

**Program Objective (PO)  
Program Specific Objective (PSO)  
Course Outcome (CO)**

**OF**

**B. Sc. in Zoology**

**B. Sc. in Genetics & Genomics**

**Ph. D. in Zoology**

**DEPARTMENT OF ZOOLOGY  
UNIVERSITY OF LUCKNOW  
LUCKNOW**

## B. Sc. in Zoology

Students of undergraduate degree Programmes of Zoology at the time of graduation will be able to:

### Program Objectives:

Zoology as one of the subjects at undergraduate level, should be studied in an integrated and cross-disciplinary manner with a comprehensive understanding of all living systems and their relationship with the ecosystem. Within the broad-range skill sets related to the discipline, it is required to impart and assess the quality of critical thinking, analytical and scientific reasoning, and problem-solving capacity.

Our undergraduate program in Zoology is designed to prepare students to have:

- PO1. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO2. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO3. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO4. **Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO5. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO6. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO7. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

### Program Specific Outcomes:

- PSO1 Help students to understand life-environment interaction.
- PSO2 Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment
- PSO3 Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
- PSO4 Help students to understand the complex evolutionary processes and behaviour of animals
- PSO5 Correlates the physiological processes of animals and relationship of organ systems
- PSO6 Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species
- PSO7 Gain knowledge of Agro based Small Scale industries like sericulture, fish farming, lac culture etc.
- PSO8 Understand various concepts of genetics and its importance in human health
- PSO9 Apply the knowledge and understanding of Zoology to one's own life and work
- PSO10 Develops empathy and love towards the animals
- PSO11 To perform laboratory procedures

## **Course Outcomes:**

### **Animal Diversity – Lower Non-Chordata**

CO1 Describe general taxonomic rules on animal classification

CO2 Understand the diversity and classification of lower non-chordates (invertebrates)

CO3 To study the habits, morphology, physiology, reproduction and development some type animals from protozoa to nemathelminthes.

### **Higher Non-Chordata from Annelida to Echinodermata**

CO1 Describe general taxonomic rules on animal classification

CO2 Understand the diversity and classification of higher non-chordates (invertebrates)

CO3 To study the habits, morphology, physiology, reproduction and development some type animals from annelida to echinodermata

### **Cell Biology and Genetics**

CO1 Structural and functional aspects of basic unit of life and cell organelles i.e. cell concepts

CO2 Mendelian and non mendelian inheritance

CO3 Concept behind genetic disorder, gene mutations- various causes associated with inborn errors of metabolism

### **Chordata**

CO1 Describe general taxonomic rules on animal classification

CO2 Understand the diversity and classification of chordates

CO3 To study the habits, morphology, physiology, reproduction and development some type animals

CO4 To study comparative anatomy of various vertebrate systems

### **Animal Physiology and Biochemistry**

CO1 Seeks to understand the mechanisms that work to keep the organism alive and functioning

CO2 Physiological and biochemical understanding into the nature of mechanical, physical, and biochemical functions of organs and the cells of which they are composed

CO3 Interactions and interdependence of physiological and biochemical processes

CO4 To understand the basic biochemical building blocks and their metabolism

### **Evolution and Developmental Biology**

CO1 Theories of Evolution

CO2 Evolution of species and their evolutionary processes

CO3 Basic concepts of developmental biology

CO4 Development of non mammalian and mammalian vertebrates

### **Animal Behaviour, Chronobiology, Endocrinology and Neurobiology**

CO1 To understand Animal behaviour and response of animals to different instincts

CO2 To understand how the rhythmic geophysical environment impacts the internal rhythms,

CO3 To understand environmental cues are perceived by the organisms and modulate the circadian physiology at molecular, cellular and systems levels

CO4 To understand the basics of endocrinology and endocrine regulation of different body functions

CO5 To understand the nervous system and its functioning

### **Economic Zoology**

CO1 To gain knowledge of Agro based Small Scale industries

CO2 To understand the life history of parasites of domestic animals

CO3 To understand the life history of vectors and pests

CO4 To study the culture of various organisms for economic benefit

### **Molecular biology and Immunology**

CO1 To study the structure and organization of DNA

CO2 Conversion of genetic information into proteins

CO3 Imparts in depth knowledge of tissues, cells and molecules involved in host defense mechanisms

CO4 Understanding the types of immunity

CO5 Interactions of antigens, antibodies, complements and other immune components

CO6 Understanding of immune mechanisms in disease control, vaccination, process of immune interactions

### **Bioinstrumentation, biotechnology, bioinformatics and biostatistics**

CO1 To study the principles and uses of basic scientific instruments

CO2 To understand the basic concepts of genetic engineering and its applications in various industries

CO3 To understand the application of information technology in biological sciences

CO4 To understand the application of statistical tools on the organisms

### **Environmental biology, Wildlife and Toxicology**

CO1 To understand the ecosystem structure, functions, processes and adaptation

CO2 To understand distribution of animals in various zoogeographical realms

CO3 To understand the concept of wildlife and their conservation

CO4 To understand environmental pollution, pollutants and their control measures

CO5 To understand the xenobiotics and their effects on organisms

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## **B. Sc. in Genetics and Genomics**

Students of undergraduate degree Programmes of Genetics and Genomics at the time of graduation will be able to:

### **Program Objectives:**

Our undergraduate program in Genetics and Genomics is designed to:

PO1 To introduce the student to the main principles of Genetics

PO2 To make student understand the different models of genetic inheritance.

PO3 Help the student to understand the principles of linkage and chromosome mapping.

PO4 Provide students with information on gene interactions, inheritance of complex traits and association mapping.

PO5 To make students aware of and appreciate the animal diversity at different levels.

PO6 To develop a comprehensive understanding of the field through an array of classes.

PO7 To cope up with the challenges arising out of the complexities and limitations of biological system

PO8 Last but not the least to give a holistic view of subject and prepare them for next level of learning

### **Program Specific Outcomes:**

PSO1 Understand and describe key processes involved in the inheritance and expression of genes

PSO2 Analyse and interpret biological and evolutionary problems in terms of genetic/genomics concepts and be able to utilise modern genetic/genomic tools to conduct further investigation

PSO3 Clearly communicate genetic concepts so they are understood across a wide range of scientific disciplines

PSO4 Develop an awareness of genetic issues as they are viewed within society and across cultural boundaries.

### **Course Outcomes:**

#### **Non-Chordata**

CO1 Describe general taxonomic rules on animal classification

CO2 Understand the diversity and classification of non-chordates (invertebrates)

CO3 To study the habits, morphology, physiology, reproduction and development some type animals from protozoa to echinodermata

#### **Basic Genetics**

CO1 To learn the gene structure and functionality

CO2 To learn Mendelian genetics and gene transmission

CO3 To understand the translation, transcription and regulation of gene expression in prokaryotes and eukaryotes

#### **Cell Biology**

CO1 To understand the structural and functional aspects of basic unit of life and cell organelles i.e. cell concepts

CO2 To learn in detail about the nucleus and chromatin structure

CO3 To understand the cell cycle and cell signaling pathways

#### **Chordata**

CO1 Describe general taxonomic rules on animal classification

CO2 Understand the diversity and classification of chordates

CO3 To study the habits, morphology, physiology, reproduction and development some type animals

CO4 To study comparative anatomy of various vertebrate systems

### **Animal Physiology and Biochemistry**

- CO1 Seeks to understand the mechanisms that work to keep the organism alive and functioning
- CO2 Physiological and biochemical understanding into the nature of mechanical, physical, and biochemical functions of organs and the cells of which they are composed
- CO3 Interactions and interdependence of physiological and biochemical processes
- CO4 To understand the basic biochemical building blocks and their metabolism

### **Developmental Genetics, Population Genetics & Behavioural Genetics**

- CO1 To understand the molecular and genetic basis of development in invertebrate and vertebrate models
- CO2 To learn about the Mendelian populations and evolutionary forces modulating them
- CO3 To understand the genotypic and phenotypic relationship and the mechanisms modulating them
- CO4 To study the types of variation, inheritance patterns and their variances
- CO5 To study gene-environment interaction and its impact on animal and human behaviour

### **Applied Molecular Genetics and Bioinstrumentation**

- CO1 To study the various techniques involved in molecular biology
- CO2 To learn recombinant DNA technology and its application
- CO2 To study the principles and uses of basic scientific instruments
- CO3 To understand the basic concepts of genetic engineering and its applications in various industries

### **Biostatistics and Bioinformatics**

- CO1 To learn various biostatistical tools and their application on the organisms
- CO2 To understand the application of information technology in biological sciences
- CO3 Students gain skills in basics of computers, operating systems, overview of programming languages
- CO4 Application of internet and statistical bioinformatics in research

### **Immunogenetics & Microbial Genetics**

- CO1 Provides basics knowledge about immune system and allows the student to create insight as how to improve heir immune system and good health.
- CO2 Types of immunity, antigens-antibodies and their properties CO3 Complement system, MHC's and immune
- CO3 Interactions of antigens, antibodies, complements and other immune components
- CO4 Understanding of immune mechanisms in disease control, vaccination, process of immune interactions
- CO5 Ability to understand concepts of tumor immunology and transplantation immunology
- CO6 To study the methods of inoculation and genetic analysis of mutants
- CO7 To study the evolution of drug resistance and pathogens
- CO8 To study various microbial systems and their biological application
- CO9 To learn different microbial technologies

### **Cancer Genetics & Clinical Genetics**

- CO1 To distinguish between different types of cancers, their cell lines and their properties
- CO2 To study cancer and tumour inducing cell transformation
- CO3 To learn about cancer diagnosis by using genetic markers
- CO4 To learn about karyotype and pedigree analysis
- CO5 To learn about chromosomal, metabolic, genome imprinting and mitochondrial disorders and syndromes
- CO6 To learn identification and management of genetic disorders

**Genomics**

CO1 To study the organization of genome in prokaryotic and eukaryotic systems

CO2 To study comparative genomics to study gene mapping and human disease genes

CO3 To gain knowledge of functional genomics

CO4 To understand the concept, need and process of personalized medicine

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## **Doctor of Philosophy (Ph. D.) in Zoology**

The Department of Zoology brings together researchers from a great diversity of disciplines. What unites us is an interest in the whole organism, and in how systems interact across different levels of organisation to generate the complexity of form, function and behaviour that is observed in the living world. The Ph.D. Program of the Department covers Doctoral research in a variety of disciplines leading to the award of Ph.D. degree. The main objectives of the Ph.D. Program are:

### **Program Objectives:**

- PO1 Formulate scientific issues
- PO2 Perform research by applying scientific methodology and place results in broader context
- PO3 Critically evaluate their own and others' research
- PO4 Co-operate effectively in cross disciplinary research
- PO5 To encourage in-depth analysis and enrich knowledge in the chosen field
- PO6 To critically analyze research findings and to understand their importance in the relevant context.
- PO7 To encourage publication of research papers in academic journals, occasional papers and monographs, books and other refereed forums

### **Program Specific Outcomes:**

By the end of the programme, students will have:

- PSO1 a comprehensive understanding of techniques, and a thorough knowledge of the literature, applicable to their own research
- PSO2 demonstrated originality in the application of knowledge, together with a practical understanding of how research and enquiry are used to create and interpret knowledge in their field
- PSO3 shown abilities in the critical evaluation of current research and research techniques and methodologies
- PSO4 demonstrated some self-direction and originality in tackling and solving problems, and acted autonomously in the planning and implementation of research

### **Course Outcome:**

#### **Research Methodology**

- CO1 The course provides wide knowledge about research, experimental & sampling design,
- CO2 Understanding of scientific method, concepts and steps in research
- CO3 Data collection, analysis & interpretation of data and allows student to present the research data in scientific method
- CO4 Gains skill to solve problems using inferential statistical tools
- CO5 Differentiate between the Quantitative and Qualitative Research and understand different types of Research Design
- CO6 Learns to collect literature collection, literature citation, and components of research report – Text, tables, figures, bibliography.
- CO7 Writing of dissertations, project proposals, project reports, research papers.
- CO8 Intellectual Property Rights – Biopiracy, copyrights, patent and traditional knowledge and plagiarism.
- CO9 Understanding of Laboratory safety measures, laboratory good practices, animal model systems, animal ethics- animal welfare guidelines for care and use of animals.

#### **Bioinstrumentation and Research Techniques**

- CO1 To understand and learn good laboratory practices
- CO2 To understand the principles and applications of basic laboratory methods and instruments



CO3 To understand the various research techniques and methodologies associated with various disciplines of Zoology

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