

Department of Zoology
Programme Name: M.Sc.

Programme outcomes

PO1 - Demonstrate and apply the fundamental knowledge of the basic principles of major fields of Zoology;

PO2- Identify, review research literature, and analyse complex situations of living forms.

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

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.

Course outcomes
First Year: MSc-I

Course: **ZOUT 111 Biochemistry and Biochemical Techniques. (Semester I)**

CO1- Define basic terms in biochemistry and biochemical techniques.

CO2- Explain the structure and functions of various biomolecules.

CO3- Illustrate the importance of pH, buffer and water in living systems..

CO4- Draw the structures of various carbohydrates and amino acids.

CO5- Classify enzymes with examples.

Biochemical techniques:

CO1: Explain the principle and applications of various biochemical techniques with examples.

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.

Course: **ZOUT 112 Cell Biology and Developmental Biology (Semester I)**

Cell Biology:

CO1: Explain the ultrastructure and functions of various cell organelles.

CO2: Explain carbon as backbone of biomolecules.

CO3: Explain the concepts of cell signalling.

CO4 : Illustrate the chemistry and organization of cytoskeleton.

CO5: Diagrammatically represent the cell cycle phases and its regulation.

Developmental Biology:

CO1: Define the terms in developmental biology

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

CO3: Explain the types of eggs, concept of gametogenesis, fertilization and cleavage pattern.

CO4: Explain the concept of mesoderm induction and pattern formation with examples

ZOUT 113 Genetics and English in Scientific Communication.

Semester I

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

Genetics:

CO1: Define the basic terminologies in genetics.

CO2: Identify genetic disorders based on Karyotypes and traits.

CO3: Explain the concept of Mendelian genetics, gene, gene regulation and multiple alleles.

CO4: Discuss Linkage and crossing with their types and significance.

ZODT 114 Freshwater Zoology.

Semester I

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

CO1: Explain the types of aquatic habitats.

CO2: Discuss the aquatic adaptations of common freshwater forms.

CO3: Demonstrate the effect of pollutants on freshwater bodies

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

CO5: Illustrate the physicochemical properties of water.

ZODP 114 Practical Freshwater Zoology. (Semester I)

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

CO1: Identify commercially important freshwater fish.

CO2: Identify the aquatic adaptations in common freshwater forms.

CO3: Prepare the culture of *Paramecium* and *Daphnia*.

CO4: Estimate the hardness and chloride content in water samples.

CO5: Analyze the Zooplanktons from local freshwater bodies.

ZOUP 115 Basic Zoology Lab-1

Semester I

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

CO1: Identify the developmental stages of chick embryo, cell structures and phases of cell division

CO2: Identify the grammatical mistakes from the given paragraph and common errors in written and spoken presentations.

CO3: Write a scientific project and research article along with its proof reading.

CO4: Demonstrate the working of different microscopes, colorimetric and spectrophotometric methods, cell fractionation and ligature in *Drosophila* larvae,

CO5: Determine the gene distance and order, genotype and phenotype ratios and allelic frequencies from the given data.

CO6: Estimate sugar and protein by suitable biochemical method, and isolate protein from biological source.

CO7: Prepare acid and base solutions of desired strength, buffers, bacterial Culture, chick embryo culture and *Drosophila* culture.

CO8: Prepare temporary slide of various cells to demonstrate the cell morphology and cell division, giant chromosome and pedigree analysis chart.

CO9: Calculate % retention and % elution of amino acids on given ion exchanger.

ZOUT 121: Molecular Biology and Bioinformatics.

Semester II

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 mechanism of DNA damage and repair.

CO4: Illustrate the process of DNA replication, transcription, translation and their regulations.

- CO5: Illustrate the database tools with their significance.
CO6: Schematically represent the processes of central dogma.
CO7: Justify the post translational and post transcriptional modifications.

ZOUT 122 Endocrinology and Parasitology.

Semester II

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

Endocrinology:

- CO1: Discuss the roles of Pituitary gland and pineal body.
CO2: Explain hormonal regulation of biomolecules and mineral metabolism.
CO3: Explain the hormonal regulation of metabolism.
CO4: Describe the role of osmoregulatory and gastrointestinal hormones.
CO5: Illustrate the mechanism of hormone action and role of hormone receptors.
CO6: Justify the significance of biological clocks and rhythms.

Parasitology:

- CO1: Define the terminologies of parasitology.
CO2: Explain the concepts of animal association with examples.
CO3: Describe the role of parasites in public health and hygiene.
CO4: Explain the morphology and life cycle of common parasites.
CO5: Explain the pathogenicity and control measures of common parasites.

ZOUT 123 Comparative Animal Physiology & Environmental Biology.

Semester II

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

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.
CO5: Illustrate the concept of osmotic regulation in various animals with suitable examples.

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: Discuss environmental hazards and risks and the socio-economic implications.

CO7: Illustrate the wildlife management practices and their significance.

ZODT 124: Ichthyology

Semester II

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

CO1: Identify the common fishes in India.

CO2: Explain the general characters and evolution of fishes.

CO3: Explain the fish morphology and anatomical modifications.

ZOUP 125 Basic Zoology Lab-2

Semester II.

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

CO1: Identify the various parasites and parasitic stages of common parasites, nitrogenous wasteproducts of animals, feshwater planktons and slides of endocrine glands.

CO2: Explain the principle and significance of gonadectomy, thyrodectomyand pancreactomy.

CO3: Demonstrate the role of eye stalk and insulin in sugar level in crab.

CO4: Demonstrate the retro cerebral complex in cockroach.

CO5: Demonstrate the RBCs of common vertebrates and effect of various osmolarities.

CO6: Demonstrate the effect of body size, oxygen consumption and Insulin on aquatic animal.

CO7: Determine the bleeding and clotting time, heartbeat of crab, species richness in selected area, physico- chemical properties of soil and water.

CO8: 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.

M.Sc- II Zoology (2019 pattern)

Program outcomes (POs): 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.

PO6. The Postgraduate and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex life activities with the scientific community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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