B.Sc. ZOOLOGY

Program outcome

- To know the scope and importance of Zoology.
- To develop scientific temper among students.

- To inculcate interest in nature and living forms and their conservation.
- To make the students eco-friendly by creating a sense of environmental awareness in them.
- To give better exposure to the diversity of life forms.
- To give awareness about natural resources and their importance in sustainable development.
- To study different ecological sites for animals in their natural habitats by field study.
- To provide opportunities for the application of the acquired knowledge in day- to - day life.
- To develop skills in doing experiments, familiarizing equipments and biological specimens.
- To undertake scientific projects which help to develop research aptitude in students.
- To expose students to various fields in biological sciences and to develop interest in related disciplines.
- To attain interdisciplinary approach to understand the application of the subject in daily life.
- To familiarize the emerging areas of Zoology and their applications in various spheres of biological sciences and to appraise the students of its relevance in future studies.

Course outcomes

SEMESTER-1

ZOL1B01T Animal Diversity : Nonchordata Part-I

Describe the principles of classification and nomenclature

Explain the five kingdom classification of living organisms

Understand the concepts of classification of animals

Explain the classification with examples and characteristic features of kingdom Protista and describe the morphology and structural organization of *Paramecium*

Describe the characteristic features of subkingdom Mesozoa
Explain the classification of phylum Porifera and elucidate the salient features of each class

Describe the characteristic features of phylum Cnidaria and Ctenophora, illustrate the classification of phylum Cnidaria down to classes and explain the structural organization of *Obelia*

Explain the salient features of phylum Platyhelminthes and illustrate its classification down to classes

Explain the characteristic features and classification of super-phylum Aschelminthes and phylum Nematoda

Elucidate the characters of Pseudocoelomate minor phyla Rotifera and Gastrotricha

SEMESTER-2

ZOL2B02T Animal Diversity : Nonchordata Part-II

Explain the classification with examples and characteristic features of phylum Annelida and describe the morphology and structural organization of *Neanthes*

Describe the distribution, peculiarities and affinities of phylum Onychophora

Explain the classification of phylum Arthropoda;elucidate the salient features of each class and describe the morphology and structural organization of *Penaeus*

Describe the characteristic features of phylum Mollusca, illustrate its classification down to classes and explain the structural organization of *Pila globosa*

Explain the salient features of phylum Echinodermata and illustrate its classification down to classes

Understand the salient features and affinities of phylum Hemichordata

Elucidate the characters of coelomate minor phyla Phoronida, Ectoprocta and Echiura

SEMESTER-3

ZOL3B03T Animal Diversity: Chordata Part-I

Explain the characteristics of chordates and outline classification of the phylum Chordata
Describe the salient features and affinities of subphylum Urochordata and its classification down to classes; elucidate the morphology and structural organization of *Ascidia*

Explain the salient features and affinities of subphylum Cephalochordata with reference to *Branchiostoma*

Describe the salient features of subphylum Vertebrata, illustrate its classification down to classes and elucidate the characteristics of division Agnatha

Enumerate the salient features of superclass Pisces and illustrate its classification down to orders and the morphology and structural organization of *Mugil cephalus*

Describe the salient features and affinities of class Amphibia and its classification up to orders; explain the morphology and organ systems of *Hoplobatrachus tigerinus*

Elucidate the characteristic features of the class Reptilia and its classification down to orders; describe the morphology and organ systems of *Calotes versicolor*

SEMESTER-4

ZOL4B04T Animal Diversity: Chordata Part-II

Describe the classification of class Aves down to orders, salient features of each order with suitable examples

Describe the external characters and functional systems of *Columba livia*
Enumerate the salient features and classification of class Mammalia down to

orders with suitable examples

Elucidate the external characters and functional systems of *Oryctolagus cuniculus*

Compare the circulatory, excretory and nervous systems of vertebrates

SEMESTER-5

ZOL5B06T Cell Biology and Genetics

Understand the principles and applications of various types of light microscopes, electron, Scanning-tunnelling and Atomic force microscope and illustrate the histological and histochemical processing of tissues

Explain the basic structure of a eukaryotic cell and the structure and functions of plasma membrane, mitochondria, lysosome, cytoskeletal elements and interphase nucleus

Illustrate the nucleosome organization of chromatin and higher order structures; structure of chromosomes and giant chromosomes

Enumerate eukaryotic cell cycle and cell division by amitosis, mitosis and meiosis

Explain the causes of transformation, characteristics of transformed cells and the role of protooncogenes and tumor suppressor genes in malignant transformation; mechanism and significance of apoptosis

Enumerate allelic and non-allelic gene interactions; supplementary, complementary, polymeric, duplicate and modifying genes and polygenic inheritance

Illustrate multiple allelism and solve problems related to blood group inheritance

Explain characteristics of linkage groups and linkage map; crossing over and calculation of recombination frequency; sex-linked, sex-influenced and sex-limited characters; sex differentiation and disorders of sexual development

Describe the mechanisms of sex determination including chromosomal, genic, haploid-diploid mechanisms; the hormonal and environmental influence on sex

determination and gynandromorphism

Explain mutagenesis, mutagens and chromosomal and gene mutations Enumerate the classification and grouping of human chromosomes; numerical and mutational human autosomal and sex chromosomal anomalies; polygenic human traits and genetic counseling

ZOL5B07T Biotechnology, Microbiology and Immunology

Illustrate the steps in genetic engineering and animal cell culture

Explain transfection methods, transgenic animals and ethical issues of transgenic animals

Enumerate the applications of biotechnology

Understand the biological diversity of microbial forms and the various techniques for handling microbes in the laboratory

Enumerate the basic structure and life cycle of bacteria and virus

Understand the industrial and medical importance of microorganisms

Describe different types of immunity and the cells and organs of the immune system

Explain antigen, antibody, immunity and major histocompatibility complex

Enumerate autoimmune and immunodeficiency diseases and immunology of tumor and organ transplantation

ZOL5B08T Biochemistry and Molecular Biology

Understand the elements of biological importance and the non-covalent interactions that stabilize biomolecules

Describe the classification, types, structure, reactions and biological roles of carbohydrates, and diabetes Type I and II

Enumerate the properties and classification of amino acids and their standard abbreviations; hierarchial levels of protein structure, classification, separation, purification and sequencing of proteins

Explain the classification and functions of lipids and fatty acids; chemistry and

structure of nucleic acids and sequencing of DNA

Understand the classification, nomenclature and properties of enzymes; enzyme action, co-enzymes, cofactors, isozymes, ribozymes and allosteric enzymes

Explain glycolysis, Kreb's cycle, glycogenesis, glycogenolysis, gluconeogenesis, HMP pathway; amino acid and fatty acid oxidation and oxidative phosphorylation

Describe the mechanism of DNA duplication and the role of enzymes
Understand the concept of gene and gene expression; genetic code and wobble hypothesis

Explain the mechanism of transcription and post-transcriptional modification of hnRNA

Enumerate the processes of translation and post-translational modification and targeting of peptides

Describe the regulation of *trp* operon, C-value, repetitive DNA, satellite DNA, selfish DNA, overlapping genes, pseudogenes, cryptic genes, transposons and retrotransposons

Explain the structure and life cycle of bacteriophages and the gene transfer mechanisms in bacteria

ZOL5B09T Methodology in Science, Biostatistics and Bioinformatics

Explain science, its importance, disciplines and the major steps in formulating a hypothesis, various hypothesis models, theory, law and importance of animal models, simulations and virtual testing

Illustrate the principles and procedures in designing experiments and elaborate the requirements for carrying out experiments

Describe the ethical concerns in practicing science

Understand the Scope and role of statistics; methods and procedures of sampling; Construction of tables, charts and graphs

Calculate central tendency and measures of dispersion and application of its knowledge on hypothesis testing as well as in problem solving

Enumerate major biological databases and database search engines

Perform DNA and protein sequence analysis, including sequence alignment and sequence similarity search using BLAST, FASTA, CLUSTAL W and CLUSTAL X
Understand molecular phylogenetics and tools and methods for construction of phylogenetic trees

Explain genome sequencing technologies, functional genomics, proteomic technologies and molecular docking and drug design

ZOL5D01T Reproductive Health and Sex Education

Understand the reproductive health, and importance of sex education for teen and youth.

Explain the chromosomal mechanism of sex determination and sex chromosomal anomalies.

Describe the structural and functional features of human reproductive system, fertilization, implantation, pregnancy, gestation, placenta, parturition and lactation.

Explain the scope of reproductive technologies in infertility management and the assisted reproductive techniques.

Understand the different methods of prenatal diagnosis and associated ethical issues

Describe the different methods of fertility control.

Understand the symptoms, mode of transmission, diagnosis and treatment of different sexually transmitted diseases and their socio economic dimensions.

Describe sexual orientation, sexual abuse and myths

Understand the ethical aspects of sex

SEMESTER-6

ZOL6B10T Physiology and Endocrinology

Describe the regulation of digestion in man, nutrition in pregnancy and infancy, nutritional disorders, balanced diet, starvation, fasting and obesity.

Understand the mechanism of transport and exchange of respiratory gases and its neurophysiological control and physiological problems in diving mammals, new-born and aged individuals.

Describe functions, composition, coagulation, transfusion, agglutination and clinical analysis of blood, haemoglobinopathies, types of heart and common cardio-vascular problems.

Understand the osmoregulatory mechanisms in animals; excretion and its hormonal control and common renal disorders in man.

Explain the ultrastructure of skeletal muscles and biochemical events and energetics of muscle contraction.

Understand the different types of nerve cells, glial cells and nerve fibres, and the mechanism of nerve impulse transmission

Understand the types, physiology and significance of bioluminescence, and the structure and functions of electric organs.

Describe invertebrate neuro-endocrine organs and hormones, vertebrate endocrine glands, their hormones and functions

Understand the concept of neurosecretion and the mode of action of peptide and steroid hormones.

ZOL6B11T Reproductive and Developmental Biology

Understand the reproductive health, and importance of sex education for teen and youth.

Explain the chromosomal mechanism of sex determination and sex chromosomal anomalies.

Describe the structural and functional features of human reproductive system, fertilization, implantation, pregnancy, gestation, placenta, parturition and lactation.

Explain the scope of reproductive technologies in infertility management and the assisted reproductive techniques.

Understand the different methods of prenatal diagnosis and associated ethical issues

Describe the different methods of fertility control.

Understand the symptoms, mode of transmission, diagnosis and treatment of different sexually transmitted diseases and their socio economic dimensions.

Describe sexual orientation, sexual abuse and myths

Understand the ethical aspects of sex

ZOL6B12T Environmental and Conservation Biology

Explain the structure of ecosystem and its functioning through energy flow and nutrient cycling

Enumerate biogeochemical cycles and understand the concept of limiting factors

Describe the ecology of population, community and habitat as a self regulating system

Understand various types of population interactions and appraise the co-evolution

Comprehend the diverse environmental and sustainability challenges ranging fro local to global and the establishment of perfect harmony between economic development, social issues and environmental conservation

Enumerate the several tools and techniques employed for studies on populations, communities and ecosystems.

Understand the threats to biodiversity, and strategies adapted for the conservation of diversity of organisms

Describe the various international strategies for conserving biodiversity

Describe the toxic chemicals, their toxicity levels and the health hazards caused by them

ZOL6B13T Ethology, Evolution and Zoogeography

Describe the patterns and mechanisms of animal behaviour

Illustrate biological rhythms and the chemical basis of communication

Identify major evolutionary transitions over time, and explain the tools and

evidences that support current hypotheses of the history of life on earth

Describe the evidences for evolution and its required corollaries

Explain the various theories of evolution

Describe the mechanisms by which evolution occurs

Recognize the significance of reproductive isolation in reducing gene flow between populations, biological and morphological species concepts and distinguish between prezygotic and postzygotic barriers to reproduction

Review the events in human evolution

Explain ecological and historical foundations for understanding the distribution and abundance of species, and their changes over time and comprehend the basic principles of biogeography as a discipline

ZOL4B05P Zoology Core Practical I (To be conducted in Semester 1-4)

Identify and describe specified protists and acoelomate & pseudocoelomate nonchordates and perform the culture of selected protists; understand the histological features of coelenterate, platyhelminth and nematode.

Identify and describe specified coelomate non-chordates and the transverse sections of annelids; Perform mounting of the specified organs of selected nonchordates.

Identify and describe specified chordates and specified bones of chordates;

Prepare key for identification of venomous snakes; Perform mounting and dissection of specified organ systems of chordates.

Identify and describe selected vertebrates and specified bones of vertebrates

ZOL6B15P Zoology Core Practical II (To be conducted in Semester 5)

Perform experiments in cell biology and genetics including demonstration of Barr body in buccal epithelial cells of man, polytene chromosome in the salivary glands of *D. melanogaster* larva, mitotic division in onion root tip cells,

micrometry of microscopic objects, prepare whole mounts of microscopic objects, and calculate mitotic and metaphase index from slides.

Enumerate the inheritance of major human genetic traits, pedigree chart, normal and abnormal human karyotypes, phenotypic differences of male and female *Drosophila* and solve problems on Monohybrid, dihybrid crosses, blood groups and sex-linked inheritance.

Understand electrophoresis, PCR, Northern blotting, Southern blotting and Western blotting, DNA sequencing and fingerprinting and isolation of genomic DNA.

Perform gram staining and preparation of culture media for bacteria and demonstrate bacterial motility by standard laboratory protocols.

Understand the detection of human blood groups and organs of immune system

Perform standard biochemical tests for the detection of reducing and nonreducing sugars, polysaccharides, proteins and lipids.

Understand the staining of mitochondria, tissue homogenization and isolation of nuclei, effect of colchicines on cell division, extraction of DNA and polyacrylamide and agarose gel electrophoresis

Solve basic problems in biostatistics and Bioinformatics

ZOL6B16P Zoology Core Practical III (To be conducted in Semester 6)

Perform standard laboratory experiments for the estimation of Hb, presence of hCG/abnormal constituents in urine, detection of blood pressure, bleeding and clotting time and identification of formed elements in blood

Identify selected stages in the development of frog and chick and chosen larval forms of invertebrates and vertebrates

Carry out experiments of laboratory standards to estimate water quality parameters including, dissolved Oxygen, Carbon dioxide, hardness and pH; determination of adulteration of selected food items and identify marine planktons and soil organisms

Demonstrate the behavioural response of earthworm/dipteran larva to selected stimuli

Describe homologous , analogous and vestigial organs, connecting links, adaptive radiation and evolution of man

Illustrate zoogeographical realms, Wallace line, Weber line, Wallacea and the distribution of *Peripatus*, lung fishes, *Sphenodon*, monotremes and marsupials

Identify the normal and selected abnormal human karyotypes and inheritance of chosen traits from pedigree charts/describe ornamental and other culture fishes/describe chosen beneficial and harmful insects

B.Sc. ZOOLOGY COMPLEMENTARY COURSE

SEMESTER-1

ZOL1C01T **ANIMAL DIVERSITY AND WILDLIFE CONSERVATION**

Describe the general characters of protists and salient features of phylum – Rhizopoda, Ciliophora, Dinoflagellata and Apicomplexa

Enumerate the salient features and examples of Phylum – Porifera, Coelenterata,

Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Onychophora, Mollusca and Echinodermata, and the structural organization of *Peneaus* sp.

Describe the characteristic features and classification of phylum Chordata with examples and, structural organization of *Oryctolagus cuniculus*

Explain levels of biodiversity, threats to biodiversity, biodiversity hotspots, importance and strategies for conservation of wildlife and sustainable development

SEMESTER-2

ZOL2C02T- **ECONOMIC ZOOLOGY**

Explain parasitism and the major protist, cestode, trematode and nematode parasites of man and major insect vectors of human diseases and their control

Understand major beneficial and harmful insects, damages caused to host plants and their control measures

Understand pisciculture, prawn, mussel and pearl culture

SEMESTER-3

ZOL3C03T- **PHYSIOLOGY AND ETHOLOGY**

Describe the structure of plasma membrane and the various trans-membrane transport mechanisms

Enumerate the constituents of normal diet and the mechanism of digestion and absorption of carbohydrates, proteins and lipids and the regulation of gastrointestinal function

Explain the mechanism of transport of respiratory gases, control of respiration, respiratory problems and artificial ventilation

Explain the structure and working of human heart and mechanism of regulation of heart beat; constituents of human blood and blood transfusion and cardiovascular problems

Illustrate the structure of human kidney, the mechanism of urine formation, hormonal control of kidney function and kidney disorders; osmoregulation and urea cycle

Enumerate the structure of myofibrils and myofilaments; muscle contractile and regulatory proteins and mechanism of muscle contraction

Explain different types of nerve cells and glial cells, maintenance of resting membrane potential, generation and propagation of action potential and synaptic transmission

Describe innate behavior, learned behavior, patterns of behavior and factors that affect behavior

Enumerate biological rhythms, communication in animals and social organization in mammals

SEMESTER-3

ZOL4C04T **- GENETICS AND IMMUNOLOGY**

Describe human karyotype , chromosomal anomalies and polygenic inheritance

Explain the mechanisms of sex determination

Enumerate the concept of genes, gene expression, genetic code, transcription and translation

Illustrate the mechanism of recombinant DNA technology and its practical applications

Explain the types of cancer, causes of transformation and characteristics of transformed cells

Identify the cells and organs of immune system, antigens and antibodies

Enumerate antigen-antibody interaction, generation of B-cell and T-cell response and major immunotechniques

Explain primary and secondary immunodeficiency diseases, autoimmune diseases, vaccination and vaccines