

<b>Department of Zoology</b>
Programme Name: M.Sc.

**Programme outcomes**

**After successfully completing the M.Sc. Zoology program students will be able to:**

**PO1. Zoology knowledge:** Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.

**PO2. Problem analysis:** Identify, review research literature, and analyse complex situations of living forms.

**PO3. Design/development of solutions:** Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in real situations.

**PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject.

**Programme specific outcomes**

PSO1- Understand the impact of the natural and anthropogenic activities in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Identify a range of invertebrates and vertebrates and justify their conservation.

PSO2- Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.

PSO3- Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology

PSO4- Understand the impact of the natural and anthropogenic activities in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Identify a range of invertebrates and vertebrates and justify their conservation.

<b>Course outcomes</b>
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**Course Code and Course Name:**

**22-ZOUT- 111 Biochemistry and Biochemical Techniques. (4 Credits:  
60 Lectures)Semester I**

After successfully completing this course, students will be able to: CO1: Define basic terms in biochemistry

CO3: Explain the structure and functions of various biomolecules.

CO3:Draw the structures of various carbohydrates and amino acids.

CO4: Classify enzymes with examples.

**Biochemical techniques:**

CO1: Explain the importance and applications of techniques in biochemistry.

CO2: Describe the concept of light, electromagnetic spectrum and its application in absorption spectroscopy.

CO3: Illustrate the importance of radioactive compounds and radioactivity in biology.CO4: Demonstrate the principle and working of Warburg's apparatus.

**Course Code and Course Name:**

**22-ZOUT-112 Cell Biology and Developmental Biology (4 Credit: 60 Lecture)  
Semester I**

**After successfully completing this course, students will be able to:**

**Cell Biology:**

CO1: Overview of cell organelles structure and functions.

CO2: Understand the organization of the cytoskeleton.

CO3: Illustrate cell cycle phases.

CO4: Explain the concepts of cell signalling.

**Developmental Biology:**

CO1: Define the terms in developmental biology

CO2: Explain the significance of model organism for developmental studies.

CO3: Explain the concept of mesoderm induction and pattern formation with examples.

CO4: Illustrate postembryonic development.

**22-ZOUT-113**

**Genetics and Skills in Scientific Communication (4 Credits)**

- CO1: Overview of Mendelian genetics.
- CO2: Conceptual understanding of non-Mendelian genetics.
- CO3: Understanding the basic concepts of population and human genetics.
- CO4: Sentence formation and basic grammar overview.
- CO5: Conceptual understanding of writing scientific papers.
- CO 6: Effective oral presentation.

**Course Code and Course Name:**

**22-ZODT-114: Freshwater Zoology (2 Credits= 30 lecturers)**

After successfully completing this course, students will be able to:

CO1: Discuss the aquatic adaptations of common freshwater forms.

CO2: Explain the adaptations in freshwater Turtles and Crocodiles.

CO3: Demonstrate the effect of pollutants on freshwater bodies

CO4: Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

**22-ZOUP-114: Zoology Lab- I (4 Credits)**

CO1: Identification of cell cycle stages.

CO2: Understand processes involved in embryonic and post-embryonic development in certain model systems.

CO3: Understand the importance and methods of lab cleanliness.

**22-ZOUP-115: Zoology Lab-II (2 Credits)**

CO1: Estimate gene frequencies

CO2: Suggest a suitable title for a research article and write the abstract, keywords, result, discussion, conclusion, and citations of references.

CO3: Estimation of parameters affecting fresh water.

CO4: Culturing of certain freshwater organisms.

**M.Sc.-I Zoology (Semester - II)**

**Course Code and Course Name: 22- ZOUT- 121: Molecular Biology and Bioinformatics.**

(4

Credits = 60 lectures)

After successfully completing this course, students will be able to:

CO1: Explain the DNA structure & types, topology, Physical properties; chromatin structure and organization.

CO2: Discuss genome organization, DNA and Protein sequencing with their application in evolutionary studies.

CO3: Explain the mobile DNA elements.

CO4: Explain mechanism of DNA damage and repair.

CO5: Illustrate the process of DNA replication, transcription, translation and their regulations.

CO6: Illustrate the database tools with their significance.

CO7: Schematically represent the processes of central dogma.

CO8: Justify the post translational and post transcriptional modifications.

**Course Code and Course Name:** 22-ZOUT-122 Endocrinology and Comparative Animal Physiology (4C)

Endocrinology:

CO1: Discuss the roles of Pituitary gland and pineal body.

CO2: Explain hormonal regulation of biomolecules and mineral metabolism.

CO3: Explain the role of hormones in moulting, change in body colour of crustaceans; yolk synthesis in amphibians; insect development.

CO4: Justify the significance of biological clocks and rhythms.

Comparative Animal Physiology:

CO1: Explain the physiology of processes like digestion, respiration, muscle contraction and excretion.

CO2: Describe the mechanism of thermoregulation in both poikilotherms and homeotherms. CO3: Explain the mechanism of chemical communication in vertebrates.

CO4: Comment on the structure and functions of various sense organs.

**Course Code and Course Name:**

**22- ZOUT- 123 Environmental Biology and Parasitology**

(4 Credits= 60 lectures)

After successfully completing this course, students will be able to:

## **Environmental Biology:**

CO1: Identify various types of natural resources, human impact on these resources, and common resource management practices.

CO2: Explain the structure and impact of biogeochemical cycles, ecosystems and energy transformation across trophic levels.

CO3: Illustrate the impact of climate and anthropogenic factors on biodiversity with reference to India.

CO4: Illustrate the wildlife management practices and their significance.

## **Parasitology:**

CO1: Define the terminologies of parasitology.

CO2: Describe the morphology, life cycle, role of parasites in public health and hygiene.

CO3: Explain the pathogenicity and control measures of common parasites.

CO4: Justify the significance of vectors and disease transmission.

## **Course Code and Course Name:**

**22-ZODT-124: Ichthyology (2**

**Credits= 30 lecturers)**

After successfully completing this course, students

will be able to:

CO1: Understand the common fishes of India.

CO2: Explain the general characters and evolution of fishes.

CO3: Explain the fish morphology, anatomical modifications and physiology.

CO4: Illustrate the physiology of reproductive and endocrine organs in fish.

CO5: Discuss the signs, symptoms and control measures of common

diseases in fish.

**Course Code and Course Name:**

**22-ZOUP-124 Zoology Lab- I (4Credits)**

CO1: Explain the principle and significance of gonadectomy, thyroidectomy and pancreatotomy.

CO2: Demonstrate the role of eye stalk and insulin in sugar level in crab. CO4: Demonstrate the retro cerebral complex in cockroach.

CO3: Demonstrate the RBCs of common vertebrates and effect of various osmolarities.

CO4: Demonstrate the effect of body size, oxygen consumption and Insulin on aquatic animal.

CO5: Determine the bleeding and clotting time, heartbeat of crab, species richness in selected area, physico- chemical properties of soil and water.

CO6: Perform Sterilization of lab equipment, prepare microbial culture, Isolate Bacterial, liver DNA and RNA from given sample, quantify and resolve them using electrophoretic procedures, analyse protein sample by PAGE and SDS PAGE and construct phylogenetic tree using tools in bioinformatics

**Course Code and Course Name:**

**22-ZOUP-125 Zoology Lab- II (2Credits)**

After successfully completing this course, students will be able to:

CO1: Identify the various parasites and parasitic stages of common parasites, nitrogenous waste products of animals

CO2: Discuss the signs, symptoms and control measures of common diseases in fish.

CO3: Justify the role of respiratory and excretory organs in survival of fishes.

CO4: Classify fishes up to order level.

CO5: Setup aquarium and manage it.

Course Code and Course Name:

**ZOUT 231 : Entomology- I (Special Paper)**

**Semester III**

After successfully completing this course, students will be able to:

CO1: Define entomology and Insects and understand origin and evolution of insects and their relation to other arthropods.

CO2: Give outline of Classification of insects up to family with distinguishing characters and examples of each order and family.

CO3: Explain the structure, chemical composition and functions of Integument and Derivatives of Integument.

CO4: Explain the structure, modifications of insect body regions and their appendages.

Course Code and Course Name:

**ZOUT 232 : Fundamentals of Systematics and Economic Zoology**

**Semester III**

After successfully completing this course, students will be able to: CO1:

**Fundamentals of Systematics**

CO1: Explain principles, methods of biological classification and diversity in kingdom Animalia.

CO2: Explain the importance of taxonomic keys and taxonomic characters.

CO3: Explain the principles of zoological classification and nomenclature

CO4: Discuss the various taxonomic procedures and molecular phylogenetics & phylogeography.

**Economic Zoology**

CO1: Illustrate the lac culture, apiculture, prawn culture, vermiculture, Poultry, dairy industry and Piggery.

CO2: Explain the role of insects of economic importance.

CO3: Explain parasitic roundworms of animal and plants.

CO4: Signify the role of parasitic and soil protozoan in human welfare.

Course Code and Course Name:

**ZOUT 233 : Research Methodology and Insect Physiology and Biochemistry**

**Semester III**

After successfully completing this course, students will be able to:

## Research Methodology

CO1: demonstrate knowledge of research processes (reading, evaluating, and developing)

CO2: perform literature reviews using print and online databases.

CO3: select and define appropriate research problem and parameters to prepare a project proposal.

CO4: identify, explain, compare, and prepare the key elements of a research proposal/report.

## Insect Physiology and Biochemistry

CO1: Explain the structure, Chemistry of integument and sclerotization.

CO2: Describe the process of digestion and metabolism

CO3: Explain the characteristics of haemolymph and types of haemocytes.

CO4: illustrate the structure, physiology and biochemistry of flight muscle.

## Course Code and Course Name:

**ZODT 234 : Immunology**

**Semester III**

After successfully completing this course, students will be able to:

CO1: List the primary and secondary immune organs.

CO2: Explain the concepts of immunity, self-nonsel immune response, autoimmune disease.

CO3: Explain the theories of antibody synthesis and generation of antibody diversity.

CO4: Explain the principle and application of the common techniques used in Immunology

## Course Code and Course Name:

**ZODP 234 : Zoology Practical Paper-3 (Immunology)**

## Semester III

After successfully completing this course, students will be able to:

CO1: Identify the pattern of identity of antigen- antibody reaction.

CO2: Identify the microscopic structure of the lymphoid organs.

CO3: Demonstrate immunoelectrophoresis technique.



Course Code and Course Name: **ZOUP 235 : Special Lab I**

Semester III

After successfully completing this course, students will be able to:

Module-II: Fundamentals of Systematics and Economic Zoology

CO1: Identify museum specimen/pictures of minor phyla, Invertebrates, Protochordates and Vertebrates.

CO2: Identify animals with the help of taxonomic keys.

CO3: Collect and preserve animal samples using common methods.

CO4: Write scientific report of field/ institutional visit.

Module-III: Research Methodology and Insect Physiology and Biochemistry

CO1: Use MS excel in presentation and analysis of data using common statistical tests.

CO2: Suggest a suitable title for a research article.

CO3: Write the abstract, key words, result, discussion, conclusion and citations of references.

CO4: Write a research project to seek funding.

Course Code and Course Name:

**ZOUT 241: Entomology- II (Special Paper)**

**Semester IV**

After successfully completing this course, students will be able to:

CO1: Explain Gametogenesis, Fertilization and oviposition.

CO2: Explain embryonic developmental stages such as Cleavage, Blastoderm and Germ band formation; Gastrulation, Blastokinesis, differentiation of germ layers, Segmentation and Appendages formation and organogenesis.

CO3: Explain post-embryonic developmental stages such as Nymph, Naiad, larva, Pupa and Metamorphosis.

CO4: Explain specialized reproductive mechanisms.

Course Code and Course Name:

**ZOUT 242: Mammalian Reproductive Physiology and Aquaculture**

**Semester IV**

After successfully completing this course, students will be able to:

## Mammalian Reproductive Physiology

CO1: Explain the male and female reproductive systems and sexual dimorphic characteristics

CO2: Explain the sexual cycles with examples

CO3: Illustrate the reproductive dysfunctions.

CO4: Diagrammatically represent the hormonal regulation of reproductive processes like pregnancy, lactation and parturition.

## Aquaculture

CO1: Identify the fish diseases and the causative organisms

CO2: Mention the various composite fish culture with significance of each type.

CO3: Describe the methods of freshwater prawn culture and its management.

CO4: Explain the methods of pearl culture and pearl harvesting.

### **Course Code and Course Name:**

**ZODT 243: Histology and Histochemistry**

**Semester IV**

After successfully completing this course, students will be able to:

CO1: Explain the fundamental tissues in details.

CO2: Describe the process of histological preparations.

CO3: Illustrate the tools used in histological preparations.

CO4: Justify the use of various stains and dyes used in histochemical detection of biomolecules.

### **Course Code and Course Name:**

**ZODP 243: Zoology Practical Paper- 4**

### **Entomology- II**

CO1: Identify the histological structure of male and female reproductive system of insect.

CO2: Identify the eggs of different insects.

CO3: Identify the different embryonic stages of insects.

### **Histology and Histochemistry**

CO1: Identify the various tissues with the help of permanent slides.

CO2: Demonstrate the effect of fixatives on tissues.

CO3: Detect the biomolecules with histochemical staining methods.

### **Course Code and Course Name:**

**ZODT 244: Apiculture**

**Semester IV**

After successfully completing this course, students will be able to:

CO1: Explain the basic concepts of apiculture like systematics, colony organization, polymorphism, morphology and foraging.

CO2: Explain the tools and management of apiary.

CO3: Explain the importance of institutions pertinent to apiculture.

CO4: Discuss the setup of beekeeping business.

**Course Code and Course Name:**

**ZODP 244 : Zoology Practical Paper- 5** (*Practicals corresponding to ZOUT 242 and ZODT 244*)

**Semester IV**

**Mammalian Reproductive Physiology**

CO1: Identify the histological slides of reproductive organ/tissues.

CO2: Explain the various types of placenta in mammals.

CO3: Comment on merits and demerits of contraceptive devices/methods.

CO4: Illustrate the technique of gonadectomy.

**Aquaculture**

CO1: Identify Indian oysters.

CO2: Identify the common freshwater fish used in culture farming.

CO3: Demonstrate the processing and storing methods for fish and prawn.

CO4: Test the freshness of fish/prawn by histological methods.

**Apiculture**

CO1: Identify the honey bees

CO2: explain the bee morphology and behaviour

CO3: Illustrate the bee enemies