

**DEPARTMENT OF ZOOLOGY
UNIVERSITY OF ALLAHABAD**

Program: B.Sc. Zoology

Learning Outcomes Descriptors and Programme Outcomes (P.O.) for a Bachelor's degree:

Bachelor's degree: The bachelor's degree qualifies students who can apply a broad and coherent body of knowledge and skills in a range of contexts to undertake professional work and/or for further learning.

Descriptor	Knowledge and understanding: The graduates should be able to demonstrate the acquisition of:
P.O. 1.	comprehensive, factual, theoretical, and specialized knowledge in broad multidisciplinary contexts with depth in the underlying principles and theories relating to one or more fields of learning.
P.O. 2.	knowledge of the current and emerging issues and developments within the chosen field(s) of learning.
P.O. 3.	procedural knowledge required for performing and accomplishing professional tasks associated with the chosen fields of learning.
Descriptor	General, technical and professional skills required to perform and accomplish tasks: The graduates should be able to demonstrate the acquisition of:
P.O. 4.	cognitive and technical skills required for performing and accomplishing complex tasks relating to the chosen fields of learning.
P.O. 5.	cognitive and technical skills required to evaluate and analyze complex ideas,
P.O. 6.	cognitive and technical skills required to generate solutions to specific problems associated with the chosen fields of learning.
Descriptor	Application of knowledge and skills: The graduates should be able to demonstrate the ability to:
P.O. 7.	apply the acquired specialized technical or theoretical knowledge, and cognitive and practical skills to gather and analyze quantitative/qualitative data to assess the appropriateness of different approaches to solving problems,
P.O. 8.	employ the right approach to generate solutions to problems related to the chosen fields of learning.
Descriptor	Generic learning outcomes: The graduates should be able to demonstrate the ability to:
P.O. 9.	listen carefully, to read text related to the chosen fields of learning analytically and present complex information in a clear and concise manner to different groups/audiences.
P.O. 10.	communicate in writing and orally the constructs and methodologies adopted for the studies undertaken relating to the chosen fields of learning,

P.O. 11.	make coherent arguments to support the findings/results of the study undertaken to specialist and non-specialist audiences.
P.O. 12.	meet one's own learning needs relating to the chosen field(s) of learning,
P.O. 13.	pursue self-paced and self-directed learning to upgrade knowledge and skills that will help adapt to changing demands of the workplace and pursue higher level of education and training.
P.O. 14.	critically evaluate evidence for taking actions to generate solutions to specific problems associated with the chosen fields of learning based on empirical evidence.
P.O. 15.	make judgement and take decisions based on the analysis and evaluation of information for formulating responses to problems, including real-life problems,

Program Specific Outcomes (PSOs)

PSO1. Comprehend and Recall Biological Diversity

Students will acquire and demonstrate foundational knowledge of animal diversity, morphology, anatomy, physiology, and evolution across non-chordate and chordate phyla. They will understand taxonomic principles, phylogenetic relationships, and the structural-functional organization of animals within ecological and evolutionary contexts.

PSO2. Apply and Analyze Zoological Principles in Life Sciences

Learners will apply zoological concepts to interpret physiological mechanisms, ecological interactions, and genetic inheritance patterns.

They will analyze complex biological systems—such as population dynamics, molecular mechanisms, and developmental processes—to understand adaptation, regulation, and behavior in animals.

PSO3. Perform and Integrate Laboratory and Field Skills

Students will acquire practical proficiency in microscopy, histological preparation, dissection, biochemical testing, physiological recording, genetic experiments, and molecular biology techniques.

They will integrate laboratory and field data, follow safety and ethical standards, and design simple experiments demonstrating independent scientific inquiry.

PSO4. Evaluate Environmental and Ethical Issues in Zoology

Graduates will assess environmental problems such as pollution, habitat degradation, and biodiversity loss, applying zoological knowledge toward sustainable solutions.

They will demonstrate ethical responsibility in animal handling, conservation efforts, and eco-friendly practices, fostering respect for all forms of life.

PSO5. Develop Research Aptitude, Communication, and Lifelong Learning Skills

Students will develop the ability to synthesize information, formulate hypotheses, and interpret data in zoological research.

They will communicate scientific ideas effectively through writing, presentation, and discussion, while cultivating a lifelong commitment to learning, innovation, and interdisciplinary collaboration.

B.Sc. Part II Zoology Theory

PAPER - I

PROTOCHORDATES, ANIMAL DISTRIBUTION AND ECOLOGY

Course Objectives

1. To provide an in-depth understanding of the morphology, anatomy, and classification of Protochordates, including Urochordata and Cephalochordata.
2. To comprehend geological and geographical distribution patterns of animals, faunal regions, and evolutionary implications of fossils.
3. To analyze the structure and function of ecosystems, energy flow, trophic interactions, and population dynamics.
4. To identify and interpret environmental factors influencing animal adaptation and distribution in diverse habitats.
5. To inculcate awareness regarding environmental pollution, wildlife conservation, and sustainable ecological practices.

Course Outcomes (COs)

CO No.	Course Outcomes
CO1	Explain the structural and functional organization of Protochordates and their evolutionary relationships.
CO2	Interpret the geological and geographical distribution of animals with respect to faunal characteristics and fossil evidence.
CO3	Analyze ecosystem structure, energy flow, and nutrient cycling in ecological systems.
CO4	Assess environmental factors, ecological adaptations, and population dynamics in animal communities.
CO5	Evaluate the impact of pollution and human activities on biodiversity and suggest conservation strategies.

CO–PO Mapping

CO No.	PO1	PO3	PO5	PO8	PO10	PO12	PO14	PO18	PO21	PO23
CO1	✓	✓	✓							
CO2		✓	✓		✓	✓				
CO3			✓	✓			✓	✓		

CO4				✓	✓				✓	
CO5						✓	✓	✓		✓

Protochordata, Urochordata, and Cephalochordata

- General characters, anatomy, histology and classification upto orders
- Post embryonic development of Amphioxus and Ascidian
- Interrelationships of Protochordata

Animal distribution

- Geological and geographical distribution of animals
- Nature, age and importance of animal fossils of different geological strata
- Zoo-geographical regions of the world with their faunal characteristics with special reference to mammals
- Factors influencing large scale animal distribution, barriers and dispersal

Ecology

- Definition and scope of ecology
- Concept of structure and function of ecosystem
- Ecological, environmental factors and limiting factors
- Trophic levels, Energy flow and concept of pyramids
- Population dynamics
- Biogeochemical cycles
- Environmental pollution
- Adaptation of animals in deserts and freshwaters
- Wildlife conservation

PAPER II

VERTEBRATA

Course Objectives

1. To provide a comprehensive understanding of vertebrate classification, morphology, and anatomy from Agnatha to Mammalia.
2. To analyze comparative anatomy of major systems including integumentary, skeletal, circulatory, digestive, respiratory, nervous, and urinogenital systems across representative vertebrates.
3. To study the physiological and evolutionary adaptations of various vertebrate groups, highlighting functional morphology and ecological significance.
4. To explore evolutionary and behavioral aspects such as migration, parental care, and origin of vertebrate classes including Amphibia and Reptilia.
5. To understand specialized adaptations such as venom mechanism in reptiles, flight in birds, and aquatic adaptations in mammals.

Course Outcomes (COs)

CO No.	Course Outcomes
CO1	Describe the distinguishing features and classification of Agnatha and Gnathostomata.
CO2	Compare the anatomical organization of major organ systems across representative vertebrates.
CO3	Explain physiological and morphological adaptations related to feeding, respiration, and locomotion in different vertebrate groups.
CO4	Analyze evolutionary trends such as migration, parental care, and origin of Amphibia and Reptilia.
CO5	Evaluate specialized vertebrate adaptations such as venom apparatus, flight mechanisms, and aquatic life in mammals.

CO-PO Mapping

CO No.	PO1	PO3	PO4	PO5	PO8	PO10	PO14	PO16	PO18	PO22
CO1	✓	✓		✓						
CO2		✓	✓	✓	✓					
CO3				✓	✓	✓		✓		
CO4						✓	✓		✓	
CO5					✓	✓			✓	✓

Agnatha

- General characters and classification

Gnathostomata

- General characters, classification and comparative anatomy of the
- Integumentary, skeletal, circulatory, digestive, respiratory, nervous and urinogenital systems with special reference to Scoliodon, Rana, Varanus, Columba and Lepus.

Special topics

- Migration in fishes
- Parental care, origin and evolution of Amphibia
- Sphenodon as living fossil
- Biting mechanism of poisonous snakes; snake venom and antivenom
- Flight adaptation of birds
- Aquatic mammals

PAPER III

GENETICS AND CELL BIOLOGY

Course Objectives

1. To understand the fundamental laws of inheritance, linkage, crossing over, and chromosomal mapping in genetic studies.
2. To gain insights into human genetics, including chromosomal abnormalities, sex determination, blood groups, and inborn metabolic errors.
3. To explore the molecular structure, function, and replication of nucleic acids and understand gene expression and mutations at the molecular level.
4. To familiarize students with cytological and ultrastructural details of cellular components through microscopy and staining techniques.
5. To comprehend the organization and function of the cell cycle, chromosomes, and organelles in maintaining cellular structure and processes.

Course Outcomes (COs)

CO No.	Course Outcomes
CO1	Explain Mendelian inheritance, linkage, and chromosomal mapping principles.
CO2	Describe human genetic disorders, sex determination mechanisms, and metabolic abnormalities.
CO3	Analyze molecular processes of DNA replication, transcription, and translation.
CO4	Discuss mutational mechanisms and outline the basic steps of gene cloning experiments.
CO5	Interpret the ultrastructure and functions of cellular organelles and chromosomal organization in eukaryotes.

CO–PO Mapping

CO No.	PO1	PO3	PO4	PO5	PO8	PO10	PO12	PO14	PO18	PO22
CO1	✓	✓		✓						
CO2		✓	✓			✓				
CO3				✓	✓		✓			
CO4					✓	✓		✓	✓	
CO5				✓	✓				✓	✓

Genetics

- Mendel's law of inheritance
- Linkage, crossing over and chromosome mapping
- Human chromosomes and human chromosomal abnormalities
- Sex linkage and sex determination in *Drosophila* and man
- Sex chromatin bodies
- Dosage compensation and Lyon's hypothesis
- Blood group and haemoglobin genetics in man
- Inborn errors of metabolism in man
- DNA and RNA structure

- Evidences that nucleic acids are the genetic material-transformation in Pneumococcus
- Hershey-Chase experiment
- RNA as genetic material in small viruses
- Replication of DNA-Messelson and Stahl's experiment
- DNA polymerases and in vitro DNA synthesis
- Transcription and translation of genetic information including post-transcriptional changes in RNA
- Genetic code
- Mutations-spontaneous versus induced mutation
- Molecular basis of mutation
- Introductory experimental outline of a gene cloning experiment

Cell Biology

- Principles of fixation, staining and autoradiography
- Fundamentals of TEM and SEM
- Cell cycle, mitosis and meiosis
- Nucleus, Nuclear membrane and nucleolus
- Structure and chemical composition of eukaryotic chromosomes
- Nucleosome structure
- Polytene and lampbrush chromosomes
- Structure and functions of plasma membrane
- Golgi apparatus, mitochondria, lysosomes, endoplasmic reticulum and ribosomes, cilia, flagella, microtubules and microfilaments

B.Sc. Part II - Zoology Practical

PAPER - I

PROTOCHORDATES, ANIMAL DISTRIBUTION AND ECOLOGY

Candidates will be required to show knowledge of classification, morphology, morphology and simple microscopical techniques and to dissect the following animals:

- Herdmania, Ciona or Amphioxus (external features only)

Ecology

- Qualitative study of plankton
- Study of adaptation in animals of different ecosystems e.g. deep sea, desert, nocturnal and hillstream
- Qualitative and Quantitative study of soil organisms

PAPER II

VERTEBRATA

Candidates will be required to show knowledge of classification, morphology, physiology and simple microscopical techniques and to dissect the following animals:

Scoliodon, Rana, Uromastix or any other lizard, Columba or any other bird, rat or squirrel

Osteology of Scoliodon, Labeo, Rana, Varanus, Gallus, rabbit and dog's skull

PAPER III

GENETICS AND CELL BIOLOGY

Genetics

- Construction of human familial pedigree utilising inheritance pattern of a single autosomal or sex linked gene.
- Detection and demonstration of ABO Blood groups in man
- Genetical problems

Cell Biology

- Study of temporary squash preparation of grasshopper testes for mitosis, meiosis, spermatogenesis and sex chromosomes.
- Demonstration of Barr body and mitochondria in buccal epithelium of man
- Cytochemical localisation of nucleic acids and proteins.