (18 hours)</b>					
	1	Mendelian principles	1	K1, K4	Lecture Brainstorming	Mind map
	2	Gene interaction- complementary, supplementary and	3	K2, K3	Chalk and Talk Group Discussion	Quiz, short answers MCQ

		epistasis, Multiple allelism				
	3	Linkage and crossing over- types, mechanism and theories	2	K2, K4	Lecture	Seminar Oral assignment
	4	Chromosome mapping- linkage maps, tetrad analysis, mapping with molecular markers and somatic cell hybrids	5	K2	Brainstorming, Group Discussion	Figures, short answer oral assignment
	5	LOD score linkage test, Polygenetic inheritance	2	K2, K5	Flipped classroom	MCQ Essay answer
	6	Heritability and its measurement, QTL mapping	3	K3, K4	Chalk and Talk, Problem solving	Slip test
<b>II</b>	<b>Molecular and human genetics (18 hours)</b>					
	1	Gene concept	1	K1, K2	Brainstorming, Group Discussion	Oral assignment
	2	Mutation- types and effects of gene mutation- mutagens – chromosomal mutation DNA damage and repair	3	K2, K3	Flipped classroom	Recall key terms short answers
	3	Human chromosome, Karyotyping, chromosomal banding and painting. Pedigree analysis	4	K3, K4	Problem-based learning	Mind map True or False
	4	Disorders of amino acid metabolism- phenyl ketonuria, alkaptonuria, albinism. Disorders of nucleic acid metabolism- gout, ADA deficiency.	4	K3, K4	Chalk and Talk	MCQ
	5	Disorders of carbohydrate metabolism- von gierke's disease, G6PD deficiency Disorders of lipid metabolism – Tay sach's disease	4	K3, K5	Brainstorming Lecture	Slip test
	6	Haemoglobin disorders- sickle cell anaemia, thalassemia	2	K2, K4	Flipped classroom	Flow chart, Oral test
<b>III</b>	<b>Population genetics and evolution (18 hours)</b>					

	1	Mendelian populations Hardy Weinberg law and genetic equilibrium.	4	K4, K5	Lecture, Chalk and talk, Problem solving	Exercises: Problem solving, Seminar
	2	Calculation of gene frequencies: for autosomal - dominant and recessive alleles, Codominant alleles, Multiple alleles.	6	K3, K4	Lecture, Problem solving	Exercises: Problem solving,
	3	Factors affecting Hardy Weinberg equilibrium - Selection, heterozygous advantage, Mutation, Migration, Random genetic drift, Founder's effect.	4	K4, K5	Lecture, PPT, Group Discussion	Seminar, Assignment, Slip Test
	4	Genetic load and death, Neutralist hypothesis, Genetic polymorphism.	4	K4	PPT, YouTube video, Group Discussion	Seminar, Assignment
<b>IV</b>	<b>Molecular evolution (18 hours)</b>					
	1	Principles of molecular evolution studies – types and rates of nucleotide substitution in DNA sequence. Molecular clock.	4	K2, K5	<b>Brainstorming</b> , PPT, Group discussion	Short test, Quiz
	2	Molecular phylogeny, Phylogenetic tree.	3	K2, K4, K5	Interactive lecture, PPT	Construct phylogenetic tree
	3	Distance Matrix and Parsimony based approach. Kinds of molecular phylogenies.	4	K3, K4, K5	Chalk and Talk, PPT	Short test, Quiz
	4	Universal Tree of Life. Phylogenetic and biological concept of species.	3	K3, K4, K5	PPT, Mind map, Lecture	Assignment
	5	Adaptive radiation, Isolating mechanisms Modes of speciation (allopatry and sympatry).	4	K4, K5	PPT, YouTube videos, Group discussion	Seminar
<b>V</b>	<b>Origin of higher categories (18hours)</b>					
	1	Major trends in the origin of higher categories. Microevolution, macroevolution, mega evolution and coevolution	4	K1, K4	Lecture Brainstorming PPT	Quiz Short answers Recall terms

						Assignment
	2	Evolution rates, phyletic gradualism and punctuated equilibrium.	4	K3	Chalk and Talk PPT	MCQ Mind map Slip test
	3	Origin and Evolution of Primates: Evolution of Anthropoid Primates	3	K4	Lecture using PPT, YouTube video	True/ False Oral test
	4	The first hominids - Australopithecines and origin of modern man	3	K2, K4	Lecture YouTube video	MCQ Seminar Short answers
	5	Bipedalism – communication - speech - language - altruism and morality. Evolution of culture	4	K4	Lecture PPT Video	Recall terms Oral test MCQ

### Course Focussing on **Employability**

**Activities:** Seminar, Assignment, Group discussion, Solve problems

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

- Disorders of amino acid, nucleic acid, carbohydrate and haemoglobin metabolism
- Altruism and morality

**Activities** related to Cross Cutting Issues: Seminar, Assignment, Group discussion

**Assignment:** (Mention Topic and Type)

- Linkage and crossing over (essay)
- Chromosome mapping (chart/diagram)
- Gene concept (points)
- Factors affecting Hardy Weinberg equilibrium (essay)
- Genetic polymorphism (observation – shells of snails)
- Universal Tree of Life (diagram)
- Major trends in the origin of higher categories (mind map)

### **Seminar Topic:**

1. Multiple allelism
2. Haemoglobin disorders
3. Linkage
4. Crossing over (mechanism and type)
5. Polygenic inheritance
6. Mutation
7. Karyotyping
8. Disorders of amino acid metabolism: Phenylketonuria, Alkaptonuria, albinism
9. Disorders of Carbohydrate Metabolism
10. Disorders of lipid metabolism: Gaucher disease and Tay-Sachs disease
11. Hardy Weinberg law
12. Phylogenetic tree
13. Factors Affecting Hardy - Weinberg Equilibrium
14. Principle of Molecular Evolution Studies
15. Isolating mechanisms
16. Modes of speciation
17. Microevolution and Macroevolution
18. Megaevolution and Coevolution
19. Origin of modern man - Bipedalism, communication, speech, Language, Altruism, morality

### **Sample questions**

### Part A

1. Which of the following specimen is NOT Mendel's law of inheritance?
  - a. Law of dominance
  - b. Law of segregation
  - c. Law of heterozygous
  - d. Law of independent assortment
2. Which of the following lipids act as lungs surfactant?
  - a. Phosphatidylcholine
  - b. Phosphatidylethanolamine
  - c. Ceramide
  - d. phosphatidylinositol
3. Which one of the following will not affect the gene frequency of a population?
  - a) genetic drift    b) natural selection    c) mutation    d) random mating
4. Phylogenetics is the study of the evolutionary history of living organisms using tree-like diagrams to represent pedigrees of these organisms. **(State True or False)**
5. When one species is transformed into another, it is called \_\_\_\_\_ speciation.
  - a) Instantaneous    b) Sympatric    c) Allopatric    d) Phyletic

### Part B

1. Compare linkage and crossing over. Are these similar or different?
2. What is pedigree analysis explain with an example?
3. If the gene frequency of a recessive allele 't' is 0.2, what will be the percentage of individuals with genotype TT, Tt, tt in the population?
4. Illustrate adaptive radiation with suitable example.
5. Demonstrate the cultural evolution of man.

### Part C

1. Polygenic inheritance: Definition, characteristics and examples.
2. What are common disorders in the following metabolism:
  - a. nucleic acid    b. amino acid
3. Calculate the gene frequencies of multiple alleles of ABO blood group.
4. Evaluate the principles of molecular evolution studies.
5. Demonstrate the major trends in the origin of higher animal categories.

**Head of the Department**

Dr. A. Shyla Suganthi

**Course Instructor**

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

**Class** : II M.Sc. Zoology  
**Title of the Course** : Culture and Capture Fisheries  
**Semester** : III  
**Course Code** : PZ2033

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	4	90	100

### Objectives

1. To impart knowledge on the construction, maintenance, and management of cultivable organisms in aqua farms.
2. To practice aqua farming and extend it to the society.

### Course outcomes

CO	Upon completion of this course the students will be able to :	PSOs addressed	Cognitive level
CO - 1	recall the culture of finfish, shellfish, and their management.	PSO - 1	K1 (R)
CO - 2	describe different types of aquatic organisms, construction of ponds, nutrition, and breeding in aquaculture.	PSO - 1	K2 (U)
CO - 3	relate culture practices, breeding techniques, fish pathology, fishery genetics.	PSO - 2	K3 (Ap)
CO - 4	analyse physico-chemical and nutritional factors for optimizing aquaculture, fish marketing and preservation.	PSO - 3	K4 (An)
CO - 5	assess profitability of an established aqua farm.	PSO - 4	K5 (E)

### Teaching Modules

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Aquaculture (18 Hrs.)</b>					
	1.	Purpose and importance of aquaculture - basic qualification of candidate species	3	K2 (U)	Lecture using Chalk and talk Introductory session,	Short essays, Concept explanations
	2.	cultivable freshwater and marine fishes - global and Indian scenario of aquaculture.	3	K1 (R)	PPT, Peer tutoring	Simple definitions, MCQ
	3.	Construction and maintenance of fish farm: selection of site - lay-out	3	K3 (Ap)	Lecture using Chalk and talk, PPT	Evaluation through short test

	4.	types of ponds -aquatic plants and their control	3	K4 (An)	Lecture using Chalk and talk	Short summary
	5	control of fish predators - liming - fertilization of ponds.	3	K3 (Ap)	Lecture using Chalk and talk	Group Discussion
	6	Kinds of aquaculture - Integrated fish farming - Sewage fed fish culture - Pen and cage culture.	3	K5 (E)	Mind mapping. Group Discussion	Longer essay/ Evaluation essay
<b>II</b>	<b>Nutrition and Breeding (18 Hrs.)</b>					
	1	Nutritional requirements, Culture of fish feed organisms - phytoplankton (diatom)	3	K2 (U)	Lecture using Chalk and talk	Evaluation through short test, MCQ
	2	zooplankton (rotifers, cladocerans, Culture of <i>Artemia, Tubifex</i> .	3	K1 (R)	Lecture using videos	Simple definitions, Recall steps
	3	Artificial feed and feed formulation.	3	K4 (An)	Lecture using Chalk and talk, PPT	Concept with examples
	4	Seed collection - Breeding techniques - Induced breeding by hypophysation,	3	K3 (Ap)	Lecture using videos	Simple definitions, Recall steps
	5	Ovaprim, Factors influencing induced breeding	3	K5 (E)	Lecture using Chalk and talk	Simple definitions, Recall steps
	6	Sex identification – collection - rearing and selection of brooders, Transportation of fish seed.	3	K3 (Ap)	Lecture using Chalk and talk	MCQ
<b>III</b>	<b>Culture and Pathology (18 Hrs.)</b>					
	1	Finfish culture - Indian major carps	3	K2 (U)	Lecture using Chalk and talk, PPT	Recall steps
	2	Tilapia and murrel. Shellfish culture: freshwater and marine prawns	3	K1 (R)	Lecture using Chalk and talk, PPT	Evaluation through short test, MCQ
	3	lobsters, crabs, edible and pearl oysters.	3	K2 (U)	Lecture using Chalk and talk	Evaluation essay
	4	Ornamental fish culture and its prospectus.	3	K3 (Ap)	Lecture using Chalk and talk	Evaluation essay
	5	Fish pathology - Bacterial, Viral and Fungal diseases,	3	K4 (An)	Peer tutoring	Map knowledge
	6	Ectoparasites, Endoparasites, nutritional deficiency diseases in fishes.	3	K5 (E)	Group Discussion	Discussion
<b>IV</b>	<b>Fishery Genetics (18 Hrs.)</b>					
	1	Chromosomes in fishes, chromosome set manipulation	3	K2 (U)	Lecture using Chalk and talk	MCQ

	2	Gynogenesis and Androgenesis: sex control-Genome centromere mapping	3	K4 (An)	Lecture using Chalk and talk, PPT	Recall steps
	3	Inbreed depression – Production of inbred lines. Intrinsic and extrinsic factors in sex control and sex reversal	3	K3 (Ap)	Lecture using Chalk and talk	Evaluation essay
	4	.Induced polyploidy. Sex determination in fishes	3	K1 (R)	Lecture using Chalk and talk	Map knowledge
	5	Sex patterns – Gonochorism – hermaphroditism	3	K2 (U)	Lecture using Chalk and talk, PPT	Evaluation through short test
	6	Diandry and Digyny – Dichromatism. Transgenic fishes.	3	K5 (E)	Lecture using Chalk and talk, PPT	Evaluation through short test
<b>V</b>	<b>Capture Fisheries (18 Hrs.)</b>					
	1	Inland fisheries (riverine, lakesterine and cold-water fisheries)	3	K5 (E)	Peer tutoring	Discussion
	2	Estuarine fisheries - Marine fisheries.	3	K5 (E)	Group Discussion	Discussion
	3	Fishing methods- crafts and gears. Remote sensing and GIS in fisheries	3	K3 (Ap)	Lecture using videos	Questioning
	4	Fish spoilage and methods of fish preservation.	3	K2 (U)	Lecture using Chalk and talk, PPT	MCQ
	5	Economic importance of fishes: Food value and fish by-products.	3	K3 (An)	Lecture using Chalk and talk, PPT	Simple definitions
	6	Fish Marketing and co-operative societies in aquaculture. Common fishes of Kanyakumari.	3	K1 (R)	Lecture using Chalk and talk	Evaluation essay

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

**Activities (Em/ En/SD):** Visit to aquaculture farm

**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 “Aquaculture in relation to Environment Sustainability”

**Assignment:** Sex determination in fishes

**Seminar Topic:**

1. Purpose and importance of aquaculture.
2. Basic qualification of candidate species.
3. Cultivable freshwater and marine fishes.
4. Global and Indian scenario of aquaculture.

5. Aquatic plants and their control.
6. Sewage fed fish culture.
7. Pen and cage culture.
8. Transportation of fish seed.
9. Culture of Indian major carp.
10. Culture of Tilapia.
11. Culture of freshwater prawn.
12. Culture of Marine prawn.
13. Culture of edible oyster.
14. Culture of pearl oyster.
15. Estuarine fisheries.
16. Marine fisheries.
17. Fishing methods – Crafts and Gears.
18. Fish spoilage and methods of preservation.
19. Food value and fish by-products.

### Sample questions

#### Part A

1. The candidate species for aquaculture should have ease of breeding in captivity. **State True/False**
2. Artemia is also known as \_\_\_\_\_.
3. Infectious dropsy in fishes is caused by \_\_\_\_\_.  
 a) Bacteria    b) Virus    c) Fungus    d) Protozoan
4. **Assertion:** Hybrid triploids are reported to grow faster than hybrid diploids.  
**Reason:** Energy required for gonadal development is diverted for body growth.  
 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.
5. The Rigor mortis is a physical effect on the muscle tissue of fish caused by chemical changes following the death. **State True/False**

#### Part B

1. Give the basic qualification of candidate species in aquaculture.
2. How will you transport fish seed?
3. Enumerate the steps involved in the culture of pearl oysters.
4. Explain Gonochorism in fishes.
5. Discuss on Remote sensing and GIS in fisheries.

#### Part C

1. Explain integrated fish farming by giving suitable examples.
2. Describe the steps involved in induced hypophysation.
3. Differentiate the nutritional deficiency diseases in fishes.
4. Discuss the protocol for producing transgenic fishes.
5. Define Fish spoilage and explain the methods of fish preservation.

#### Head of the Department

Dr. A. Shyla Suganthi

#### Course Instructor

Dr. P.T. Arokya Glory  
 Dr. A. Punitha

**Class : II M.Sc. Zoology**  
**Title of the Course : Forensic Biology**  
**Semester : III**  
**Course Code : PZ2035**

**Elective III (b)**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	4	90	100

### Objectives

1. To emphasize the importance of scientific methods in crime detection.
2. To develop skills for disseminating information on the advancements in the field of forensic science.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the fundamentals of forensic biology, psychology, and criminal profiling.	PSO - 1	R
CO - 2	outline the use of scientific evidence in a legal context using basic facts, fundamental principles, and functions of forensic science.	PSO - 2	U
CO - 3	apply the knowledge gained on forensic, dermatoglyphic, serological and odonatological techniques to render forensic service during real-time crime scenes.	PSO - 3	Ap
CO - 4	analyse fingerprints, personal identification evidence, bite marks and pug marks.	PSO - 3	An
CO - 5	Evaluate information to find strategies to resolve problems in forensic biology.	PSO - 4	E

### Teaching Modules

**Total Hours: 60 (Incl. Seminar & Test)**

Unit	Module	topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment
	<b>Introduction to Forensic Biology: 12 hrs</b>					
<b>I</b>	<b>1</b>	Concepts and scope, functions, and historical aspects of forensic science.	<b>2</b>	K 1 (R) K 2 (U)	Didactic Teaching PPT	MCQ Seminar
	<b>2</b>	Importance, nature, location, collection and preservation of biological exhibits and crime scene investigation of biological evidence.	<b>4</b>	K 2 (U) K3(Ap)	Cooperative learning Socratic Questioning	Seminar
	<b>3</b>	Forensic dermatoglyphics - biological basis of fingerprints, formation of ridges, fundamental principles of fingerprinting	<b>4</b>	K4 (An)	Visualization, Experiential learning	Class test Assignment (Poster making)

	4	Types of fingerprints, fingerprint patterns, automated fingerprint identification system.	2	K4 (An) K5 (E)	Cooperative learning	Assignment
II	<b>Forensic examinations (12 hrs.)</b>					
	1	Forensic examination of hair - importance, nature, location, structure, growth phases of hair, collection, evaluation, and tests for their identification.	3	K1 (R) K2 (U)	Interactive presentation	Short test Seminar
	2	Forensic Serology - identification of body fluids, collection and preservation of blood evidence, distinction between human and non-human blood.	2	K2 (U) K3 (Ap)	Cooperative learning	Questioning, Recitation
	3	semen - forensic significance of semen, composition and morphology of spermatozoa, collection, evaluation and tests for identification of semen	2	K2 (U) K4 (An)	Jigsaw, Inquiry-based teaching	Seminar
	4	Composition and forensic significance of saliva, sweat, milk and urine.	2	K2 (U) K5 (E)	Socratic Seminars	Seminar, Class test
III	<b>Forensic Odontology: (12 hrs.)</b>					
		Structural variation, types of teeth - human and non-human teeth	3	K2 (U)	Interactive presentation Seminar	MCQ
		determination of age from teeth, eruption sequence, dental anomalies, their significance in personal identification.	3	K3 (Ap)	Interactive presentation	Short test. Case study
		Bite marks - forensic significance, collection and preservation of bite marks, photography and evaluation of bite marks	3	K2 (U) K4 (An)	Case-Based Learning	MCQ Case study
		lip prints in forensic investigations.	3	K3 (Ap)	Didactive teaching and Cooperative learning	Class test, MCQ
IV	<b>Forensic Entomology and Forensic Microbiology: (12 hrs.)</b>					
	1	Forensic Entomology - insects of forensic importance, collection of entomological	3	K2 (R)	Introductory session, Seminar, Lecture	Short test, MCQ

		evidence during death investigations.				
	2	The role of aquatic insects in forensic investigations, insect succession on carrion and its relationship to determine time since death	4	K3 (Ap) K4 (An)	Blended learning, Group Discussion	Oral test, Essay test
	3	Factors influencing insect succession on carrion, its application to forensic entomology.	3	K2 (R)	Seminar, Interactive PPT	Open book test, MCQ
	4	Forensic Microbiology - types and identification of microbial organisms of forensic significance.	2	K3 (Ap)	Video class, Discussion	Assignment - Poster
<b>V</b>	<b>Wildlife Forensics: (12 hrs.)</b>					
	1	Importance of Wildlife Protection Act-1972- Schedules in the protection of endangered species of flora and fauna.	3	K1 (U) K2 (R)	Flipped classroom, Group discussion	Short quiz, draw the organ test
	2	Identification of wildlife materials such as skin, fur, bones, nails, horn, teeth, plants, plant parts and products by conventional and modern methods.	3	K3 (Ap)	PPT, Jigsaw,	slip test Seminar
	3	Identification of pug marks of various animals	2	K4 (An)	Didactive teaching, Jigsaw	Flow chart, Quizziz
	4	DNA techniques in wildlife investigations.	4	K2 (R)	Seminar, YouTube video	MCQ, Poster making

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

Employability and Skill Development

**Activities:** Seminar, Assignment, Case study, Group work, Group discussion, Solve problems

**Course Focussing on Cross Cutting Issues (Professional Ethics/ Human**

**Values/Environment Sustainability/ Gender Equity):** Professional ethics, ethical considerations, human values, environmental sustainability.

**Activities** related to Cross Cutting Issues:

Seminar, Assignment, Group discussion

**Assignment:** (Mention Topic and Type)

- Analysis of finger print patterns of their (student's) fingers- **Personalized Learning**
- **Case study** related to solved and unsolved crimes - **Service Learning**

## Seminar Topic:

1. Concepts and scope and functions of Forensic Science
2. Historical aspects of forensic science.
3. Collection and preservation of biological exhibits.
4. Forensic dermatoglyphics
5. Automated fingerprint identification system.
6. Forensic examination of hair
7. Forensic Serology
8. Semen - forensic significance of semen
9. Composition and forensic significance of saliva, sweat.
10. Composition and forensic significance of milk and urine
11. Structural variation, types of teeth
12. human and non-human teeth
13. Bite marks - forensic significance
14. Lip prints in forensic investigations
15. Insects of forensic importance
16. The role of aquatic insects in forensic investigations
17. Insect succession on carrion
18. Factors influencing insect succession on carrion
19. Importance of Wildlife Protection Act-1972
20. Identification of wildlife materials such as skin, fur, bones

## Sample questions

### Part A

1. What is the primary goal of forensic biology?
  - a) To analyze fingerprints
  - b) To investigate cyber crimes
  - c) To study geological formations
  - d) To apply biological principles to legal investigations
2. **Assertion (A):** Biological exhibits collected from crime scenes require careful preservation to prevent DNA degradation.  
**Reason (R):** Biological evidence is highly resistant to environmental factors, so preservation measures are unnecessary.  
Statement 'A' and 'R' are true.  
Statement 'A' is true and statement 'R' is false.  
Statement 'A' is false and statement 'R' is true.  
Statement 'A' and 'R' are false.
3. Semen is composed of various components including spermatozoa and \_\_\_\_\_ fluid.
4. Lip prints can be used for forensic investigations primarily to
  - a) Identify an individual's dietary habit
  - b) Determine the individual's gender
  - c) Establish the time of death
  - d) Assist in personal identification
5. The collection of entomological evidence during death investigations is important for determining the \_\_\_\_\_ of death.

### Part B

1. What is the scope of forensic biology, and how does it relate to forensic science as a whole?
2. What are the key steps involved in collecting and preserving blood evidence for forensic serology?

3. Justify the forensic significance of dental anomalies in personal identification.
4. What are the types of microbial organisms with forensic significance in forensic microbiology?
5. What are some common wildlife materials that can be identified using forensic methods?

**Part C**

1. Discuss the historical development of forensic science and its functions in modern criminal
2. Explain the process of identifying and evaluating semen as forensic evidence. Describe the composition and morphology of spermatozoa
3. Discuss the role of forensic odontology in age determination using teeth.
4. Explain how insect succession on carrion can help estimate the time of death and what factors influence this process. Provide examples of cases
5. Describe the role of pug mark identification and DNA techniques in wildlife investigations.

**Course In-charge**

Dr. A. Shyla Suganthi

**Head of the Department**

Dr. A. Shyla Suganthi