

# **DAYANAND VEDIC COLLEGE, ORAI**

## **B.Sc. ZOOLOGY**

### **PROGRAMME COURSE OUTCOME**

Zoology is one of the oldest branches of basic natural sciences, which deals with study of classical and modern aspects of Zoology/Animal Sciences and issues related to them.

The lab courses have been designed in such a way that students will be trained to join public or private labs.

#### **Knowledge Apprising:**

After completing B.Sc. Zoology, students will understand –

**PO1:** Candidates will be more equipped to learn and know about modern areas including cell biology and genetics, molecular biology, biochemistry, physiology followed by biostatistics, Evolutionary biology, bioinformatics and genetic engineering have been included to make the study of animals more interesting and relevant to human studies which is the requirement in recent times.

**PO2:** Utilize their knowledge to study animal diversity in Indian subcontinent, environmental science and behavioural ecology.

**PO3:** Moreover, they will be able to qualitatively and quantitatively analyse evolutionary parameters using various bioinformatics and computational tools used in modern sciences.

**PO4:** Students can apply their knowledge to find the further research issues and work in the knowledge gaps. Awareness about the present issues of global and national scale related to environment and conservation will sensitize students and mould them to responsible citizens.

#### **Skill developmental outcomes:**

**PO5:** The programme will cater the basic curiosity of students about the animal sciences and help them to find their career goals.

**PO6:** Candidates may find jobs as Ethologists, Conservationist, Wildlife Biologist, Zoo Curator, Wildlife Educator, Zoology faculty, Forensic experts, Lab technicians, self dependent in terms of higher education and free lancing etc. Candidates find opportunities in government departments, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental/ecological fields.

**PO7:** They will develop good laboratory practices in students and to train them about proper handling of lab instruments.

**PO8:** Acquired skills in diagnostic testing, haematology, histopathology, staining procedures etc. used in clinical and research laboratories will provide them opportunity to work in diagnostic or research laboratory.

**PO9:** Students undertaking skill enhancement courses like aquaculture, sericulture and apiculture will inculcate skills involved in rearing fish, bees and silk moth which would help in getting an insight to create their own small scale startup thereby making them a successful entrepreneurs.

## PROGRAMME SPECIFIC OUTCOMES

- **PSO1:** Understanding basic biology, ecosystem, and basic concepts of nature, ecology, cell biology, biology and zoology as whole.
- **PSO2:** To analyze and bridge between various components of living (animals) and nonliving (abiotic factors).
- **PSO3:** To understand basic laboratory methods for taxonomy, histology, physiology, cell biology, economic zoology, fisheries, field methods, abiotic analysis as well as research methodology.
- **PSO4:** Understanding applied zoology and economic zoology for daily living.
- **PSO5:** Develop insight to understand and address towards environmental issues of the nation and participating in nature drives.

### Structure of UG Program in Zoology

Programme/Year	Semester	Course Codes	Paper Title
<b>1 Certificate Course in Medical Diagnostics &amp; Public Health</b>	I	<b>B050101T</b>	Cytology, Genetics and Infectious Diseases
		<b>B050102P</b>	Cell Biology & Cytogenetics Lab
	II	<b>B050201T</b>	Biochemistry and Physiology
		<b>B050202P/R</b>	Physiological, Biochemical & Hematology Lab
<b>2 Diploma in Molecular Diagnostics and Genetic Counselling</b>	III	<b>B050301T</b>	Molecular Biology, Bioinstrumentation & Biotechniques
		<b>B050302P</b>	Bioinstrumentation & Molecular Biology Lab
	IV	<b>B050401T</b>	Gene Technology, Immunology and Computational Biology
		<b>B050402P/R</b>	Genetic Engineering and Counselling Lab
<b>3 Degree in Bachelor of Science</b>	V	<b>B050501T</b>	Diversity of Non-Chordates, Parasitology and Economic Zoology
		<b>B050502T</b>	Diversity of Chordates and Comparative Anatomy
		<b>B050503P</b>	Lab on Virtual Dissection, Anatomy, Economic Zoology and Parasitology
	VI	<b>B050601T</b>	Evolutionary and Developmental Biology
		<b>B050602T</b>	Ecology, Ethology, Environmental Science and Wildlife
		<b>B050603P</b>	Lab on Environmental Science, Behavioral Ecology, Developmental Biology, Wildlife, Ethology

Total no. of Programme in UG Zoology: 01

Total no. of Courses in UG Zoology: 14

## COURSEOUTCOMES

<b>B.Sc I Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	This course introduces System Biology and various functional components of an organism. Emphasis will be on physiological understanding abnormalities and anomalies associated with white blood cells and red blood cells. The course emphasizes cell identification, cell differentiation and cell morphology evaluation procedures. This will enhance hematology analytical skills along with skill of using many instruments.
<b>PSO2</b>	The students will earn the basic principles of genetics and how to prepare karyotypes to study the chromosomes.
<b>PSO3</b>	How chromosomal aberrations are inherited in humans by pedigree analysis in families.
<b>PSO4</b>	The students will have hands-on training in the techniques like microscopy, centrifugation and chromatography, and various biochemical techniques, preparation of slides which will help them in getting employment in pathology labs and contribute to healthcare system.

<b>Diploma in Molecular Diagnostics and Genetic Counselling</b>	
<b>B.Sc II Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	The student at the completion of the course will be able to have a detailed and conceptual understanding of molecular processes viz. DNA to trait. The differential regulation of genes in prokaryotes and eukaryotes leads to the development of an organism from an embryo.
<b>PSO2</b>	The students will be able to understand and apply the principles and techniques of molecular biology which prepares students for further career in molecular biology. Independently execute a laboratory experiment using the standard methods and techniques.
<b>PSO3</b>	The principles of genetic engineering, gene cloning, immunology and related technologies will enable students to play an important role in applications of biotechnology in various fields like agriculture, forensic sciences, industry and human health and make a career out of it. Students can have their own start-ups as well.
<b>PSO4</b>	The basic tools of bioinformatics will enable students to analyze large amount of genomic data and its application to evolutionary biology. Apply knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics existing software effectively to extract information from large data bases and to use this information in computer modeling.
<b>PSO5</b>	<b>The Diploma courses will ensure employability in Hospitals/Diagnostics and Pathology labs with good hands-on training.</b>

<b>Degree in Bachelor of Science</b>	
<b>B.Sc III Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	<ul style="list-style-type: none"> <li>This programme aims to introduce students to animal diversity of invertebrates and vertebrates. The students will be taught about invertebrates and vertebrates using observational strategies, museum specimens and field reports.</li> </ul>
<b>PSO2</b>	<ul style="list-style-type: none"> <li>The basic concepts of biosystematics, evolutionary biology and biodiversity will enable students to solve the biological problems related to environment.</li> </ul>
<b>PSO3</b>	<ul style="list-style-type: none"> <li>Inclusion of ecology and environmental sciences will enrich students with our world which is crucial for human well being and prosperity. This section will provide new knowledge of the interdependence between people and nature that is vital for food production, maintaining clean air and water, and sustaining biodiversity in a changing climate.</li> </ul>
<b>PSO4</b>	<ul style="list-style-type: none"> <li>Students will also come to know about the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.</li> </ul>
<b>PSO5</b>	<ul style="list-style-type: none"> <li><b>The Degree course will enable students to go for higher studies like Masters in Zoology and Allied subjects.</b></li> </ul>

<b>Programme/Class:</b> Certificate	<b>Year:</b> First	<b>Semester:</b> First
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050101T Course Code: B050102P	<b>Course Title:</b> Cytology, Genetics and Infectious Diseases Course Title: Cell Biology & Cytogenetics Lab	
<b>Course outcomes:</b> The student at the completion of the course will be able to: <ul style="list-style-type: none"><li>• Understand the structure and function of all the cell organelles.</li><li>• Know about the chromatin structure and its location.</li><li>• To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.</li><li>• How cell communicates with its neighboring cells?</li><li>• Understand the basic principles of genetics and how genes are inherited from one generation to another.</li><li>• Understand the Mendel’s laws and the deviations from conventional patterns of inheritance.</li><li>• Comprehend how environment plays an important role by interacting with genetic factors.</li><li>• To use simple and compound microscopes.</li><li>• To prepare slides and stain them to see the cell organelles.</li><li>• To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.</li><li>• The chromosomal aberrations by preparing karyotypes.</li><li>• How chromosomal aberrations are inherited in humans by pedigree analysis in families.</li><li>• The antigen-antibody reaction.</li></ul>		

<b>Programme/Class:</b> Certificate	<b>Year:</b> First	<b>Semester:</b> Second
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050201T B050202P/R	<b>Course Title:</b> Biochemistry and Physiology and Physiological, Biochemical & Hematology Lab	
<b>Course outcomes:</b>  The student at the completion of the course will learn: <ul style="list-style-type: none"><li>• To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates</li><li>• How simple molecules together form complex macromolecules.</li><li>• To understand the thermodynamics of enzyme catalyzed reactions.</li><li>• Mechanisms of energy production at cellular and molecular levels.</li><li>• To understand systems biology and various functional components of an organism.</li><li>• To explore the complex network of these functional components.</li><li>• To comprehend the regulatory mechanisms for maintenance of function in the body.</li><li>• Understand the structure of biomolecules like proteins, lipids and carbohydrates</li><li>• Perform basic hematological laboratory testing,</li><li>• Distinguish normal and abnormal hematological laboratory findings to predict the diagnosis of hematological disorders and diseases.</li></ul>		

<b>Programme/Class:</b> Diploma	<b>Year:</b> Second	<b>Semester:</b> Third
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050301T and B050302P	<b>Course Title:</b> Molecular Biology, Bioinstrumentation & Biotechniques and Bioinstrumentation & Molecular Biology Lab	
<b>Course outcomes:</b> The student at the completion of the course will be able to have: <ul style="list-style-type: none"><li>• A detailed and conceptual understanding of molecular processes viz. DNA to trait.</li><li>• A clear understanding of the processes of central dogma viz. transcription, translation <i>etc.</i> underlying survival and propagation of life at molecular level.</li><li>• Understanding of how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.</li><li>• Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms.</li><li>• How genes are regulated differently at different time and place in prokaryotes and eukaryotes.</li><li>• Understand the basic principles of microscopy, working of different types of microscopes</li><li>• Understand the basic techniques of centrifugation and chromatography for studying cells and separation of biomolecules</li><li>• Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer and use them in Biochemistry.</li><li>• Learn about some of the commonly used advance DNA testing methods.</li></ul>		

<b>Programme/Class:</b> Diploma	<b>Year:</b> Second	<b>Semester:</b> Fourth
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050401T and B050402P/R	<b>Course Title:</b> Gene Technology, Immunology and Computational Biology & Genetic Engineering and Counselling Lab	
<b>Course outcomes:</b> The student at the completion of the course will be able to: <ul style="list-style-type: none"><li>• Understand the principles of genetic engineering, how genes can be cloned in bacteria and the various technologies involved in it.</li><li>• Know the applications of biotechnology in various fields like agriculture, industry and human health.</li><li>• To have an in depth understanding about Immune System &amp; its mechanisms.</li><li>• Get introduced to DNA testing and utility of genetic engineering in forensic sciences.</li><li>• Get introduced to computers and use of bioinformatics tools.</li><li>• Understand the principles of genetic engineering with hands-on experiments in mutation detection, testing of infectious diseases like Covid 19.</li><li>• Get introduced to DNA testing and utility of genetic engineering in forensic sciences.</li><li>• Apply knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics existing software effectively to extract information from large databases and to use this information in computer modeling.</li><li>• Use bioinformatics tools to find out evolutionary/phylogenetic relationship of organisms using gene sequences.</li><li>• Get employment in Hospitals/Diagnostic and forensic labs/Counsel families with genetic disorders.</li><li>• <b>Enable students to take up research in biological sciences.</b></li><li>• <b>Enable students to get employment in pathology/Hospital.</b></li></ul>		

<b>Programme/Class:</b> Degree	<b>Year:</b> Third	<b>Semester:</b> Fifth
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050501T	<b>Course Title:</b> Diversity of Non-Chordates and Economic Zoology	
<b>Course Code:</b> B050502T	<b>Course Title:</b> Diversity of Chordates and Comparative Anatomy	
<b>Course Code:</b> B050503P	<b>Course Title:</b> Lab on Virtual Dissection, Anatomy, Economic Zoology and Parasitology	
<b>Course outcomes:</b> The student at the completion of the course will be able to: <ul style="list-style-type: none"><li>• demonstrate comprehensive identification abilities of non-chordate diversity</li><li>• explain structural and functional diversity of non-chordate</li><li>• explain evolutionary relationship amongst non-chordate groups</li><li>• Get employment in different applied sectors</li><li>• Students can start their own business i.e. self employments.</li><li>• Demonstrate comprehensive identification abilities of chordate diversity</li><li>• Explain structural and functional diversity of chordates</li><li>• demonstrate comprehensive identification abilities of chordate and non- chordates diversity</li><li>• explain evolutionary relationship amongst chordates and non- chordates</li><li>• Take up research in biological sciences.</li></ul>		

<b>Programme/Class:</b> Degree	<b>Year:</b> Third	<b>Semester:</b> Sixth
<b>Subject:</b> ZOOLOGY		
<b>Course Code:</b> B050601T	<b>Course Title:</b> Evolutionary and Developmental Biology	
<b>Course Code:</b> B050602T	<b>Course Title:</b> Ecology, Ethology, Environmental Science and Wildlife	
<b>Course Code:</b> B050603P	<b>Course Title:</b> Lab on Ecology, Environmental Science, Behavioral Ecology & wildlife	
<b>Course outcomes:</b> The student at the completion of the course will be able to: <ul style="list-style-type: none"><li>• Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.</li><li>• Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.</li><li>• Understand how the single cell formed at fertilisation forms an embryo and then a full adult organism.</li><li>• Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.</li><li>• Understand a variety of interacting processes, which generate an organism’s heterogeneous shapes, size, and structural features.</li><li>• Understand how a cell behaves in response to an autonomous determinant or an external signal, and the scientific reasoning exhibited in experimental life science.</li><li>• Complexities and interconnectedness of various environmental levels and their functioning.</li><li>• Global environmental issues, their causes, consequences and amelioration.</li><li>• To understand and identify behaviours in a variety of taxa.</li><li>• The proximate and ultimate causes of various behaviours.</li><li>• About the molecules, cells, and systems of biological timing systems.</li><li>• Conceptualizing how species profitably inhabit in the temporal environment and space out their activities at different times of the day and seasons.</li><li>• To interpret the cause and effect of lifestyle disorders contributing to public understanding of biological timing.</li><li>• To understand the importance of wildlife conservation.</li><li>• To understand the basic concepts, importance, status and interaction between organisms and environment.</li><li>• Get employment in forest services, sanctuaries, conservatories etc.</li></ul>		

## **M.Sc. ZOOLOGY**

### **Programme Specific Outcomes**

PSO 1 Understand the ecological & evolutionary significance of different taxa of animals.

PSO2 To analyse the mechanisms involved in life processes up to the molecular level.

PSO 3 To perform the analytical experiments in various fields of biological science. PSO 4 To understand basic laboratory methods for histology, physiology, cell-biology, economic zoology, fisheries, tour, abiotic analysis as well as research methodology.

PSO5 To identify a research problem and to formulate a scientific solution.

### **Course Outcomes**

<b>Course component</b>	<b>Outcome</b>
<b>Comparative Anatomy of Vertebrates and Invertebrates</b>	Students will understand the structures of different systems such as, integumentary, skeletal, digestive, respiratory, circulatory, urinogenital, nervous and sensory organs in comparative way among the vertebrate groups using different animal type specimen. They will understand evolutionary phenomenon of development of comparative anatomy of heart, kidney and brain.
<b>Biochemistry &amp; Molecular cell biology Instrumentation and Biotechnology</b>	Students will understand the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids with theory and methods of detection in laboratory. They will also understand the nature, mechanism, and kinetics of enzyme action. Some instrumentation such as microscopy, centrifugation, spectrophotometry etc. will also be learnt. The student will learn about modern biotechnology basics, Structure of DNA, RNA and chromosomes and their abbreviations.
<b>Chordate and non chordate</b>	Student from first to last year study chordate and non chordate taxonomy in practical as well theory at various academic levels. Students will be able to understand the basic principles of taxonomy and systematic. They will also learn to identify the invertebrates and vertebrate animals to their species level and will cater their curiosity on field.
<b>Ecology and Animal Behavior</b>	Students learn the basic concepts of ecology and environment from basic level to detailed understanding at their third year. Moreover, they will learn about various ecosystems like Grassland and forest ecosystem, marine ecosystem, Aquatic ecosystem, Arid areas and their uniqueness of biota. By the end students will be able to understand biological and ecological interactions and functioning.
<b>Cell biology and genetics</b>	Students will understand the structures, positions and functions of various cell and all cellular organelles in details. They will acquire knowledge about chromosomes and cell divisions, both mitosis and meiosis. They will also know about cell signalling and cancers. They will know about vital processes of life like programme cell death. Students will learn genetics at all the three years to different level. They will learn about basic concepts of genetics, mendelian principal, crossing over mechanisms, chromosome mutations and various genetics studies with experiment examples.



<b>Taxonomy, ecology and behavior of Fish</b>	Students will know the classification, adaptation, food chain, parental care, diseases associated with fishes.
<b>Fish anatomy and Physiology</b>	Students will know the physiology of digestion, respiration, circulation, excretion and adaptation in fishes.
<b>Evolution, developmental biology</b>	The students will learn about evolutionary process and evolution of tetrapods. They will learn about Darwin's theories and various evolutionary theories. Students will learn the different aspects of early, late and post embryonic developments, fertilization, mutation, twins, placenta etc.
<b>Biodiversity and Wild Life Conservation</b>	Students will be learning important fauna of State and nation, zoogeography, IUCN and Indian Wildlife Act. They will also be able to use various tools used in field biology. Course part will also include research methodology and know how to write a research proposal and dissertation report. It will also address various issues like air, water, soil pollution as well as global challenges like climate change, sea level rise, ozone depletion etc.