

**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,
P.O. 16.	exercise judgement across a broad range of functions based on empirical evidence, for determining personal and/or group actions to generate solutions to specific problems associated with the chosen fields of learning.
Descriptor	Constitutional, humanistic, ethical, and moral values: The graduates should be able to demonstrate the willingness and ability to:
P.O. 17.	Embrace constitutional, humanistic, ethical, and moral values, and practice these values in life.
P.O. 18.	identify ethical issues related to the chosen fields of study,
P.O. 19.	formulate coherent arguments about ethical and moral issues, including environmental and sustainable development issues, from multiple perspectives.

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-III**PAPER-I****MOLECULAR BIOLOGY AND GENETIC ENGINEERING**

Course Outcome (CO No.)	Description
CO1	Describe the organization of the eukaryotic genome, including unique and repetitive DNA sequences, and explain mechanisms of genetic recombination and chromosome mapping in bacteria and viruses.
CO2	Explain the molecular basis of gene regulation in prokaryotes and eukaryotes, including inducible and repressible systems, transposons, and somatic cell genetics.
CO3	Illustrate the structure and function of immune system components—immunoglobulins, MHC complex, and cellular responses—and analyze how gene regulation and somatic hybridization influence immune and malignant cell behavior.
CO4	Demonstrate understanding of the principles and techniques of genetic engineering, including the use of restriction enzymes, cloning vectors, recombinant DNA synthesis, cDNA probe preparation, and sequencing methodologies.
CO5	Evaluate the applications and biosafety implications of recombinant DNA technology in biological research, medicine, agriculture, and industry, including microinjection and transgenic approaches.

Mapping of Course Outcomes

CO No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PO 16
CO 1	✓	✓	✓	✓	✓	✓			✓	✓						

CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Molecular Biology

Eukaryotic genome organisations

Unique and repetitive DNA sequences

Recombination and chromosome mapping in bacteria and virus

Molecular basis of gene regulation in prokaryotes, inducible, repressible systems

Immune system

Cellular components of the immune system

Immunoglobulin

The major histocompatibility complex

The immune system and disease

Somatic cell genetics

Heterokaryons and cell hybrids

Gene regulation in Heterokaryons and somatic cells

Somatic hybridisation studies in malignancy

Transposons

Genetic Engineering

Scope of genetic engineering

Restriction enzymes and their use in gene cloning.

Nucleotide sequencing, isolation and analysis of mRNA and cDNA probes and their synthesis

In vitro synthesis of recombinant DNA and gene cloning techniques

Noncoding intervening sequences within eukaryotic genes

Application of recombinant DNA technology in biology.

medicine, industry and agriculture

Potential hazards of recombinant DNA technology

Microinjecting gene into animal oocytes, eggs and embryos

PAPER II

ECONOMIC ZOOLOGY AND ENVIRONMENTAL BIOLOGY

Course Outcome (CO No.)	Description
CO1	Explain the economic importance of various groups of animals and describe the life cycles, zoonotic significance, and control measures of parasites such as <i>Entamoeba histolytica</i> , <i>Plasmodium</i> , <i>Diphyllbothrium latum</i> , <i>Dracunculus medinensis</i> , ticks, and mites.
CO2	Identify beneficial and harmful insects, understand plant and stored-grain pests, and describe biological and chemical methods for insect pest control including vector-borne diseases such as malaria, dengue, and encephalitis.
CO3	Demonstrate understanding of aquaculture principles, management techniques, and economic importance of fisheries including pearl culture and their role in sustainable resource use.
CO4	Describe the sources, types, and effects of environmental pollution (air, water, soil, and noise) and explain global, regional, and local pollution control measures along with environmental degradation and conservation initiatives such as the Chipko movement.
CO5	Explain the fundamental concepts of toxicology, ecotoxicology, and environmental health, including the behavior and fate of toxicants, radiation hazards, wildlife management, and the impact of urbanization and human activities on health and ecosystem balance.

Mapping of Course Outcomes

C	P	P	P	P	P	P	P	P	P	PO	PO	PO	PO	PO	PO	PO	PO
O	O	O	O	O	O	O	O	O	O	10	11	12	13	14	15	16	17
N	1	2	3	4	5	6	7	8	9								

o.																	
C O 1	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓					
C O 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
C O 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
C O 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C O 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Economic Zoology

Economic importance of different groups of animals in general with exception of Protozoa, Nematoda and Arthropoda which will be dealt at appropriate places

Protozoa: Protozoan parastic diseases of man and domestic animals with special reference to zoonotic significance of Entamoeba histolytica, Plasmodium Protozoa and soil fertility

Platyhelminthes: Life cycle and zoonotic significance of Diphylobothrium latum

Aschelminthes: Life cycle and zoonotic significance of Dracunculus medinensis

Arthropoda: Life cycle and zoonotic significance of representative tick and mite

Beneficial and harmful insects

Plant and stored grain pests and role of insecticides in their control

Interrelationship of mosquito with malaria, yellow fever, danguue, encephalities and dermatobia their prevention and control

Biological control of insect pests

Aquaculture: Its basic concepts, management and economics (including Pearl Fishery)

Environmental Biology

Environmental pollution

Definition and sources of pollution

Different types of pollution such as air, water, soil and noise pollution and their global, regional and local aspects.

Air pollution

Nature of pollutants, their sources and effects on humans, plants and animals and their control

Water pollution

Sources, consequences and control

Soil pollution

Sources, nature and harmful effects

Socio-economic aspects of environmental degradation.

Natural calamities (floods, famines, drought, storm, gale, volcanic eruptions etc.)

Deforestation and desertification, Chipko movement.

deforestation and overgrazing etc

Basic concepts of soil science, soil erosion.

Environmental hazards of radiation, General principles of radiation biology

Introduction, general principles and history of toxicology

Toxicants and industrial effluents, Absorption, distribution and excretion of toxicants and their undesirable effects.

Biological factors affecting toxicity

Ecotoxicology

Environmental health

Animal in relation to human health

Water in relation to human disease, urbanisation stress and health

Behaviour patterns of health and disease

Basic concepts of wild life management

Basic concepts of Environmental monitoring

PAPER III

DEVELOPMENTAL BIOLOGY AND ETHOLOGY

Course Outcome (CO No.)	Description
C01	Describe the mechanisms and types of asexual and sexual reproduction, including gametogenesis, vitellogenesis, parthenogenesis, and metamorphosis, and compare blastogenesis with embryogenesis.
C02	Explain the processes and factors involved in regeneration, including amphibian limb regeneration, regeneration in Hydra, and the histological and physiological basis of metaplasia, field, polarity, and gradients.
C03	Interpret the biological principles of growth, degrowth, aging, and cell death, and analyze the roles of chromosomal engineering, teratogenesis, and biogenetic laws in developmental regulation.
C04	Explain the fundamentals of animal behaviour, distinguishing innate and learned behaviours such as imprinting, fixed action patterns, courtship, and territoriality using ethological methods.
C05	Discuss adaptive and social behaviours such as antipredator strategies, communication, migration, nesting, and social hierarchy, emphasizing their evolutionary and ecological significance.

Mapping of Course Outcomes

CO No.	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
C01	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓					
C02	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓			
C03	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			
C04		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C05		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Developmental Biology

Asexual reproduction

The morphogenetic processes and the stages (blastema, blastogenesis and blastozoids)

The kinds (fission, budding, gemmule formation)

Comparison between blastogenesis and embryogenesis

Sexual reproduction

Gametogenesis (spermatogenesis and oogenesis)

Maturation of gametes

Vitellogenesis

Parthenogenesis

Metamorphosis

The morphogenetic processes and causation in amphibians and insects

Tissue reactivity and induction process

Factors controlling moulting in insects

Regeneration

The morphogenetic processes in regeneration

Ambhibian limb regeneration

Ability of regeneration in different groups of animals

Regeneration in *Hydra*

Histology of regeneration process (metaplasia)

Field, polarity and gradient

Factors influencing regeneration (stimulation, suppression)

Growth and aging

Concept of growth, degrowth and cell death

Mechanism of growth

Growth curves and their interpretation

Type of cell growth

Aging

Miscellaneous: The biogenetic law. Teratogenesis,
Chromosomal engineering and practical implications

Ethology

Innate and learned behaviour

Imprinting and Fixed action Patterns

Methods used in Ethological studies

Antipredator behaviour

How animals defeat their predators by fleeing, fighting, protective
armour, chemical defence, camouflage, warning signals, startle displays

Fighting behaviour

How animals mark their territories and defend them

Perform threat displays and indulge in physical combat

Social behaviour

Advantages of being social

How animals establish social hierarchies, communicate

Mating groups

Courtship displays and courtship behaviour

Nesting behaviour

How animals construct a protective home to rear their young

Migratory behaviour of fish

Migratory behaviour of birds and navigation