

Course Outcomes of All Courses of M.Sc. Pre. Zoology

Course Code	Course Title	Course Outcome1	Course Outcome2	Course Outcome3	Course Outcome4	Course Outcome5
M. Sc. Pre Z1	Zoology - I	The first step in classifying an animal is to identify its distinguishing features, or characters. These characters can be physical, such as body size, shape, and color, or behavioral, such as feeding habits and mating rituals. By comparing the characters of different animals, taxonomists can group them into categories based on their similarities.	A clade is a group of organisms that share a common ancestor and all its descendants. Clades are the fundamental units of classification in modern taxonomy. They are based on the principle of monophyly, which means that all members of a clade must share a more recent common ancestor with each other than with any other organism outside the clade.	Once animals have been grouped into clades, they can be further classified into a hierarchy of taxonomic ranks.	There are two main sets of codes that govern the naming and classification of animals: the International Code of Zoological Nomenclature (ICZN) for animals and the International Code of Nomenclature for algae, fungi, and plants (ICPN) for plants, algae, and fungi. These codes ensure that there is a standardized system for naming and classifying organisms, so that scientists from all over the world can communicate with each other clearly.	Animal taxonomy is not just about academic curiosity; it is also essential for conservation efforts. By understanding the relationships between different animals, we can better identify species that are at risk of extinction and develop strategies to protect them. Additionally, taxonomy can help us track the spread of invasive species and diseases.
M. Sc. Pre Z2	Zoology - II	Identify and describe the major invertebrate phyla, their defining characteristics, and evolutionary relationships.	Explain the structural and functional adaptations of invertebrates to diverse habitats and lifestyles.	Analyze the physiological processes of invertebrates, including respiration, circulation, digestion, excretion, and reproduction.	Demonstrate laboratory techniques for observing and studying invertebrate structure and function, such as dissection, microscopy, and staining.	Apply knowledge of invertebrate structure and function to real-world issues, such as conservation, pest control, and disease transmission.

M. Sc. Pre Z3	Zoology - III	Grasp the Fundamentals of Life at the Molecular Level: Explain the structure and function of DNA, RNA, and proteins. Understand the central dogma of molecular biology: DNA replication, transcription, and translation. Analyze mechanisms of gene regulation in prokaryotes and eukaryotes.	Master Key Molecular Techniques: Perform basic gel electrophoresis and DNA extraction techniques. Apply polymerase chain reaction (PCR) to amplify specific DNA sequences. Utilize restriction enzymes and cloning vectors for recombinant DNA manipulation.	Explore Cutting-Edge Genomic and Proteomic Tools: Analyze DNA sequences using bioinformatics tools to identify genes and mutations. Understand the principles of next-generation sequencing (NGS) technologies. Interpret mass spectrometry data to characterize protein structure and function.	Connect Molecular Biology to Diverse Applications: Explain the molecular basis of human diseases and potential therapeutic strategies. Discuss the role of genetic engineering in biotechnology and crop improvement. Analyze ethical considerations surrounding CRISPR-Cas9 and other gene editing technologies.	Develop Scientific Skills and Critical Thinking: Design and interpret scientific experiments related to molecular biology. Evaluate and communicate scientific findings in written and oral formats. Think critically about the latest discoveries and advancements in molecular research.
M. Sc. Pre Z4	Zoology - IV	Analyze the fundamental physiological processes of animals: Explain the principles of homeostasis and its role in maintaining internal balance. Describe the cellular basis of function, including membrane transport, energy metabolism, and signal transduction. Analyze the mechanisms of nerve impulse transmission and muscle contraction.	Understand the function of major organ systems in animals: Explain the physiology of digestion, absorption, and nutrition in different animal groups. Analyze the mechanisms of gas exchange and transport in various respiratory systems. Describe the structure and function of the circulatory system, including blood composition and regulation. Identify the mechanisms of excretion and osmoregulation in diverse animal species.	Explore the influence of environment and adaptation on animal physiology: Discuss the physiological adaptations of animals to extreme environments, such as cold, heat, and dehydration. Analyze the impact of environmental factors like salinity, altitude, and light on animal physiology. Explain the role of physiological adaptations in animal behavior and locomotion.	Integrate knowledge of animal physiology with other disciplines: Apply principles of animal physiology to understand ecological interactions and animal distribution. Analyze the physiological basis of animal behaviors, such as reproduction, communication, and defense. Discuss the application of animal physiology in agriculture, animal husbandry, and veterinary medicine.	Develop critical thinking and research skills in animal physiology: Design and interpret experiments to investigate specific physiological processes in animals. Evaluate and critically analyze scientific literature on animal physiology. Communicate scientific findings effectively through written and oral presentations.

M. Sc. Pre Z5	Zoology - V	<p>Grasp the fundamentals of life at the molecular level: Explain the structure and function of carbohydrates, lipids, proteins, nucleic acids, and other biomolecules. Understand the central dogma of molecular biology: DNA replication, transcription, and translation. Analyze energy metabolism pathways including glycolysis, Krebs cycle, and oxidative phosphorylation.</p>	<p>Explore the intricate world of enzymes and enzyme kinetics: Explain the principles of enzyme catalysis and enzyme specificity. Analyze factors affecting enzyme activity, including pH, temperature, and inhibitors. Predict enzyme reaction rates using Michaelis-Menten kinetics. Diagrams of enzyme structure and illustrations of Michaelis-Menten plots.</p>	<p>Delve into the diverse metabolic processes of living organisms: Analyze the pathways of carbohydrate, lipid, protein, and nucleic acid metabolism in health and disease. Understand the regulation of metabolic pathways based on cellular needs and environmental conditions. Discuss the interconnections between different metabolic pathways and their roles in maintaining cellular homeostasis.</p>	<p>Connect biochemistry to real-world applications: Explain the biochemical basis of human diseases like diabetes, cancer, and neurodegenerative disorders. Discuss the role of biochemistry in biotechnology, drug development, and forensic science. Analyze the metabolic consequences of dietary choices and nutritional imbalances.</p>	<p>Develop critical thinking and research skills in biochemistry: Design and interpret biochemical experiments to investigate cellular processes. Evaluate and critically analyze scientific literature on biochemical topics. Effectively communicate scientific findings through written and oral presentations.</p>
M. Sc. Pre Z6	Zoology - VI	<p>Comprehend the fundamental principles of evolution and their application to animals: Explain Darwinian theory, natural selection, and other mechanisms of evolution. Identify and analyze evidence for evolution from various sources, including paleontology, molecular biology, and comparative anatomy. Discuss the process of speciation and the divergence of animal lineages throughout history.</p>	<p>Utilize biostatistical methods to analyze and interpret biological data: Apply descriptive statistics like measures of central tendency and dispersion to summarize animal data. Perform hypothesis testing using parametric and non-parametric statistical tests. Design and analyze experiments related to animal evolution and ecology.</p>	<p>Integrate evolutionary theory with biostatistical analysis in diverse contexts: Analyze the evolution of specific animal traits and adaptations using relevant statistical methods. Investigate the relationship between environmental factors and animal variation and distribution. Discuss the impact of human activities on animal populations and the potential for evolutionary change.</p>	<p>Develop critical thinking and analytical skills in the context of animal evolution and biostatistics: Evaluate the strengths and limitations of different evolutionary and biostatistical approaches. Interpret scientific literature critically and identify potential biases or errors in methodology. Effectively communicate evolutionary and biostatistical findings in written and oral presentations.</p>	<p>Explore the ethical implications of studying and applying evolutionary and biostatistical knowledge: Discuss the ethical considerations involved in research on animal subjects and conservation efforts. Analyze the potential misuse of evolutionary and biostatistical knowledge for discriminatory or harmful purposes. Promote responsible and ethical application of these disciplines for the benefit of animals and ecosystems.</p>

Course Outcomes of All Courses of M.Sc. Final. Zoology

Course Code	Course Title	Course Outcome1	Course Outcome2	Course Outcome3	Course Outcome4	Course Outcome5
MSc Final Z1	Zoology - I	Students will be able to describe the origin, evolution, and general characteristics of Agnatha (Ostracoderms and Cyclostomes).	Students will be able to explain the early Gnathostomes (Placoderms).	Students will be able to compare and contrast the Elasmobranchii, Holocephali, Dipnoi, and Crossopterygii.	Students will be able to analyze the adaptive radiation in bony fishes.	Students will be able to discuss the origin, evolution, and adaptive radiation of Amphibia.
MSc Final Z2	Zoology - II	Students will be able to explain the concept of ecosystem dynamics and management.	Students will be able to assess the environmental impact on ecosystems.	Students will be able to describe the principles of conservation and biodiversity management.	Students will be able to analyze the organization and dynamics of ecological communities.	Students will be able to discuss the ecological outlook and its implications.
MSc Final Z3	Zoology - III	Students will be able to describe the different cleavage types and give a comparative account of gastrulation in various animals.	Students will be able to explain the processes of neurulation, mesoderm and endoderm formation during early vertebrate development.	Students will be able to distinguish between cell commitment and differentiation and provide examples of cell specification in nematodes and germ cell determinants.	Students will be able to discuss the establishment of body axes in different animals, including the role of proximate tissue interactions and genetics.	Students will be able to explain the concept of homeobox genes and their function in different phylogenetic groups.
MSc Final Z4	Zoology - IV	Students will be able to describe the basic principles and applications of various microscopy techniques, including scanning electron microscopy, transmission electron microscopy, atomic force microscopy, and freeze-fracture replica technique.	Students will be able to explain the principles and applications of various centrifugation and electrophoresis techniques, including differential and density gradient centrifugation, paper, agarose, PAGE, and capillary electrophoresis.	Students will be able to compare and contrast various chromatography techniques, including paper, thin-layer chromatography, gas chromatography, high-performance liquid chromatography, ion exchange chromatography, and affinity chromatography.	Students will be able to discuss the principles and applications of various radiation techniques in biology, including radiation dosimetry, use of radioisotopes and tracers, and autoradiography.	Students will be able to explain the design and applications of various assays, including colorimetric assays, enzyme-linked immunosorbent assays (ELISA), and bioassays.

MSc Final Z5	Zoology - V	Students will be able to describe the factors affecting population growth, including density-dependent and density-independent factors.	Students will be able to explain the different methods of population estimation, including census, sampling, indices, and transect estimates.	Students will be able to discuss the techniques for restoration of wildlife populations, such as captive breeding, soft and hard release, and management of endangered species.	Students will be able to analyze the methods for habitat evaluation, including reconnaissance surveys, permanent condition trend transects, and wildlife evaluation techniques.	Students will be able to explain the concept of environmental monitoring and its importance, including the use of physical, chemical, and biological indicators.
MSc Final Z6	Zoology - VI	Students will be able to describe the major groups of microorganisms including bacteria, archaea, protists, and fungi, and their distinguishing characteristics.	Students will be able to explain the basic principles of microbial growth and metabolism, including the processes of nutrient uptake, energy production, and macromolecule synthesis.	Students will be able to discuss the ecological roles of microorganisms in the environment, including their involvement in biogeochemical cycles, decomposition, and symbiosis.	Students will be able to analyze the applications of microorganisms in various fields, such as biotechnology, medicine, agriculture, and environmental remediation.	Students will be able to explain the principles of microbial control methods, including physical, chemical, and biological methods.

M.Sc. Zoology Program Summary Sheet

S.NO.	Program Outcomes (POs):	Program Specific Outcomes (PSOs):	Program Educational Objectives (PEOs):
PO1/PSO1/PEO1	Analyze and interpret biological data related to animal classification and phylogenetic relationships.	Apply taxonomic principles and codes (ICZN and ICPN) for accurate classification and naming of animal species.	Promote responsible taxonomic practices that consider ethical and environmental implications.
PO2/PSO2/PEO2	Describe the structural and functional adaptations of diverse invertebrate groups to their environments.	Conduct laboratory investigations to observe and analyze invertebrate morphology and physiology.	Apply knowledge of invertebrates to real-world issues like conservation and disease control in a responsible and ethical manner.
PO3/PSO3/PEO3	Explain the fundamental principles of molecular biology and apply them to various cellular processes.	Utilize key molecular techniques (gel electrophoresis, PCR, cloning) to manipulate and analyze DNA.	Uphold ethical considerations in gene manipulation and genetic engineering practices.
PO4/PSO4/PEO4	Analyze the physiological mechanisms and adaptations of animals in different environmental contexts.	Integrate knowledge of animal physiology with other disciplines like ecology and behavior.	Apply insights from animal physiology to inform sustainable practices in agriculture and animal management.
PO5/PSO5/PEO5	Understand the intricate workings of metabolism and its connection to human health and disease.	Analyze biochemical processes using enzyme kinetics and metabolic pathway knowledge.	Apply evolutionary principles and biostatistical methods to analyze and interp
PO6/PSO6/PEO6	Apply evolutionary principles and biostatistical methods to analyze and interpret data related to animal Advocate for responsible application of biochemistry in drug development and forensic science.populations.	Utilize critical thinking and analytical skills to evaluate scientific literature and research methodologies.	Promote responsible and ethical use of evolution and biostatistics for conservation efforts and animal welfare.

Mapping of Course Outcomes of Various Courses of M.Sc. Zoology Program With Program Outcomes (Pos), Program Specific Outcomes (Psos) & Program Educational Objectives (Peos)				
Course Outcome	PO	PSO	PEO	Level
MSC Pre ZOOLOGY PAPER I				
Identify distinguishing features for animal classification	PO 1	PSO 1	PEO 1	Analyze Medium
Understand and explain concept of clades	PO 1	PSO 1	PEO 1	Understand , Medium
Apply cladistics for further animal classification	PO 1	PSO 1	PEO 1	Apply, Medium
Analyze and apply naming codes (ICZN/ICPN)	PO 1	PSO 1	PEO 1	Analyze, Medium
Explain importance of taxonomy for conservation & other issues	PO 1	PSO 1	PEO 1, PEO 2	Apply, Medium
MSC Pre ZOOLOGY PAPER II				
Identify & describe invertebrate phyla, characteristics, & relationships	PO 2	PSO 2	PEO 2	Analyze, Medium
Explain invertebrate adaptations to diverse habitats & lifestyles	PO 2	PSO 2	PEO 2	Apply, Medium
Analyze physiological processes of invertebrates	PO 4	PSO 2	PEO 2	Analyze, Medium
Demonstrate laboratory techniques for studying invertebrate structure & function	PO 2	PSO 2	PEO 2	Apply, Medium
Apply knowledge of invertebrates to real-world issues	PO 2, PO 4	PSO 2	PEO 2, PEO 4	Apply, Medium
MSC Pre ZOOLOGY PAPER III				
Explain structure & function of DNA, RNA, proteins & central dogma	PO 3	PSO 3	PEO 1, PEO 3	Analyze, Hard
Master key molecular techniques (gel electrophoresis, PCR, cloning)	PO 2, PO 6	PSO 3	PEO 2, PEO 3	Apply, Hard
Explore cutting-edge genomic & proteomic tools (NGS, mass spectrometry)	PO 1, PO 6	PSO 3	PEO 1, PEO 3	Analyze, High
Connect molecular biology to diverse applications (diseases, engineering, ethics)	PO 3, PO 4	PSO 3	PEO 1, PEO 3, PEO 5	Apply, Hard
Develop scientific skills & critical thinking (experiments, communication, reflection)	PO 1, PO 2, PO 6	PSO 3	PEO 1, PEO 2, PEO 3	Create, Hard
MSC Pre ZOOLOGY PAPER IV				
Analyze homeostasis, cellular basis of function, & nerve/muscle mechanisms	PO 4	PSO 4	PEO 1, PEO 3, PEO 4	Analyze, Hard
Understand & explain major organ system functions	PO 4	PSO 4	PEO 1, PEO 3, PEO 4	Analyze, Medium
Explore environmental & adaptive influences on physiology	PO 4	PSO 4	PEO 1, PEO 3, PEO 4	Analyze, Medium
Integrate animal physiology with other disciplines	PO 1, PO 4	PSO 4	PEO 1, PEO 3, PEO 4, PEO 6	Apply, Hard

Develop critical thinking & research skills in animal physiology	PO 1, PO 2, PO 6	PSO 4	PEO 1, PEO 2, PEO 3, PEO 6	Create, Hard
MSC Pre ZOOLOGY PAPER V				
Explain structure & function of biomolecules & central dogma	PO 3	PSO 3	PEO 1, PEO 3	Analyze, Hard
Explore enzymes & enzyme kinetics	PO 3	PSO 3	PEO 1, PEO 3	Analyze, Hard
Analyze metabolic pathways & regulation	PO 3	PSO 3	PEO 1, PEO 3	Analyze, Hard
Connect biochemistry to real-world applications	PO 3, PO 5	PSO 3	PEO 1, PEO 3, PEO 5	Apply, Hard
Develop critical thinking & research skills	PO 1, PO 2, PO 6	PSO 3	PEO 1, PEO 2, PEO 3, PEO 6	Create, Hard
MSC Pre ZOOLOGY PAPER VI				
Comprehend evolution principles & evidence	PO 1, PO 4	PSO 6	PEO 1, PEO 3, PEO 6	Analyze, Hard
Utilize biostatistical methods for data analysis	PO 1, PO 6	PSO 6	PEO 1, PEO 3, PEO 6	Apply, Hard
Integrate evolution & biostatistics in diverse contexts	PO 1, PO 4	PSO 6	PEO 1, PEO 3, PEO 4, PEO 6	Apply, Hard
Develop critical thinking & analytical skills	PO 1, PO 2, PO 6	PSO 6	PEO 1, PEO 2, PEO 3, PEO 6	Evaluate, Hard
Explore ethical implications of evolution & biostatistics	PO 3, PO 8	PSO 6	PEO 1, PEO 3, PEO 5, PEO 6, PEO 8	Apply, Medium

Mapping of Course Outcomes of Various Courses of M.Sc. Zoology Program With Program Outcomes (Pos), Program Specific Outcomes (Psos) & Program Educational Objectives (Peos)				
Course Outcome	PO	PSO	PEO	Level
MSC Final ZOOLOGY PAPER I				
Agnatha origin, evolution, and characteristics	PO 1	PSO 1	PEO 1, PEO 3	Analyze, Medium
Early Gnathostomes (Placoderms)	PO 1	PSO 1	PEO 1, PEO 3	Explain, Medium
Compare and contrast Elasmobranchii, Holocephali, Dipnoi, and Crossopterygii	PO 1	PSO 1	PEO 1, PEO 3	Analyze, Medium
Analyze adaptive radiation in bony fishes	PO 1, PO 4	PSO 1	PEO 1, PEO 3, PEO 4	Analyze, Hard
Amphibia origin, evolution, and adaptive radiation	PO 1	PSO 1	PEO 1, PEO 3	Analyze, Medium
MSC Final ZOOLOGY PAPER I				
Explain ecosystem dynamics & management	PO 1, PO 4	PSO 4	PEO 1, PEO 3, PEO 4	Understand, Medium
Assess environmental impact on ecosystems	PO 1, PO 3, PO 4	PSO 4	PEO 1, PEO 3, PEO 4, PEO 5	Apply, Hard
Describe conservation & biodiversity management principles	PO 1, PO 3	PSO 4	PEO 1, PEO 3, PEO 5	Understand, Medium
Analyze community organization & dynamics	PO 1, PO 4	PSO 4	PEO 1, PEO 3, PEO 4	Analyze, Hard
Discuss ecological outlook & implications	PO 1, PO 3, PO 8	PSO 4	PEO 1, PEO 3, PEO 5, PEO 8	Apply, Medium
MSC Final ZOOLOGY PAPER I				
Describe cleavage types & compare gastrulation	PO 3	PSO 2	PEO 1, PEO 3	Analyze, Medium
Explain neurulation, mesoderm & endoderm formation	PO 3	PSO 2	PEO 1, PEO 3	Analyze, Medium
Distinguish cell commitment & differentiation, provide examples	PO 3	PSO 2	PEO 1, PEO 3	Apply, Medium
Discuss body axis establishment in different animals	PO 3	PSO 2	PEO 1, PEO 3	Analyze, Hard
Explain homeobox genes & their function across groups	PO 3	PSO 2	PEO 1, PEO 3	Analyze, Medium
MSC Final ZOOLOGY PAPER I				
Describe microscopy techniques & applications	PO 2	PSO 2	PEO 2, PEO 3	Understand, Medium
Explain centrifugation & electrophoresis techniques & applications	PO 2, PO 6	PSO 2	PEO 2, PEO 3, PEO 6	Analyze, Medium
Compare & contrast chromatography techniques	PO 2, PO 6	PSO 2	PEO 2, PEO 3, PEO 6	Analyze, Medium

Discuss radiation techniques & applications in biology	PO 1, PO 2	PSO 2	PEO 1, PEO 2, PEO 3	Apply, Medium
Explain assay design & applications	PO 2, PO 6	PSO 2	PEO 2, PEO 3, PEO 6	Apply, Medium
MSC Final ZOOLOGY PAPER I				
Describe factors affecting population growth	PO 1	PSO 3	PEO 1, PEO 3, PEO 4	Analyze
Explain population estimation methods	PO 2	PSO 3	PEO 2, PEO 3, PEO 4	Understand
Discuss wildlife population restoration techniques	PO 2, PO 4	PSO 3	PEO 2, PEO 3, PEO 4, PEO 5	Apply
Analyze habitat evaluation methods	PO 2, PO 6	PSO 3	PEO 2, PEO 3, PEO 6	Analyze, Medium
Explain environmental monitoring and its importance	PO 1, PO 4	PSO 3	PEO 1, PEO 3, PEO 4, PEO 5	Apply, Medium
MSC Final ZOOLOGY PAPER I				
Describe major microbial groups & characteristics	PO 1	PSO 2	PEO 1, PEO 3	Analyze, Medium
Explain basic microbial growth & metabolism	PO 1	PSO 2	PEO 1, PEO 3	Analyze, Medium
Discuss ecological roles of microorganisms	PO 1, PO 4	PSO 2	PEO 1, PEO 3, PEO 4	Apply, Medium
Analyze applications of microorganisms	PO 1, PO 4, PO 5	PSO 2	PEO 1, PEO 3, PEO 4, PEO 5	Analyze, Hard
Explain microbial control methods	PO 1	PSO 2	PEO 1, PEO 3	Analyze, Medium