

**Department of Zoology**  
**Program Outcomes, Program Specific Outcomes and Course**  
**Outcomes of**  
**B.Sc. in Zoology Programme**

**Programme Outcomes: B.Sc. in Zoology**

In Zoology, the animal Kingdom is studied in terms of their structural diversity, biology, embryology, evolution, habits and distribution for both living and extinct. The subject is modern, interdisciplinary and applied in nature that will help them to have an insight into various disciplines, so as to apply their knowledge in future endeavor in higher academics and research

PO-1	They will gain knowledge and skill in the fundamentals and systematic of animal kingdom and the knowledge on anatomical structure, metabolic and physiological activities of animals at molecular level
PO-2	They will understand the ecology of animals and role of environment and the need for the conservation of endangered, vulnerable and critical species and their habitat and protection of environment as well
PO-3	They will know about various techniques in biology and understand various topics in genetics, microbiology and immunology and the social wellbeing related to this
PO-4	They will be aware of academic and professional ethics and responsibilities to have an positive impact on its own and social life.

## Programme Specific Outcomes: B.Sc. in Zoology

In modern era apart from the classical zoology a zoologist is required to have a fair concept on various aspects of zoology. This programme will enable the students to compete globally with knowledge and skill base for undertaking further studies in modern biology and related areas or multidisciplinary areas.

PSO-1	Acquire comprehensive knowledge and gain skill on various aspects of zoology and its subfields like animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics, molecular biology and evolutionary biology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases.
PSO-2	Understand good laboratory practices and safety; Carry out experimental techniques and methods both in field and laboratory for the topics Ecology, Physiology and Biochemistry, Cell biology, Genetics, Applied Zoology, Biological techniques, Toxicology.
PSO-3	Understand the application of biological sciences in Pisciculture, Poultry farming, Apiculture, Animal husbandry. Skill Enhancement courses will enable them to think further about Aquarium fish keeping, vermicomposting at professional level.
PSO-4	Get a flavor of research while doing project works using sophisticated instruments for biological work, thus making them able to think independently and interpret as well.
PSO-5	Aware of ethical principles, commitment and responsibility towards the profession with biological practices.
PSO-6	Knowledge in various aspects of environment will enable them to act sustainably towards the future development in biological sciences and society as well.

## Course Outcomes: B.Sc. in Zoology with Honors

Through core courses (CC) students would get in-depth subject knowledge. While studying the discipline specific electives (DSE) they will come to know about the applied aspects of the subject as well as its applicability in both academia and industry. Generic electives (GE) will also enable them to integrate their knowledge among various interdisciplinary courses. The skill enhancement courses (SEC) would further incorporate skill in their learning that can be used for proving themselves capable for further academia, entrepreneurship and industry.

### SEMESTER – I

#### CC1 - Non-Chordates I (ZOOACOR01T & ZOOACOR01P)

After Successful completion of this course, students will be able to

CO-1	Characterize and classify Protista, Parazoa, Metazoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematelminthes classes
CO-2	Understand the life cycles of <i>Giardia intestinalis</i> , <i>Leishmania donovani</i> , <i>Entamoeba histolytica</i> and <i>Plasmodium vivax</i> , <i>Fasciola hepatica</i> and <i>Taenia solium</i> , <i>Ascaris lumbricoides</i> , <i>Ancylostoma duodenale</i> and <i>Wuchereria bancrofti</i>
CO-3	Know the diversity, biological facts and formation of coral reefs
CO-4	Group and identify animals based on morphological characters and structure.
CO-5	Develop ideas how a simple single cell creature evolve to a creature with complex body plan
CO-6	Get a flavor of research while working on a short project on any related topic on pond water protozoan or invertebrate diversity/ life cycles of mosquitoes, butterfly/moth etc /coral and coral reefs

#### CC2 - Ecology (ZOOACOR02T & ZOOACOR02P)

After Successful completion of this course, students will be able to

CO-1	Understand the history and basis of animal ecology through studying the levels of organization
CO-2	Understand the characteristics and dynamics of Population while studying different aspects of population ecology, population interactions and animal to animal relations
CO-3	Know the characteristics of community while studying different diversity indices

CO-4	Understand the ecosystem energetic while studying the energy flow through the ecosystem
CO-5	Develop ideas on how knowledge of ecology can be applied in protection and conservation of nature, natural resources and animals
CO-6	Get a flavor of research while gathering data in field as a part of educational excursion. They will understand well the theoretical aspects taught in classroom besides the field techniques.

## SEMESTER - II

### CC3 - Non-Chordates II (ZOOACOR03T & ZOOACOR03P)

After Successful completion of this course, students will be able to

CO-1	Understand the evolution of coelomate animals
CO-2	Know the diversity, evolution and general characteristics of different taxa of non-chordate from Annelida to Half-chordate (Hemichordata)
CO-3	Develop ideas on physiological techniques, organization of body plan of nonchordates
CO-4	Understand the phylogenetic relationship between chordate and non chordate and evolutionary significance of taxon.
CO-5	Group and identify animals based on morphological characters and structure.
CO-6	Learn the anatomy of internal system through dissection of a few animals

### CC4 - Cell Biology (ZOOACOR04T & ZOOACOR04P)

After Successful completion of this course, students will be able to

CO-1	Get an overview of cells (Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions)
CO-2	Understand the importance of cell and cell organelles as structural and functional unit for sustaining life
CO-3	Know the dynamics of plasma membrane and endomembrane structures and their working mechanism and responsibilities for functioning of cell
CO-4	Acquire knowledge on the different pathways of cell signaling and apoptosis thus enabling them to understand the basis and anomalies in cancer
CO-5	know the methods for preparation of permanent slides demonstrating DNA, Mucopolysaccharides and protein
CO-6	Identify different stages of mitosis and meiosis cell division

## SEMESTER - III

### CC5 - Chordates (ZOOACOR05T & ZOOACOR05P)

After Successful completion of this course, students will be able to

CO-1	Characterize and classify the phylum chordate with a knowledge on homology and homoplasy
CO-2	Understand the origin and evolution of chordate and vertebrates and their complex organ system
CO-3	Acquire knowledge on zoogeographical realms and distribution of animals all over the world.
CO-4	Group and Identify animals from protochordata to Mammalia based on their morphological characters.
CO-5	Study the anatomy of animals through dissection.
CO-6	Know the life sustaining mechanisms like Metamorphosis and parental care in Amphibia, Biting mechanism in Snake, Principles and aerodynamics of flight and adaptive radiation and echolocation in maamal.

### CC6 - Physiology: Controlling and Coordinating Systems (ZOOACOR06T & ZOOACOR06P)

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge on Structure, locations, classification and functions of epithelial tissues, connective tissues, muscular tissues and nerve tissues
CO-2	Understand the basis of Structure and types of bones and cartilages and Ossification technique
CO-3	Acquire knowledge on structural and functional aspects of nervous system, Muscular system, Reproductive system and Endocrine system.
CO-4	Get ideas on how simple muscle twitch is recorded with electrical stimulation
CO-5	Learn the microtomy techniques thus enabling them to prepare permanent slides of different organs and glands
CO-6	study the anatomical features of organs through permanent slides

## **CC7 - Biochemistry (ZOOACOR07T & ZOOACOR07P)**

After Successful completion of this course, students will be able to

CO-1	Understand the Fundamentals of biochemical reactions and metabolism
CO-2	Get ideas on the structure and function of biological macromolecules (Carbohydrate, Lipid, Protein, Nucleic acids and enzymes)
CO-3	Know the metabolic pathways involved in the metabolism of biological macromolecules
CO-4	Understand the concept enzymes kinetics and oxidative phosphorylation (Review of mitochondrial respiratory chain)
CO-5	Experience different biochemical techniques like Protein estimation by Lowry method, Protein separation by SDS-PAGE, Paper chromatography of amino acid.
CO-6	Study enzymatic activity of Trypsin and Lipase, Acid and Alkaline Phosphatase.

## **SEC-1 – Aquarium Fish Keeping (ZOOSSEC001 - For Honors and ZOOSSEC01M – For General)**

After Successful completion of this course, students will be able to

CO-1	Obtain knowledge in The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes, and problems of releasing aquarium fishes into natural habitats.
CO-2	Gain skill to raise aquarium with the obtained knowledge in biology of aquarium fish and their food and feeding behavior
CO-3	Gain skill to consider this practice at professional level with knowledge on Live fish transport - Fish handling, packing and forwarding techniques and maintenance of aquarium.

## SEMESTER – IV

### CC8 - Comparative Anatomy (ZOOACOR08T & ZOOACOR08P)

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge on Structure, function and derivatives of integument in amphibian, birds and mammals
CO-2	Know about axial and appendicular skeleton; Jaw suspension; Visceral arches.
CO-3	Understand the comparative anatomy brain, Cranial nerves in mammals, heart and aortic arches and stomach in mammals.
CO-4	Have ideas on structural and functional aspects of respiratory system, circulatory system, Urinogenital system
CO-5	Understand the features of different scale types, disarticulated skeleton of Toad, Pigeon and Guineapig.
CO-6	Demonstrate Carapace and plastron of turtle.
CO-7	Identify between herbivorous and carnivorous skull.
CO-8	Acquire knowledge on Circulatory system, Brain, pituitary, urinogenital system of Tilapia through dissection

### CC9 - Physiology: Life sustaining system (ZOOACOR09T & ZOOACOR09P)

After Successful completion of this course, students will be able to

CO-1	Understand the Structural organisation and functions of Gastrointestinal tract and Associated glands; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes
CO-2	Get knowledge in Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning
CO-3	Understand the components of blood and their structural and functional aspects
CO-4	Acquire knowledge on origin and conduction of cardiac impulses, structure of mammalian heart and associated structures
CO-5	Understand the process of thermoregulation and Osmoregulation
CO-6	Understand the structure and function of kidney and urine formation
CO-7	Determine ABO Blood group and enumerate red blood cells and white blood cells after staining

CO-8	Learn how to estimate haemoglobin, prepare haemin and haemochromogen crystals and record blood pressure.
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### **CC10 - Immunology (ZOOACOR10T & ZOOACOR10P)**

After Successful completion of this course, students will be able to

CO-1	Get idea on basic concept of health and diseases in the light of immune response of the body
CO-2	Identify the major cellular and tissue components which comprise the innate and adaptive immune system
CO-3	Acquire knowledge on Antigen, Antigen presentation & MHC
CO-4	Understand how immune responses are initiated and regulated by Tcells and B cells
CO-5	Learn immunoassays techniques (ELISA and RIA), Hybridoma technology, Monoclonal antibody production.
CO-6	Learn about Immunology of diseases and concept of vaccines
CO-7	Understand the importance of cytokines and Chemokines and pathways of complement system
CO-8	Learn histology of immune organs, demonstrate lymphoid organs and ELISA using kit.

### **SEC-2 - Vermicompost Production (ZOOSSEC002 - For Honors and ZOOSSEC02M - For General)**

After Successful completion of this course, students will be able to

CO-1	Obtain knowledge Vermicompost and the need for it and suitable criteria for the production in terms of suitable worm species and their availability, operational and maintenance procedure.
CO-2	Apply the knowledge to raise production at large/small scale depending on the available species and rearing criterias.
CO-3	Develop ideas on harvesting, properties of vermicompost, benefits of vermicompost and their application.



## SEMESTER - V

### CC11 – Molecular Biology (ZOOACOR11T & ZOOACOR11P)

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge in the basic structure and function of DNA and RNA
CO-2	Understand the underlying mechanism in DNA replication, Transcription and Translation
CO-3	Know about Post Transcriptional Modifications and Processing of Eukaryotic RNA
CO-4	Get idea on Gene regulation and DNA repair mechanisms
CO-5	Acquire knowledge on different Molecular Lab Techniques like PCR, Western and Southern blot, Northern Blot, Sanger DNA sequencing, cDNA technology.
CO-6	Demonstrate polytene Chromosome from Drosophila /Chironomid larvae and Agarose Gel Electrophoresis
CO-7	Isolate and quantify genomic DNA using spectrophotometer (A260 measurement)

### CC12 – Genetics (ZOOACOR12T & ZOOACOR12P)

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge on Mendelian Genetics and its Extension
CO-2	Understand the molecular basis of Linkage, Crossing Over and Chromosomal Mapping
CO-3	Understand the basic concept of genetic mutations and chromosomal aberrations, cause and effect of alteration in chromosome structure and function
CO-4	Know the Mechanisms of sex determination in Drosophila with reference to alternative splicing Sex determination in mammals Dosage compensation in Drosophila & Human
CO-5	Know about Criteria for extra chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Kappa particle in Paramecium Shell spiralling in snail
CO-6	Have idea on Recombination methods in bacteria and viruses and Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, LINE, SINE, Alu elements in humans

CO-7	Analyze Pedigree of some inherited traits in human and identify chromosomal aberration in <i>Drosophila</i> from photographs
CO-8	Analyze Chi-square and Student t test comparing means of two small samples from normal populations (paired/unpaired)

### **DSE-1 - Animal Behaviour and Chronobiology (ZOOADSE01T & ZOOADSE01P)**

After Successful completion of this course, students will be able to

CO-1	Know the history of animal behavior studies including the works of renowned scientists in this field
CO-2	Learn various theoretical and practical techniques used to study animal behavior and construct actogram on locomotor activity of suitable animals.
CO-3	Acquire knowledge on the the objectives of modern animal behaviour studies: Tinbergen's four questions.
CO-4	Understand different types of behavior in individuals and develop concept on evolution of social behavior and ecological forces acting on sexual selection
CO-5	Develop knowledge and concept in chronobiology and Biological rhythm.
CO-6	Acquire knowledge on field techniques to study behavioral activities of animals in wild while taking part in educational excursion to researve forests.

### **DSE-3 - Endocrinology (ZOOADSE03T & ZOOADSE03P)**

After Successful completion of this course, students will be able to

CO-1	Get general idea on Endocrine systems, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones
CO-2	Learn about Epiphysis, Hypothalamo-hypophysial Axis, Hypothalamo-hypophysial portal system, hormonal regulation and hormonal disorders
CO-3	Develop concept on Peripheral endocrine glands, hormonal secretion, function and regulation and associated disorders.
CO-4	Understand the underlying mechanism of hormone action
CO-5	Acquire knowledge practically on endocrine glands through permanent slides and by dissecting rat to study the endocrine glands of the same.
CO-6	Estimate plasma level of any hormone using ELISA and designing of primers of any hormone.

## SEMESTER - VI

### CC13 - Developmental Biology (ZOOACOR13T & ZOOACOR13P)

After Successful completion of this course, students will be able to

CO-1	Know about Phases of Development, Cell-cell interaction, Differentiation and growth, Differential gene expression
CO-2	Understand the mechanism of Early Embryonic development, Late Embryonic development and Post Embryonic Development
CO-3	Know about the field where the knowledge of developmental biology can be implemented
CO-4	Identify of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
CO-5	Acquire knowledge on the developmental stages and life cycle of Drosophila, different sections of placenta (microphotographs/ slides)
CO-6	Learn the technique of Drosophila Culture/ chick embryo development through the short term project.

### CC14 - Evolutionary Biology (ZOOACOR14T & ZOOACOR14P)

After Successful completion of this course, students will be able to

CO-1	Understand the basic concept behind origin of life in the light of Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes.
CO-2	Know the historical aspect of evolutionary concept through Pre-Darwinian Concepts and theories including Lamarckism, Darwinian Theory, Neo-Darwinian Synthesis
CO-3	Learn the evidences in favor of evolution through fossil records
CO-4	Understand the concept population genetics in the light of Hardy-Weinberg equilibrium
CO-5	Understand the modes of speciation, Isolating mechanisms Adaptive radiations/ macroevolution as exemplified by Galapagos finches.
CO-6	Learn about the mass extinction in this earth and origin and evolution of man.

CO-7	Understand the basic concept of molecular phylogeny, Neutral theory of molecular evolution, molecular clock (brief introductions)
CO-8	Know about fossil from the models/photographs and homology and analogy from suitable specimens (from Photographs/models)
CO-9	Verify Hardy-Weinberg equilibrium in a population by chi square analysis and apply other statistical analysis from collected data.

#### **DSE-4 – Fish and Fishery (ZOOADSE04T & ZOOADSE04P)**

After Successful completion of this course, students will be able to

CO-1	Classify the phylum fish along with their general description and ecoogy
CO-2	Develop ideas on fish morphology and physiological activities of fish
CO-3	Acquire knowledge techniques and details of aquaculture and application of remote sensing and GIS in fisheries
CO-4	Get ideas on fish research in their future study by visiting fish farms/ pisciculture unit/Zebra fish rearing Lab
CO-5	Group and identify fish depending on their morphological characters and learn about different internal organs
CO-6	Learn about the techniques and considerable facts required for aquaculture

#### **DSE-6 – Wildlife and Conservation (ZOOADSE06T & ZOOADSE06P)**

After Successful completion of this course, students will be able to

CO-1	Learn the Values of wild life, Importance of conservation, Causes of depletion of Wildlife in India, management and restoration of habitats
CO-2	Estimate forest covers through the application of remote sensing and GIS
CO-3	Develop ideas on different ecological methods for Population and population density estimations
CO-4	Acquire knowledge on Management planning of wild life in protected areas, man – animal conflict, means and methods for wildlife conservation
CO-5	Identify common local flora, mammalian fauna, avian fauna, herpeto-fauna
CO-6	Learn about the basic equipments required in wildlife studies and different field techniques for flora and fauna estimation

## Course Outcomes: B.Sc. with Zoology as General

### SEMESTER - I

#### CC1 – Animal Diversity (ZOOGCOR01T & ZOOGCOR01P)

After Successful completion of this course, students will be able to

CO-1	Characterize and classify from Non-chordate Protista to vertebrate mammals
CO-2	Understand the life cycles of <i>Taenia solium</i> and <i>Ascaris lumbricoides</i> ,
CO-3	Gain knowledge on physiological systems of different organism at different taxa like canal system in Sycon, Polymorphisms in Hydrozoa, Vision and metamorphosis in insects, respiration in mollusks, feeding in <i>Branchostoma</i> , biting mechanism in snakes and flight aerodynamics in birds.
CO-4	Group and identify animals based on morphological characters and structure.
CO-5	Develop ideas how a simple single cell creature evolve to a creature with complex body plan
CO-6	Gain practical knowledge on different taxa by constructing an“animal album” containing photographs, cut outs, with appropriate write up about the learned taxa.

### SEMESTER - II

#### CC2 – Physiology and Biochemistry (ZOOGCOR02T & ZOOGCOR02P)

After Successful completion of this course, students will be able to

CO-1	Understand the Structural organisation and functions of internal system, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes
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CO-2	Get ideas on the structure and function and metabolism of biological macromolecules (Carbohydrate, Lipid, Protein, Nucleic acids and enzymes)
CO-3	Get knowledge in Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood
CO-4	Acquire knowledge on origin and conduction of cardiac impulses, structure of mammalian heart and associated structures
CO-5	Identify mammalian glands and organs histologically.
CO-6	Perform qualitative tests to identify functional groups of carbohydrates in given solutions: Glucose (Benedict's test), Sucrose (Iodine test) and estimate total protein.

### **SEMESTER - III**

#### **CC-3 – Insect, Vectors and Diseases (ZOOGCOR03T & ZOOGCOR03P)**

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge on morphological features of insects and vectors and their relationship with host.
CO-2	Develop awareness about the causative agents and control measures of many commonly occurring diseases.
CO-3	Know the details on mode of infection, spread and control measures for disease causing agents and the remedy from the disease as well.
CO-4	Group and identify different insect vectors through permanent slides
CO-5	Construct a report on the insect vectors and disease transmitted by them
CO-6	Undertake measures or start awareness programmes for maintenance of hygienic conditions, avoidance of contact from vector, destruction of breeding spots in the vicinity of houses as a part of public health education campaign

### **SEMESTER - IV**

#### **CC4 – Environment and Public Health (ZOOGCOR04T & ZOOGCOR04P)**

After Successful completion of this course, students will be able to

CO-1	Identify the source of environmental hazards, fate of toxic and persistent substances in the environment and evaluate and assess Dose response and Exposure respectively
CO-2	Acquire knowledge on cause and effect of global warming and ozone hole depletion and consequent climate change
CO-3	Learn about cause, effect and prevention against air pollution, water pollution and noise pollution.

CO-4	Get knowledge on various waste management technologies for a wide range of waste products both liquid and solid.
CO-5	Identify the causes, symptoms and control of different disease like tuberculosis, Asthma, Cholera, Minamata disease, typhoid and filariasis
CO-6	Determine several phyico-chemical parameters like pH, Cl, SO <sub>4</sub> , NO <sub>3</sub> in soil and water samples from different sources.

## SEMESTER - V

### DSE-1 – Applied Zoology (ZOOGDSE01T & ZOOGDSE01P)

After Successful completion of this course, students will be able to

CO-1	Learn the transmission, Prevention and control of diseases like Tuberculosis and Typhoid
CO-2	Acquire knowledge about the biology, control and damage caused by <i>Helicoverpa armigera</i> , <i>Pyrilla perpusilla</i> and <i>Papilio demoleus</i> , <i>Callosobruchus chinensis</i> , <i>Sitophilus oryzae</i> and <i>Tribolium castaneum</i> , <i>Rickettsia prowazekii</i> , <i>Borrelia recurrentis</i> and <i>Treponema pallidum</i> .
CO-3	Learn about the life history and pathogenecity of <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> and <i>Trypanosoma gambiense</i> , <i>Ancylostoma duodenale</i> and <i>Wuchereria bancrofti</i> .
CO-4	Understand the medical importance and control of <i>Pediculus humanus corporis</i> , <i>Anopheles</i> , <i>Culex</i> , <i>Aedes</i> , <i>Xenopsylla cheopis</i>
CO-5	Apply the knowledge in the field of animal husbandry, pisciculture and poultry farming for their livelihood.
CO-6	Group and identify the insect vector, medically and economically important organisms according to the morphological charaters.

## SEMESTER - VI

### DSE-4 – Immunology (ZOOGDSE04T & ZOOGDSE04P)

After Successful completion of this course, students will be able to

CO-1	Acquire knowledge on Antigen, Antigen presentation & MHC
CO-2	Identify the major cellular and tissue components which comprise the innate and adaptive immune system

CO-3	Understand how immune responses are initiated and regulated by Tcells and B cells
CO-4	Learn about Immunology of diseases and concept of vaccines
CO-5	Determine ABO blood group and prepare stained blood film to study various types of blood cells
CO-6	Identify different immune organs histologically.