**DEPARTMENT OF ZOOLOGY**

**PROGRAM OUTCOME AND COURSE OUTCOME**

**PROGRAM OUTCOME**

1. Zoology has various scopes in different areas of life. Students gain knowledge on skill in fundamental of animal science and understand the complex interaction among various living organisms.
2. Zoology students are employed as experts of biomass and biogas technology in field of agriculture.
3. Pollution, which is a burning problem now-a-days, zoology students may help in this regard to maintain equilibrium using ecological knowledge.
4. The students of zoology in the fishery department act as extension officer, caretaker, induced breeder & marketing manager etc.
5. In case of self-employment apiculture, sericulture, fisheries, dairy farming, pest control management are the important areas covered in zoology.
6. The zoology student may be treated as key person in pathological and forensic laboratories.
7. Besides this the student of zoology may be engaged in departments of ZSI, archaeology, museum curator, wild life management, documentation and photography etc.

**Course Outcome:**

1. **CORE-1: ANIMAL DIVERSITY (LOWER NON-CHORDATES):** To enable students identify, classify different animals and learn about the fundamentals of general body structure, life cycle and their importance.

**U-1: Protista, Parazoa, Metazoa & Porifera:** Understanding the habitat, general characters, distribution of Protists & Porifera. Learning especially about pathological significance of parasitic protozoa.

**U-2: Cnidaria & Coelenterata:** Understanding the habitat, general characters, distribution of coelenterates in general. Knowing about corals, their ecological significance and the threats to corals caused by climate change.

**U-3: Platyhelminthes:** Students acquire knowledge about parasitic flatworms & diseases caused by them.

**U-4: Nemathelminthes:** Students gain informationabout parasitic roundworms & diseases caused by them. They are well informed about how to control the parasitic animals.

1. **CORE-2: PRINCIPLES OF ECOLOGY**: Analyze complex interactions among the various animals, their distribution and their relationship with the environment.

**U-1: Ecosystem & Applied Ecology:** Students develop awareness about ecosystem & how to protect the ecosystem from environmental pollution.

**U-2: Population:** This unit develops the understanding of a population in a particular area, Population interactions, mortality, natality etc. & Gause’s Principle.

**U-3: Community:** This portion gives clear idea to students aboutspecies richness, dominance, diversity, abundance, Ecotone and edge effect; Ecological succession.

**U-4: Biometry:** In this unit, students develop their biostatistical skills & implication of biostatistical methods like frequency polygon and histogram, Mean, median and mode calculation, mean deviation and standard deviation, Chi-square test, t- test.

1. **CORE-3: ANIMAL DIVERSITY (HIGHER NON-CHORDATES):** Students will be able to identify & classify different animals and learn about the fundamentals of general body structure, life cycle and their importance.

**U-1: Coelomates & Annelids:** Understanding fundamental body patterns of Annelids, their organ systems, emphasizing on ecology and behaviour of earthworms.

**U-2: Arthropoda & Onychophora:** Studying classification of these animals, their structural pattern, physiology etc. & the process of Metamorphosis & Social life in insects. Onychophorans play a connecting role in between both Annelids & Arthropods.

**U-3: Mollusca:** Identifying, classifying different types of Mollusca, studying unique phenomenon like ‘Torsion in Gastropods’. Significance of their larval forms.

**U-4: Echinodermata:** Students gain knowledge by studying the general characters, classification of Echinoderms with emphasis on ‘Water vascular system’ & larval forms.

1. **CORE-4: CELL BIOLOGY:** Understanding the basic concepts of structure and function of different types of cells and cell organelles. Applying the knowledge of internal structure of cell, its functions in control of various metabolic functions.

**U-1: Overview of cells and plasma membrane:** Information about prokaryotic & eukaryotic cells, virus, viroids, *Mycoplasma* & prions helps students in controlling different diseases. Studying models of plasma membrane helps in pharmaceutical research.

**U-2: Cytoskeleton &** **Endomembrane System:** Students get insight into the cytoskeletal components & Endomembrane System & their role in cellular manufacturing of biomolecules, their packaging & transport.

**U-3: Mitochondria and Peroxisomes:** In this unit students acquire knowledge about the “Power house of Cell” & the generation of energy & its utilization.

**U-4: Nucleus, Cell Division and Cell signalling:** This unit helps the students gathering knowledge about Nucleus; the controlling unit of cell & how it plays a major role during cell division & cell signaling.

1. **CORE-5: DIVERSITY AND DISTRIBUTION OF CHORDATA**: Students will be able to classify the animals from Protochordata to Mammalia and understand their complex physical & physiological characters.

**U-1:** **Protochordates & Origin of Chordates:** this portion gives a detail idea to students regarding protochordates & chordate characters, their outlined classification & their evolutionary history.

**U-2:** **Agnatha, Pisces & Amphibia:** Students get idea about the general characters, classification system of Pisces & learn about their behavioral phenomena like ‘migration & parental care’. Students also Identify & classify the class Amphibia.

**U-3:** **Reptilia & Aves:** Students will be able to Identify & classify both classes while focusing on their evolutionary connection. Flight & its mechanism will provide insights into special adaptations by class Aves.

**U-4:** **Mammals & Zoogeography:** Students will gain knowledge about important attributes of class Mammalia & their geographical distribution pattern while focusing on Plate tectonic and Continental drift theory.

1. **CORE-6: PHYSIOLOGY: CONTROLLING AND COORDINATION SYSTEM:** Students will gain knowledge about the various vital physiological processes especially endocrine system and nervous system of animals and how they are interlinked.

**U-1: Tissue & Tissue System:** Students get to learn about the tissue system in detail; types, structure, function etc.

**U-2: Muscle & Nervous System:** Studentsacquire knowledge about the structure, function of different types of muscles; with special attention on mechanism of skeletal muscle contraction. Learning basic structure of neurons, nerve impulse transmission, reflexes & sensory organs etc.

**U-3: Reproductive System:** Students willlearn about the reproductive organs in both males & females, hormonal regulations of various reproductive processes and contraceptive methods for sexual wellbeing.

**U-4:** **Endocrine System:** Studying about different endocrine glands, their hormones & the deficiency diseases will enable students realize the role of the Endocrine System in the maintenance of normal body physiology.

1. **CORE-07: FUNDAMENTALS OF BIOCHEMISTRY AND MICROBIOLOGY:** Students will learn about the important biomolecules which form the building blocks of life. Learning about their chemical structures & their role in maintaining & sustaining life processes.

**U-1:** **Carbohydrates & Lipids:** Students will learn the chemical structure of different Carbohydrates & Lipids with their physiological, nutritional importance.

**U-2: Proteins:** Proteins are the major products of cellular biosynthesis made during translation. They mediate virtually all cellular processes. Students learn detailed structure, function of Proteins & can apply this knowledge in biochemical, pathological, nutritional research.

**U-3: Enzymes**: Students learn about these essential biocatalysts, their mechanism, kinetics, and properties and how they catalyze different physiological reactions. Enzymes have significant applications in food industry & pharmaceutical industry.

**U-4: Microbiology:** Learning about both pathogenic & beneficial microbes, their structure, reproduction, nutrient requirements & culture will be essential for the students to apply this knowledge in developing food items, beverages, medicines, vaccines etc.

1. **CORE-08: COMPARATIVE ANATOMY OF VERTEBRATES:**

**U-1: Integumentary & Skeletal System:** Studying integument derivatives & structures.

**U-2:** **Digestive & Respiratory System:** Comparing Digestive & Respiratory System among vertebrates.

**U-3: Circulatory & Urinogenital System:** Comparing Circulatory & Urinogenital System among vertebrates.

**U-4: Nervous System & Sense Organs:** Comparing nervous System among vertebrates.

1. **CORE-9: PHYSIOLOGY: LIFE SUSTAINING SYSTEM:** Correlating the physiological processes of animals and relationship of organ systems.

**U-1: Physiology of Digestion:** Digestive glands, enzymes & digestion gives an overall idea to lead a healthy life.

**U-2: Physiology of Respiration:** Students gain knowledge about the structure, histology of lungs & respiratory mechanism.

**U-3: Renal physiology and Blood:** Students gather knowledge regarding the role of kidneys in the maintenance of homeostasis & different diseases due to renal failure.

**U-4: Physiology of Heart:** Heart is a vital organ & by gathering knowledge about itsstructure & function, helps a person to maintain cardiac health.

1. **CORE-10: BIOCHEMISTRY OF METABOLIC PROCESSES**: Students will realize the role of metabolism both in good health & in diseases.

**U-1: Overview of Metabolism:** Students will learn about basics of metabolism, the reactions involved, role of ATP in energy transactions.

**U-2: Carbohydrate Metabolism:** Students can learn about pathways of glucose oxidation during cellular respiration and generation of energy.

**U-3: Lipid & Protein Metabolism:** Students learn about the synthesis & degradation of lipids & fats & related metabolic diseases.

**U-4: Oxidative Phosphorylation:** Learning about the ETC & its inhibitors, students will gain insight into the process of ATP generation.

1. **CORE-11: MOLECULAR BIOLOGY:** Understanding the structure of the hereditary material; nucleic acids, their decoding & regulation.

**U-1: Nucleic Acid, DNA** **Replication & Repair:** Studying thestructure of Nucleic Acids & related processes will help students in the extraction & manipulation of various genetic samples using recent advanced technology.

**U-2: Transcription & Translation:** Studying these basic information decoding processes, the students will be able to analyze the genomic expression levels of different organisms using various molecular techniques.

**U-3: Post-transcriptional Modifications & Processing of Eukaryotic RNA:** Students learn the interrupted nature of eukaryotic gene, its splicing & processing to functional product.

**U-4: Gene Regulation & Regulatory RNAs:** Studying the “Bacterial Operon System”, enables the students to understand the prokaryotic genome regulation. Studying different eukaryotic gene regulation mechanisms will also be handy during its application in the research field.

1. **CORE-12: PRINCIPLES OF GENETICS**: Students will understand about various concepts of heredity; Mendel’s laws, gene interactions, mutations, the genome of bacteria & viruses etc.

**U-1: Mendelian Genetics, Linkage, Crossing Over and Chromosomal Mapping:** Studying the classical Mendelian experiments & laws of inheritance, the students will be able to understand the basics of heredity & apply this knowledge in plant breeding or in agriculture.

**U-2: Mutation:** Studying different mutagens will be helpful to find cure of genetic diseases like Cancer.

**U-3: Sex Determination & Extra-chromosomal Inheritance:** To studyBasis of sex determination in *Drosophila* & Human. Cytoplasmic & maternal inheritance.

**U-4: Recombination in** **Bacteria and Viruses & Transposable Genetic Elements:** To studyGene exchange in Bacteria and Viruses, Ac-Ds elements in maize and P elements in Drosophila, Human retrotransposons.

1. **CORE-13: DEVELOPMENTAL BIOLOGY**: Understanding the basics of how animal develops and its importance and implication.

**U-1: Introduction to Developmental Biology, Gametogenesis & Fertilization:** Understanding various concepts of development will help to diagnose any abnormal conditions related to human reproduction & fertility.

**U-2: Early Embryonic Development:** Understanding cleavage planes, patterns in different phyla, fate mapping to trace cell lineage & process of gastrulation in frog & chick. Spemann-Mangold organizer concept.

**U-3: Late Embryonic Development:** Learning about germ layer derivatives, Extra-embryonic membranes, Implantation & Placenta.

**U-4: Post Embryonic Development & Implications of Developmental Biology:** Learning about fascinating phenomena in animals like metamorphosis, regeneration etc. Studying ageing & teratogenesis.

1. **CORE-14**: **EVOLUTIONARY BIOLOGY:** Students will understand the complex evolutionary processes, evolution of species and behaviour of animals.

**U-1: Theories, Evidences of Evolution and Extinction:** Studying “Origin of Life”, Theories of evolution; Lamarckism, Darwinism, Neo-Darwinism. Types of Extinction gives an overall idea about the sustenance

**U-2: Process of Evolutionary changes:** Studying Hardy-Weinberg equilibrium, Natural selection, Genetic Drift etc. will help to understand attributes of natural populations.

**U-3: Species concept and Speciation:** Studying Species concept & speciation gives insight into evolution & generation of diversity of life on Earth.

**U-4: Concept of Origin and Evolution of man:** Studying human evolution will give students knowledge of our own ancestral history.

1. **GE 1**: **ANIMAL DIVERSITY (NON-CHORDATA), PHYSIOLOGY AND ENDOCRINOLOGY:** Analysing complex interactions among the various animals of different phyla, their distribution and relationship with the environment.

**U-1: Protista, Porifera, Radiata, Aceolomates and Pseudocoelomates:** Understanding the habitat, general characters, distribution of Protists & Porifera. Learning especially about pathological significance of parasitic protozoa.

**U-2: Coelomate Protostomes,** **Arthropoda, Mollusca and Coelomate Deuterostomes:** Classifying & identifying Arthropoda, Mollusca.

**U-3: Protochordata, Pisces, Amphibia:** Comparing Hemichordates, Urochordates, & Cephalochordates on basis of their chordate characters. Learning the Pisces characters, classification. Identifying, classifying the class Amphibia.

**U-4: Reptiles, Aves and Mammals:** Identifying, classifying both classes & focusing on their evolutionary connection. Mechanism & adaptations of flight in birds. Studying general characters, classification of Mammals.

1. **GE 3**: **HUMAN PHYSIOLOGY:**

**U-1: Digestion and Respiratory Physiology:** studying digestive & respiratory organs.

**U-2: Functioning of Excitable Tissue (Nerve and Muscle):** Learning basic structure of neurons, nerve impulse transmission, reflexes & sensory organs etc.

**U-3: Renal Physiology and Cardiovascular Physiology:** Studying renal filtration, heart structure, function.

**U-4: Endocrine and Reproductive Physiology:** Studying endocrine glands & hormones.

1. **DSE 1**: **ANIMAL BIOTECHNOLOGY:** Application of biotechnology in livestock improvement, pharmaceutical, forensic etc.

**U-1: Introduction to Animal Biotechnology:** Studying cloning techniques & cloning vectors helps in DNA manipulation.

**U-2: Molecular Techniques:** Tools of molecular technology used to develop drugs, vaccines, gene therapy & diagnostic test which improve human & animal health.

**U-3: Genetically Modified Organisms:** Students will learn applications ofGMOs in agriculture like-weeds, pest, drought resistant crops & Crops that contain good nutritional value. Transgenic animals can resist any deviation of environmental pollution & are helpful in lab.

**U-4: Culture Techniques and Applications:** Animal cell culture in biomedical research is important for vaccine production & treatment of genetic disorders.

1. **DSE 2**: **IMMUNOLOGY:** Studying the body’s defense system will enable the students to understand the role of immune system in fighting pathogens.

**U-1: Innate and Adaptive Immunity:** Studying History of immunology, types of immunity, gives students understanding of our immune system.

**U-2: Antigens and Immunoglobulins:** Studying antigen-antibody interaction will provide students knowledge behind blood grouping, transfusion etc.

**U-3: Major Histocompatibility Complex,** **Cytokines and Complement system:** Studying the self-nonself recognition factor. Role of Cytokines and Complement system in immunity.

**U-4:** **Hypersensitivity and Vaccines:** Studying Hypersensitivity gives an idea about allergy & autoimmunity. Vaccines will give cure from diseases.

1. **DSE 3:** **WILDLIFE CONSERVATION AND MANAGEMENT**: Conserving the endangered species and restoring the ecosystem.

**U-1: Wildlife:** Learning in detail about the wildlife,Conservation strategies for animals in Odisha & India.

**U-2: Management of habitats:** Managing & restoring habitats with different techniques.

**U-3: Population estimation:** Studying different demographic parameters. Census methods.

**U-4: Management planning of wildlife in protected areas:** learning about National parks & sanctuaries, different conservation acts.

1. **DSE 4:** **PROJECT:** Student gains knowledge about how to make research proposal, Construct tool of data collection, learn fieldwork modalities, understands the process of data analysis and writing research projects.