Programme: M.Sc. (Zoology) (Two-year degree programme)

PROGRAMME OUTCOMES (POs)

PO 1: Gain a thorough grounding in the fundamentals in different areas of Zoology such as ecology, biodiversity, entomology, developmental biology, applied zoology etc.

PO 2: Develop the skill of applying concepts and techniques used in animal sciences.

PO 3: Apply ethical principles in animal behaviour, wild life conservation etc.

PO 4: Effectively aware the society about human wildlife conflict.

PO 5: Develop an attitude to perform effectively and efficiently as a leader as well as a member of a team in a sustainable development.

PO 6: Ability to engage in lifelong learning.

PO 7: To integrate knowledge, skill and attitude that will sustain an environment of learning and creativity among the students.

PO 8: Exposure about museums, zoos, national parks, sanctuaries, apairy, diary, vermicomposts units and laboratories.

PO 9: Enabling students to be capable of making decisions at personal and professional level.

PO 10: Getting prepared for post graduate studies and other competitive exams in order to achieve success in their professional careers.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Students will be able to develop, demonstrate and disseminate the knowledge and skills to laymen about climate change, pollution, communicable diseases and biodiversity.

PSO 2: Students also acquire skills to work as animal trainers; animals care takers, conservationists, lab technicians, zookeeper, wildlife biologists and many more.

PSO 3: Students will be able to play roles of animal breeder, forensic experts, lab technicians etc. which will help learners to possess knowledge and other soft skills and to react aptly when confronted with critical or unethical decision making.

PSO 4: Students will learn modern techniques such as composite culture such as pisciculture, aquaculture, sericulture, lac culture, oyster culture etc. applying these skills in their future careers in Zoology and other applied fields.

PSO 5: Students will be able to develop and demonstrate knowledge of applied zoology in integrated farming system for sustainable development.

PSO 6: Students will gain thorough systematic and subject skills within various disciplines of entomology, parasitology, embryology, physiology, ecology and applied zoology (apairy, diary, vermiculture etc.).

PSO 7: Learners will be able to recognize the role of zoologist, animals and wild life educators, veterinarian, entomologist, parasitologist etc. which will help learners to possess knowledge and other soft skills.

PSO 8: Learners will acquire the skills like effective communication, decision - making, problem solving in day to day life affairs.

PSO 9: Learners will involve in various co-curricular activities to demonstrate relevancy of foundational and theoretical knowledge of their academic major and to gain practical exposures therein.

PSO 10: Apart from theoretical knowledge learners can also acquire practical skills to work as zoo keeper, wildlife educators, animal trainers, veterinarian and various sectors such as healthcare centres, Pharmaceutical companies, pathology labs, medical camps academic institutions etc.

Course	Course outcomes (COs)
	M. Sc. Zoology (1st Sem.)
Biosystematics (ZOO-511)	**CO 1:** Students will learn basics of taxonomy its types, stages of taxonomy and importance of taxonomy in biology. Rules for the classification of organisms, identification criteria and taxonomic characters. **CO 2:** Students will be able to explain various types of species concepts such as typological, biological evolutionary and other kinds of species. **CO 3:** Students will understand morphological, embryological, ecological, behavioural, cytological and biochemical approaches used in taxonomy. **CO 4:** Students will understand various techniques used in taxonomy such as electrophoresis, infrared spectrophotometry, histochemical analysis and DNA hybridization etc.
Structure & Functional Organization of Animal -I (ZOO-512)	**CO 1:** Students will understand basics of nutrition & digestion and mechanism of digestion and regulation of secretion in non-chordates and chordates. **CO 2:** Learners will get knowledge on circulatory system in chordates and non-chordates, types of hearts such chambered, tubular and ampullary hearts, neurogenic and myogenic hearts. **CO 3:** It will equip the students about respiratory system: Types of respiration and types of respiratory organs in aquatic and terrestrial animals. Distribution, role and brief chemistry of respiratory pigments in non-chordates and chordates. **CO 4:** It will brief the students about excretion and osmoregulation, excretory products and excretory structures in non-chordates and chordates.

Evolutionary Biology (ZOO-514)	**CO 1:** Students should know about the evolution of complex organic molecule from complex inorganic compounds and formation of protobionts (first primitive cell). **CO 2:** Equip the students about patterns of similarities and differences among living beings over time and across habitats through action of biological processes such as natural selection, mutation and genetic drift. **CO 3:** Students should learn about phylogeny and evolutionary history of horse and man. **CO 4:** Students should know about geological time scales, eras, epochs and evolution of various animal groups in these ages.
Comparative Vertebrate Endocrinology and Reproduction (ZOO-515)	**CO 1:** Learners will get knowledge on neuro-endocrine glands, structure, secretion, functions and their regulation. **CO 2:** Students will understand mechanisms of hormone action. **CO 3:** Understanding of reproductive patterns and larval forms and their evolution in vertebrates **CO 4:** Students will get knowledge on gametogenesis; Gamete maturation, fertilization, implantation, parturition, lactation and their regulations.
General Microbiology (MICRO-511)	**CO 1:** Students will get knowledge on general history of microbiology, Scope and importance of microbiology. Bacterial cell structure, shapes, cell membrane, cell wall, flagella, capsule, pili, endospores and magnetosomes etc. **CO 2:** Learners will get knowledge onmorphology, habitat, life cycle, nutrition and classification of archaea, fungi (yeats and molds), algae, protozoa and viruses. **CO 3:** It will brief the students about reproduction and growth of microorganisms, growth measurement paremeters, Effect of pH, temperature and oxygen on growth of bacteria. **CO 4:** Students will understand about antibiotics: types, properties, mode of action, drug resistance and mechanism of antibiotic resistance in microbes.
General Biochemistry(BIOCHEM-511)	**CO 1:** Learners will get knowledge on classification, structure and functions of carbohydrates, lipids and nucleic acids **CO 2:** Learners will get knowledge on enzymes: structure, classification, mechanism of action, regulation and factors affecting enzyme action. **CO 3:** It will brief the students about photosynthesis and respiration. General metabolism of carbohydrates, proteins and lipids. **CO 4:** Understanding of genetic material its structure, replication, transcription, translation and recombinant DNA technology.
M. Sc. Zoology (2nd Sem.)	
Structure & Functional Organization of Animal - II (ZOO-521)	**CO 1:** Students will get knowledge on integumentary system: General features of the Integument, specializations of integument and its evolution in various animal groups. **CO 2:** To understand muscular system: Classification of

	muscles, structure and chemical and molecular events occurring during muscle contraction. **CO 3:** To understand skeletal system: Exo and endo skeletons in vertebrates and invertebrates. **CO 4:** Understanding of sensory system: General sensory organs, free sensory receptors, encapsulated sensory receptors, associated sensory receptors and mechanisms of perceiving stimuli.
Embryology (ZOO-522)	**CO 1:** To learn about sex determination and mechanism of sex determination. Differentiation of gonad and the genital tract. Spermatogenesis: structural and molecular events occurring during spermatogenesis. **CO 2:** To know about Sertoli and Leydig cells their structure and functions: Leydig and Sertoli cell proliferation during foetal and postnatal development. **CO 3:** Learners will understand about male sterility and related conditions such as azoospermia, oligozoospermia, asthenozoospermia, varicocele and genetic basis for male infertility. **CO 4:** To know about reproductive cycles in females such as menstrual cycle in human and estrous cycle in rat.
Endocrinology (ZOO-523)	**CO 1:** Students will get knowledge on the basic concepts of endocrinology: introduction to the endocrine system, classes of hormones, modes of hormone secretion and comparative aspects of endocrine physiology in vertebrates. **CO 2:** To know about evolution of pituitary gland and physiological actions of pituitary hormones. Evolution of renin-angiotensin system. **CO 3:** To know about evolution of thyroid gland. Thyroid hormone synthesis and its regulation. **CO 4:** To know about pancreatic hormones and its role in glucose homeostasis.
Limnology(ZOO-524)	**CO 1:** To get basics of Limnology – Definition, historical development and scope of Limnology. Types of freshwater habitats such as ponds, streams and rivers. **CO 2:** Students will get knowledge to analyse methods of water quality testing such as BOD, DO and COD etc. **CO 3:** Students will become aware about resource conservation and other related issues such as aquatic pollution, regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs. **CO 4:** Students will be able to understand about use and misuse of inland waters.
Insect and Environment (ZOO-525)	**CO 1:** Students will get knowledge about apiculture, sericulture and Lac culture **CO 2:** Students will understand the importance of insects as biological control agents, insects as pollution indicator, insects as food, Insects as scavengers and Insects as pollinators. **CO 3:** Students will know about the role of insects in pharmacy and in forensic investigations.

	CO 4: Students will get knowledge about various types of adaptations (Morphological, Ecological, Physiological) found in insects at high altitudes.
Plant and Animal Biotechnology(BT-507)	**CO 1:** To equip the students about plant and animal biotechnology: historical perspectives, laboratory organization and tissue culture media. **CO 2:** Students will get knowledge about molecular markers, construction of maps, molecular breeding and DNA fingerprinting. Also successful examples drought resistant plants such as transgenic papaya, Bt cotton, flavrsavr tomato and golden rice. **CO 3:** Students will get knowledge on animal cell culture. Different types of culture media and application of animal cell culture along with cryopreservation of cell lines, also in-vitro fertilization, embryo transfer technology and animal cloning. **CO 4:** Understanding of stem cells applications in medicine and tissue engineering technologies.
Molecular Biology and Genetic Engineering (MICRO-524)	**CO 1:** Understanding of genetic material: Structure of DNA, replication, DNA damage and repair; Types of RNA and their role in gene expression. **CO 2:** Understanding of translation; components involved, t-RNA as adapter, genetic code and its salient features. **CO 3:** To get knowledge on cloning strategies: cloning of genomic DNA, cDNA cloning, selection and characterization of clones. **CO 4:** To learn about PCR: principle, types and role in molecular biology.
M. Sc. Zoology (3rd Sem.)	
Cytogenetics (ZOO-531)	**CO 1:** To understand Mendelian principles of heredity. **CO 2:** To understand chromosomal aberrations **CO 3:** Polyploidy and its significance. **CO 4:** Students will get knowledge about mutations such as spontaneous and induced, physical and chemical mutagens.
Research Methodology (ZOO-599)	**CO 1:** To equip the students about history, myths and ethnic practices and research process. **CO 2:** To know about how to write synopsis of research projects etc. **CO 3:** To know the importance of computer and informatics in research. **CO 4:** Students should be aware about the current status and future prospects of research
Tools and Techniques in Biology (ZOO-532)	**CO 1:** Students will be get knowledge about microscopy, its principle & applications along with the other techniques used in biochemistry and microbiology. **CO 2:** Students will get knowledge about chromatography, electrophoresis their principles, type and applications. Radioisotopes and main isotope techniques in biology. **CO 3:** Students will learn about histological techniques: Principles of tissue fixation, microtomy, staining, mounting and other parameters used in histochemistry.

	CO 4: Students will study various cell culture techniques: Culture media, essential components and preparation, cell viability and testing etc.
Computational Biology & Biostatistics (BT-505)	**CO 1:** Students will understand basics of biostatistics, concept of variables in biological systems, collection, classification, and tabulation, graphical and diagrammatic representation of numerical data. **CO 2:** Students will learn about correlation and regression coefficients; curve fitting by least squares methods. **CO 3:** Understanding of DNA microarrays, databases and data management cluster analysis. **CO 4:** To equip the students with gene finding algorithms and Hidden Markov Models (HMM) softwares.
Parasitology (ZOO-534)	**CO 1:** Indepth understanding of protozology: Brief history of protozology, ecology and host parasite relationship along with zoonotic potentiality of protozoa. **CO 2:** Students will learn about morphology, life cycle, pathology, symptomatology, laboratory diagnosis and treatment of some pathogenic and non-pathogenic protozoans. **CO 3:** Students will learn about morphology, life cycle, pathology, symptomatology, laboratory diagnosis and treatment of some pathogenic helminths. **CO 4:** Students will learn about arthropod vectors of human diseases. Classification and general characteristics of important insect vectors and mode of transmission of various diseases.
Entomology (ZOO-535)	**CO 1:** Students will understand the history of entomology in India. Factors for insect abundance and classification of phylum arthropoda upto orders. **CO 2:** Students will get knowledge about insect morphology: Body segmentation, structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts and legs. Wing venation, modifications and wing coupling apparatus. Structure of male and female genetalia. **CO 3:** Students will learn about sensory system and sensory organs found in insects. **CO 4:** Students will be able to understand metamorphosis and diapause in insects.
Credit Seminar (ZOO-536)	**CO1:** Develop skills to critically review scientific literature related to zoology. **CO2:** Enhance oral communication skills through effective seminar presentations. **CO3:** Improve scientific writing abilities by preparing seminar reports and abstracts. **CO4:** Foster critical thinking and analytical skills by engaging in discussions and responding to questions. **CO5:** Build confidence and professionalism in presenting and defending scientific ideas before peers and faculty.
M. Sc. Zoology (4th Sem.)	
Insect Diversity and	**CO1:** Understand the classification, taxonomy, and

Physiology (ZOO-541)	evolutionary relationships of major insect groups. **CO2:** Describe the anatomical structure and physiological functions of insect organ systems. **CO3:** Analyze the adaptations of insects to various ecological niches and environmental conditions. **CO4:** Explain insect sensory, nervous, and endocrine systems and their roles in behavior and development. **CO5:** Apply knowledge of insect physiology to issues related to pest management and environmental conservation.
Animal Physiology (ZOO-543*)	**CO1:** Understand the structure and function of major physiological systems in animals, including nervous, muscular, circulatory, and respiratory systems. **CO2:** Explain the mechanisms of homeostasis and regulation in response to internal and external stimuli. **CO3:** Analyze physiological processes such as digestion, excretion, thermoregulation, and reproduction. **CO4:** Apply knowledge of animal physiology to understand adaptations to different environmental conditions. **CO5:** Interpret experimental data related to physiological functions and assess the effects of physiological disorders.
Animal Behaviour (ZOO-544*)	**CO1:** Understand the principles and theories underlying animal behavior and its evolutionary significance. **CO2:** Describe different types of behaviors including innate, learned, social, and reproductive behaviors. **CO3:** Analyze the role of genetics, environment, and physiology in shaping animal behavior. **CO4:** Explain communication methods and signaling mechanisms used by animals. **CO5:** Apply knowledge of animal behavior to conservation, wildlife management, and ethological research.
Wild life and its Management (ZOO-545*)	**CO1:** Understand the diversity, ecology, and behavior of wildlife species in various ecosystems. **CO2:** Explain the fundamental principles and techniques used in wildlife conservation and management. **CO3:** Analyze the effects of anthropogenic activities on wildlife populations and habitats. **CO4:** Evaluate different strategies for habitat restoration, species protection, and sustainable management. **CO5:** Apply legal frameworks and ethical principles in wildlife conservation and management practices.
Project Work (ZOO-500*)	**CO1:** Develop the ability to identify and formulate a research problem in zoological sciences. **CO2:** Plan and execute scientific investigations using appropriate research methodologies and tools. **CO3:** Analyze and interpret experimental data critically and accurately. **CO4:** Enhance skills in scientific writing by preparing detailed project reports. **CO5:** Improve oral communication and presentation skills through project defense and discussions.
Thesis (ZOO-600*)	**CO1:** Design and conduct independent research experiments in zoological sciences with scientific rigor.

	CO2: Collect, analyze, and interpret experimental data using appropriate statistical and analytical tools. **CO3:** Develop critical thinking and problem-solving skills through in-depth research analysis. **CO4:** Prepare a comprehensive thesis document presenting research findings clearly and coherently. **CO5:** Demonstrate effective oral communication skills by defending the thesis before an academic committee.