

**ZOOLOGY HONOURS**

**PART I: SEMESTER 1**

**COURSE OUTCOME 1**

**CORE COURSE 1. Non-Chordates I: Protists to Pseudocoelomates**

**ZOOA-CC1-1-TH**

Unit 1: Basics of Animal Classification: Understanding basic concepts Classification, Taxonomy and Systematics. Explaining different concept of classification.

Unit 2: Protista and Metazoa: Describing the general features and classification of the phylum Protozoa and understanding lifecycle and pathogenicity of some common Protozoans. Beside this, it is explaining the evolution of symmetry and segmentation of Metazoa.

Unit 3: Porifera: Explaining the general features and classification scheme and canal system in sponges.

Unit 4: Cnidaria: Explaining the general features and classification scheme and metagenesis and polymorphism in Cnidaria. In addition to that it is explaining the process of formation of corals and types. Explaining the effect of climate change on coral reef.

Unit 5: Ctenophora: Describing the general features of ctenophore.

Unit 6: Platyhelminthes: Describing the general features and classification of the phylum and understanding lifecycle and pathogenicity of two common disease causing species.

Unit 7: Nematoda: Describing the general features and classification of the phylum and understanding lifecycle and pathogenicity of two common disease causing species. And in addition to that it also explains the parasitic adaptations in helminthes.

**ZOOA-CC-1-1-P**

Identification of organisms from each phylum and staining of protozoa or helminth from gut of *Periplaneta* sp

**COURSE OUTCOME 2**

**CORE COURSE 2. Molecular Biology**

**ZOOA-CC1-2-TH**

Unit 1: Nucleic Acids: Describing structure and features of DNA and RNA with types, their properties.

Unit 2: DNA replication: Describing the processes of copying the genetic materials i.e the DNA in prokaryotic as well as eukaryotic systems. To understand the details process we have to know the major enzymes that regulate the process of replication in a semi-conservative manner. After primer removal how telomerase enzyme solves the end replication problem.

Unit 3: Transcription: The process and mechanism of transcription in both prokaryotes and eukaryotes, detailed idea about transcription factors.

Unit4: Translation: Describing the process of translation in prokaryotes, detailed idea on genetic code, wobble hypothesis.

Unit 5: Post Transcriptional Modifications And Processing Of Eukaryotic RNA: Detailed idea about 5'capping, splicing, polyadenylation and editing of eukaryotic RNA. Special emphasys on splicing, RNA editing.

Unit 6: Gene Regulation: This topic includes lactose and tryptophan operon. The role of activator, enhancers, silencer, repressor, siRNA and miRNA mediated gene silencing and DNA methylations etc.

Unit 7: DNA Repair Mechanism: Detailed study about the DNA repair mechanisms tounderstand how a cell identifies and corrects damage to the DNA molecules that encode its genome. DNA repair ensures the survival of a species by enabling parental DNA to be inherited as faithfully as possible by offspring. Various mechanisms are involved regarding this process.

Unit 8: Molecular Techniques: Understanding various functions i.e separation of DNA or protein their interactions etc. Our syllabus includes PCR and Blotting techniques.

**ZOOA-CC1-2-P**

Genomic DNA isolation, agarose gel elewctrophoresis, demonstration of polytene and lampbrush chromosomes and histogical staining of DNA, RNA.

**PART II: SEMESTER III**

**COURSE OUTCOME 1**

**CORE COURSE 5. Chordata**

**ZOOA-CC3-5-TH**

Unit 1: Introduction to Chordates: Explaining general characteristics and outline classification of Phylum Chordata.

Unit 2: Protochordata: Explaining general characteristics and classification of urochordata and cephalochordate.

Unit 3: Agnatha: Explaining general characteristics and classification of cyclostomes up to order.

Unit 4: Pisces: Describing general characteristics and classification up to living sub classes and in addition to that accessory respiratory organ, Migration in fishes; Parental care in fishes; Swim bladder in fishes.

Unit 5: Amphibia: Describing general characteristics and classification up to living Orders Metamorphosis, Paedomorphosis, Parental care in Amphibia.

Unit 6: Reptilia: Explaining general characteristics and classification upto living Orders. Poison apparatus and Biting mechanism in Snake. Poisonous & Non-poisonous snake.

Unit 7: Aves Explaining general characteristics and classification up to living Sub-Classes, Exoskeleton and migration in Birds; Principles and aerodynamics of flight.

Unit 8: Mammals Describing general characters and classification. It explains exoskeleton derivatives of mammals and adaptive radiation in mammals. Beside this, it describe the Echolocation in Micro chiropterans.

**ZOOA-CC-3-5-P**

Chordata Identification of organisms from each group of Chordata and Dissection of brain and pituitary – ex situ, digestive and Urino-genital system of Tilapia Pecten from Fowl head. This portion helps to know different organisms.

**COURSE OUTCOME 2**

**CORE COURSE 6. Animal Physiology: Controlling and Co-ordinating System**

**ZOOA-CC3-6-TH**

Unit 1: Tissues: Detailed explanation on structure, location and functions of different types of tissues (epithelial, connective, muscular and nervous)

Unit 2: Bone and cartilage: Analysis of types of bones and cartilages along with ossification process.

Unit 3: Nervous system: Explanation on neuron structure, action potential and its propagation, synapse, synaptic transmission and neuromuscular junction.

Unit 4: Muscular system: Histological study on muscle, its ultra-structure, characters, muscle fiber and an elaborative study on muscle contraction.

Unit 5: Reproductive system: Histological study of mammalian testis and ovary and detailed mechanism of menstrual and oestrous cycle.

Unit 6: Endocrine system: Histological study and function of mammalian thyroid, pancreas, pituitary and adrenal. Detailed study on hormones along with classification and their mechanism of action.

**ZOOA-CC3-6-P**

Study of muscle twitching with electrical stimulation, temporary mount preparation of slides, study of histological section of mammalian tissues, microtomy technique and permanent slide preparation of mammalian tissues

**COURSE OUTCOME 3**

**CORE COURSE 7. Fundamentals of Biochemistry**

**ZOOA-CC3-7-TH**

Unit 1: Carbohydrates: Detailed study about monosaccharides, disaccharides, polysaccharides; derivatives of monosaccharides; Study on carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis. Through this

course the students are exposed to importance of carbohydrate as biological molecules. Gather basic concepts of Cells along with various cellular functions.

Unit 2: Lipids: Studying structure and significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpenoids. Lipid metabolism:  $\beta$ -oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)}; Fatty acid biosynthesis. Acquiring knowledge about physiological significance of lipids in biological system.

Unit 3: Proteins: Analysing amino acids: Structure, Classification, General and Electrochemical properties of  $\alpha$ -amino acids; Physiological importance of essential and non-essential amino acids, Proteins Bonds stabilizing protein structure; Levels of organization; Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids. Studying the influence and role of proteins in the process of biological regulation.

Unit 4: Nucleic acids: Students are expected to learn Structure of purines, pyrimidines, nucleosides and nucleotides; nucleic acid metabolism: Catabolism of adenosine, guanosine, cytosine and thymine. Understanding role of nucleic acids and basic concepts of molecular Biology along with functions of DNA and RNA.

Unit 5: Enzymes: Detailed structure of nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition. It is important to acquire knowledge of function and significance of enzymes in biological process.

Unit 6: Oxidative phosphorylation: Understanding mechanism of the metabolic pathway used to produce energy through ATP inside cells. Students are expected to know Redox systems; Mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System

### **ZOOA-CC3-7-P**

Qualitative tests for carbohydrates, proteins, lipids, urea, uric acid. Quantitative estimation of protein and paper chromatography of amino acids.

**COURSE OUTCOME 4**

**Skill Enhancement courses (SEC)**

**SEC-1 Apiculture ZOOA-SEC(A)-3-1-TH**

Unit 1: Biology of Bees: Describing *Apis* and Non-*Apis* Bee species and their identification. General Morphology of *Apis* Honey Bees. Social Organization of Bee Colony

Unit 2: Rearing of Bees: Explaining bee rearing modern techniques and associated modern bee keeping equipment and methods of Extraction of Honey.

Unit 3: Diseases and Enemies: Describing disease and enemies of bee and control measures

Unit 4: Bee Economy: Explaining products of apiculture industry like Honey, Bees Wax, Propolis, Pollen etc. and uses

Unit 5: Entrepreneurship in Apiculture: Describing the recent scenario of Bee Keeping Industry and Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

**PART III: SEMESTER V**

**COURSE OUTCOME 1**

**CORE COURSE 11. Ecology**

**ZOOA-CC5-11-TH**

Unit 1: Introduction to Ecology: Notes on autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.

Unit 2: Population: Unitary and Modular populations Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation – density dependent and independent factors, Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition.

Unit 3: Community: Study of community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect; Ecological succession with one example.

Unit 4: Ecosystem: Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow, Ecological pyramids and Ecological efficiencies; Nitrogen cycle.

Unit 5: Applied Ecology: Types & level of biodiversity, Mega-diversity countries, biodiversity hot spot, Flagship species, Keystone species, Wildlife Conservation (*in situ* and *ex situ* conservation), concept of protected areas. red data book, Indian wild life act & Schedule. Concept of corridor, advantages and problem of corridor. Study on the threats to survival conservation strategies for Tiger, Olive ridley, White Rumped Vulture.

### **ZOOA-CC5-11-P**

1. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO<sub>2</sub>
3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden

### **COURSE OUTCOME 2**

#### **CORE COURSE 12. Principle of genetics**

### **ZOOA-CC5-12-TH**

Unit 1: Mendelian Genetics and its Extension: Principles of inheritance, Incomplete dominance and co-dominance, Concept of epistasis, Multiple alleles, Isoallele (White eye mutations), Pseudoallele (Lozenge Locus) & Cis-trans test for allelism, lethal alleles, pleiotropy, penetrance & expressivity

Unit 2: Linkage, Crossing Over and Linkage Mapping: Linkage and Crossing, Complete & Incomplete Linkage, measuring recombination frequency . Linkage map construction using three factor crosses, Interference and coincidence. Study of sex linkage in *Drosophila* (White eye locus) & Human (Haemophilia).

Unit 3: Mutations: Types of gene mutations (Classification), Types of chromosomal aberrations, variation in chromosome number; Notes on nondisjunction of X chromosome in *Drosophila*; Non-disjunction of Human Chromosome 21. Detailed study on molecular basis

of mutations in relation to UV light and chemical mutagens. Mutation detection in *Drosophila* by attached X method. Biochemical mutation detection in *Neurospora*.

Unit 4: Sex Determination: Mechanisms of sex determination in *Drosophila* and in man; Dosage compensation study in *Drosophila* & Human.

Unit 5: Extra-chromosomal Inheritance: Kappa particle in *Paramecium*, Shell spiralling in snail.

Unit 6: Genetic Fine Structure: Complementation test in Bacteriophage (Benzer's experiment on rII locus)

Unit 7: Transposable Genetic Elements: Study of IS element in bacteria, Ac-Ds elements in maize and P elements in *Drosophila*, LINE, SINE, Aluelements in humans.

### **ZOOA-CC5-12-P**

1. Chi-square analyses for genetic ratio test
2. Identification of chromosomal aberration in *Drosophila* and man from photograph
3. Pedigree analysis of some inherited traits in animals.

### **COURSE OUTCOME 3**

#### **Discipline Specific Elective**

#### **DSE 1. Parasitology**

#### **ZOOA-DSE(A)-5-1-TH**

Unit 1: Introduction to Parasitology: Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector); Host parasite relationship.

Unit 2: Parasitic Protists: Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*.

Unit 3: Parasitic Platyhelminthes: Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Schistosoma haematobium*, *Taenia solium*.

Unit 4: Parasitic Nematodes: Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereriabancrofti*, Study of nematode plant interaction.



Unit 5: Parasitic Arthropods: Biology, importance and control of ticks: Soft tick (*Ornithodoros*), Hard tick (*Ixodes*), mites (*Sarcoptes*), Lice (*Pediculus*), Flea (*Xenopsylla*) and Bug (*Cimex*). Parasitoid.

Unit 6: Parasite Vertebrates: Study on cookicutter Shark, Hood Mocking bird, Vampire bats their parasitic behaviour and effect on host.

### **ZOOA-DSE(A)-5-1-P**

1. Study of life stages of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmaniadonovani*, *Plasmodium vivax*, *Plasmodium falciparum* through permanent slides/micro photographs
2. Study of adult and life stages of *Schistosoma haematobium*, *Taeniasolium* through permanent slides/micro photographs
3. Study of adult and life stages of *Ancylostomaduodena* through permanent slides/micro photographs.
4. Study of monogenea from the gills of fresh/marine fish.
5. Study of nematode/cestode parasites from the intestines of Poultry bird.
6. Submission of a brief report on parasitic vertebrates

### **COURSE OUTCOME 4**

#### **DSE 1. Endocrinology**

### **ZOOA-DSE(B)-5-1-TH**

Unit 1: Introduction to Endocrinology: Brief idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neuro-secretions and Neuro-hormones: Examples and Functions.

Unit 2: Hypothalamo-Hypophyseal Axis: Structure and functions of hypothalamus and hypothalamic nuclei, regulation of neuroendocrine glands, feedback mechanisms, Hypothalamo-Hypophyseal-Gonadal Axis. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system.

Unit 3: Peripheral Endocrine Glands: Structure, hormones and functions of thyroid gland, parathyroid, adrenal, pancreas, ovary and testis. Disorders of endocrine glands (*Diabetes mellitus* type I & Type II; Graves' Disease).

Unit 4: Regulation of Hormone Action: Mechanism of action of steroidal, non-steroidal hormones with receptors (cAMP, IP3-DAG), Studying calcium and glucose homeostasis in mammals. Bioassays of hormones using RIA & ELISA, estrous cycle in rat and menstrual cycle in human.

Unit 5. Non Mammalian Vertebrate Hormone: Functions of prolactin in fishes, amphibia & birds. Function of Melanotropin in teleost fishes, amphibians and reptiles.

### **ZOOA-DSE(B)-5-1-P**

1. Dissection and display of endocrine glands in laboratory bred rat.
2. Study of the permanent slides of all the endocrine glands.
3. Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland.
4. H-E staining of Histological slides.

## **ZOOLOGY GENERAL**

### **PART I: SEMESTER 1**

#### **COURSE OUTCOME 1**

#### **CORE COURSE1. Animal Diversity**

#### **ZOOG-CC1-1-TH**

Unit 1: Kingdom Protista: Describing the general feature of protozoa and its classification up to phylum. Understand the locomotion in *Amoeba* and *Paramecium*.

Unit 2: Phylum Porifera: Describing the general feature of porifera and its classification up to classes. To understand the canal system in *Sycon*.

Unit 3: Phylum Cnidaria: Describing the general feature of cnidaria and its classification up to classes. To understand the process of metagenesis in *Obelia*.

Unit 4: Phylum Platyhelminthes: Explaining the general characteristics and classification up to classes in platyhelminthes. To understand the life cycle of *Taenia solium*.

Unit 5: Phylum Nematelminthes: Describing the general feature and classification up to classes in nematode. From here the life cycle and parasitic adaptations in *Ascaris lumbricoides* are described.

Unit 6: Phylum Annelida: Describing the general characters and classification up to classes and explaining the metamerism in annelids.

Unit 7: Phylum Arthropoda: Explaining the general features and classification up to classes. In addition with this, it also explaining eye in cockroaches and metamorphosis in Lepidoptera.

Unit 8: Phylum Mollusca: Describing the general characteristics and classification up to classes and the mode of respiration in *Pila* .

Unit 9: Phylum Echinodermata: Explaining the general features and classification up to classes. With this the Water vascular system in Asteridea.

Unit 10: Protochordates: Describing the general characteristics. With this the general structure of pharynx and the feeding mechanism in *Amphioxus*.

Unit 11: Agnatha: Describing the general features of Agnatha and classification of cyclostomes up to classes.

Unit 12: Pisces: Explaining the general features and classification up to orders. With this the mechanism of osmoregulation in fishes.

Unit 13: Amphibia: Describing the general features and classification up to orders. With this the process of parental care.

Unit 14: Reptiles: Describing the general features and classification up to orders. Make the differentiation between poisonous and non-poisonous snakes and the process of biting mechanism in poisonous snake.

Unit 15: AveS: Describing the general features and classification up to orders with this describing the flight adaptations in birds.

Unit 16: Mammals: Describing the classification up to orders. Also describing the structure and function of horn, hair, antler, nail and claw.

### **ZOOG-CC1-1-P**

Identification with reasons of various specimens of invertebrates and vertebrates.

Identify with reasons the poisonous and non-poisonous snakes.

Dissecting the digestive, mouth parts, salivary gland of cockroach and study their female reproductive system.

## **PART II: SEMESTER 3**

### **COURSE OUTCOME 1**

#### **CORE COURSE 3. Physiology and Biochemistry**

### **ZOOG-CC3-3-TH**

Unit 1: Nerve And Muscle: Detailed structure of a neuron, with this the membrane potentials, origin of nerve impulse. Beside this the detailed ultra structure of skeletal muscle and their molecular and chemical basis of contraction.

Unit 2: Digestion: Explaining the physiology of digestion and the absorption mechanism.

Unit 3: Respiration: Study the pulmonary ventilation and transportation of gases.

Unit 4: Cardio-Vascular System: Study the composition of blood, detailed structure of heart, cardiac impulse and cardiac cycle.

Unit 5: Excretion: Basic structure of nephron, detailed mechanism of urine formation and counter current mechanism.

Unit 6: Reproduction And Endocrine Glands: Brief physiology of male and female reproduction, detailed histology of testis and ovary, hormonal control in hypothalamo-hypophyseal gonadal axis, with this the structure and function of few endocrine glands.

Unit 7: Carbohydrate Metabolism: Detailed pathway of carbohydrate metabolism.

Unit 8: Lipid Metabolism: Detailed pathway of beta oxidation.

Unit 9: Protein Metabolism: Explained the process of transamination and deamination. With these the process of urea cycle.

Unit 10: Enzymes: Types of classification, their action, inhibition.

### **ZOOG-CC3-3-P:**

Study of histological slides of pituitary, thyroid, pancreas, adrenal glands.

Study of histological slides of duodenum, liver, lung, kidney.

Qualitative test for carbohydrate.

## **PART III: SEMESTER 5**

### **COURSE OUTCOME 1**

#### **DISCIPLINE SPECIFIC COURSES: ELECTIVE COURSE**

#### **ZOOG-DSE-A-5-1-TH: Applied Zoology**

Unit 1: Host & Parasitic Relationship: Different types of hosts and their interactions.

Unit 2: Epidemiology Of Diseases: Studied transmission, preventive measures and control of tuberculosis and typhoid.

Unit 3: Parasitic Protozoa: Life history, pathogenesis and control of various parasitic protozoans like *Entamoeba*, *Plasmodium* and *Trypanosoma*.

Unit 4: Parasitic Helminthes: Life history, pathogenesis and control of parasitic helminth like *Ancylostoma*, *wuchereria*.

Unit 5: Insect Of Economic Importance: Studied biology, control and damage caused by various insects.

Unit 6: Insect Of Medical Importance: Several medical importance and control of *Anopheles*.

Unit 7: Animal Husbandry: Study the process of artificial insemination in cattle, the preservation method, with this the induction of early puberty and synchronization of estrus in cattle.

Unit 8: Poultry Farming: Study different types of poultry bird with their characters, management of breeding stock & broilers, processing and preservation of their eggs.

Unit 9: Fish Technology: Study the genetic improvements in aquaculture industry, process of induced breeding and transportation of fish seed.

**ZOOG-DSE-A-5-1-P:**

Study of various protozoans and parasites from the permanent slides.

Study of arthropod vectors which are associated with human diseases.

Sudy of insect pest.

Identifying feature and economic importance of various pests.