

Department of Zoology, Vidyasagar College for Women
NEP Curriculum for Zoology (Under CCF), University of Calcutta

Program Outcomes

Program Specific Outcomes

Course Outcomes

1. Program Outcome

PO1 - Students attain knowledge and get skilled in the basics of animal sciences, understands the complex interactions at various levels and discover the interaction with the environment.

PO2 – The students will understand the basics of cellular structure, functioning and cellular signalling mechanisms.

PO3 – They will realise the complex evolutionary processes, animal behaviour, physiology and implement this knowledge to improve human health.

PO4 – They will attempt strategies to correlate the different conservation and ecological restoration process and will implement the knowledge to improve biodiversity and enhanced protection of wildlife habitat and protection of endangered species.

PO5 – They will inculcate the basics of entrepreneurship through understanding different small-scale industries like sericulture, aquaculture, apiculture, animal husbandry, poultry farm and other different agricultural innovations.

PO6 – The ethics of animal maintenance and sacrifices are integral to the studies. In this respect the course is designed to impart such knowledge at various levels and build the learners with acute sense of responsibilities and professional ethics.

PO7 – Administering love, empathy, concern for the organisms and integrating the knowledge attained for the improvement of ecosystem and humanity.

1. Program Specific Outcome of the course Zoology

PSO1. Students will understand the basic structure, vivid architecture and the components of cells; focussing on macromolecules, membranes, and cellular organelles. The students will gradually explore molecular events governing cellular function and explore the relevant aspects of applied biology.

PSO2. Students will apply their knowledge to understand the cellular doctrine and implement their knowledge to understand the basic principles of signal transduction mechanisms.

PSO3. Students will learn specific techniques for cell culture, further fractionation into different cellular components and will be trained to view the cell at magnified level.

PSO4. Students will learn about the fascinating aspects of zoology like biology of insects, fish, parasites, poultry farming and animal husbandry; the important branches related to economic zoology. They will learn taxonomy, structural and physiological adaptations including their diversity, evolution, and interactions with the environment. Importantly they will have theoretical, practical and field visit to witness these important attributes.

PSO5. Students will learn the basic principles of inheritance at various levels - molecular, cellular and organismal. They will learn to describe different variations in population, the drifts happening and understand the important aspects of Hardy-Weinberg, fitness and natural selection.

PSO6. Students will learn to describe how interactions of various kinds operates between the organisms and with their environment, the factors involved operating at spatial and temporal scales, various biotic and abiotic components, relative abundance and species diversity.

PART I: SEMESTER-I

CORE COURSE -1:Cell Biology

CC1 THEORY

CO 1:

Knowing the structural organization of different components (eg. Phospholipid bilayer, peripheral and integral proteins, glycolipids and glycoproteins) of the plasma membrane of a cell and the role of the membrane in cellular processes like cell signalling, transport and cellular adhesion. This will help the students understand how the membrane helps to maintain the proper functioning of the cell of an organism and dysfunction of which could lead to diseases like cancer, neurological disorders and infectious diseases in human and other animals as well.

CO 2:

Learning about the ultrastructure of important cellular organelles present in the cytoplasm like endoplasmic reticulum, golgi apparatus and lysosomes and also understanding their role in protein synthesis, folding, protein sorting, export, vesicular transport, lysosomal endocytosis and more. The significance of these organelles is immense, dysfunction of which could cause protein misfolding, ER stress, viral infection, protein trafficking defects, apoptosis leading to human diseases like Alzheimer's, Parkinsons, diabetes, genetic mutations, muscular dystrophy etc.

CO 3:

Gain to know the structure and dynamic role of cellular organelles- mitochondria, peroxisomes and centrosomes. It will help them understand the importance of mitochondria in performing many essential cellular functions including but not restricted to ATP production by cellular respiration, redox regulation, oxidative phosphorylation, cell signalling, apoptosis. They will also learn about the role of peroxisomes (detoxification, beta- oxidation, amino acid and purine -pyrimidine metabolism) and how centrosomes are important in cell division.

CO 4:

Understanding cytoskeletal structure of the cell that provides mechanical support, shape and movement. Components of microtubules(tubulin), microfilaments (actin) and other accessory

protein molecules are studied. Learn about cellular processes like muscle function, cell-cell interaction, cell migration and more, which would help the students to study on altered cytoskeleton structure and dynamics, muscle disorders etc.

CO 5:

Learning the structure and function of the nucleus and eventually the role of the nucleus in cellular processes (e.g., growth, division, gene expression). It will help them to understand the organization of DNA within the nucleus. The knowledge so gained in nuclear biology can be applied to fields like medicine, biotechnology, or genetics.

CO 6:

Gaining knowledge on the phases of the cell cycle (interphase, prophase, metaphase, anaphase, telophase, cytokinesis), checkpoints and regulation mechanisms. Give an understanding on the role of cyclins, CDKs, and other regulatory proteins and also the consequences of cell cycle dysregulation that can further help them investigate cell cycle-related diseases like aneuploidy, genomic instability etc.

CO 7:

Explaining the fundamental principles of cell signaling, including signal reception, transduction, and response. Learning about the different types of cell signaling pathways (e.g., JAK/STAT, MAPK) and the key signaling molecules (e.g., receptors, kinases, phosphatases). It will help them understand the implications of cell signaling dysregulation in human diseases like cancer.

CO 8:

Introduction to the principles and applications of various cell biology techniques. An idea of advantages and limitations of different cell culture methods will be gained. There will be an elaboration of advances in cell biology research and its applications.

Cell Biology Lab; ZOOA-CC-1-P

CO 1:

Learn how a stain(Trypan blue) can be used to identify and quantify live or dead cells in a pool of mixed cells. This method will help the students understand its various advanced applications like cell culture monitoring, cytotoxicity assays, stem cell research, tissue engineering etc.

CO 2:

The students will gain skill to measure small microscopic objects inclusive of small organisms, organelles, or other objects by using ocular and stage micrometer under a light microscope.

CO 3:

The students will learn how to take sample of cells, process, stain, observe and interpret the finding by studying the cell morphology and staining intensities. They could apply this method for many downstream diagnostic and research applications like cancer diagnosis, infection diagnosis, cellular research etc.

CO 4:

Gain an advanced hands-on experience of a crucial technique in biomedical research. The students will be enriched with experiences of handling a rat/mouse as a model organism, understand advance research concepts of hematopoiesis studies, cancer research, immunology, stem cell research as well as toxicology.

PART I: SEMESTER-I

SEC-1: Applied Entomology

SEC-1-THEORY

CO 1- Characterize Class- Insecta, along with identification some of the living orders with examples. Gain knowledge about the morphological and physiological adaptations in insects.

CO 2- Gain knowledge on some vectors - mosquitoes, ticks, *Phlebotomus* sp. and the diseases caused by them. Awareness of vector management at personal and community level

CO 3- Conceptualize pest and pest management. Gain knowledge on the bionomics of some common pests and their control measures.

CO 4- The students will gain a comprehensive understanding of sericulture, from the biology of silk moths to the practical aspects of silk production and disease management. This foundation prepares them for potential careers in the sericulture industry and related fields

CO 5- The students will have a thorough understanding of honeybee biology, modern beekeeping practices, and the production and management of apiculture products. This foundation prepares them for potential careers in apiculture and related fields.

Applied Entomology Lab: SEC-1-P

CO 1- The students will gain skills and competencies on the dissection and mounting of the mouth parts.

CO 2- Gain hands-on learning of methods for collecting economically important insects, including sweep nets, light traps, and pitfall traps.

CO 3- The students will be able to identify key insect pests affecting major crops, understand the economic impact of these pests on agricultural production.

CO 4- Develop hands-on experience in observing and documenting the different life stages of honeybees and silkworms.

CO 5- Students will develop understanding of critically insects (primarily mosquito) driven diseases. The knowledge gained will help them to develop insight that can be pursued by the students in their higher studies and as research topics.

CO 6- Students' visit to fields like – agricultural farm/sericulture farm/apiary/health centre will acquaint them with real world, help them to investigate interactions of biotic & abiotic components and inculcate the value of entrepreneurships.

PART I: SEMESTER-II
CORE COURSE-2: Biochemistry
CC2 THEORY

CO1: Understand the classification, structure, and properties of Monosaccharides, Disaccharides, and polysaccharides. Physiological importance of different types of carbohydrates. Apply carbohydrate biochemistry principles to veterinary medicine animal health.

CO2: Learn the structure, classification and electrochemical properties of essential and non-essential amino acids as well as understand the structure and classification of primary, secondary and tertiary structure of protein. Apply protein biochemistry principles to veterinary medicine animal health and understand protein nutrition and dietary requirements in animals.

CO3: Learn the classification of saturated, unsaturated, essential and non-essential fatty acids as well as understand the structure and formation of triglyceride. Relate lipid biochemistry to human health. Apply lipid biochemistry principles to biomedical research and medicine.

CO4: Learn the nomenclature, classification and properties of cofactors and coenzyme. Understand the effect of different factors to enzyme action as well as mechanism of enzyme action and kinetics. Understand the enzyme biochemistry and action of mechanism application in biotechnology, medicine and industry.

CO5: Students will learn the pathways, chemical reactions, and significance of Glycolysis, the Citric acid cycle, the Pentose phosphate pathway, Gluconeogenesis from lactate and glycerate, Glycogenesis, and Glycogenolysis. (Pathways with names of enzymes and significance)

CO6: Students will understand the pathways, reactions, and significance of Protein Metabolism, Transamination, and Deamination, and learn the Fate of the C-skeleton of Glucogenic and Ketogenic amino acids.

CO7: Students will gain knowledge of the process and calculate the ATP molecules of β -oxidation of saturated fatty acids fatty acid like (Palmitic acid) and unsaturated fatty acids like Linoleic acid. Understand the pathways of Fatty acid biosynthesis.

CO8: The students will gain a comprehensive understanding of the degradation of purine, the purine salvage pathway and its significance.

CO9: The students will understand the types of free radicals and antioxidants and also learn the concept of free radicals and antioxidants with examples.

Biochemistry Lab; CC-2-P

Gr. A Practical

CO1: Identify the unknown carbohydrates using various test (Molisch test, Barfoed test, Benedict test, Fehling test, Seliwanoff test, Hydrolysis test for sucrose, Iodine test). Relate carbohydrate analysis to biomedical research and medicine.

CO2: Identify the unknown protein using various test (Biuret test, Million's test, Xanthoproteic test, Ninhydrin test). Understand the protein analysis to biomedical research and medicine.

CO3: Identify the unknown lipid using Grease spot test. Relate lipid analysis to biomedical research.

Gr. B Practical

CO: Students will develop hands-on training on colorimetric estimation of the protein by Lowry's method and amylase activity and also learn the mathematical calculation and put the value on a graph.

PART I: SEMESTER-II

SEC-2 Aquaculture

SEC-2 TH

CO1: The students will understand the qualities of Cultivable fish and also learn to identify with examples of some Indigenous and Exotic species.

CO2: The students will understand the types of Sustainable Aquaculture Culture Systems like Extensive, Semi-intensive, Extensive, and water quality in culture ponds and factors controlling water quality. The students will gain a comprehensive knowledge of the preparation and management of fish culture ponds in composite fish Culture, Cage Culture, Pen Culture, and Raceways. Flow through the system. Bio floc. They will gain knowledge of Cold-water fishery, Jeol Fishery, Sewage fishery, Mariculture with special emphasis on seaweed culture, Induced Breeding of Carps, Synthetic Hormones in Hypophysation, Management of Fin Fish Hatcheries, Glass Jar Hatchery, and Chinese Hatchery.

CO3: Learning the cultivation strategy and application of aquarium fisheries, biology of Common ornamental fish, fish nutritional requirements, capture fishery like fishing crafts and gears, post harvesting technology, fish transport, marketing, fish preservation and by-products. Knowledge gaining from the preparation and management of fish aquarium, fish biotechnology will help them to understand the technological aspects in applied scale.

CO4: Learning of different infective diseases with their causative agents, symptoms and control. Knowledge gaining by the students for the prevention of the diseases to maintain the cultivable fishes.

CO5: Learning of the breeding techniques in shrimps, prawns and the techniques of artificial pearl culture. Knowledge will be acquired by them are the application and of prospects of applied biology.

Aquaculture Lab: SEC-2-P

CO1: The students will be able to identify different fish species using Meristic characters. (Systematic position, specimen characters)

CO2: Gain hands-on learning of economically important fishes at nearby fish market, and understand the economic impact of these fishes on pisciculture. Develop hands-on experience in observing and documenting fish economy and prepare a report.

PART II: SEMESTER-III
CORE COURSE-3: Genetics
CC3 THEORY

CO1: Students will derive basic information on the structure, function and different types of chromosome. They will attempt to visualize the genetic blueprint of the human body.

CO2: Students will understand the basics of genetics like the concept of alleles, pseudoalleles, pleiotropy, expressivity etc. These information's are integral to the understanding of traits, inheritance etc.

CO3: Seymour Benzer's complementation test is an important concept of Genetics that revolutionized and redefined various concepts including the relationship between classical genetics with the molecular interpretation of genetic material. Hence, students' understanding of such topics are important and integral.

CO4: The important events of heredity like linkage and cross-over are integral to studies of genetics. Hence, learning these will make the students develop proper understanding of the subject.

CO5: Understand different types of mutation and chromosomal aberrations in human and *Drosophila* as well as learn the molecular basis of mutation. Also, understand different types of mutagen and how to detect the mutation. Relate the genetic mutation to human diseases (cancer, down syndrome etc). Importance of mutation research in biotechnology and applying knowledge chromosomal aberrations in genetic disorder counseling.

CO6: Learn Extra-chromosomal or cytoplasmic inheritance in *Paramoecium* and Snail as well as Snail shell polymorphism and its genetic basis. Evaluate the effect of environmental factors on extra-chromosomal inheritance.

CO7: The students will gain a comprehensive understanding of different Transposable Genetic elements in in-vertebrates and vertebrates.

CO 8: The students will have a thorough understanding on the concept of quantitative traits, polygenic inheritance and the types of Heritability in their curriculum for better understanding the sense of heritability.

Genetics Lab; CC-3-P

CO 1: The students will gain a comprehensive understanding of biostatistical knowledge and difference between expected and observed trait by sample testing. The knowledge will be gained by them at the significance level and acceptance and rejection of the hypothesis.

CO 2: The students will be able to identify different chromosomal aberration in *Drosophila* and Human from photograph and will acquire the knowledge of mutation at gene as well as nucleotide level.

CO 3: Analyze and interpret pedigree charts to understand inheritance patterns and genetic relationships. Identify and classify various pedigree patterns, including autosomal dominant, autosomal recessive, and X-linked inheritance. Apply Mendelian laws and probability calculations to predict genotype and phenotype probabilities. Design and construct pedigree charts from family data. Explain the role of pedigree study in identifying genetic disorders.

CO 4: Upon completing this course, students will understand the principles of meiosis, including synapsis, crossing over, and independent assortment, using grasshopper as a model organism. They will be able to describe and analyze the stages of meiosis I and II and explain its significance of meiosis.

PART II: SEMESTER-III
CORE COURSE-4: CELLS AND TISSUE STRUCTURE
CC4 THEORY

CO1: Explain the principles of staining and histochemistry and the types of stains and dyes used. Understand the applications of histochemistry in biomedical research and diagnostics. Identify cellular and tissue structures using histochemical stains. Recognize the importance of histochemistry in disease diagnosis and research.

CO2: Describe the structure, function, and classification of epithelial tissue. Understand the role of epithelial tissue in various bodily systems (e.g., skin, respiratory, gastrointestinal) and thereby analyze its role in disease processes.

CO3: Describe the structure, function, and classification of connective tissue and identify the characteristics of different connective tissue types (e.g., loose, dense, cartilage, bone). It will also help to recognize the importance of connective tissue in maintaining tissue integrity and its significance in human health.

CO4: Describe the structure, function, and classification of muscle tissue. Explain the types of muscle cells (e.g., skeletal, smooth, cardiac). They will also get to understand the role of muscle tissue in movement, support, and regulation. Finally, they will apply the knowledge of muscle tissue to understand musculoskeletal disorders (e.g., muscular dystrophy).

CO5: The students will be learning about the nervous system – its basic unit, the detailed structure and functioning. A deep insight into related diseases would be done as an attempt toward clinical implications.

CO6: The students will be made aware of tissue repair, the factors involved, different types of tissue repair mechanisms primarily. These knowledges are important owing to the understanding of disease diagnosis and treatment.

Cells and Tissue Structure Lab; CC-4-P

CO 1- Gaining hands on expertise on tissue staining also have an in-depth idea about the structure of different tissues.

CO 2- Develop the ability to identify and differentiate among lung, liver, stomach and kidney under microscope.

CO 3- Acquire the ability to fix biological tissues for microscopic examination.

PART II: SEMESTER-III
SEC 3: POULTRY FARMING & ANIMAL HUSBANDRY
SEC-3 THEORY

CO-1: learn to identify various fowl breeds, Recognize key physical & behavioural traits for identification. Apply critical thinking to solve identification challenges.

CO-2: Able to design & manage poultry housing system which promote health, welfare & productivity with a lookout to sustainability. Students can design & layout poultry houses, including space allocation & ventilation.

CO-3: Understand the importance of nutritional requirements, feed formulation, feeding programs and apply this knowledge to practical fields. They Can design effective feeding programs for optimizing poultry production.

CO-4: Come to know about the disease transmission, epidemiology & pathogenesis of zoonotic diseases. Learn the importance of disease monitoring & surveillance system & develop biosecurity protocol for poultry operations.

CO-5: Identify key players in Indian market & market segments (e.g. broiler, layer, hatchery). Analyze market trends, demand supply gaps & pricing strategies. Can develop marketing plans & strategies for poultry products.

CO 6: Recognize different cattle breeds, their origin & breed specific traits (coat, colour .horn shape ,body size etc.). Can compare between indigenous & non indigenous species.

CO 7- Typically encompass a variety of knowledge related to the formulation, evaluation, and management of cattle diets.

CO 8- Gain in-depth knowledge related to advanced reproductive technologies.

CO 9- Learning composition of milk and other dairy products along with their commercialization by different national industry.

CO 10- An overview on the different types of cattle diseases and their control techniques.

Poultry Farming and Animal Husbandry Lab; SEC 3-P

CO-1: Identify between different poultry breeds, learn differences in plumage patterns, beak shapes, leg characteristics etc. Able to conduct field observation & record accurate identification data. Can use identification guides, keys & resource effectively.

CO 2: Identify various Indian cattle breeds & understand characteristics of different breeds (milk, meat draft). Familiarize with Indian cattle breed classification systems. Apply knowledge to practical livestock management scenario.

CO 3- Explore a range of knowledge, skills, and competencies related to the care, management, and production of poultry and livestock.

SEC G FOR MDC

Applied Zoology- THEORY

CO 1-The students will have an in-depth understanding on bionomics of some key agricultural pests (insect pests and mammalian pest). This knowledge will help them identify the pests and may work to upgrade control management to protect the crops from pests in future.

CO 2- The students will gain a comprehensive understanding of sericulture, from the biology of silk moths to the practical aspects of silk production and disease management. This foundation prepares them for potential careers in the sericulture industry and related fields.

CO 3- The students will have a thorough understanding of honeybee biology, modern beekeeping practices, and the production and management of apiculture products. This foundation prepares them for potential careers in apiculture and related fields.

CO 4: Upon completing this course, a comprehensive understanding of apiculture, including the biology and behavior of honey bees, social structure, and communication methods will be achieved. They will be able to manage bee colonies for honey production and pollination, conduct beekeeping operations, identify and control pests and diseases, and extract and process honey and other bee products.

CO 5: Understand the prawn culture (Penaeid and Palaemonid) and its application. Learn the difference between major and minor carp. Also, learn composite fish farming and Induced breeding. Apply prawn culture, composite fish farming and induced breeding principles to commercial aquaculture.

CO 6: Students will learn introductory knowledge about dairy and common dairy animals, types of cattle breeds, and their distribution in India. The students will gain a comprehensive understanding of exotic cattle breeds, principles and methods of breeding, inbreeding, outbreeding, crossbreeding, artificial insemination and MOET, cattle feed, roughage and concentrate, dairy by-

products, dairy pathology, and vaccination programs. They also learn about types of breeds (fowl) with features and examples, rearing methods like deep litter system, feed formulation for chicks, poultry by-products with economic importance, poultry diseases, and their control measures.

CO7: Upon completing a course in Lac Culture, students will be able to understand the fundamentals of lac cultivation, including lac insect biology, host plant selection, and climatic requirements. They would identify and classify different types of lac, including Shellac, Seedlac, and Sticklac. Develop skills in lac cultivation practices, such as insect rearing, host plant management, and lac harvesting. Analyze the production processes of various lac products, including lac dye, lacquer, and shellac. Apply knowledge of quality control measures to ensure high-quality lac production. Understand the market dynamics and economic importance of lac culture in India and globally. Apply integrated pest management strategies to control diseases and pests affecting lac cultivation.

Applied Zoology Lab

CO1: The students will be able to identify various castes/life stages of economically important insects. They will develop the expertise to identify different earthworms and the ectoparasites and will have an in depth understanding of the host pathogen relationship as well. These techniques will make them future ready to handle specimens and prepare them for research-based studies.

CO2: Students will be able to identify and classify different aquatic species using their morphological characteristics and also have a in depth knowledge of aquatic diversity of species and their distribution in various aquatic ecosystems.

CO3: Students will be capable of identifying the common agricultural pests accurately and will learn about the collection methods along with record keeping including labeling and report preparation.