



# DHRUBA CHAND HALDER COLLEGE

(FORMERLY DAKSHIN BARASAT COLLEGE)

ESTD. - 1965

**A NAAC Accredited Degree College Affiliated to University of Calcutta**

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Ref. No. ....

Date .....20

## DEPARTMENT OF ZOOLOGY

Honours, CBCS, Calcutta University

### PROGRAMME SPECIFIC OUTCOME (PSO) – COURSE OUTCOME (CO)

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#### Programme Specific Outcome (PSO)

- PSO 01:** Given a biological phenomenon, formulate questions about that phenomenon
- PSO 02:** Use scientific methods in conducting experimental research.
- PSO 03:** Perform original observations of biological principles.
- PSO 04:** Present an oral explanation of any biological principle or any biological information.
- PSO 05:** Write an explanation of a biological principle or information from the biological literature.
- PSO 06:** Create and interpret a graph or other visual representation of information.
- PSO 07:** Evaluate arguments supporting different perspectives.
- PSO 08:** Explain how biology affects social issues and how social issues affect biology.
- PSO 09:** Discuss ethical dilemmas that are introduced into society through science or introduced into science through the social views of researchers.
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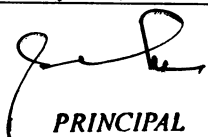
**PRINCIPAL**  
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South 24 Parganas, Pin- 743372

| COURSE CODE  | CONTENT OF CU SYLLABUS  | COURSE OUTCOME   |
|--|---|--|
| <b>SEMESTER 1</b>                                    |   |  |
| <b>NON-CHORDATES- I</b><br><br><b>ZOOA- CC1-1-TH</b> | <p><b>Protists to Pseudocoelomates</b></p> <p><b>Unit 1: Basics of Animal Classification</b><br/> Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Concept of classification – three kingdom concept of Carl Woese, 1977 and five kingdom concept of Whittaker, 1969</p> <p><b>Unit 2: Protista and Metazoa</b></p> <p><b>Protozoa</b><br/> General characteristics and Classification up to phylum (according to Levine <i>et. al.</i>, 1980)Locomotion in <i>Euglena</i>, <i>Paramecium</i> and <i>Amoeba</i>; Conjugation in <i>Paramecium</i>. Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i></p> <p><b>Metazoa</b><br/> Evolution of symmetry and segmentation of Metazoa</p> <p><b>Unit 3: Porifera</b><br/> General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6<sup>th</sup> Ed.); Canal system and spicules in sponges</p> <p><b>Unit 4: Cnidaria</b><br/> General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6<sup>th</sup> Ed.) Metagenesis in <i>Obelia</i>; Polymorphism in Cnidaria; Corals and coral reef diversity, Role of symbiotic algae in reef formation. Conservation of coral and coral reefs.</p> <p><b>Unit 5: Ctenophora</b><br/> General characteristics</p> <p><b>Unit 6: Platyhelminthes</b><br/> General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6<sup>th</sup> Ed.)Life cycle and pathogenicity and control measures of <i>Fasciola hepatica</i> and <i>Taenia solium</i></p> | <p>Students will be able to</p> <p><b>CO 01.</b> Identify and discuss features and concepts of animal classification from unicellular to multicellular level.</p> <p><b>CO 02.</b> Understand general Characters of animals based on grades of organization, symmetry, body cavity etc.</p> <p><b>CO 03.</b> Study the characteristic features of each phylum up to class with examples.</p> <p><b>CO 04.</b> Describe unique Concepts found in specific animal groups like metagenesis, canal system, polymorphism, pathogenicity, parasitic adaptations etc.</p> |




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| <p><b>NON-CHORDATES- I</b><br/><b>ZOOA-CC1-1- P</b></p>  | <p><b>Unit 7: Nematoda</b><br/>General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6<sup>th</sup> Ed.) Life cycle, and pathogenicity and control measures of <i>Ascaris lumbricoides</i> and <i>Wuchereriabancrofti</i> Parasitic adaptations in helminthes</p> <p><b>PRACTICAL</b><br/>Study of whole mount of <i>Euglena</i>, <i>Amoeba</i> and <i>Paramoecium</i> Identification with reason &amp; Systematic position of <i>Amoeba</i>, <i>Euglena</i>, <i>Entamoeba</i>, <i>Paramecium</i>, <i>Plasmodium</i>, <i>Balantidium</i>, <i>Vorticella</i> (from the prepared slides) 3. Identification with reason &amp; Systematic position of <i>Sycon</i>, <i>Poterion</i> (Neptune's Cup), <i>Obelia</i>, <i>Physalia</i>, <i>Aurelia</i>, <i>Gorgonia</i>, <i>Metridium</i>, <i>Pennatula</i>, <i>Madrepora</i>, <i>Fasciola hepatica</i>, <i>Taenia solium</i> and <i>Ascaris lumbricoides</i>. Staining/mounting of any protozoa/helminth from gut of <i>Periplaneta</i> sp.</p> | <p>The students will develop a clear<br/><b>CO 05.</b> Knowledge of whole mount slide preparation, identification according to specific classification system and brief concepts on staining and mounting process of different gut parasites in cockroach.</p>                              |
| <p><b>MOLECULAR BIOLOGY</b><br/><b>ZOOA-CC1-2-TH</b></p> | <p><b>Unit 1: Nucleic Acids</b><br/>Salient features of DNA, Chargaff's Rule, Hypo and Hyperchromic shift. Watson and Crick<br/>Model of DNA. RNA types &amp; Function.</p> <p><b>Unit 2: DNA Replication</b><br/>Mechanism of DNA Replication in Prokaryotes, Prove that replication is Semi-conservative, bidirectional and discontinuous, RNA priming, Replication of telomeres.</p> <p><b>Unit 3: Transcription</b><br/>Mechanism of Transcription in</p>   | <p>The students will develop a clear concept of<br/><b>CO 01.</b> Explaining the basic structure of nucleic acid and molecular mechanisms of DNA replication in prokaryotes and eukaryotes.<br/><b>CO 02.</b> Deciphering concepts of Transcription in prokaryotes and eukaryotes, mRNA</p> |

  
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| <p><b>MOLECULAR BIOLOGY</b></p> <p><b>ZOOA-CC-1-2-P</b></p> | <p>prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.</p> <p><b>Unit 4: Translation</b><br/>Genetic code, Degeneracy of the genetic code and Wobble Hypothesis.<br/>Mechanism of protein synthesis in prokaryotes.</p> <p><b>Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA</b><br/>Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing and RNA editing</p> <p><b>Unit 6: Gene Regulation</b><br/>Regulation of Transcription in prokaryotes: <i>lac</i> operon and <i>trp</i> operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing.<br/>Epigenetic Regulation: DNA Methylation, Histone Methylation &amp; Acetylation.</p> <p><b>Unit 7: DNA Repair Mechanisms</b><br/>Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair</p> <p><b>Unit 8: Molecular Techniques</b><br/>PCR, Western and Southern blot, Northern Blot</p> <p><b>List of Practicals:</b></p> <ol style="list-style-type: none"> <li>1. Demonstration of polytene and lampbrush chromosome from photograph</li> <li>2. Isolation and quantification of genomic DNA from goat liver.</li> <li>3. Agarose gel electrophoresis for DNA.</li> <li>4. Histological staining of DNA and RNA in prepared slides</li> </ol> | <p>processing and modifications and concept of genetic code, mechanism of protein synthesis and post translational modification.</p> <p><b>CO 03.</b> Describing how gene expression is regulated at the transcriptional and post transcriptional level.</p> <p><b>CO 04.</b> Different types of DNA repairing mechanism and estimation of nucleic acids and protein.</p> <p><b>CO 05.</b> Concepts of giant chromosomes and DNA isolation, visualization and quantification techniques.</p> |
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| COURSE CODE   | CONTENT OF CU SYLLABUS  | COURSE OUTCOME   |
| <b>SEMESTER 2</b>   |   |  |
| <p><b>NON-CHORDATES-II</b></p> <p><b>ZOO A-CC2-3-TH</b></p> | <p><b>Coelomates</b></p> <p><b>Unit 1: Introduction</b><br/>Evolution of coelom</p> <p><b>Unit 2: Annelida</b><br/>General characteristics and Classification up to classes (Ruppert and Barnes, 1994)<br/>Excretion in Annelida through nephridia; Metamerism in Annelida.</p>   | <p>The 2<sup>nd</sup> part of Non-chordates will give the students a clear picture of</p> <p><b>CO 01.</b> Basic concept of Evolution in non-chordates like development of coelom,</p>   |

  
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| <p><b>NON-CHORDATES-II</b></p> <p><b>ZOO A-CC2-3-P</b></p> | <p><b>Unit 3: Arthropoda</b><br/>General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Insect Eye (Cockroach only). Respiration in Prawn and Cockroach; Metamorphosis in Lepidopteran Insects; Social life in Termite</p> <p><b>Unit 4: Onychophora</b><br/>General characteristics and Evolutionary significance</p> <p><b>Unit 5: Mollusca</b><br/>General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Nervous system in <i>Pila</i> sp. Torsion in Gastropoda. Feeding and respiration in <i>Pila</i> sp.</p> <p><b>Unit 6: Echinodermata</b><br/>General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Water vascular system in <i>Asterias</i>. Echinoderm larva and affinities with chordates</p> <p><b>Unit 7: Hemichordata</b><br/>General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates</p> <p><b>Practical</b><br/><b>Non-Chordates II</b><br/>1. Study of following specimens:<br/>a. Annelids - <i>Aphrodite</i>, <i>Nereis</i>, <i>Chaetopterus</i>, <i>Earthworm</i>, <i>Hirudinaria</i><br/>b. Arthropods - <i>Limulus</i>, <i>Palaemon</i>, <i>Balanus</i>, <i>Eupagurus</i>, <i>Scolopendra</i>, <i>Peripatus</i>, Silkworm – life history stages, Termite – members of a colony and Honey bee – members of the colony<br/>c. Molluscs - <i>Dentalium</i>, <i>Patella</i>, <i>Chiton</i>, <i>Pila</i>, <i>Achatina</i>, <i>Pinctada</i>, <i>Sepia</i>, <i>Octopus</i>, <i>Nautilus</i><br/>d. Echinoderms - <i>Asterias</i>, <i>Ophiura</i>, <i>Clypeaster</i>, <i>Echinus</i>, <i>Cucumaria</i> and <i>Antedon</i><br/>2. Anatomy study: Nervous system, Reproductive system (Male &amp; female), Mouth parts &amp; Salivary apparatus in <i>Periplaneta</i> sp.</p> | <p>Study of salient identifying features and special features like metamerism, metamorphosis, eusociality and variation in physiological process in non- chordates like respiration, excretion, vision, etc.</p> <p><b>CO 02.</b> Concept of connecting link with evolutionary significance.</p> <p><b>CO 03.</b> Study on classification and salient features of non- chordates from Mollusca to Hemichordata.</p> <p><b>CO 04.</b> Different physiological adaptations including torsion in Mollusca, Water vascular system in Echinoderms and affinities of Hemichordates.</p> <p>The students will develop the skill for</p> <p><b>CO 05.</b> Study of spot identification of non-chordates specimen and detailed anatomical studies in <i>Periplaneta</i> sp</p> |
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| <b>CELL BIOLOGY</b><br><b>ZOOA- CC2-4-TH</b> | <p>Unit 1: Plasma Membrane</p> <p>Ultra-structure and composition of Plasma membrane: Fluid mosaic model, Transport across membrane - Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Gap junctions, Desmosomes</p> <p>Unit 2: Cytoplasmic organelles I</p> <p>5Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes; Protein sorting and mechanisms of vesicular transport</p> <p>Unit 3: Cytoplasmic organelles II</p> <p>7Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis; Peroxisomes: Structure and Functions 9 Centrosome (Kinetochore and centromeric DNA): Structure and Functions</p> <p>Unit 4: Cytoskeleton</p> <p>Type, structure and functions of cytoskeleton; Accessory proteins of microfilament &amp; microtubule Unit 5: Nucleus Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome),</p> <p>Unit 6: Cell Cycle 10 Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras. Process of Proto-oncogene activation</p> <p>Unit 7: Cell Signalling 8 Cell signalling transduction pathways; Types of signalling molecules and receptors (Classification and Example only): RTK &amp; JAK/STAT. Apoptosis</p> | <p>Students will be able to gain concept on</p> <p><b>CO 01.</b> Demonstration and understanding of structure and functions of different cellular organelles.</p> <p><b>CO 02.</b> Describing the mechanisms of vesicular and protein transport to various sub cellular sites.</p> <p><b>CO 03.</b> Concepts on Mitochondria, its origin and different biochemical processes, structure and function of Peroxisome, centrosome and cytoskeleton. Brief concepts on different grades of packaging of chromatin fibre with detailed structure and function of nucleus.</p> <p><b>CO 04.</b> Discuss the mechanisms of cell to cell signaling, including intracellular second –messenger pathways.</p> <p><b>CO 05.</b> Explain the cell cycle and its regulation. Demonstrate an understanding of molecular pathways that are altered in cancers including oncogenes, tumor suppressors, apoptosis and DNA repair.</p> |
| <b>CELL BIOLOGY</b><br><b>ZOOA- CC2-4-P</b>  | <p><b>PRACTICAL</b></p> <p>1. Preparation of temporary stained squash of onion/arum root tip to study</p>  | <p><b>CO 06.</b> Study on the mechanism of mitosis in meristematic tissue of</p>   |

  
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|   | various stages of mitosis<br>2. Study of various stages of meiosis from grasshopper testis<br>3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.<br>4. Preparation of permanent slide to demonstrate:<br>a. DNA by Feulgen reaction<br>b. Cell viability study by Trypan Blue staining   | onion and Meiosis in grasshopper.<br>Demonstrating presence of DNA in permanent slide by Feulgen reaction, Barr body demonstration in buccal epithelium, Cell viability study using Trypan Blue.   |
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| COURSE CODE                                 | CONTENT OF CU SYLLABUS   | COURSE OUTCOME   |
| <b>SEMESTER 3</b>                           |  |  |
| <b>CHORDATA</b><br><br><b>ZOOA-CC3-5-TH</b> | <b>Unit 1:</b> Introduction to Chordates<br>General characteristics and outline classification of Phylum Chordata (Young, 1981)<br><b>Unit 2:</b> Protochordata<br>General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes (Young, 1981). Metamorphosis in Ascidia.<br>Chordate Features, structure of pharynx and feeding in <i>Branchiostoma</i><br><b>Unit 3:</b> Agnatha<br>General characteristics and classification of cyclostomes up to order (Young, 1981)<br><b>Unit 4:</b> Pisces<br>General characteristics and classification up to living sub classes (Young, 1981); Accessory respiratory organ, Migration in fishes; Parental care in fishes; Swim bladder in fishes.<br><b>Unit 5:</b> Amphibia<br>General characteristics and classification up to living Orders (Young, 1981); Metamorphosis, Paedomorphosis, Parental care in Amphibia<br><b>Unit 6:</b> Reptilia<br>General characteristics and classification up to living Orders (Young, 1981); Poison apparatus and Biting mechanism in Snake. Poisonous & Non-Poisonous snake.<br><b>Unit 7:</b> Aves<br>General characteristics and classification up to living Sub-Classes (Young, 1981); Exoskeleton and migration in Birds; Principles and aerodynamics of flight<br><b>Unit 8:</b> Mammals<br>General characters and classification up to living sub classes (Young, 1981); | Students will be able to gain concept on<br><b>CO 01.</b> Understanding the levels of organization in chordates.<br><br><b>CO 02.</b> Learning general characters of each vertebrate class.<br><br><b>CO 03.</b> Describing unique characters of Urochordates, Cephalochordates and fishes.<br><br><b>CO 04.</b> Describing unique characters of amphibians, reptiles, aves and mammals upto subclass/ order.<br><br><b>CO 05.</b> To understand the special features of some chordates like metamorphosis, paedomorphosis, parental care in Fishes and Amphibia, biting mechanism and poison apparatus in poisonous snake, migration and aerodynamics principle of bird flight, |


  
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| <p><b>CHORDATA</b></p> <p><b>ZOOA-CC3-5-P</b></p>   | <p>Exoskeleton derivatives of mammals;<br/>Adaptive radiation in mammals with reference to locomotory appendages;<br/>Echolocation in Micro chiropterans</p> <p><b>PRACTICAL</b></p> <p>Identification with Reasons</p> <p>a) Protochordata: <i>Balanoglossus</i>, <i>Branchiostoma</i></p> <p>b) Agnatha: <i>Petromyzon</i></p> <p>c) Fishes: <i>Scoliodon</i>, <i>Sphyrna</i>, <i>Pristis</i>, <i>Torpedo</i>, <i>Mystus</i>, <i>Heteropneustes</i>, <i>Labeo rohita</i>, <i>Exocoetus</i>, <i>Hippocampus</i>, <i>Anabas</i>, Flat fish</p> <p>d) Amphibia: <i>Necturus</i>, <i>Bufo</i> (<i>Duttaphrynus</i>) <i>melanostictus</i>, <i>Rana</i> (<i>Hoplobatrachus</i>) <i>tigerinus</i>, <i>Hyla</i>, <i>Tylotriton</i>, Axolotl larva</p> <p>e) Reptilia: <i>Chelone</i>, <i>Trionyx</i>, <i>Hemidactylus</i>, <i>Varanus</i>, <i>Calotes</i>, <i>Chamaeleon</i>, <i>Draco</i>, <i>Vipera</i>, <i>Naja</i>, <i>Hydrophis</i>,</p> <p>f) Mammalia: Bat (Insectivorous and Frugivorous), <i>Funambulus</i> (Indian Palm squirrel)</p> <p>Dissection of brain and pituitary – ex situ, digestive and Urino-genital system of <i>Tilapia</i></p> <p>Pecten from Fowl head</p> <p>Power point presentation on study of habit, habitat or behaviour of any one animal by student – for internal assessment only</p> | <p>exoskeletal derivative and echolocation in Mammals.</p> <p><b>CO 06.</b> Identification of representative types from each class with appropriate reasons</p> <p><b>CO 07.</b> Practical based study of internal organs and systems</p>  |
| <p><b>ANIMAL PHYSIOLOGY : CONTROLLING AND COORDINATING SYSTEM</b></p> <p><b>ZOOA-CC3-6-TH</b></p> | <p><b>Unit 1: Tissues</b><br/>Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue</p> <p><b>Unit 2: Bone and Cartilage</b><br/>Structure and types of bones and cartilages, Ossification</p> <p><b>Unit 3: Nervous System</b><br/>Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and non-myelinated nerve fibres; Types of synapse, Synaptic transmission and Neuromuscular junction</p> <p><b>Unit 4: Muscular system</b><br/>Histology of different types of muscle; Ultra-structure of skeletal muscle; Molecular and chemical basis of muscle</p>  | <p>Students will be able to gain concept on</p> <p><b>CO 01.</b> Development of concept of different tissues and their organization.</p> <p><b>CO 02.</b> Learning Principles and concepts of basic physiological processes to relate the various levels of organization and interaction amongst them to ensure proper functionality of an individual.</p> |


  
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| <p><b>ANIMAL<br/>PHYSIOLOGY :<br/>CONTROLLING AND<br/>COORDINATING<br/>SYSTEM</b></p> <p><b>ZOOA-CC3-6-P</b></p> | <p>contraction; Characteristics of muscle fibre</p> <p><b>Unit 5: Reproductive System</b><br/>Histology of mammalian testis and ovary; physiology of mammalian reproduction – menstrual and oestrous cycle</p> <p><b>Unit 6: Endocrine System</b><br/>Histology and function of thyroid, pancreas and adrenal. Function of pituitary. Classification of hormones; Mechanism of Hormone action; Signal transduction pathways for Steroidal and Non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary; Placental hormones</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Recording of cardiac and simple muscle twitch with electrical stimulation</li> <li>2. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells</li> <li>3. Study of permanent slides of Mammalian Skin, Spinal cord, Pancreas, Testis, Ovary, Adrenal, Lung, pyloric stomach, cardiac stomach, Thyroid, small intestine and large intestine of mammal (white rat)</li> <li>4. Microtomy: Preparation of permanent slide of any five mammalian (Goat/ white rat) tissues</li> </ol> | <p><b>CO 03.</b> Learning the practical methods to analyze different physiological processes.</p> <p><b>CO 04.</b> Learning to identify histological sections of different mammalian tissues.</p> <p><b>CO 05.</b> Learning the techniques of microtomy and staining of different mammalian tissue sections.</p> |
| <p><b>FUNDAMENTALS<br/>OF BIOCHEMISTRY</b></p> <p><b>ZOOA-CC3-7-TH</b></p>                                       | <p><b>Unit 1: Carbohydrates</b><br/>Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis</p> <p><b>Unit 2: Lipids Structure and Significance:</b><br/>Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpenoids.<br/>Lipid metabolism: <math>\beta</math>-oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C</p>   | <p>Students will be able to gain concept on</p> <p><b>CO 01.</b> Development of biochemical background in various life sustaining processes.</p> <p><b>CO 02.</b> Learning the structure and function of different macro and/or micro molecules.</p>   |

  
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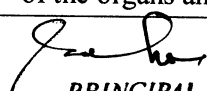
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| <p><b>FUNDAMENTALS OF BIOCHEMISTRY</b><br/><b>ZOOA-CC3-7-P</b></p> | <p>18:2)); Fatty acid biosynthesis</p> <p><b>Unit 3: Proteins</b><br/>Amino acids: Structure, Classification, General and Electro chemical properties of <math>\alpha</math>-amino 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</p> <p><b>Unit 4: Nucleic Acids</b><br/>Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of adenosine, Guanosine, cytosine and thymine.</p> <p><b>Unit 5: Enzymes</b><br/>Nomenclature and classification; 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.</p> <p><b>Unit 6: Oxidative Phosphorylation 2</b><br/>Redox systems; Mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Qualitative tests for carbohydrates, proteins and lipids</li> <li>2. Qualitative estimation of Urea &amp; Uric acid</li> <li>3. Paper chromatography of amino acids.</li> <li>4. Quantitative estimation of water soluble proteins following Lowry Method</li> </ol> | <p><b>CO 03.</b> Basic concept on enzyme action, mechanism of action, kinetics, derived equations and their graphical representation, inhibition and electron transport chain, inhibitors and uncouplers.</p> <p>Students will achieve the knowledge on</p> <p><b>CO 04.</b> Learning the practical knowledge to analyze different biochemical samples and assess the presence of macro and micro molecules both qualitatively and quantitatively.</p> |
| <p><b>APICULTURE</b><br/><b>ZOOA-SEC(A)-3-1-TH</b></p>             | <p><b>Unit 1: Biology of Bees</b><br/>Apis and Non-Apis Bee species and their identification. General Morphology of Apis Honey Bees Social Organization of Bee Colony</p> <p><b>Unit 2: Rearing of Bees</b> Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth box Bee Pasturage Selection of Bee Species for Apiculture Modern Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)</p> <p><b>Unit 3: Diseases and Enemies</b><br/>Bee Diseases and Enemies Control and</p>   | <p>The students will develop the skill to rear honeybees and use the knowledge for economic upliftment through entrepreneurship</p> <p><b>CO 01</b> Concept of biology of honeybees, their types, castes, social behavior, rearing methods, their products of economic importance, their vulnerability to diseases and pests.</p>  |

  
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|   | Preventive measures<br><b>Unit 4:</b> Bee Economy<br>Products of Apiculture Industry and its Uses – Honey, Bees Wax, Propolis, Pollen etc.<br><b>Unit 5:</b> Entrepreneurship in Apiculture<br>Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens   | <b>CO 02</b> Bee keeping for Economic development as well as their important role in pollination for crop production.  |
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| COURSE CODE   | CONTENT OF CU SYLLABUS   | COURSE OUTCOME   |
| <b>SEMESTER 4</b>   |  |  |
| <b>COMPARATIVE ANATOMY OF VERTEBRATES</b><br><br><b>ZOOA-CC4-8-TH</b> | <b>Unit 1:</b> Integumentary System<br>Structure, function and derivatives of integument in amphibian, birds and mammals<br><b>Unit 2:</b> Digestive System<br>Comparative anatomy of stomach; dentition in mammals<br><b>Unit 3:</b> Respiratory System<br>Respiratory organs in fish, birds and mammals<br><b>Unit 4:</b> Circulatory System<br>General plan of circulation, Comparative account of heart and aortic arches<br><b>Unit 5:</b> Urinogenital System<br>Succession of kidney in different vertebrate groups; evolution of urino-genital ducts<br><b>Unit 6:</b> Nervous system and sense organs<br>Comparative account of brain in vertebrates; cranial nerves; olfactory and auditory receptors in vertebrates<br><b>Unit 7:</b> Skeletal system Overview of axial and appendicular skeleton – limbs, girdles of pigeon; jaw suspension in mammals<br><b>PRACTICAL</b><br><b>Comparative Anatomy of Vertebrates LAB</b><br>1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs<br>2. Study of disarticulated skeleton of toad, Pigeon, Guineapig (limb bones, vertebrae, limb and girdle)<br>3. Comparative study of heart and brain, with the help of model/picture<br>4. Identification of skulls: Pigeon, one herbivore (Guineapig) and one carnivore (Dog) animal | The students will have a preliminary idea about<br><b>CO 01.</b> Development of clear concept anatomy of different vertebrate forms.<br><b>CO 02.</b> Correlation between different body plans of various vertebrate taxa and their utilities like integumental derivatives in vertebrates, rumination and dentition in mammals, evolution of aortic arches, succession of kidney, olfactory and auditory receptors.<br><b>CO 03.</b> Evolution of brain, types of olfactory receptors, basic features of axial and appendicular skeleton.<br><br><b>CO 04.</b> Correlating the theoretical knowledge with practical curricula to develop a holistic idea on Vertebrate Zoology by considering their skeletal systems. |
| <b>COMPARATIVE ANATOMY OF VERTEBRATES</b><br><br><b>ZOOA-CC4-8-P</b>  |  |  |

  
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| <p><b>ANIMAL<br/>PHYSIOLOGY : LIFE<br/>SUSTAINING<br/>SYSTEMS</b></p> <p><b>ZOOA- CC4-9-TH</b></p> | <p><b>Unit 1:</b> Physiology of Digestion<br/>Structural organisation and function of gastro-intestinal tract; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids and Proteins in Human</p> <p><b>Unit 2:</b> Physiology of Respiration<br/>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</p> <p><b>Unit 3:</b> Physiology of Circulation<br/>Structure and functions of haemoglobin; Blood clotting system; Haematopoiesis; Basic steps and its regulation; Blood groups; ABO and Rh factor</p> <p><b>Unit 4:</b> Physiology of Heart<br/>Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses; Cardiac Cycle and cardiac output</p> <p><b>Unit 5:</b> Thermoregulation &amp; Osmoregulation<br/>Thermal regulation in camel and polar bear, Osmoregulation in aquatic vertebrates</p> <p><b>Unit 6:</b> Renal Physiology<br/>Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid base balance</p> | <p>Students will be able to gain concept on</p> <p><b>CO 01.</b> Learning principles and concepts of basic physiological processes to relate the various levels of organization and interaction amongst them to ensure proper functionality of an individual.</p> <p><b>CO 02.</b> Understanding in brief physiological processes like chemical digestion and absorption of food, mechanism of respiration, role of respiratory pigments, CO poisoning, haematopoiesis, blood clotting, blood grouping, Rh factor, working principle of myocardial fibres, conduction of cardiac impulse, cycle and output.</p> <p><b>CO 03.</b> Understanding extreme thermal adaptation, thermoregulatory mechanism in camel and polar bear, osmoregulatory properties, counter current mechanism of urine formation and different types of acid-base buffer.</p> |
| <p><b>ANIMAL<br/>PHYSIOLOGY : LIFE<br/>SUSTAINING<br/>SYSTEMS</b></p> <p><b>ZOOA- CC4-9-P</b></p>  | <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Determination of ABO Blood group</li> <li>2. Estimation of haemoglobin using Sahli's haemoglobin meter</li> <li>3. Identification of blood cells from human blood</li> <li>4. Preparation of haemin crystals and haemochromogen crystals</li> <li>5. Identification of blood cells from cockroach haemolymph</li> <li>6. Demonstration of blood pressure by digital meter</li> </ol>   | <p><b>CO 04.</b> Estimation of different haematological and physiological parameters by means of simple tools.</p>  |
| <p><b>IMMUNOLOGY</b></p> <p><b>ZOOA- CC4-10-TH</b></p>   | <p><b>Unit 1:</b> Overview of Immune System<br/>Introduction – concept of health and disease; Cells and organs of the Immune system</p> <p><b>Unit 2:</b> Innate and Adaptive Immunity<br/>Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).</p>   | <p><b>CO 01.</b> Identification the cellular and molecular basis of immune responsiveness</p> <p><b>CO 02.</b> Understand the fundamental concepts of immunity, contributions of the organs and cells in</p>  |

  
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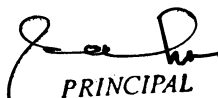
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| <p><b>IMMUNOLOGY</b><br/><b>ZOOA- CC4-10-P</b></p>                | <p><b>Unit 3:</b> Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes<br/> <b>Unit 4:</b> Immunoglobulins Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Monoclonal antibody production<br/> <b>Unit 5:</b> Major Histocompatibility Complex Structure and functions of MHC molecules. Structure of T cell Receptor and its signalling, T cell development &amp; selection<br/> <b>Unit 6:</b> Cytokines<br/> Types, properties and functions of cytokines.<br/> <b>Unit 7:</b> Complement System<br/> components and pathways of complement activation.</p> <p><b>Unit 8:</b> Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities.<br/> <b>Unit 9:</b> Vaccines<br/> Various types of vaccines. Active &amp; passive immunization (Artificial and natural)</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Demonstration of lymphoid organs (by picture).</li> <li>2. Histological study of Bursa of Fabricius, spleen, thymus and lymph nodes through slides/ photographs</li> <li>3. Demonstration of ELISA</li> </ol> | <p>immune responses.<br/> <b>CO 03.</b> Conceptualize how the innate and adaptive immune responses coordinate to fight invading pathogens.</p> <p><b>CO 04.</b> Realize how the MHC molecules function and conceptualize.</p> <p><b>CO 05.</b> Comprehend the overreaction by our immune system leading to hypersensitive conditions and its consequences.</p> <p>The students will be able to describe<br/> <b>CO 06.</b> Immunological response and how it is triggered and regulated.<br/> <b>CO 07.</b> Learning about different lymphoid organs by histological studies.<br/> <b>CO 08.</b> Understanding of ELISA.</p> |
| <p><b>AQUARIUM FISH KEEPING</b><br/><b>ZOOA-SEC(B)-4-1-TH</b></p> | <p><b>Unit 1:</b> Introduction to Aquarium Fish Keeping The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes<br/> <b>Unit 2:</b> Biology of Aquarium Fishes<br/> Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish<br/> <b>Unit 3:</b> Food and feeding of Aquarium fishes Use of live fish feed organisms. Preparation and composition of</p>   | <p><b>CO 01</b> Study of Aquarium fish keeping as a vocation based course for future prospects as an industry<br/> <b>CO 02</b> Understanding the biology and rearing methods of different species of cultivable ornamental fishes.</p>  |

  
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|   | <p>formulated fish feeds, Aquarium fish as larval predator</p> <p><b>Unit 4:</b> Fish Transportation<br/>Live fish transport - Fish handling, packing and forwarding techniques.</p> <p><b>Unit 5:</b> Maintenance of Aquarium<br/>General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry</p>  | <p><b>CO 03</b> Designing and maintenance of aquariums, logistics related to commercial handling of ornamental fishes.</p>  |
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| COURSE CODE                                       | CONTENT OF CU SYLLABUS   | COURSE OUTCOME  |
| <b>SEMESTER 5</b>                                 |  |   |
| <p><b>ECOLOGY</b></p> <p><b>ZOOA-CC-11-TH</b></p> | <p><b>Unit 1:</b> Introduction to Ecology<br/>Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.</p> <p><b>Unit 2:</b> Population<br/>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.</p> <p><b>Unit 3:</b> Community<br/>Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect; Ecological succession with one example</p> <p><b>Unit 4:</b> Ecosystem<br/>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.</p> <p><b>Unit 5:</b> Applied Ecology<br/>Types &amp; 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 &amp; Schedule. Concept of corridor, advantages and problem of corridor. Threats to survival and conservation strategies for</p> | <p>Students will learn the concept about</p> <p><b>CO 01.</b> Describe the different levels of organization used in ecology.</p> <p><b>CO 02.</b> Unique and group attributes of population, r and k strategies, population regulation, Gause's principle, Lotka- Volterra equation for competition.</p> <p><b>CO 03.</b> Community characteristics and indices, concepts on vertical stratification, ecotone and edge effect, ecological succession.</p> <p><b>CO 04.</b> Types of ecosystem, different types of food chain, food web, concept of energy flow, ecological pyramid and nitrogen cycle</p> <p><b>CO 05.</b> Explain the large scale patterns of biodiversity, describes methods for measuring biodiversity indices, predict the consequences of continuous species loss and strategic methods of conservation.</p> |

  
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| <p><b>ECOLOGY</b></p> <p><b>ZOOA-CC-11-P</b></p>                  | <p>Tiger, Olive ridley, White Rumped Vulture</p> <p><b>PRACTICAL</b></p> <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</p> <p>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></p> <p>3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden</p>  | <p>Students will develop the skill to get idea about</p> <p><b>CO 06.</b> Population density and diversity measurement with use of different indices, study of aquatic ecosystem with special reference to planktons and estimation of different physical factors (Temperature, pH, DO<sub>2</sub>, DCO<sub>2</sub>, COD, CO<sub>2</sub>).</p> <p><b>CO 07.</b> Detailed report on ecological uniqueness of place of ecological interest.</p>  |
| <p><b>PRINCIPLE OF GENETICS</b></p> <p><b>ZOO A-CC5-12-TH</b></p> | <p><b>Unit 1: Mendelian Genetics and its Extension</b><br/>Principles of inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Isoallele (White eye mutations), Pseudoallele (Lozenge Locus) &amp; Cis-trans test for allelism, Lethal alleles, Pleiotropy, Penetrance &amp; Expressivity</p> <p><b>Unit 2: Linkage, Crossing Over and Linkage Mapping</b><br/>Linkage and Crossing, Complete &amp; Incomplete Linkage, Measuring Recombination frequency and linkage map construction using three factor crosses, Interference and coincidence<br/>Sex linkage in <i>Drosophila</i> (White eye locus) &amp; Human (Haemophilia).</p> <p><b>Unit 3: Mutations</b><br/>Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example from <i>Drosophila</i> and Human of each), variation in chromosome</p> | <p>The students will learn about the</p> <p><b>CO 01.</b> Principles of Mendelian inheritance pattern and exception, different allele concepts, cis-trans test.</p> <p><b>CO 02.</b> Linkage and crossing over concepts, estimation of recombination frequency, linkage map construction using three factor cross, sex linkage in <i>Drosophila</i> and human.</p> <p><b>CO 03.</b> Types of gene mutations and chromosomal aberrations, molecular basis of mutation detection techniques.</p> |


  
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| <p><b>PRINCIPLE OF GENETICS</b></p> <p><b>ZOO A-CC5-12-P</b></p> | <p>number; Nondisjunction of X chromosome in <i>Drosophila</i>; Non-disjunction of Human Chromosome 21. Molecular basis of mutations in relation to UV light and chemical mutagens. Mutation detection in <i>Drosophila</i> by attached X method. Biochemical mutation detection in <i>Neurospora</i>.</p> <p><b>Unit 4: Sex Determination</b><br/>Mechanisms of sex determination in <i>Drosophila</i> and in man; Dosage compensation in <i>Drosophila</i> &amp; Human</p> <p><b>Unit 5: Extra-chromosomal Inheritance</b><br/>Kappa particle in <i>Paramoecium</i>, Shell spiralling in snail.</p> <p><b>Unit 6: Genetic Fine Structure</b><br/>Complementation test in Bacteriophage (Benzer's experiment on rII locus)</p> <p><b>Unit 7: Transposable Genetic Elements</b><br/>6 IS element in bacteria, Ac-Ds elements in maize and P elements in <i>Drosophila</i><br/>LINE, SINE, Alu elements in humans.</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Chi-square analyses for genetic ratio test</li> <li>2. Identification of chromosomal aberration in <i>Drosophila</i> and man from photograph</li> <li>3. Pedigree analysis of some inherited traits in animals</li> </ol> | <p><b>CO 04.</b> Mechanism of sex determination and dosage compensation, examples of extra chromosomal inheritance, complementation test in bacteriophage, different types of transposable genetic elements and their functions.</p> <p><b>CO 05.</b> Concept on genetic ratio test, chromosomal aberration detection techniques and pedigree analyses.</p> |
| <p><b>PARASITOLOGY</b></p> <p><b>ZOOA-DSE(A)-5-1-TH</b></p>      | <p><b>Unit 1: Introduction to Parasitology</b><br/>Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector); Host parasite relationship</p> <p><b>Unit 2: Parasitic Protists</b><br/>Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of <i>Giardia intestinalis</i>, <i>Trypanosoma gambiense</i>, <i>Leishmania donovani</i></p> <p><b>Unit 3: Parasitic Platyhelminthes</b><br/>Study of Morphology, Life Cycle,</p>  | <p>Students will be able to acquire knowledge about</p> <p><b>CO 01.</b> Concepts of Parasitism Parasitoid, Vectors and Host- parasite relationship</p> <p><b>CO 02.</b> Understanding biology, life cycle, epidemiology, clinical features, laboratory diagnosis, treatment and prevention of common human</p>   |


  
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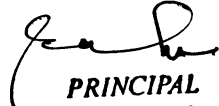
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| <p><b>PARASITOLOGY</b><br/><b>ZOOA-DSE(A)-5-1-P</b></p>   | <p>Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of <i>Schistosoma haematobium</i>, <i>Taenia solium</i></p> <p><b>Unit 4: Parasitic Nematodes</b><br/>Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of <i>Ascaris lumbricoides</i>, <i>Ancylostoma duodenale</i>, <i>Wuchereria bancrofti</i>, Nematode plant interaction.</p> <p><b>Unit 5: Parasitic Arthropods</b><br/>Biology, importance and control of ticks: Soft tick (<i>Ornithodoros</i>), Hard tick (<i>Ixodes</i>), mites (<i>Sarcoptes</i>), Lice (<i>Pediculus</i>), Flea (<i>Xenopsylla</i>) and Bug (<i>Cimex</i>). Parasitoid.</p> <p><b>Unit 6: Parasite Vertebrates</b><br/>Cookicutter Shark, Hood Mocking bird, Vampire bats their parasitic behaviour and effect on host.</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>Study of life stages of <i>Giardia intestinalis</i>, <i>Trypanosoma gambiense</i>, <i>Leishmania donovani</i>, <i>Plasmodium vivax</i>, <i>Plasmodium falciparum</i> through permanent slides/micro photographs</li> <li>Study of adult and life stages of <i>Schistosoma haematobium</i>, <i>Taenia solium</i> through permanent slides/micro photographs</li> <li>Study of adult and life stages of <i>Ancylostoma duodenale</i> through permanent slides/micro photographs.</li> </ol> | <p>parasitic infections, Parasitic protists and platyhelminths</p> <p><b>CO 03.</b> Understanding biology, life cycles, epidemiology, clinical features, laboratory diagnosis, treatment and prevention of common helminth and arthropod parasites of human as well as explaining behavior of hosts of some Vertebrate parasites and its effect on host.</p> <p><b>CO 04.</b> Demonstrate familiarity of some protozoan, platyhelminth, helminth parasites of human, fish, birds and other livestock using permanent slides/ photomicrographs/ charts.</p> |
| <p><b>ENDOCRINOLOGY</b><br/><b>ZOOA-DSE(B)-5-1-TH</b></p> | <p><b>Unit 1: Introduction to Endocrinology</b><br/>General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neuro-secretions and Neuro-hormones: Examples and Functions</p> <p><b>Unit 2: Hypothalamo-Hypophyseal Axis</b><br/>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</p> <p><b>Unit 3: Peripheral Endocrine Glands</b><br/>Structure, Hormones and Functions of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis. Disorders of endocrine glands (<i>Diabetes mellitus</i> type I &amp; Type II; Graves' Disease).</p> <p><b>Unit 4: Regulation of Hormone Action</b><br/>Mechanism of action of steroidal, non-</p>   | <p>Students will be able to acquire knowledge about</p> <p><b>CO 01.</b> General idea of classification, characteristics, different modes of transport of endocrine hormones at their function.</p> <p><b>CO 02.</b> Structure and function of Hypothalamus, pituitary, their hormones, function, neuroendocrine regulation through different hypothalamo-hypophysial axis.</p> <p><b>CO 03.</b> Structure, Hormones and Functions of several peripheral endocrine glands and associated disorders.</p>  |

  
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| <p><b>ENDOCRINOLOGY</b><br/><b>ZOOA-DSE(B)-5-1-P</b></p>         | <p>steroidal hormones with receptors (cAMP, IP3-DAG), Calcium and Glucose homeostasis in mammals. Bioassays of hormones using RIA &amp; ELISA, Estrous cycle in rat and menstrual cycle in human.<br/><b>Unit 5. Non Mammalian Vertebrate Hormone</b><br/>Functions of Prolactin in Fishes, Amphibia &amp; Birds<br/>Function of Melanotropin in Teleost fishes, Amphibians and Reptiles.<br/><b>PRACTICAL</b><br/>1. Dissect and display of Endocrine glands in laboratory bred rat.<br/>2. Study of the permanent slides of all the endocrine glands<br/>3. Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland.<br/>4. H-E staining of Histological slides.</p>   | <p><b>CO 04.</b> Mechanism of action of steroid / non-steroidal hormones, calcium and glucose homeostasis, bioassays (RIA, ELISA), oestrous and menstrual cycle, function of prolactin and melanotropin in non-mammalian vertebrates.</p> <p><b>CO 05.</b> Anatomy of different endocrine glands in rat, histological slide preparation following dissection, fixation, paraffin embedding, tissue block preparation using microtomy and H-E staining protocols.</p> |
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| COURSE CODE  | CONTENT OF CU SYLLABUS  | COURSE OUTCOME   |
| <b>SEMESTER 6</b>  |   |  |
| <p><b>ANIMAL BIOTECHNOLOGY</b><br/><b>ZOOA-DSE(A)-6-2-TH</b></p> | <p><b>Unit 1: Introduction 5</b><br/>Organization of <i>E.coli</i> and <i>Drosophila</i> genome.<br/><b>Unit 2: Molecular Techniques in Gene manipulation</b><br/>Recombinant DNA technology, Restriction endonucleases.<br/>Cloning Vectors &amp; their features: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, and HAC. Shuttle and Expression Vectors.<br/>Construction of Genomic libraries and cDNA libraries<br/>Transformation techniques: Cloning in bacteria and detection technique of clone<br/>Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting,<br/>Polymerase chain reaction: Allele specific, RAPD &amp; RT PCR, DNA Fingerprinting<br/><b>Unit 3: Genetically Modified Organisms</b><br/>Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection.</p> | <p>The students will get a deep insight into</p> <p><b>CO 01.</b> Techniques in recombinant DNA technology, gene manipulation, isolation of genetic material through blotting techniques, PCR, RAPD, RT PCR and allied areas.</p> <p><b>CO 02.</b> GMO production methods.</p>   |

  
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| <p><b>ANIMAL BIOTECHNOLOGY</b><br/><b>ZOOA-DSE(A)-6-2-P</b></p> | <p>Applications of transgenic animals:<br/>Production of pharmaceuticals,<br/>production of donor organs,<br/>knock-out mice.</p> <p><b>Unit 4: Culture Techniques and Applications</b><br/>Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anaemia, Thalassemia).<br/>Dolly &amp; Polly cloning<br/>Genetically modified economically important animal<br/>Gene Therapy</p> <p><b>PRACTICAL</b><br/>1. Genomic DNA isolation from <i>E. coli</i> and Plasmid DNA isolation (pUC 18/19) from <i>E. coli</i><br/>2. To study following techniques through photographs - Southern Blotting, Northern Blotting, Western Blotting, PCR, DNA fingerprinting<br/>3. Project report on animal cloning &amp; Application &amp; ethical Issues</p>   | <p><b>CO 03.</b> Techniques of animal cell culture, determination of molecular genetic diseases, cloning and gene therapy.</p> <p><b>CO 04.</b> Genomic and plasmid DNA isolation using specified techniques, quantitative analyses of DNA, RNA, Protein, DNA amplification, animal cloning and related ethical issues.</p>   |
| <p><b>DEVELOPMENTAL BIOLOGY</b><br/><b>ZOOA-CC6-13-TH</b></p>   | <p><b>Unit 1: Early Embryonic Development</b><br/>Gametogenesis: Spermatogenesis, Oogenesis (sea urchin &amp; mammal); Types of eggs, Egg membranes; Fertilization in sea urchin and mammal; Planes and patterns of cleavage; Types of Blastula [frog and chick]; Fate map in chick embryo, fate mapping using vital dye and radioactive technique; Gastrulation in frog and chick; Embryonic induction and organizers in <i>Xenopus</i> (Spemann &amp; Mangold's experiment)</p> <p><b>Unit 2: Late Embryonic Development</b><br/>Extra-embryonic membranes in Chick; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)</p> <p><b>Unit 3: Post Embryonic Development</b><br/>Development of brain and Eye in Chick. Molecular Induction in Brain and Eye development.</p> <p><b>Unit 4: Implications of Developmental Biology</b><br/><i>In vitro</i> fertilization (IVF), Stem cell: Concept of potency, types, markers and applications of stem cell therapy in bone marrow transplantation and cartilage</p> | <p>Students will be able to gain an</p> <p><b>CO 01.</b> Understanding basic concepts of gametogenesis, fertilization and early embryonic development in different animal groups and appreciating the differences in animal development.</p> <p><b>CO02.</b> Explaining process of implantation and placentation, application aspects of in vitro fertilization, stem cell therapy, transplantation and regeneration.</p> <p><b>CO 03.</b> Explore and gain understanding of embryology through the investigation of development in Chick</p> |

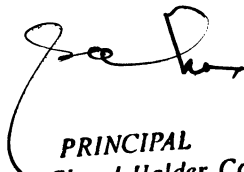
  
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| <p><b>DEVELOPMENTAL BIOLOGY</b></p> <p><b>ZOOA-CC6-13-P</b></p> | <p>regeneration</p> <p><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Study of whole mounts of developmental stages of chick embryo through permanent slides: 24, 48, and 96 hours of incubation.</li> <li>2. Study of the developmental stages and life cycle of <i>Drosophila</i></li> <li>3. Study of different sections of placenta (photomicrograph/ slides)</li> <li>4. Identification of Invertebrate larva through slides/ photographs of Phylum Annelida, Arthropoda, Mollusca and Echinodermata.</li> </ol>   | <p>and <i>Drosophila</i> through slides and charts. Brief idea about some non-chordate larval morphology.</p>   |
| <p><b>EVOLUTIONARY BIOLOGY</b></p> <p><b>ZOOA-CC6-14-TH</b></p> | <p><b>Unit 1</b><br/>Origin of Life (Chemical basis), RNA world hypothesis</p> <p><b>Unit 2</b><br/>Historical review of Evolutionary concepts: Lamarkism, Darwinism and Neo Darwinism</p> <p><b>Unit 3</b><br/>Geological time scale, Fossil: types and age determination by Carbon dating, Evolution of horse</p> <p><b>Unit 4</b><br/>Natural Selection: Modes with Examples;</p> <p><b>Unit 5</b><br/>Species concept, Isolating mechanisms, modes of speciation; Speciation by chromosome rearrangement in <i>Drosophila</i>. Adaptive radiation/macroevolution (exemplified by Galapagos finches).</p> <p><b>Unit 6</b><br/>Origin and Evolution of Man, Unique Hominid characteristics contrasted with primate characteristic</p> <p><b>Unit 7</b><br/>Population genetics: Hardy-Weinberg Law; factors disrupting H-W equilibrium (Genetic Drift, Migration and Mutation and Selection in changing allele frequencies (only derivations required). Simple problems related to estimation of allelic and gene frequencies.</p> <p><b>Unit 8</b><br/>Extinction, back ground and mass extinctions, detailed example of K-T extinction</p> <p><b>Unit 9</b><br/>Phylogenetic trees, construction and interpretation of Phylogenetic tree using parsimony, convergent and divergent</p> | <p>Students will be able to gain knowledge about</p> <p><b>CO 01.</b> Concept on origin of life, different evolutionary concepts, evolutionary clock and fossil age determination techniques with special reference to evolution of horse. Brief idea about natural selection, speciation and adaptive radiation.</p> <p><b>CO 02.</b> Brief concept on population genetics including Hardy Weinberg equilibrium and factors affecting equilibrium and factors affecting equilibrium, methods of estimating allele and genotypic frequencies.</p> <p><b>CO 03.</b> Detailed concepts on extinction, examples, phylogenetic tree construction and interpretation using parsimony and types of evolution.</p> |

  
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|  | <p>5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.</p> <p>6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).</p> | <p><b>CO 05.</b> Visit to conserved places of zoological interest to study behavioural activities of animals, study of circadian functions in human following definite patterns.</p> |
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# DHRUBA CHAND HALDER COLLEGE

(FORMERLY DAKSHIN BARASAT COLLEGE)

ESTD. - 1965

**A NAAC Accredited Degree College Affiliated to University of Calcutta**

P.O. - DakshinBarasat Dist. - South 24 Parganas West Bengal Pin - 743372

E-mail: dchcollege@yahoo.com, Website: www.dchcollege.org

Phone: (03218) -222550 (Prin.) /223-668 (Off.)

Ref. No. ....

Date .....20

## DEPARTMENT OF ZOOLOGY

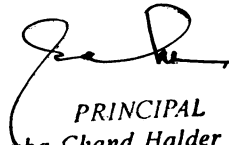
General Course under CBCS, Calcutta University

### PROGRAMME SPECIFIC OUTCOME (PSO)- COURSE OUTCOME (CO)


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#### Programme specific outcome (PSO):

- PSO 01:** To provide basic knowledge about classical Zoology to get familiar with non-chordates and chordates, their economic and environmental importance, their taxonomy and conservation.
- PSO 02:** Preparing students to apply the concepts and knowledge acquired in conducting experimental research.
- PSO 03:** To deliver oral presentations of any biological principle or information.
- PSO 04:** To write explanatory notes on biological principles and informations from relevant literatures.
- PSO 05:** Visually represent information gathered through diagrams and graphs.
- PSO 06:** To acquaint students with modern tools and techniques and developing skills for future entrepreneurship in entomology and fishery.
- PSO 07:** To develop better observation skills in the area of field and environmental biology and imbibing in them knowledge for creating a sustainable environment and maintaining the biodiversity of a particular area.
- PSO 08:** To build the fundamental basis for carrying out higher studies in the subject or related areas as well as motivate the students to acquire further knowledge as a foundation for academic career options as well as provide them hands on knowledge in operating different tools and techniques used in medical diagnosis and animal biotechnology.
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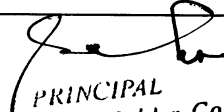
  
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| Core Courses                                   | Content of CU Syllabus   | Course outcome  |
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| <b>SEMESTER I</b>                              |  |   |
| <b>Animal Diversity<br/>ZOOG-CC1-1-<br/>TH</b> | <p><b>Unit 1: Kingdom Protista</b><br/>General characters and classification up to classes (Levine et. al., 1980); Locomotory Organelles and locomotion in <i>Amoeba</i> and <i>Paramecium</i></p> <p><b>Unit 2: Phylum Porifera</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in <i>Sycon</i></p> <p><b>Unit 3: Phylum Cnidaria</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in <i>Obelia</i></p> <p><b>Unit 4: Phylum Platyhelminthes</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of <i>Taeniasolium</i></p> <p><b>Unit 5: Phylum Nematelminthes</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); history of <i>Ascarislumbricoides</i> and its adaptation</p> <p><b>Unit 6: Phylum Annelida</b><br/>General characters and classification up to classes (Rupert and Barnes, 1994, 6th Ed.); Metamerism in Annelida</p> <p><b>Unit 7: Phylum Arthropoda</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera</p> <p><b>Unit 8: Phylum Mollusca</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Respiration in <i>Pila</i></p> <p><b>Unit 9: Phylum Echinodermata</b><br/>General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Watervascular system in Asteroidea</p> <p><b>Unit 10: Protochordates</b><br/>General Characters ; Pharynx and feeding mechanism in <i>Amphioxus</i></p> <p><b>Unit 11: Agnatha</b><br/>General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)</p> <p><b>Unit 12: Pisces</b><br/>General features and Classification up to orders (Young, 1981); Osmoregulation in Fishes</p> <p><b>Unit 13: Amphibia</b><br/>General features and Classification up to orders (Young, 1981); Parental care</p> <p><b>Unit 14: Reptiles</b><br/>General features and Classification up to orders (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism</p> <p><b>Unit 15: Aves</b></p> | <p>The students will get a clear idea of</p> <p><b>CO 01</b> Understanding the Taxonomic position of non- chordates (upto Class), protochordates and chordates (upto Order) based on their characteristics, similarities and dissimilarities.</p> <p><b>CO 02</b> Discussing special features specific to different phyla and their role in feeding, respiration, locomotion, circulation, adaptation including parasitism and development.</p> <p><b>CO 03</b> Study of classification of Vertebrates by discussing special features like osmoregulation in fishes, parental care in amphibians, biting mechanism of snakes, flight adaptations in birds and exoskeletal derivatives in mammals.</p> |


  
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| <p><b>Animal Diversity</b><br/><b>ZOOG-CC1-1-P</b></p> | <p>General features and Classification up to orders (Young, 1981); Flight adaptations in birds<br/><b>Unit 16: Mammals</b><br/>Classification up to orders (Young, 1981); Hair, Horn &amp; Antler, Nail &amp; claw</p> <p><b>List of Practicals</b></p> <p>1. Identification with reasons of the following specimens:<br/><i>Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taeniasolium, Ascaris lumbricoides</i>(Male and female), <i>Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria</i>and <i>Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeorohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Bat, Funambulus</i></p> <p>2. Key for Identification of poisonous and non-poisonous snakes</p> <p>3. Study of anatomy of digestive system, salivary gland, mouth parts of <i>Periplaneta</i>, Study of reproductive system of female cockroach</p> <p>4. Preparation of an “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa.</p> | <p><b>CO 04</b> Visualizing the external features of selected museum specimens and understanding the basis of classification of such animals on the basis of the observed features in the animal kingdom.</p> <p><b>CO 05</b> Gaining expertise in insect dissection by studying different systems of Cockroach.</p> <p><b>CO 06</b> Developing skills in preparing projects and reports</p> |
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| <b>SEMESTER 2</b>  |  |  |
| <b>Comparative Anatomy &amp; Developmental Biology</b><br><b>ZOOG-CC2-2-TH</b> | <b>Unit 1: Integumentary System</b><br>Derivatives of integument with respect to glands in Birds & Mammals<br><b>Unit 2: Digestive System</b><br>Stomach and Dentition<br><b>Unit 3: Respiratory System</b><br>Brief account of Gills, lungs, air sacs and swim bladder<br><b>Unit 4: Circulatory System</b><br>Evolution of heart and aortic arches<br><b>Unit 5: Urino-genital System</b><br>Succession of kidney, Evolution of urino-genital ducts<br><b>Unit 6: Early Embryonic Development</b><br>Gametogenesis: Spermatogenesis and Oogenesis with respect to mammals.<br>Fertilization: Sea-Urchin; Early development of frog; structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula; types of morphogenetic movements; Fate of germ layers<br><b>Unit 7: Late Embryonic Development</b><br>Placenta types and function; Metamorphic events in frog life cycle and its hormonal regulation<br><br><b>List of Practicals:</b><br>1. Osteology: Limb bones, girdle and vertebra of Pigeon &Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog.<br>2. Larval stages: Veliger, Nauplius, Trochophore, Mysis.<br>3. Study of the different types of placenta-histological sections through photomicrographs.<br>4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs. | The students will get a clear picture of<br><br><b>CO 01</b> Understanding anatomical and physiological variations in different animal systems by comparative study.<br><br><b>CO 02</b> Getting insight into the knowledge of early and late stages of embryonic development in sea urchin, frog, chick and mammals.<br><br><b>CO 03</b> Visually identifying osteology of different specimens Identifying the larval forms of certain invertebrate phyla. Studying the histological structure of mammalian placenta. Histologically identifying the different developmental stages of chick embryo . |
| <b>SEMESTER 3</b>  |  |  |
| <b>Physiology and Biochemistry</b><br><b>ZOOG-CC3-3-TH</b>                     | <b>Unit 1: Nerve and muscle</b><br>Structure of a neuron, resting membrane potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction<br><b>Unit 2: Digestion</b><br>Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids   | The students will get a clear understanding of<br><br><b>CO 01</b> Basic physiological functions like nerve coordination, digestion, respiration, excretion and reproduction along with hormonal control.  |

  
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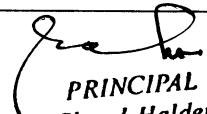
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| <b>Physiology and Biochemistry</b><br><b>ZOOG-CC3-3-P</b> | <p><b>3: Respiration</b><br/>Pulmonary ventilation, Transport of Oxygen and carbon di oxide.</p> <p><b>Unit 4: Cardio-vascular system</b><br/>Composition of blood, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle</p> <p><b>Unit 5: Excretion</b><br/>Structure of nephron, Mechanism of Urine formation; Counter-current Mechanism</p> <p><b>Unit 6: Reproduction and Endocrine Glands</b><br/>Physiology of male reproduction: Histology of testis, hormonal control of spermatogenesis;<br/>Physiology of female, reproduction: Histology of ovary, hormonal control of menstrual cycle.<br/>Structure and function of pituitary, thyroid, pancreas and adrenal.</p> <p><b>Unit 7: Carbohydrate Metabolism</b><br/>Glycolysis, Kreb's cycle, Glycogenesis, Electron Transport Chain.</p> <p><b>Unit 8: Lipid metabolism</b><br/>Beta oxidation of Palmitic acid {saturated (C 16:0)} and Linoleic acid {unsaturated (C 18:2)}</p> <p><b>Unit 9: Protein Metabolism</b><br/>Transamination, Deamination, Urea cycle</p> <p><b>Unit 10. Enzyme</b><br/>Enzyme Classification, factors affecting enzyme action, Inhibition.</p> <p><b>List of Practicals</b><br/>1. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland.<br/>2. Study of permanent histological sections of mammalian duodenum, liver, lung, kidney.<br/>3. Qualitative tests for carbohydrate samples</p> | <p><b>CO 02</b> Functions of different important biochemicals like carbohydrate, protein, lipids, their metabolism and also the mode of action of different enzymes involved in the process.</p> <p><b>CO 03</b> Identification of mammalian tissues on the basis of histological observation. Qualitative tests for analyzing the types of carbohydrates present in samples.</p> |
| <b>Skill Enhancement Elective Courses</b>                 | <b>Content of CU Syllabus</b>  | <b>Course outcome</b>   |
| <b>SEMESTER 3</b>   |  |   |
| <b>Apiculture</b><br><b>ZOOG-SEC-A-3-1-TH</b>             | <p><b>Unit 1: Biology of Bees</b><br/>Classification and Biology of Honey Bees Social Organization of Bee Colony</p> <p><b>Unit 2: Rearing of Bees</b><br/>Artificial Bee rearing; Apiary, Beehives - Newton and Langstroth, Bee Pasturage; Selection of Bee Species for Apiculture; Bee Keeping Equipment; Methods of Extraction of Honey; Indigenous and Modern</p> <p><b>Unit 3: Diseases and Enemies</b><br/>Bee Diseases and Enemies Control and Preventive measures</p>  | <p>The students will develop the skill to rear honeybees and use the knowledge for economic upliftment through entrepreneurship</p> <p><b>CO 01</b> Concept of biology of honeybees, their types, castes, social behavior, rearing methods, their products of economic</p>  |

  
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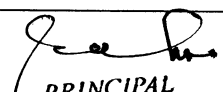
|  | <b>Unit 4: Bee Economy</b><br>Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc<br><b>Unit 5: Entrepreneurship in Apiculture</b><br>Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Beehives for Cross pollination.   | importance, their vulnerability to diseases and pests.<br><br><b>CO 02</b> Bee keeping for economic development as well as their important role in pollination for crop production.  |
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| Core Courses   | Content of CU Syllabus  | Course outcome   |
| <b>SEMESTER 4</b>  |   |  |
| <b>Genetics &amp; Evolutionary Biology</b><br><b>ZOOG-CC4-4-TH</b> | <b>Unit 1: Mendelian Genetics and its Extension</b><br>Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, lethal alleles, sex linked inheritance in <i>Drosophila</i> (White eye locus) & Human (Thalassemia).<br><b>Unit 2: Linkage, Crossing Over</b><br>Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model<br><b>Unit 3: Mutation</b><br>Chromosomal mutation, Deletion, duplication, inversion, translocation, aneuploidy, gene mutation, induced mutation, types & example<br><b>Unit 4: Sex determination</b><br>Genic Balance theory and dosage compensation in <i>Drosophila</i> .<br><b>Unit 5: Origin of Life</b><br>Chemical Origin of life<br><b>Unit 6: Evolutionary Theories</b><br>Lamarckism, Darwinism, Neo-Darwinism.<br><b>Unit 7: Process of Evolutionary changes</b><br>Isolating mechanism, Natural Selection.<br><b>Unit 8: Speciation</b> Sympatric, Allopatric, Parapatric<br><br><b>List of Practicals:</b><br>1. Verification of Mendelian Ratio using Chi square test.<br>2. Identification of Human Aneuploidy using photo graph of karyotype.<br>3. Phylogeny of horse with diagram of limb and skull.<br>4. Study and identification of Darwin Finches from photographs.<br>5. Visit to natural history museum and submission of report. | The students will get a clear understanding of<br><br><b>CO 01</b> Classical Mendelian Genetics and its extended application studies.<br><br><b>CO 02</b> Basic concepts of genetic recombination, proposed models, chromosomal aberrations and gene mutations, fundamentals of sex determination.<br><br><b>CO 03</b> Chemical basis of origin of life on Earth.<br><b>CO 04</b> Theories of Evolution, mechanisms of isolation and Natural selection and their significant roles in evolution and origin of new species.<br><br><b>CO 05</b> Skill to statistically interpret problems on genetics, understand the evolution of modern day horses based on their anatomy and morphology and that of Darwin finches based on their food habits. |
| <b>Genetics &amp; Evolutionary Biology</b><br><b>ZOOG-CC4-4-P</b>  |   |  |

  
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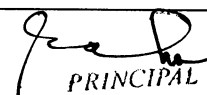
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|  |   | <b>CO 06</b> Get an idea of evolution of extinct animals from palaeontological evidence.  |
| <b>Skill Enhancement Elective Courses</b>                | <b>Content of CU Syllabus</b>   | <b>Course outcome</b>   |
| <b>SEMESTER 4</b>  |   |   |
| <b>Aquarium fish keeping</b><br><b>ZOOG-SEC-B-4-2-TH</b> | <b>Unit 1: Introduction to Aquarium Fish Keeping</b><br>The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes<br><b>Unit 2: Biology of Aquarium Fishes</b><br>Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish<br><b>Unit 3: Food and feeding of Aquarium fishes</b><br>Use of live fish feed organisms. Preparation and composition of formulated fish feeds<br><b>Unit 4: Fish Transportation</b><br>Live fish transport - Fish handling, packing and forwarding techniques.<br><b>Unit 5: Maintenance of Aquarium</b><br>General Aquarium maintenance - budget for setting up an Aquarium Fish Farm as a Cottage Industry | <b>CO 01</b> Study of Aquarium fish keeping as a vocation based course for future prospects as an industry<br><br><b>CO 02</b> Understanding the biology and rearing methods of different species of cultivable ornamental fishes.<br><br><b>CO 03</b> Designing and maintenance of aquariums, logistics related to commercial handling of ornamental fishes. |
| <b>Discipline specific courses</b>                       | <b>Content of CU Syllabus</b>   | <b>Course outcome</b>   |
| <b>SEMESTER 5</b>  |   |   |
| <b>Applied Zoology</b><br><b>ZOOG-DSE-A-5-1-TH</b>       | <b>Unit I: Host &amp; Parasite Relationship</b><br>Type of Host, Types of Parasites, Other types of Relations.<br><b>Unit 2: Epidemiology of Diseases</b><br>Transmission, Prevention and Control of Tuberculosis and Typhoid.<br><b>Unit 3: Parasitic Protozoa</b><br>Life History and pathogenicity of <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> and <i>Trypanosoma gambiense</i> .  | Students will gain idea of<br><br><b>CO 01</b> Host – Parasite interactions, pathogenicity of different parasites, clinical symptoms, treatment and preventive measures.  |

  
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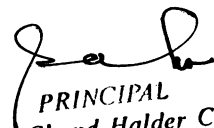
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| <p><b>Applied Zoology</b><br/><b>ZOOG-DSE-A-5-1-P</b></p>  | <p><b>Unit 4: Parasitic Helminthes</b><br/>Life History and pathogenicity of <i>Ancylostomaduodenale</i>, <i>Wuchereriabancrofti</i>.</p> <p><b>Unit 5: Insect of Economic Importance</b><br/>Biology, Control and Damage caused by <i>Helioverpaarmigera</i>, <i>Pyrillaperpusilla</i>, <i>Sytophilus oryzae</i> and <i>Triboliumcastaneum</i>.</p> <p><b>Unit 6: Insect of Medical Importance</b><br/>Medical Importance and control of <i>Anopheles</i></p> <p><b>Unit 8: Animal Husbandry</b><br/>Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle</p> <p><b>Unit 9: Poultry Farming</b><br/>Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs</p> <p><b>Unit 10: Fish Technology</b><br/>Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed</p> <p><b>List of Practicals:</b></p> <ol style="list-style-type: none"> <li>1. Study of <i>Plasmodium vivax</i>, <i>Entamoebahistolytica</i>, <i>Trypanosomagambiense</i>, <i>Ancylostoma duodenale</i> and <i>Wuchereriabancrofti</i> and their life stages through permanent slides/photomicrographs or specimens.</li> <li>2. Study of arthropod vectors associated with human diseases: <i>Pediculus</i>, <i>Culex</i>, <i>Anopheles</i>, <i>Aedes</i></li> <li>3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.</li> <li>4. Identifying feature and economic importance of <i>Helicoverpa</i>; <i>Heliothisarmigera</i>, <i>Papiliodemoleus</i>, <i>Pyrillaperpusilla</i>, <i>Callosobruchuschinensis</i>, <i>Sitophilusoryzae</i> and <i>Triboliumcastaneum</i></li> <li>5 Visit to poultry farm or animal breeding centre.<br/>Submission of visit report</li> <li>6. Maintenance of freshwater aquarium(demonstration only)</li> </ol> | <p><b>CO 02</b> Insects as pests, damage caused by them and control measures, insects as vectors and hosts for transmission of diseases.</p> <p><b>CO 03</b> Concepts of Animal Husbandry, Poultry farming and Fisheries.</p> <p><b>CO 04</b> Observe and identify pathogenic parasites, their morphology, life stages; damages caused by insect pests, rearing of poultry birds, cattle and fishes for economic purpose.</p> |
| <p><b>SEMESTER 5</b></p>                                   |   |   |
| <p><b>Aquatic biology</b><br/><b>ZOOG-DSE-A-5-2-TH</b></p> | <p><b>Unit 1: Aquatic Bionics</b><br/>Brief introduction of the aquatic biomes: Freshwater ecosystem; lakes, wetlands, streams and rivers, estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.</p> <p><b>Unit 2: Freshwater Biology lakes</b><br/>Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases; Oxygen, Carbon dioxide. Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.</p> <p><b>Streams:</b> Different stages of stream development, Physico-chemical environment, Adaptation of hill-</p>   | <p>Students will gain by</p> <p><b>CO 01</b> Understanding Concepts of fresh water and Marine ecosystems; management of aquatic resources.</p> <p><b>CO 02</b> Understanding special features of different types of water bodies, their physico-chemical properties and measures to</p>   |

  
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| <p><b>Aquatic biology</b><br/><b>ZOOG-DSE-A-5-2-P</b></p> | <p>stream fishes.</p> <p><b>Unit 3: Marine Biology</b><br/>Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.</p> <p><b>Unit 4: Management of Aquatic Resources</b><br/>Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation ;legislations, Sewage treatment Water quality assessment - BOD and COD.</p> <p><b>List of Practicals:</b></p> <ol style="list-style-type: none"> <li>1. Determine the area of a lake using graphimetric and gravimetric method.</li> <li>2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.</li> <li>3. Determine the amount of dissolved Oxygen, and free Carbon dioxide, in water collected from a nearby lake / water body.</li> <li>4. Visit to any aquatic Ecosystem and preparation and submission of report.</li> </ol>   | <p>maintain their health and ecology.</p> <p><b>CO 03</b> Determine area of a water body, its physico- chemical properties, identify different macrophytes and planktons as bio indicators.</p> <p><b>CO 04</b> Documentation of health status of an aquatic ecosystem and preparation of a study report.</p>  |
| <p><b>Skill Enhancement Elective Courses</b></p>          | <p><b>Content of CU Syllabus</b></p>   | <p><b>Course outcome</b></p>   |
| <p><b>SEMESTER 5</b></p>                                  |  |  |
| <p><b>Sericulture</b><br/><b>ZOOG-SEC-A-5-3-TH</b></p>    | <p><b>Unit 1: Introduction</b><br/>Sericulture: Definition, history and present status; Silk route; Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture</p> <p><b>Unit 2: Biology of Silkworm</b><br/>Life cycle of <i>Bombyx mori</i>; Structure of silk gland and secretion of silk</p> <p><b>Unit 3: Rearing of Silkworms</b><br/>Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing Appliances, Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages; Spinning and harvesting and storage of cocoons.</p> <p><b>Unit 4: Pests and Diseases</b><br/>Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases</p> <p><b>Unit 5: Entrepreneurship in Sericulture</b> Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.</p> | <p>To develop skills based on knowledge obtained</p> <p><b>CO 01</b> Historical background and development of sericulture as an industry. Knowledge of the biology of silkworms and their host plants.</p> <p><b>CO 02</b> Techniques of mulberry plantation and management.</p> <p><b>CO 03</b> Maintenance and rearing of silk worms, harvesting of cocoons for production of silk.</p> <p><b>CO 04</b> Identifying probable threats involved during rearing of silkworms and their prevention.</p> <p><b>CO 05</b> Visiting sericulture</p> |

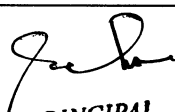
  
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|  |   | centres to gain a firsthand physical experience of the knowledge gained theoretically and familiarity with different sericulture practices.   |
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| Discipline specific courses                          | Content of CU Syllabus  | Course outcome  |
| <b>SEMESTER 6</b>                                    |   |   |
| <b>Biology of Insect</b><br><b>ZOOG-DSE-B-6-1-TH</b> | <b>Unit I: Introduction to Insects</b><br>General Features of Insects, Morphological features, Head, Eyes, Types of antennae, Mouth parts with respect to feeding habits<br><b>Unit II: Concept of Vectors</b><br>Brief introduction of Carrier and Vectors; mechanical and biological vector, Reservoirs, Hostvectorrelationship, Adaptations as vectors, Host Specificity<br><b>Unit III: Insects as Vectors</b><br>Classification of insects up to orders, detailed features of orders with insects as vectors - Diptera, Siphonaptera, Siphunculata, Hemiptera<br><b>Unit IV: Dipteran as Disease Vectors</b><br>Dipterans, as important insect vectors - Mosquitoes, Sand fly, Houseflies; Study of mosquitobornediseases - Dengue, Viral encephalitis, Filariasis; Control of mosquitoes.<br><b>Unit V: Siphonaptera as Disease Vectors</b><br>Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases - Plague, Typhus fever; Control of fleas<br><b>Unit VI: Siphunculata as Disease Vectors</b><br>Human louse; Head, Body and Pubic louse as important insect vectors; Study of louse-borne diseases -Typhus fever, Relapsing fever, Trench fever; Control of human louse<br><b>Unit VII: Hemiptera as Disease Vectors</b><br>Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures<br><br><b>List of Practicals:</b><br>1. Study of different kinds of mouth parts of insects<br>2. Study of following insect vectors through permanent slides/photographs: <i>Aedes</i> , <i>Culex</i> , <i>Anopheles</i> , <i>Pediculus humanus capitis</i> , <i>Pediculus humanus corporis</i> , <i>Phlebotomus argentipes</i> , <i>Musca domestica</i> , | Students will get an insight into<br><br><b>CO 01</b> General characteristics of insects, their morphological features and modification of body parts.<br><br><b>CO 02</b> Concept of vectors and carriers, host- vector relationship and specificity.<br><br><b>CO 03</b> Insects of different Orders as vectors and their role in transmission of diseases.<br><br><b>CO 04</b> Modification of insect mouth parts for performing different functions; identification of insect vectors and preparation of a report |
| <b>Biology of Insect</b><br><b>ZOOG-DSE-B-6-1-P</b>  |   |   |

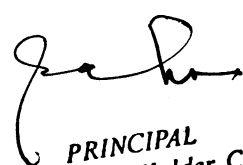
  
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|   | 3. Submission of a project report on any one of the insect vectors and disease transmitted by the insect.  | on any insect vector and its role in disease transmission.  |
| <b>SEMESTER 6</b>                                 |  |   |
| Ecology & Wild life<br>Biology; ZOOG-DSE-B-6-2-TH | <p><b>Unit 1: Introduction to Ecology</b><br/>Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.</p> <p><b>Unit 2: Population</b><br/>Attributes of population: Life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, Population regulation: density-dependent and independent factors,</p> <p><b>Unit 3: Community</b><br/>Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect.</p> <p><b>Unit 4: Ecosystem</b><br/>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 through the ecosystem, Ecological pyramids and Ecological efficiencies</p> <p><b>Unit 5: Wild Life</b><br/>Wildlife Conservation (in-situ and ex-situ conservation): Necessity for wildlife conservation; National parks &amp; sanctuaries, Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.</p> | <p>The students will understand</p> <p><b>CO 01</b> Concepts of Ecology, the factors governing them and role of population in maintaining the ecological balance in different communities.</p> <p><b>CO 02</b> Concepts of energy sources and flow of energy in an ecosystem, food chain, ecological pyramids; Wildlife management and conservation challenges.</p>                   |
| Ecology & Wild life<br>Biology; ZOOG-DSE-B-6-2-P  | <p><b>List of Practicals:</b></p> <ol style="list-style-type: none"> <li>1. Identification of flora, mammalian fauna, avian fauna</li> <li>2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)</li> <li>3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc.</li> <li>4. 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>.</li> </ol>   | <p>Students will develop skills to interpret</p> <p><b>CO 03</b> On field knowledge of wildlife ecology through identification of flora and fauna,</p> <p><b>CO 04</b> Usage of different tools for observation and recording of ecological and wildlife field study.</p> <p><b>CO 05</b> Study of water quality indicators both chemical and biological of an aquatic ecosystem.</p> |

  
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| Skill Enhancement Elective Courses  | Content of CU Syllabus   | Course outcome  |
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| <b>SEMESTER 6</b>                   |  |   |
| Medical diagnosis ZOOG-SEC-B-6-4-TH | <p><b>Unit 1: Diagnostics Methods Used for Analysis of Blood</b><br/> Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentation Rate (E.S.R)</p> <p><b>Unit 2: Diagnostic Methods Used for Urine Analysis</b><br/> Urine Analysis: Physical characteristics; Abnormal constituents, Urine culture</p> <p><b>Unit 3: Non-infectious Diseases</b><br/> Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit</p> <p><b>Unit 4: Infectious Diseases</b><br/> Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite (Microscope based and ELISA based)</p> <p><b>Unit 5: Clinical Biochemistry</b><br/> Lipid profiling, Liver function test. PSA test</p> <p><b>Unit 6: Clinical Microbiology</b><br/> Antibiotic Sensitivity Test</p> <p><b>Unit 8: Tumours</b><br/> Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture,</p> <p><b>Unit 9: Visit to Pathological Laboratory and Submission of Project</b></p> | <p>Students will develop skills to</p> <p><b>CO 01</b> Handle diagnostic tools and methods for analysis of blood, urine and other pathological samples.</p> <p><b>CO 02</b> Diagnose non-infectious and infectious diseases using clinical biochemistry, microscopy and ELISA.</p> <p><b>CO 03</b> Imaging and tissue culture techniques for detection of certain diseases..</p> <p><b>CO 04</b> Preparing a report on visit to a Pathology laboratory.</p> |

  
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