

PROGRAM OUTCOME AND COURSE OUTCOMES OF POSTGRADUATE COURSE

M. Sc ZOOLOGY

VISION AND MISSION STATEMENTS

VISION

To provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge ; and to help students to mould themselves to become model practitioners and contributors in Zoology.

MISSION

The Mission of M.Sc Zoology program is to full fill the inquisitiveness of students in areas of Zoology and its allied subjects by giving exposure to cutting edge knowledge and experiences in practical aspects thereby contributing to personal development and service to society

PROGRAM OUTCOME FOR M.SC. ZOOLOGY

Student will be able to develop knowledge and understanding of living organisms at several levels of biological organization from the cellular through molecular to whole organisms level and at ecosystem level in an evolutionary perspective. Student will be able to acquire knowledge related to concepts like ecology, evolution, taxonomy, biochemistry, molecular biology etc. and apply the knowledge in new situations. The student will develop skills in experimental techniques in the subjects of study. The student will be able to develop scientific way of thinking and scientific attitude pertaining to the concepts in ecology, evolution, taxonomy, biochemistry, molecular biology etc

FIRST SEMESTER THEORY

ZOL1C01 - BIOCHEMISTRY AND CYTOGENETICS

COURSE OUTCOMES [COs]

- CO1. The student will describe the importance of various chemical interactions in the biological system.
- CO2. The Student develops the ability to analyze the structure, classification, and biochemical properties of carbohydrates from other organic molecules.
- CO3. The student develops the ability to describe classification, structural organization, and purification techniques of proteins.

- CO4. The student acquire knowledge regarding the classification and functions of lipids and fatty acids.
- CO5. The student develops appreciation on the mechanisms of enzyme action, inhibition, and acquire knowledge regarding classification of enzymes that facilitate the functioning of enzymes.
- CO6. The student develops appreciation on Watson and Crick model of DNA.
- CO7. The student will explore various anabolic and catabolic pathways of biomolecules such as glucose, nucleic acids, amino acids and lipids.
- CO8. The student develops a conceptual knowledge regarding the principles of energetics in biological systems.
- CO9. The student acquire knowledge about the structure and functions of Cellular components, plasma membrane and its models, membrane transport mechanisms and properties , cytoskeletal elements and Intracellular trafficking.
- CO10. The student gain knowledge of Chromatin structure and chromosomal alterations, Interrupted genes, gene families and extra chromosomal inheritance.
- CO11. The student explore and appreciate the importance of cellular adhesion molecules, cell-cell and cell -matrix interactions, intercellular communications along with noted signal transduction pathways and intracellular signaling mechanisms and their significance.
- CO12. The student will describe the process and significance of necrosis and apoptosis and, its regulation in the cellular level.

FIRST SEMESTER THEORY

ZOL1C02 - BIOPHYSICS AND BIOSTATISTICS

Course outcomes (COs)

- CO1. The student develops conceptual knowledge regarding the basic principles of physics involved in biological processes.
- CO2. The student appreciate the biological aspects and implications of sound energy.
- CO3. The student will be able to differentiate various ionizing radiations and to understand a comparative account of their biological effects.
- CO4. The student may familiarize with various biophysical and electrophysiological methods.
- CO5. The student gain conceptual knowledge on the principles of microscopy.
- CO6. The student explore the possibilities of the applications of separation techniques.
- CO7. The student will describe gravity 'G' force and its multi-faceted applications.

- CO8. The student will explore and appreciate nano technology as a highly promising arena in biological investigations.
- CO9. The student skills in various methods of data collection, tabulation and presentation of data for biological research.
- CO10. The student develops ability to apply measures of central tendency and dispersion in biological research, and various types of probability distribution.
- CO11. The student analyze and apply parametric and non parametric tests and its applications in biological research.
- CO12. The student learn how to apply different types of ecological indexes in biological Research.

FIRST SEMESTER THEORY

ZOL1C03 - ECOLOGY AND ETHOLOGY

Course outcomes (COs)

- CO1. The student develops ability to differentiate between the concepts of Habitat, Niche.
- CO2. The student explain the concepts of, Ecosystem energetic sand Mineral cycling.
- CO3. The student learn to appreciate nature's way to maximize efficiency in utilization of energy and resources; to reduce competition.
- CO4. The student will be able describe the characteristics of population growth and species interaction.
- CO5. The student will explain the components of Ecological community, the process of Ecological succession, Biomes etc.
- CO6. The student will appreciate the complexity of relationship between organisms.
- CO7. The student will be able to describe the characteristics of various biogeographically realms, and Indian biodiversity.
- CO8. The student will be able to give explanation to the differential distribution of organisms across the world.
- CO9. The student will describe the characteristics of various biogeographically realms, and Indian biodiversity.
- CO10. The student will explain the concept of Carbon credit, Carbon trading etc.
- CO11. The student will learn to analyse various aspects of Green building technology and interlinking of rivers.

- CO12. The student learn to appreciate the richness of Indian biodiversity and various strategies of Wildlife conservation.
- CO13. The student will be able to describe the components of animal behaviour, factors of motivation and conflict behaviour, properties of instinctive behaviour, types of learning, adaptiveness of behaviour, importance of biological rhythms and parental care, influence of hormones on behaviour.
- CO14. The student develops appreciation about the importance of nature watch and field study.

FIRSTSEMESTER PRACTICALS

ZOL2L01 – BIOCHEMISTRY

- CO1. The student develops skills to perform and compare the importance of pH in biological processes.
- CO2. The student familiarize with qualitative tests to identify and distinguish various carbohydrates.
- CO3. The student learn to conduct qualitative analysis to identify proteins and nonprotein nitrogenous substances.
- CO4. The student acquire skills to perform quantitative tests for carbohydrates, lipids, proteins and non- protein nitrogenous substances.

ZOL2L02 – CYTOGENETICS

- CO1. The student develops skills on the basics of differential centrifugation.
- CO2. The student explore the knowledge to process and visualize salivary gland polytene chromosome from drosophila larva.
- CO3. The student gain hands own training in preparing squash preparation of grass hopper testis , to visualize stained chromosomes to identify meiotic stages.
- CO4. The student will be able to compare and evaluate the karyotypes and Abnormalities.

ZOL2L01 - Biophysics and Biostatistics

- CO1. Th student familiarize with the instruments/ techniques in biophysics; P_H meter, Paper chromatography, TLC, Gel electrophoresis

- C02. The student learn the applications of colorimetry in quantitative analysis C03 The student gather knowledge regarding collection, grouping and graphical representation of data with special emphasis on Microsoft Excel.
- C04. The student learn to calculate measures of dispersion and their applications in data analysis.
- C05. Familiarising with data interpretation in statistics; ANOVA, Correlation and Regression analysis.

SECOND SEMESTER THEORY

ZOL2C04-PHYSIOLOGY

Course outcomes (Cos)

- CO1. The student create an awareness among the society to promote balanced lifestyle and improve people's diet.
- CO2. The student will be able to explain the role of nutrition in health.
- CO3. Discuss the physiology of various organ systems in the body.
- CO4. The student will be able to differentiate the structure and functions of various organs in the human body.
- CO5. The student will describe different functional areas of cerebral cortex.
- CO6. The student will describe the cardiac cycle.
- CO7. The student will be able to discuss the physiology and mechanisms of respiration.
- CO8. The student will Identify and define neuro-anatomical structures.
- CO9. The student will summarize the various neurological disorders.
- CO10. Discuss different types of excretory organs in different animal groups.
- CO11. Explain the role of excretory system in the regulation of water balance, acid base balance and electrolyte balance.
- CO12. Identify the symptoms of life style diseases and suggest ways to control them.
- CO13. Explain the environment's influence on the physiological function and performance of living Organisms.

SECOND SEMESTER

ZOL2C05 - MOLECULAR BIOLOGY

Course outcomes

- CO1. The student will acquire knowledge regarding the mechanism of DNA replication- both chromosomal and extra chromosomal, enzymes involved, models of replication, inhibitors and the significance of DNA replication.
- CO2. The student learn to know the safeguard systems of DNA, restriction enzymes and their significance, mechanisms involved in damage and repair of eukaryotic DNA and its importance.
- CO3. Learn to explain the general features of genetic code, special features of the genetic code in mitochondria, and variations in genetic code.
- CO4. The student gain in-depth knowledge regarding the structural organization of mRNA in prokaryotes and eukaryotes, the mechanism of transcription, translation, post transcriptional and translational modifications, structure, biogenesis and role of ribosomes in protein synthesis; and RNA editing.
- CO5. The student will gain knowledge regarding the regulation of gene expression in Phages, Bacteria, and in Eukaryotes; recent research findings like antisense RNA strategies and role of si RNA and mi RNA in the regulation of eukaryotic gene expression and their applications.
- CO6. The components, organization and special features of eukaryotic genome, interrupted genes and their evolution; concept of gene families, and molecular evolutionary clock.
- CO7. Introduction to transposition mechanisms in prokaryotes and eukaryotes, and their significance.
- CO8. Molecular mechanisms of genetic recombination, models, and significance.
- CO9. Special features of microbial genetics, and organelle genome, their replication and mapping.
- CO10. The student gain an in depth knowledge regarding the events and regulation of cell cycle, its alteration and causes of cancer. Genes involved in the regulation of cancer and modern therapeutic interventions like immunotherapy and gene therapy.

SECOND SEMESTER THEORY

ZOL2C06 - SYSTEMATICS AND EVOLUTION

Part –A: Systematics

Course outcomes (Cos)

- CO1. The student develops skills in the identification and taxonomic classification of organisms based on their characters.
- CO2. The student will be able to describe different levels of taxonomy.
- CO3. Aware about Place, importance, applications and goals of taxonomy.
- CO4. Learn about purpose of classification, use of classification, theories of biological classification and types of classification
- CO5. Explain taxonomic procedures like Taxonomic collections, Curation, Recording of field data, storage of collection, labelling and cataloguing of collection Identification- methods of identification, Use of keys, Taxonomic descriptions, Taxonomic and ecological publication and their difference.
- CO6. The student will acquire knowledge regarding Species concept and the taxonomic diversity within species, different kinds of species, sub species and other infra specific categories, hybrids.
- CO7. Recognize the importance of Zoological nomenclature, International Code of Zoological Nomenclature.
- CO8. Interpret Principle of priority, Homonymy and Synonymy and Different kinds of types in descriptive taxonomy.
- CO9. Use new trends in Systematics especially Chemo and Serotaxonomy, Cytotaxonomy, Numerical taxonomy, Cladistics, Molecular systematics and DNA bar coding vs traditional taxonomy.
- CO10. Recognize the ethics related to taxonomic collections and publication.
- CO11. Realize the taxonomic impediments.
- CO12. Describe the mechanism of natural selection and the evolutionary mechanisms.
- CO13. Explain tempo of evolution.
- CO14. Describe molecular evolutionary theories like Neutral theory of molecular evolution, Molecular clocks- genetic equidistance- human mitochondrial molecular clock and Phylogenetic relationships.
- CO15. Recognize Evolutionary trends in Biochemical evolution and primates evolution.

- CO16. An enhanced knowledge about the Mechanism of natural selection.
- CO17. The student develops conceptual understanding on Hardy-Weinberg law, founder principle, bottleneck effect and genetic drift, process of Isolating mechanisms- Prezygotic and Postzygotic isolating mechanisms; speciation-allopatric, peripatric-parapatric-heteropatric-sympatric speciation; ecotypes etc.
- CO18. The student develops appreciation about the major processes involved in the Co-evolution; Microevolution, Macroevolution etc.
- CO19. The process involved in the Gradualism and punctuated equilibrium along with anagenesis and cladogenesis will be acquired.
- CO20. An enhanced level of conceptual learning regarding Neutral theory of molecular evolution; molecular divergence; molecular drive, Molecular clocks- genetic equidistance- human mitochondrial molecular clock , Phylogenetic relationships- DNA barcoding vs traditional taxonomy etc.
- CO21. An elevated understanding of the Biochemical evolution- Collapse of Orthogenesis along with Stages in primate evolution ; African origin for modern humans, Y-chromosomal Adam-mitochondrial Eve, the process of Communication, speech, language and self awareness in Primates etc.

SECOND SEMESTER PRACTICALS

ZOL2L02 – PHYSIOLOGY

Course outcomes

- CO1. The student gain practical knowledge regarding the methods of analysis of enzyme activity and its dependent factors.
- CO2. The student will compare the effects of biotic and abiotic factors on aquatic life.
- CO3. The student gain a thorough practical knowledge related to the analysis of various blood parameters.

ZOL2L02- MOLECULAR BIOLOGY

Course outcomes

- CO1. The student develops practical knowledge to isolate genomic DNA from animal tissues.

- CO2. The student acquire hands own training in the Quantification of DNA, RNA and Proteins by colourimetric methods.
- CO3. As a Core curriculum course, students completing this course along with the practical sessions will demonstrate competence in gathering, analyzing, synthesizing, evaluating and applying information gathered.

ZOL2L03- SYSTEMATICS AND EVOLUTION

Course outcomes

- CO1. The student may gather basic knowledge regarding Collection and Identification of animals up to species level.
- CO2. Scientific handling of specimens collected, preservation and museum Curation.

THIRD SEMESTER THEORY

ZOL3C07 – IMMUNOLOGY

Course outcomes

- CO1. An in depth knowledge in the process of immune cell synthesis and maturation, antigen receptor structure and the mechanisms of antigen recognition by B-cell and T-cells.
- CO2. The student will explore the Structure and diversity of immunoglobulins, antigens and its classification, production and clinical uses of monoclonal antibodies and antigen antibody interactions.
- CO3. The student gain conceptual knowledge regarding key principles, procedure and applications of different Immunetechniques used in the biomedical field and to develop new methods and techniques on the basis of the earned knowledge.
- CO4. Mechanisms of humoral and cellular immunity, immune cell receptor and intracellular signal cascades related to immune system activation and response.
- CO5. The student explore the fundamentals of Immune effector mechanisms, chemical signalling through cytokines, its therapeutic uses and cytokine related diseases.
- CO6. The complement system and its components, hypersensitivity and allergic responses, diseases related to hypersensitivity, autoimmune disorders and complement deregulation.
- CO7. The student will appreciate the scientific principles behind vaccination, types of vaccines and their role in fighting diseases.

- CO8. The student will be able to describe the mechanisms of autoimmunity and immune deficiency Diseases.

THIRD SEMESTER THEORY

ZOL3C08–DEVELOPMENTAL BIOLOGY & ENDOCRINOLOGY

Course outcomes

- CO1. The student will gain knowledge on basic concepts in development.
- CO2. The student will explain the process of gametogenesis, fertilization and embryonic development.
- CO3. The student will appreciate the genetic, cellular and molecular basis of development.
- CO4. The student will describe the process of ageing and mechanisms.
- CO5. The student realize the impact of environment on development.
- CO6. Describe different classes of chemical messengers and their physical characteristics.
- CO7. Explain how the secretion of hormone is regulated through positive and negative feedback mechanisms.
- CO8. Summarize the anatomy, regulation, and physiological functions of the hormones of the hypophysis, thyroid, parathyroid, pancreas adrenal, hypothalamus and adrenal glands.
- CO9. Describe the anatomy of male and female reproductive systems including hormonal functions and pathophysiology.

THIRD SEMESTER THEORY ELECTIVE

COURSE- ENTOMOLOGY-I

ZOL3E0901 -MORPHOLOGY AND TAXONOMY

Course outcomes

- CO1. The student will explain how insects originated and evolved on earth.
- CO2. The student gain knowledge regarding fossil insects.
- CO3. The student will be able to describe diversity, systematics, biology and habits of insects.
- CO4. The student will explore the external morphology of insects.

- CO5. The student will appreciate the behavior and ecology of insects.

THIRD SEMESTER THEORY ELECTIVE

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THIRD SEMESTER PRACTICALS

ZOL4L04 – IMMUNOLOGY

Course outcomes

- CO1. Students may gain a thorough knowledge regarding the immune components and production of antiserum in animals.
- CO2. The student gain hands on training on various immunotechniques.
- CO3. Students are expected to demonstrate proficiency in Practical immunology in order to satisfactorily complete the course. In addition, the extent of a student's mastery of these objectives, will help guide the course evaluation and grade. Laboratory sessions throughout the Immunology course will help to integrate theory and practical skills meaning the students learn about all aspects of the field and develop strong transferable skills, both in and out of the lab.

THIRD SEMESTER PRACTICALS

ZOL4L04- Developmental Biology & Endocrinology

Course outcomes

- CO1. The student gain knowledge about the identification of different developmental stages of frog.
- CO2. The student will identify common larval forms.
- CO3. The student gain skills in the vital staining technique.

- CO4. The student will be able to perform the whole mount preparation of different developmental stages of chick embryo.
- CO5. The student will be trained to do the mounting of various larval forms.
- CO6. The student learn the stages of insect development.
- CO7. The student compare morphological and histological details of different types of placenta in mammals.
- CO8. The student appreciate the effects of hormones in amphibian metamorphosis.

THIRD SEMESTER PRACTICALS ELECTIVE

COURSE- ENTOMOLOGY –I

ZOL4L0501 - MORPHOLOGY & TAXONOMY

Course outcomes

- CO1. The student will develop skills in the procedures of collection, preservation, spreading, and curation of insects for scientific studies.
- CO2. The student explore the anatomy of insects through dissections.

FOURTH SEMESTER THEORY

ZOL4C10-BIOTECHNOLOGY&MICROBIOLOGY

Part - A. BIOTECHNOLOGY

Course Outcomes (COs)

- CO1. The student learn the features of various types of cloning vectors.
- CO2. The student explore different steps involved in molecular cloning.
- CO3. The student will describe the techniques involved in the production of molecular probes, Genomic and CDNA library.
- CO4. The student evaluate and compare various types of PCR techniques.
- CO5. The student will analyze techniques involved in isolation, sequencing and synthesis of genes.
- CO6. The student explore and appreciate the applications of biotechnology in animal health care, agriculture and environmental protection.
- CO7. The student get familiar with the biotechnological techniques involved in animal cell tissue culture, gene silencing and cloning.
- CO8. The student ethical and social implications of biotechnology.
- CO9. The student understand taxonomy, structure, nutrition, growth of various microbes.

- CO10. The student analyse various types of microbial diseases and its control measures.
- CO11. The student appreciates beneficial effects of microbes.

FOURTH SEMESTER ELECTIVE COURSE- ENTOMOLOGY–II

ZOL4E1101- ANATOMY AND PHYSIOLOGY

Course outcomes

- CO1. The student explore the physiological systems of insects.
- CO2. The student gain ability to explain the anatomy of insects.
- CO3. The student compare embryonic and post embryonic development of insects.
- CO4. The student explore various methods of locomotion of insects.
- CO 5. The student explore physiology and biochemistry of insects through different laboratory experiments.
- CO 6 The student gain hands on experience on the preparation of taxonomic keys, enabling to identify and classify insects.
- CO7. The student explore diversity of insects in their natural habitat by various field visits.

FOURTH SEMESTER THEORY ELECTIVE

COURSE-ENTOMOLOGY-III

ZOL4E1201- AGRICULTURAL, MEDICAL & FORENSICENTOMOLOGY

Course outcomes (COs)

- CO1. The student explore insect pests and types of damage done by insects to plants, pest surveillance and forecasting of pest outbreak.
- CO2. The student identify and evaluate insect pests attacking agricultural crops, their biology, damage, and control measures.
- CO3. The student will appreciate Concepts of Economic levels.
- CO4. The student explore insect vectors of human diseases and their control.
- CO5. The student learn about the principles of insect pest management including ecological based pest management and chemical control.
- CO6. The student gain skills in various equipment for insecticide application.
- CO7. The student evaluate the use of insecticides and its impact on wild life and human health and insecticide resistance.

FOURTH SEMESTER PRACTICALS

ZOL4L04 –BIOTECHNOLOGY

Course outcomes

- CO1. The student secure hands own training to isolate plasmid DNA and RNA from bacteria and other tissues.
- CO2. The student know how to separate DNA /RNA by electrophoresis.
- CO3. The student acquire practical knowledge to work with PCR machine in order to amplify DNA and experience on cell immobilization

ZOL4L04 - MICROTECHNIQUE AND HISTOCHEMISTRY

Course Outcomes

- CO1. The student attain skills in Tissue fixation and staining.
- CO2. Student will demonstrate the differential staining.

FOURTH SEMESTER PRACTICALS

ELECTIVE COURSE- ENTOMOLOGY II

ZOL4L0501 - ANATOMY AND PHYSIOLOGY

Course outcomes

- CO1. The will be trained on the physiology and biochemistry of insects through different laboratory experiments.
- CO2. The student gain hands on experience on the preparation of taxonomic keys, enabling to identify and classify insects.
- CO3. The student will appreciate the diversity of insects in their natural habitat by various field visits.

COURSE- ENTOMOLOGY III

ZOL4L0601 - AGRICULTURAL, MEDICAL AND FORENSIC

ENTOMOLOGY

Course outcomes

- CO1. The student will explore the insect pests attacking various agricultural crops by field observation identification and collection.

- CO2. The student will evaluate the insect pests of man and domestic animals through field visits.
- CO3. The student gain experience of techniques for laboratory rearing of Insect pests and understanding of their life histories
- CO4. The student gain skills on laboratory rearing of parasitoids, and predators by visit to their breeding stations.
- CO5. The student will compare various insecticide appliances and their application in the field.
- CO6. The student will be exposed to industrial entomology by visit to bee keeping stations and sericulture institutes.
- CO7. The student will explore the toxicological studies on insects by visit to toxicological labs.

AUDIT COURSES			
<i>Course Code</i>	<i>Title of the Course</i>	<i>Course Outcomes</i>	<i>Semester</i>
ZOL1A01	Seminar presentation on a frontier area of biological research (AEC - Ability Enhancement Course)	<ul style="list-style-type: none"> ▪ To impart necessary presentation skills to students. ▪ To analyze a research problem. 	1
ZOL2A02	Museum Curation Skills (PCC - Professional Competency Course)	<ul style="list-style-type: none"> ▪ To familiarize them with the diverse techniques and strategies of museum curation. 	2