

## **Course Outcomes: B.Sc. in Zoology with core courses**

Through core courses (CC) students would acquire comprehensive knowledge of the subject. While studying the discipline specific electives (DSE) they will be acquainted with the applied arena 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 skills that can be utilized for future educative, commercial and industrial fields.

### **SEMESTER 1**

#### **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.

**CO 2:** Academic attainment of the life cycles of *Giardia intestinalis*, *Leishmania donovani*, *Entamoeba histolytica* and *Plasmodium vivax*, *Fasciola hepatica* and *Taeniasolium*, *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Wuchereria bancrofti*

**CO 3 :** Knowledge of the diversity, biological facts and formation of coral reefs

**CO 4:** Grouping and identification of animals based on morphological characters and structure.

**CO 5:** Development of ideas how a simple single cell creature evolve to a creature with complex body plan

**CO 6:** Get **vulnerability** to 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 acquaintance to 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:** Acquainted with the diversity, evolution and general characteristics of different taxa of non-chordate from Annelida to Hemichordata.

**CO 3:** Develop ideas on physiological techniques, organization of body plan of non-chordates

**CO 4:** Aware of the phylogenetic relationship between chordate and non-chordate and evolutionary significance of taxon.

**CO 5:** Recognise 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 impression 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 signalling as well as apoptosis thus enabling them to understand the basis and anomalies in cancer.

**CO 5 :** To 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

### **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 )**

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 of releasing aquarium fishes into natural habitats.

**CO 2:** Gain with the obtained knowledge in biology of aquarium fish and their food and feeding behaviour.

**CO 3:** Gain skill to consider this practice at professional level with knowledge on living fish transport as well as 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 functional aspects

**CO 3 :** Get comparative enlightenment of stomach and dentition.

**CO 4:** Acquire information on origin and conduction of cardiac impulses, structure of mammalian heart and associated structures

**CO 5:** Perceive the process of thermoregulation and Osmoregulation.

**CO 6 :** Interpret 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.

### **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 T cells 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)**

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 criteria.

**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 .

### **CC12 –(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:** Perceive the molecular basis of Linkage, Crossing Over and Chromosomal Mapping

**CO 3:** Realize the basic concept of genetic mutations and chromosomal aberrations cause and effect of alteration in chromosome structure and function

**CO 4:** Be aware the Mechanisms of sex determination in *Drosophila* with reference to alternative splicing Sex determination in mammals Dosage compensation in *Drosophila* & Human

**CO 5:** Be acquainted about Criteria for extra chromosomal inheritance, Antibiotic resistance in *Chlamydomonas*, Kappa particle in *Paramecium* Shell spiralling in snail.

**CO 6:** Have Insight into 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 human.

**CO 7:** Analyze Pedigree of some inherited traits in human and identify chromosomal aberration in *Drosophila* 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 of modern animal behaviour studies: Tinbergen's four questions.

**CO 3:** Acquaintance to different types of behavior in individuals and develop concept on evolution of social behavior and ecological forces acting on sexual selection .

**CO 4:** Develop ideas and concept in chronobiology and Biological rhythm.

**CO 5:** Acquire knowledge on field techniques to study behavioral activities of animals in wild while taking part in educational excursion to reserve forests.

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

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

**CO 1:** Get general ideas 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.

## **VI Semester**

### **Developmental Biology ZOOACOR13T & ZOOACOR13P**

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

**CO 1 :** The journey from a single cell (fertilized egg/ zygote) to its ultimate multi-cellular form is best delineated in the course of Developmental Biology.

**CO 2 :** The course deals with the morphological, cellular, molecular and biochemical processes/events involved in this transformation.

**CO 3 :** Cellular changes depicting its potential versatility to its specialized cellular characters that makes it the functional unit in the specific tissue of the organism is dealt with in details.

**CO 4** : The course ends with a unit dedicated to the use of this science in various fields.

## **Evolutionary Biology ZOOACOR14T & ZOOACOR14P**

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

**CO 1**: The course enable the students to improvise the subjects more precisely in the light of evolution.

**CO 2** : They can understand the impact of genotypes and phenotypes of populations change over time, and thereby how the species evolve and become extinct is crucial for understanding biological diversity. Hence it is important to develop clear concepts about the mechanisms of evolution.

**CO 3** : This course introduces how the concepts of evolutionary biology developed, and provides a foundation for understanding the mechanisms of evolution through fossil studies, population genetics and phylogeny.

**CO 4** : This course provides training in developing evolutionary thinking without which knowledge and understanding about zoology would remain poor and largely incomplete.

## **Parasitology ZOOADSE05T & ZOOADSE 05P**

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

**CO 1**: Obtain knowledge of Parasite, parasitism, Parasitoid and Vectors (mechanical and biological vector), host parasite relationship, zoonosis and other forms of animal associations.

**CO 2**: Furthermore expanding on the information on the study of morphology, life cycle, prevalence, epidemiology, pathogenicity, diagnosis and prophylaxis of parasitic Protists, Platyhelminthes, Nematodes, Arthropoda and Vertebrates.

**CO3** :Acquainted the relationship in both Zoology and biomedical sciences

## **Wildlife and Conservation ZOOADSE06T & ZOOADSE06P**

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

**CO 1** : Appreciate biodiversity and conservation explore natural landscapes, species and ecosystems and acquires theories and practical methods in preserving environments and organisms.

**CO 2** :Recognise biodiversity and conservation related awareness and understanding of how human **life depends on preserving animal species and natural ecosystems.**

**CO 3**: Comprehend the relation of biodiversity and conservation with similar disciplines like environmental science, natural resources management and animal sciences.

**CO 4**:Aware of the threats to biodiversity, including habitat modification and loss, unsustainable resource use, introduced species and climate change.

**CO 5** :Figure out the management actions that are used to mitigate threats to biodiversity, including selecting nature reserves, connectivity and wildlife corridors, ecosystem restoration and control of pest plant.



## **SEM I**

### **Generic Elective/Department Specific Core Course-1**

#### **ZOOHGEC01T & ZOOHGEC01P / ZOOGCOR01T & ZOOGCOR01P**

#### **Animal Diversity**

##### **Course Objective**

- Demonstrate a fundamental understanding of the academic field of Zoology, its different learning areas and applications, and its link with related disciplinary areas/subjects; provides awareness on the divisions in Animal Kingdom, their distribution, relationship among them and with the environment.
- Show Procedural knowledge in various professions related to the subject in different fields inclusive of research and development, teaching, government and public services with the help of practical tests in different branches; Use it to analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.

##### **Course Outcome**

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

**CO 1** : Acquire an entry level detailed idea of animal kingdom.

**CO 2** :Enough to teach in schools, act as a keeper of animal specimens, help in identification of species.

**CO 3** : The student will able to act as an assistant.

## **SEM II**

### **Generic Elective/Department Specific Core Course-2**

#### **ZOOHGEC02T & ZOOHGEC02P / ZOOGCOR02T & ZOOGCOR02P**

#### **Human Physiology & Biochemistry**

##### **Course Objective**

- This will form as an introductory level of detailed study of physiology (higher vertebrates) and biochemistry. A simple approach to understand in mammalian physiology into various principles of life- supporting process like nervous system, respiration, digestive system etc.

- The biochemistry part will mainly introduce to structure and metabolism of protein, carbohydrate and lipids. The course does not intend to deal with very much details which will be higher compared to the standard of class 12 but much simpler than its counterpart courses in the Major section.

### **Course Outcome**

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

**CO 1:** Understand the process of digestion and its control.

**CO 2 :**Develop understanding in muscle structure and contraction mechanism.

**CO 3 :** Learn the process of respiration and transport of gases.

**CO 4 :** Understand kidney structure and regulation of urine formation.

**CO 5 :** Understand heart structure and functioning.

**CO 6 :** Understand function of endocrine glands and formation of gametes.

**CO 7:** Understand about the importance and scope of biochemistry.

## **SEM III**

### **Generic Elective/Department Specific Core Course-3**

### **ZOOHGEC03T & ZOOHGEC03P / ZOOGCOR03T & ZOOGCOR03P**

### **Insect Vectors and Diseases**

#### **Course Objective**

- This course has two distinct parts, the first dealing with insect classification (basic level not as detailed as in Major) of Insects,
- The second part is dedicated in understanding in the part that the insects act as vectors and the disease they cause. More emphasis is laid on second part that is vector biology as that is the more important part in recent times.

#### **Course Outcome**

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

**CO1 :** To learn understand the general features of insects and gain knowledge about their distribution and success on Planet Earth and to learn Insect's taxonomy, general morphology and physiology

**CO2 :** Learn about vector and vector borne diseases.

**CO3 :** Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.

**CO 4.** Diagnose the causative agents, describe pathogenesis and treatment for important diseases like malaria, leishmaniasis, Dengue, Chikungunya, Viral encephalitis, Filariasis .

**CO 5.** Explain how the infectious disease can transmit to human.

CO 6. Properly understand the prevention and control mechanism of infectious diseases.

CO 7. Develop education, communication programme and learn how to maintain proper WHO guidelines about infectious diseases.

## **SEM IV**

### **Generic Elective/Department Specific Core Course-4 ZOOHGEC04T & ZOOHGEC04P / ZOOGCOR04T & ZOOGCOR04P Environment and Public Health**

#### **Course Objective**

- The final part of the course involves the fall out of anthropogenic activities on environment. The effect of such anthropogenic activities on climate change, pollution and ultimately diseases will be dealt with in this course.
- The student shall be scientifically aware of the consequences of environmental perturbations and its effect on nature and ultimately on human health.

#### **Course Outcome**

Knowledge on the followings

1. Understand different causes of environmental pollution and their remedies
2. Learn about the depletion and contamination of natural resources.
3. To learn waste management technologies and its applications.
4. Develop awareness about the causative agents and control measures of many commonly occurring diseases