



M. V. P. Samaj's G. M. D. Arts, B. W. Commerce and Science College, Sinnar
Course Outcome, Program Outcome, Program Specific Outcome

DEPARTMENT OF ZOOLOGY

B.Sc. Zoology

Goals:

- To motivate the students for their fruitful life.
- To develop the broad knowledge about the biology of animals.
- To impart entrepreneurial skills through application-oriented subjects.
- To provide the best education for students to achieve their goals.
- To promote research and learning.
- To create awareness about health-related problems by curriculum

Program Outcomes:

- PO-1:** Apply the knowledge of various branches of Zoology meant both for a graduate course and higher studies.
- PO-2:** Acquire basic skills in the observation and study of nature, biological techniques and scientific investigation.
- PO-3:** Develop positive attitude towards sustainable development.
- PO-4:** Understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance.

Program Specific Outcomes:

At the end of course student will be able to

- PSO-1:** Learning the diversity of animal world, their habit, habitat, life history and evolution.
- PSO-2:** Learn to study morphology, anatomy, physiology, reproduction and development of organisms.
- PSO-3:** Learn heredity by study of cytology and genetics.
- PSO-4:** Learn about predators, parasites and pathogens, and diseases affecting animal world and find solutions for prevention.
- PSO-5:** Ecological knowledge with help to know the reasons of environmental degradation and help them to formulate ways for its up keeping.
- PSO-6:** Fundamental mathematical tools like statistics, models are used to analyses complex biological situations.
- PSO-7:** Theoretical knowledge associated with practical skills, seminar presentations, undertaking project works will help them to acquire in depth knowledge in the field of zoology.

Program Specific Outcomes:

F. Y. B. Sc. Zoology

Paper-I, Animal Diversity I

At the end of course student will be able to

- CO 1.** To understand the Animal diversity around us.
- CO2.** To understand the underlying principles of classification of animals.
- CO3.** To understand the terminology needed in classification.
- CO4.** To understand the differences and similarities in the various aspects of classification.
- CO5.** To classify invertebrates and to be able to understand the possible group of the invertebrate observed in nature.
- CO 6.** To understand our role as a caretaker and promoter of life.
- CO 7.** The student will be able to understand classify and identify the diversity of animals.
- CO 8.** The student understands the importance of classification of animals and classifies them effectively using the six levels of classification.
- CO 7.** The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life

Paper-II, Animal Ecology

By the end of this course students will able to

- CO 1:** The learners will be able to identify and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics and its impact on ecosystem and biosphere due to the dynamics in population.
- CO 2:** To understand anticipate, analyse and evaluate natural resource issues and act on a lifestyle that conserves nature.
- CO 3:** The Learner understands and appreciates the diversity of ecosystems and applies beyond the syllabi to understand the local lifestyle and problems of the community.
- CO 4:** The learner will be able to link the intricacies of food chains, food webs and link it with human life for its betterment and for non-exploitation of the biotic and abiotic components.
- CO 5:** The working in nature to save environment will help development of leadership skills to promote betterment of environment

Paper-III, Practical Zoology

At the end of course student will able to

- CO 1.** Familiarity with non-chordate world.
- CO 2.** Identify and classify invertebrates.
- CO 3.** Able to appreciate the process of evolution.
- CO 4.** Understand the basis of life processes

S. Y. B. Sc. Zoology

Paper-I, Animal Diversity III

After completion of course student will able to

- CO 1.** The students will be able to understand, classify and identify the diversity of higher vertebrates.
- CO 2.** The students will able to understand the complexity of higher vertebrates
- CO 3.** The students will be able to understand different life functions of higher vertebrates.
- CO 3.** The students will be able to understand the linkage among different groups of higher vertebrates.
- CO 4.** The student will become aware regarding his role and responsibility towards nature as protector, to understand his role as a trustee and conservator of life which he has achieved by learning, observing and understanding life.\

Paper-I, Animal Diversity - IV, Sem II

After completion of course student will able to

- CO 1.** The students will be able to understand, classify and identify the diversity of higher vertebrates.
- CO 2.** The students will able to understand the complexity of higher vertebrates
- CO 3.** The students will be able to understand different life functions of higher vertebrates.
- CO 4.** The students will be able to understand the linkage among different groups of higher vertebrates.
- CO 5.** The student will become aware regarding his role and responsibility towards nature as a protector, to understand his role as a trustee and conservator of life which he has achieved by learning, observing and understanding life.

Paper-II, Applied Zoology I, Sem I

After completion of course student will able to

- CO 1.** The learner understands the basics about beekeeping tools, equipment, and managing bee hives.
- CO 2.** The learner understands the basic information about fishery, cultural and harvesting methods of fishes and fish preservation techniques.
- CO 3.** The learner understands the biology, varieties of silkworms and the basic techniques of silk production.
- CO 4.** The learner understands the types of agricultural pests, Major insect pests of agricultural importance and Pest control practices.

Paper-II, Applied Zoology II, Sem. II

After completion of course student will able to

- CO 1.** The learner understands the basics about beekeeping tools, equipment, and managing bee hives.
- CO 2.** The learner understands the basic information about fishery, cultural and harvesting methods of fishes and fish preservation techniques.

CO 3. The learner understands the biology, varieties of silkworms and the basic techniques of silk production.

CO 4. The learner understands the types of agricultural pests, Major insect pests of agricultural

Paper-III, Zoology Practical Paper

After completion of practical course student should be able to

CO 1. The learner understands the basics about beekeeping tools, equipment, and managing beehives.

CO2. The learner understands the basic information about fishery, cultural and harvesting methods of fishes and fish preservation techniques.

CO3. The learner understands the biology, varieties of silkworms and the basic techniques of silk production.

CO4. The learner understands the types of agricultural pests, Major insect pests of agricultural importance and Pest control practices.

T.Y.B.Sc. Zoology

Paper I, Pest Management Sem V

At the end of course students will able to

CO 1. Define pest management.

CO 2. Describe the economic, ecological, and sociological benefits of IPM.

CO 3. Distinguish positive and negative impacts of pesticide use.

CO 4. Understand problems resulting from misuse, overuse, and abuse of chemical pesticides.

CO 5. Define and describe pesticide resistance and how it develops.

CO 6. Identify ecological and biological characteristics important in development of pest populations.

CO 7. Identify 10 tactics commonly used in IPM and be able to distinguish them.

CO 8. Understand society's role in IPM decisions.

CO 9. Describe different groups of pests and compare them to weeds and plant pathogens.

CO 10. Analyse and compare management tactics to determine the best approach to reducing pest populations, weeds, and disease presence.

CO 11. Locate appropriate, scientifically valid sources of information on specific tactics to manage insect pests, weeds, and diseases.

CO 12. Know and how to develop an IPM program.

Paper I, Medical & Forensic Zoology Sem VI

At the end of course students will able to

CO 1. The students will be able to understand the basics principles of Medical and Forensic Zoology.

- CO 2.** The students will be able to understand scientific methods in crime detection.
- CO 3.** The students will be able to understand the advancements in the field of Medical and Forensic Zoology.
- CO 4.** The students will be able to understand modern tools, techniques and skills in forensic investigations.
- CO 5.** The students will be able to describe the fundamental principles and functions of forensic science and its significance to human society.

Paper II, Histology Sem V

At the end of course students will be able to

- CO 1.** The students will be able to understand, classify and identify the different types of tissue.
- CO 2.** The students will understand the complexity of various tissues in an organ.
- CO 3.** The students will be able to learn structure & functions of various tissues.
- CO 4.** The students will understand the various diseases related to organs.
- CO 5.** The student will be able to know the role of glands in mammals.

Paper II, Animal Physiology Sem VI

At the end of course students will be able to

- CO 1.** Learners shall be able to understand basic concepts and significance of Animal Physiology
- CO 2.** The students will learn about the physiological process
- CO 3.** The students will learn about the physiological diseases their biological and clinical significance.
- CO 4.** The students will be able to understand, interpret structure and importance of proteins, carbohydrates and lipids
- CO 5.** Learners will be able to understand process of physiological reactions

Paper III, Biological Chemistry Sem V

At the end of course students will be able to

- CO 1.** Learners shall be able to understand basic concepts and significance of biochemistry
- CO 2.** The students will learn about the pH and Buffers.
- CO 3.** The students will learn about the chemical structures of carbohydrate, and their biological and clinical significance.
- CO 4.** The students will be able to understand, interpret structure and importance of proteins, carbohydrates and lipids
- CO 5.** Learners will be able to comprehend variations in enzyme activity and kinetics.

Paper III, Molecular Biology Sem VI

At the end of course students will be able to

- CO 1.** Learners shall be able to understand basic concepts and significance of Molecular Biology
- CO 2.** The students will learn about the DNA & RNA

- CO 3.** The students will learn about the chemical structures of DNA .
- CO 4.** The students will be able to understand, interpret structure and importance of Replication, Transcription
- CO 5.** Learners will be able to comprehend variations in Central Dogma

Paper IV, Genetics Sem V

At the end of course students will be able to

- CO 1.** Learners shall be able to understand basic concepts and significance of Genetics
- CO 2.** The students will learn about the Genes & Alleles
- CO 3.** The students will learn about the Types of mutations .
- CO 4.** The students will be able to understand, interpret structure and importance of Replication, Transcription
- CO 5.** Learners will be able to comprehend variations in Central Dogma

Paper IV –Entomology Sem VI

At the end of course students will be able to

- CO 1.** Understand basic concepts in Entomology and its scope.
- CO 2.** Learn morphology and anatomy of Insects.
- CO 3.** Understand the concept of social organization in Insects.
- CO 4.** Understand the development process of Insects.
- CO 5.** Identify disease causing insect vectors.
- CO 6.** Will be able to design and implement pest controlling methods against pests.

Paper V – Developmental Biology Sem V

At the end of course students will be able to

- CO 1.** Understand basic concepts in Entomology and its scope.
- CO 2.** Learn morphology and anatomy of Insects.
- CO 3.** Understand the concept of social organization in Insects.
- CO 4.** Understand the development process of Insects.
- CO 5.** Identify disease causing insect vectors.
- CO 6.** Will be able to design and implement pest controlling methods against pests.

Paper V – Techniques in Biology Sem VI

At the end of course students will be able to

Paper VI – Parasitology Sem V

At the end of course students will be able to

- CO 1.** The students will be able to learn about basics and scope of Parasitology.
- CO 2.** The students will be able to learn the types of host and parasite with examples.
- CO 3.** The students will be able to learn about the morphology, life cycle, pathogenicity and treatment of common parasites (Protists and Platyhelminthes).

- CO 4.** The students will be able to learn about host -parasite relationships and their effects on host body.
- CO 5.** The students will be able to learn about the arthropod parasites and their role as vector.

Paper VI – Evolutionary Biology Sem VI

At the end of course students will able to

- CO 1.** Students will be able to learn most of the essential aspects of Evolutionary Biology in detail which will help them in acquiring better understanding regarding the subject.
- CO 2.** Explain important processes, principles and concepts and critically evaluate theories and empirical research within evolutionary biology
- CO 3.** Apply evolutionary theory and concepts to address empirical and theoretical questions in evolutionary biology.
- CO 4.** Independently investigate evolutionary questions using literature and analyses of empirical data.
- CO 5.** Communicate the principles, theories, problems and research results associated with questions that lie within the evolutionary framework to students

Paper VII – Aquarium Management Sem V

At the end of course students will able to

- CO 1.** The students will be able to understand the Aquarium Management practices.
- CO 2.** The students will able to understand the Aquarium Management techniques.
- CO 3.** The students will be able to understand Aquarium Management techniques.
- CO 4.** The students will be able to understand feeding requirement and food ingredients.
- CO 5.** The students will be able to understand the Aquarium disease and their pathogens.
- CO 6.** The students will be able to understand market value of Aquarium Management.

Paper VIII – Poultry Management Sem V

At the end of course students will able to

- CO 1.** The students will be able to understand the Poultry farming practices.
- CO 2.** The students will able to understand the poultry breeding techniques.
- CO 3.** The students will be able to understand poultry rearing techniques.
- CO 4.** The students will be able to understand feeding requirement and food ingredients.
- CO 5.** The students will be able to understand the poultry disease and their pathogens.
- CO 6.** The students will be able to understand market value of poultry products.

Paper VII – Environmental Impact Assessment Sem V

At the end of course students will able to

- CO 1.** The students will be able to understand the Environment
- CO 2.** The students will able to understand the Pollution
- CO 3.** The students will be able to understand Sustainable Development
- CO 4.** The students will be able to understand Environmental Protection acts

CO 5. The students will be able to understand the concept of Environmental Impact Assessment

CO 6. The students will be able to understand market EIA Process

Paper VIII – Project Sem VI

At the end of course students will able to

CO 1. The students will be able to understand planning the project

CO 2. The students will be able to understand selecting a suitable title

CO 3. The students will be able to understand Significance of the work

CO 4. The students will be able to understand Hypothesis, Objectives

CO 5. The students will be able to understand reviewing the available literature

CO 6. The students will be able to understand Methodology to be used

CO 7. The students will be able to understand Outcomes of the Project work

CO 8. The students will be able to understand Conclusion and Discussion

CO 9. The students will be able to understand Future plans

Zoology Practical Paper I

At the end of course students will able to

CO 1. Determination of serum urea

CO 2. Determination of serum uric acid

CO 3. Hemoglobin estimation using Sahli's haemoglobinometer.

CO 4. Preparation of haemin and haemochromogen crystals.

CO 5. To estimate the blood glucose level from given sample.

Zoology Practical Paper II

At the end of course students will able to

CO 1. Lab safety techniques & sterilisation

CO 2. Absorption spectra of DNA isolated from Liver

CO 3. Principle & application of Spectrophotometer & PCR

CO 4. Study of external characters of any Insect (Grasshopper / Cockroach / Plant bug).

CO5. Study of Insect Head, its articulations and types of mouthparts and their modifications.

Zoology Practical Paper III

At the end of course students will able To

CO 1. Compound and Stereo microscope: Components, usage and maintenance.

CO 2. To observe different kind of cells under compound microscope and its

CO 3. Measurement using micrometer scale or by image analysis software

CO 4. Tissue collection, fixation & Block preparation.

CO 5. Sectioning, staining & mounting.

CO 6. Submission of any three permanent

CO 7. Slides from three different organs.

M. Sc. Entomology

Goals:

- To motivate the students for their fruitful life.
- To develop the broad knowledge about the biology of animals.
- To impart entrepreneurial skills through application-oriented subjects.
- To provide the best education for students to achieve their goals.
- To promote research and learning.
- To create awareness about health-related problems by curriculum

Program Outcomes:

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

- PO-1. Zoology knowledge:** Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.
- PO-2. Problem analysis:** Identify, review research literature, and analyse complex situations of living forms.
- PO-3. 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.
- PO-4. 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.
- PO-5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject.
- PO-6. 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.
- PO-7. 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.
- PO-8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.
- PO-9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO-10. 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.
- PO-11. 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.
- PO-12. 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.

Program Specific Outcomes:

- PSO-1.** Understand the biological diversity and grades of complexity of various animal forms through their systematic classification and comparative structural studies.
- PSO-2.** Learn how earth was formed and how life started and evolved on the planet through process of organic evolution.
- PSO-3.** Understand the roles of plants, animals and microbes in the sustainability of the environment and their interaction among themselves and deterioration of the environment due to anthropogenic activities.
- PSO-4.** Understand the concepts and principles of biochemistry, immunology, physiology, ethology, endocrinology, developmental biology, cell biology, genetics, molecular biology and microbiology.
- PSO-5.** Develop technical skills in biotechnology, bioinformatics and biostatistics.
- PSO-6.** Delve into the wonderful world of insects, their success on the planet and their diversity .
- PSO-7.** Acquire knowledge on harmful and beneficial insects, their adaptations for life and control measures.
- PSO-8.** Perform laboratory procedures as per standard protocols in the areas of animal diversity, systematics, cell biology, genetics, biochemistry, molecular biology, microbiology, physiology, immunology, developmental biology, environmental biology, ethology, evolution and Entomology.

Course Outcomes:

M.Sc. Part- I Semester-I (Entomology)

ZOUT 111 Biochemistry and Biochemical Techniques

At the end of course students will able to

- CO1:** Define basic terms in biochemistry and biochemical techniques.
- CO2:** Explain the applications of the various biochemical techniques.
- CO3:** Explain the structure and functions of various biomolecules.
- CO4:** Explain the importance of tools and techniques in biology.
- CO5:** Illustrate the importance of pH, buffer and water in living systems.
- CO6:** Illustrate the principle, working and applications of basic techniques used in biology.
- CO7:** Draw the structures of various carbohydrates and amino acids.
- CO8:** Classify enzymes with examples.

Biochemical techniques:

- CO1:** Explain the importance and applications of techniques in biochemistry.
- CO2:** Explain the principle and applications of various chromatographic techniques with examples.
- CO3:** Explain the principle, working, materials used and applications of _____

electrophoresis.

CO4: Describe the concept of light, electromagnetic spectrum and its application in absorption spectroscopy.

CO5: Illustrate the importance of radioactive compounds and radioactivity in biology.

CO6: Demonstrate the principle and working of Warburg's apparatus.

CO7: Demonstrate the principle, working, applications of centrifugation.

CO8: Justify the applications of radioactivity compounds in biology.

ZOUT 112 Cell Biology and Developmental Biology

At the end of course students will able to

CO1: Label the various cell parts

CO2: Sketch and label various types of cells and cell organelles.

CO3: Explain carbon as backbone of biomolecules.

CO4: Explain the ultrastructure and functions of various cell organelles.

CO5: Explain the concepts of cell signalling.

CO6: Illustrate the chemistry and organization of cytoskeleton.

CO7: Illustrate the types, development and causes of tumor.

CO8: 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 fertilization and cleavage pattern.

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

CO5: Describe neural competence and induction.

CO6: Explain the concept of growth and differentiation.

CO7: Illustrate postembryonic development.

CO8: Compare and contrast spermatogenesis and oogenesis

ZOUT 113 Genetics and English in Scientific Communication.

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

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.

CO5: Explain the principles of Population genetics.

CO6: Illustrate the modified Mendelian laws of inheritance.

CO7: Justify the inheritance of qualitative and quantitative traits.

CO8: Solve the problems based on gene frequency.

English in Scientific Communication:

CO1: Write the outline of a scientific paper.

CO2: Write the title, abstract, discussion and citations of a given scientific article.

CO3: Prepare a scientific presentation using PowerPoint.

CO4: Explain language as a tool for effective scientific communication.

- CO5:** Use the formal elements of specific types of scientific writing.
- CO6:** Critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.
- CO7:** Practice the unique qualities of professional rhetoric and writing style, such as sentence conciseness, clarity, accuracy, honesty, avoiding wordiness or ambiguity, using direct order organization, readability, coherence and transitional devices.
- CO8:** Justify the importance of plagiarism check and Proof-read given article.

ZODT 114 Freshwater Zoology Semester I

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

- CO1:** Enlist the diagnostic features of shrimps.
- CO2:** Explain the types of aquatic habitats.
- CO3:** Discuss the aquatic adaptations of common freshwater forms.
- CO4:** Explain the adaptations in freshwater Turtles and Crocodiles.²⁶
- CO5:** Illustrate the physicochemical properties of water.
- CO6:** Demonstrate the effect of pollutants on freshwater bodies
- CO7:** Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

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.
- CO6:** Evaluate the bio-indicators of pollution in freshwater.

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 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.

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:** Describe the role of osmoregulatory and gastrointestinal hormones.
- CO4:** Explain the role of hormones in moulting, change in body colour of crustaceans; yolk synthesis in amphibians; insect development.
- CO5:** Explain the hormonal regulation of metabolism.
- CO6:** Illustrate the mechanism of hormone action and role of hormone receptors.
- CO7:** Justify hormones as coordination molecules.
- CO8:** Justify the significance of biological clocks and rhythm

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.
- CO6:** Illustrate the process of parasitic infections to human.
- CO7:** Justify the importance of control strategies against parasitic infections.
- CO8:** Justify the significance of vectors and disease transmission

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.
- CO6: Compare the physiology of regulatory mechanisms in various groups of animals.
- CO7: Justify the survival strategies of organism in varied climatic conditions.
- CO8: Justify the evolution of various life processes in living forms.

Environmental Biology:

- CO1: List the endangered, endemic and extinct animal species of India.
- CO2: Identify various types of natural resources, human impact on these resources, and common resource management practices.
- CO3: Explain the structure and impact of biogeochemical cycles, ecosystems and energy transformation across trophic levels.
- CO4: Describe concepts in population ecology and their significance.
- CO5: Discuss environmental hazards and risks and the socio-economic implications.
- CO6: Illustrate the impact of climate and anthropogenic factors on biodiversity with reference to India.
- 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.
- CO4: Illustrate the physiology of reproductive and endocrine organs in fish.
- CO5: Discuss the signs, symptoms and control measures of common diseases in fish.
- CO6: Justify the role of respiratory and excretory organs in survival of fishes.
- CO7: Classify fishes upto order level.
- CO8: Setup aquarium and manage it.

ZOUP 125 Basic Zoology Lab-2

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, freshwater planktons and slides of endocrine glands.
- CO2: Explain the principle and significance of gonadectomy, thyrorectomy and 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. Part- I Semester-II (Entomology)

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.

ZOUT 231: Entomology- I 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.
- CO5:** Explain the Comparative anatomical and histological structure of various body systems.
- CO6:** Explain the location structure and functions of various Endocrine and Exocrine glands.
- CO7:** Explain the location and structure of Light and Sound producing organs in various insects

ZOUT 232: Fundamentals of Systematics and Economic Zoology Semester III

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

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.
- CO5:** Illustrate the methodologies used in systematics.

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.
- CO5:** Justify the use of animals in pharmaceutical research.
- CO6:** Explain coral reef and its significance.

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.
- CO5:** compare and contrast quantitative and qualitative research paradigms
- CO6:** Use sampling methods, measurement scales and instruments, and appropriate uses of each.
- CO7:** Justify the rationale for research ethics,

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.
- CO5:** Demonstrate the process of excretion, detoxification and water balance
- CO6:** Justify the role of insect hormones in physiological processes.

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
- CO5:** Illustrate the events and dynamics of inflammation
- CO6:** Compare the MHC molecules and diseases associated with HLA.
- CO7:** Differentiate between active and passive immunization
- CO8:** Compare the three pathways of complement fixation pathway.

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.
- CO4:** Demonstrate the double diffusion techniques.
- CO5:** Detect the human blood groups by antigen -antibody reactions
- CO6:** Prepare the human blood smear to identify various blood cells.

ZOUP 235: Special Lab I Semester III

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

Module-I: Animal Physiology-I

- CO1:** Demonstrate the effect of body size and salinity on oxygen consumption in given animal.
- CO2:** Demonstrate the effect of starvation on liver and muscle glycogen in given animal
- CO3:** Demonstrate the effect of exercise on breathing, pulse rate and blood lactate level.

- CO4:** Demonstrate the effect of pH, temperature and inhibitors on salivary amylase.
CO5: Map the taste buds on human tongue

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.
CO5: Compare the methods of collection and curation of insects.
CO6: Identify the poultry breeds.
CO7: Identify edible freshwater fish from nearby area.
CO8: Demonstrate the apiculture equipment.
CO9: Demonstrate the methods of prawn culture.
CO10: Compare various fishing tools, crafts and gears.

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.
CO5: Conduct a scientific survey.
CO6: Perform protein purification experiment.
CO7: Demonstrate the heart and haemocytes of cockroach.
CO8: Demonstrate the effect of starvation on glycogen in insects.
CO9: Demonstrate the effect of temperature on water loss in cockroach.
CO10: Detect the amino acids in insect haemolymph by chromatographic method.
CO11: Determine the oxygen consumption in dragon fly nymph
CO12: Perform the assay of amylase activity in midgut of insect

M.Sc. Zoology, Part II, Semester – IV

ZOUT 241: Entomology- II (Special Paper) (4 Credits: 60 Lectures) 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.
CO5: Explain Hadorn's experiments with imaginal disc, Regeneration and Aging.
CO6: Explain Occurrence, Initiation, Preparations for diapauses and its Controls.

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.
- CO5:** Prepare the flow chart to demonstrate the hormonal coordination of reproductive Processes
- CO6:** Justify the artificial control of reproduction.

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.
- CO5:** Illustrate the preparation and management of fish culture ponds.
- CO6:** Demonstrate the methods of packaging and transport of fish and brood fish.
- CO7:** Illustrate techniques of fish harvesting, preservation & processing.
- CO8:** Compare the techniques used in fishery development.

ZODT 243: Pest Control Semester IV

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

- CO1:** Explain the Pest, nature of damage caused by pests and pest control.
- CO2:** Explain medical, veterinary, Household and stored grain pests.
- CO3:** Explain the Principles and methods of pest control including Biological control measures.
- CO4:** Explain the Integrated pest management (IPM)
- CO5:** Explain the Non- insect pest and their control: Rat, Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels.
- CO5:** Explain the principle and working of pesticide appliances.

ZODP 243: Zoology Practical Paper- 4 Semester IV

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

Animal Physiology- II

- CO1:** Determine the bleeding and clotting time of human blood.
- CO2:** Demonstrate the invertebrate heart.
- CO3:** Calculate the heartbeats of *Daphnia/Drosophila* larva.
- CO4:** Determine serum urea and protein and glucose in human blood and urine.
- CO5:** Justify the effects of various physical and chemical factors on frog heart and muscle.

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.
- CO4: Identify the different post-embryonic stages of insects.
- CO5: demonstrate various body organs, systems and appendages of housefly and butterfly.

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.
- CO4: Sketch and label the microscopic details of tissues.
- CO5: Prepare the permanent histological slides.

Pest Control

- CO1 : Identify beneficial and harmful insects.
- CO2 : Identify and classify insect pest of agricultural, veterinary and public health importance.
- CO3 : Know the effects of contact insecticides and fumigants on behavior of insect pests.
- CO4 : Determine the LD₅₀
- CO5 : Behavior of insects to repellants and attractants.
- CO6 : Know the principle and working of pesticide appliances.⁴⁵
- CO7 : Identify and know the role of biological controlling agents.
- CO8 : Know the non-insect pests.

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.
- CO5: Illustrate the bee keeping as occupation.
- CO6: Justify the presence of bees to increase the agriculture productivity

ZODP 244: Zoology Practical Paper- 5 Semester IV

Module- I : Practicals corresponding to ZOUT 242 MRP,

Module- II: Practicals corresponding to ZOUT 242 Aquaculture and

Module- III: Practicals corresponding to ZODT 244 Apiculture

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

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.
- CO5:** Perform vaginal smear technique to identify the phases of oestrous cycle.
- CO6:** Distinguish the male and female anatomical features of reproductive system in mammals.

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.
- CO5:** Test the freshness of fish/prawn by biochemical methods.
- CO6:** Prepare the culture of Daphnia and rotifers.
- CO7:** Estimate the productivity of water bodies.

Pollution Biology

- CO1:** Identify the bioindicators from given water sample.
- CO2:** Write a report on eutrophication of water body.
- CO3:** Determine the LC50 value for the given compound
- CO4:** Determine the biomass of given sample.
- CO5:** Analyze pH and salinity of given sample.
- CO6:** Estimate calcium and magnesium, sulphate from polluted water.

Apiculture

- CO1:** Identify the honey bees
- CO2:** explain the bee morphology and behaviour
- CO3:** Illustrate the bee enemies
- CO4:** Justify the rearing techniques and bee management


 Head of Dept.
HEAD
 DEPARTMENT OF ZOOLOGY
 G.M.D. Arts, B.W. Commerce
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