PROGRAM SPECIFIC OUTCOMES

B.SC IN ZOOLOGY

- Understand the biological diversity and grades of complexity of various animal forms through their systematic classification and process of organic evolution.
- Understand the roles of plants, animals and microbes in the sustainability of the environment and their interaction among themselves and deterioration of the environment due to anthropogenic activities.
- Understand the concepts and principles of biochemistry, immunology, physiology, ethology, endocrinology, developmental biology, cell biology, genetics, molecular biology and microbiology and develop technical skills in biotechnology, bioinformatics and biostatistics.
- Perform laboratory procedures as per standard protocols in the areas of animal diversity, systematics, cell biology, genetics, biochemistry, molecular biology, microbiology, physiology, immunology, developmental biology, environmental biology, ethology, evolution and science methodology.
- Understand the issues of environmental contexts and sustainable development.

COURSE SPECIFIC OUTCOME

ZOOLOGY MAJOR

SEMESTER-I

Course Code: ZOO-DC-MJ-101

Title of the Course: Diversity of Non-Chordates

Students will be able to:

- Understand and explain the general characteristics and classification of non-chordates, contributing to a deeper knowledge of animal evolution and diversity.
- Classify and describe the unique features of protochordates, agnathas, fishes, amphibians, reptiles, birds, and mammals, enhancing their ability to identify different vertebrate species.
- Analyze important physiological processes such as retrogressive metamorphosis in Ascidia, respiration in amphibians, and echolocation in bats, gaining insights into adaptations and survival strategies in various environments.
- Understand the evolutionary transitions in chordates, from water-based life to terrestrial adaptations in amphibians, reptiles, and mammals, providing a foundation for studying evolutionary biology.
- Gain practical knowledge of structural features like scales, poison apparatus in snakes, and the exoskeleton of birds, which will help in fields such as wildlife conservation and zoology research.
- Recognize the ecological roles of chordates, including their migrations, feeding habits, and parental care behaviours, providing insights into biodiversity conservation efforts.
- This course will also prepare students for advanced studies and careers in zoology, veterinary science, evolutionary biology, and wildlife conservation, enabling them to apply their knowledge in various biological and ecological fields.

SEMESTER-II

Course Code: ZOO-DC-MJ-201

Title of the Course: Diversity of Chordates & Comparative Anatomy of Vertebrates

Students will be able to:

- Identify and explain the general characteristics and classification of the phylum Chordata and its subgroups.

- Understand the biology of protochordates, including their classification, life processes, and the significance of retrogressive metamorphosis in Ascidia and feeding mechanisms in Branchiostoma.
- Classify and describe the characteristics of agnatha (jawless) chordates, including Cyclostomes.
- Analyze the structural and functional adaptations in fishes, including scales, respiratory organs, and swim bladders, along with understanding fish migration.
- Explain the classification, parental care, respiration, and metamorphosis in amphibians, emphasizing their adaptation to dual life forms (aquatic and terrestrial).
- Describe the classification of reptiles, focusing on their poison apparatus and biting mechanisms in snakes.
- Understand the classification of birds, their exoskeleton structures, and migratory behaviors, emphasizing their adaptation to flight and diverse habitats.
- Explain the structure, functions, and evolutionary adaptations of the integument in amphibians, birds, and mammals, including their specialized derivatives (e.g., scales, feathers, hair).
- Understand the mechanisms of jaw suspension and visceral arches and explain how these skeletal features differ across vertebrate groups.
- Compare the anatomy of the stomach in various vertebrates, with a focus on evolutionary specializations in different feeding habits and describe the diversity of dentition in mammals.
- Analyze the structure and function of respiratory organs across fishes, amphibians, birds, and mammals, explaining how these systems have evolved.
- Provide a comparative account of the structure of the heart and aortic arches across vertebrates, illustrating evolutionary modifications to meet the demands of different physiological environments.
- Compare the anatomical and functional adaptations of kidneys in different vertebrate groups.
- Discuss the comparative anatomy of the brain across vertebrates, with particular attention to the origin, distribution, and nature of cranial nerves in mammals, explaining their functional significance in different species.
- Upon completing this course, students will gain insights into key physiological adaptations, such as fish respiration, amphibian metamorphosis, snake venom mechanisms, and bird migration. This knowledge will be invaluable for students pursuing careers in zoology, wildlife conservation, evolutionary biology, and veterinary sciences. Understanding chordate diversity, comparative anatomy and evolutionary traits will also provide a solid base for advanced studies in anatomy, physiology, and ecology, preparing students for research and academic roles in the biological sciences.

SEMESTER-III

Course Code: ZOO-DC-MJ-301

Title of the Course: Ecology and Conservation Biology

Students will be able to:

- Comprehend the evolution of ecological science, understand the levels of ecological organization, and recognize the significance of limiting factors such as temperature and light in ecological systems.
- Understand the population dynamics by evaluating population attributes, interpreting survivorship curve and population growth models, and analyzing population interactions.
- Analyze the characteristics of ecological communities, including species diversity, dominance, richness, and vertical stratification. Moreover, understand the significance of ecotones, edge effects, and ecological succession, particularly Hydrarch succession.
- Differentiate between various types of ecosystems and understand the role of food chains (detritus, grazing) and food webs in energy flow. Interpret ecological pyramids, efficiencies, and nutrient cycling, including the nitrogen cycle, within ecosystems.
- Identify different levels and types of biodiversity, and understand the importance of biodiversity hotspots, keystone, and flagship species.
- Gain familiarity with conservation strategies, including in-situ and ex-situ conservation, protected areas, and wildlife laws (Indian Wildlife Act 1972).
- Recognize the importance of wildlife conservation, the causes of species depletion, and strategies to conserve key species like tigers, lions, and rhinos.
- Understand the causes and consequences of human-wildlife conflicts and their implications for conservation.

SEMESTER-III

Course Code: ZOO-DC-MJ-302

Title of the Course: Cell Biology

Students will be able to:

- Accurately distinguish between prokaryotic and eukaryotic cells based on structural and functional characteristics and describe the molecular biology of acellular entities like viruses, viroids, and prions.
- Critically evaluate the ultra-structural organization of the plasma membrane, including lipid bilayer composition and membrane protein functions. Compare and contrast different models of membrane structure, such as the fluid mosaic model, and explain their relevance.
- Explain the mechanisms of membrane transport, including facilitated diffusion, active transport, and ion channels. Understand the molecular architecture and function of cell-cell junctions, including tight junctions, gap junctions, and desmosomes.
- Examine the structure and function of key organelles, including the endoplasmic reticulum, Golgi apparatus, and lysosomes, with a focus on their roles in protein synthesis, sorting, and trafficking.
- Analyze the semi-autonomous nature of mitochondria and critically evaluate the endosymbiotic hypothesis as a model for the evolution of eukaryotic cells.
- Elucidate the structure and function of the centrosome and ribosome, highlighting their roles in cell division and protein synthesis, respectively.
- Describe the structural organization of the nucleus, including the nuclear envelope, nuclear pore complexes, and nucleolus, and explain their functions in nuclear transport and ribosome biogenesis. Basic idea about DNA and RNA molecule. Explain the molecular mechanisms of chromatin condensation and packaging into nucleosomes. Interpret the structure of chromosomes and provide an overview of specialized chromosomal forms, such as polytene and lampbrush chromosomes.
- Investigate the structure, composition, and dynamics of the cytoskeleton, including actin filaments, microtubules, and intermediate filaments, and explain their roles in maintaining cell shape, motility, and intracellular transport.
- Describe the regulation of the cell cycle, with specific reference to checkpoints and molecular regulators in Saccharomyces cerevisiae.
- Compare the processes of mitosis and meiosis, elucidating their stages and biological significance in growth, development, and genetic diversity.
- Analyze the molecular components of cell signaling pathways, including types of signaling molecules (ligands) and receptors (e.g., GPCRs). Explain the role of second messengers, such as cyclic AMP (cAMP), in transducing extracellular signals and regulating cellular responses.

SEMESTER-IV

Course Code: ZOO-DC-MJ-401

Title of the Course: Genetics

Students will be able to:

- Explain the principles of Mendelian inheritance, including concepts of incomplete dominance, co-dominance, and gene interactions. Analyze genetic phenomena such as multiple alleles, lethal alleles, pleiotropy, and their role in inheritance.
- Differentiate between sex-linked, sex-influenced, and sex-limited inheritance and explain polygenic inheritance patterns.
- Understand the mechanisms of sex determination in Drosophila and humans.
- Identify criteria for extra-chromosomal inheritance and provide examples such as Kappa particles in Paramecium. Explain the genetic basis of maternal effects with examples like shell spiraling in snails.
- Understand the molecular basis of inheritance, the role of DNA and RNA as the genetic materials and examine key experimental evidence that led to the identification of DNA as the hereditary material.
- Understand the concept of genetic linkage and its implications for inheritance.
- Describe the cytological and molecular basis of crossing over, including the Holliday model, and explain somatic crossing over.
- Construct chromosomal maps based on recombination frequency data.
- Classify different types of gene mutations and chromosomal aberrations, providing relevant examples. Explain the phenomenon of non-disjunction and its role in variations in chromosome number.
- Understand the genetic basis of inborn errors of metabolism, single-gene disorders and chromosomal aberration disorders.
- These outcomes will equip students with an in-depth understanding of classical and modern genetics, enabling them to explore genetic principles in research, medicine, and biotechnology.

SEMESTER-IV

Course Code: ZOO-DC-MJ-402

Title of the Course: Histology & Endocrinology

Students will be able to:

- Understand the principles of tissue fixation, the types of fixatives, and the procedures used in histology.
- Describe the classification, composition, and properties of histological dyes and stains, particularly Haematoxylin and Eosin, and explain double and triple staining methods.

- Identify and describe the histology of various mammalian tissues, including skin, cartilage, bone, pituitary, thyroid, liver, pancreas, adrenal glands, testis, and ovary.
- Understand the basics of the endocrine system, including the classification and transport of hormones, as well as the roles of neurosecretions and neurohormones. Explain the function of the epiphysis and hypothalamo-hypophysial axis, including the regulation of biological rhythms, reproduction, and feedback mechanisms in hormone regulation.
- Understand the synthesis and functions of hormones produced by the thyroid, ovary, testis, parathyroid, adrenal glands, and pancreas, and their role in homeostasis. Moreover, explain the mechanisms of action of steroidal and non-steroidal hormones, including their interactions with receptors.
- Describe the estrous cycle in rats and the menstrual cycle in humans and understand hormonal regulation during these processes. Discuss the roles of vasopressin and oxytocin, and their involvement in physiological functions like parturition.
- Understand disorders of the endocrine glands, including dysfunctions related to the pituitary, thyroid, and adrenal glands, and their impact on homeostasis (calcium and glucose regulation).

SEMESTER-IV

Course Code: ZOO-DC-MJ-403

Title of the Course: Animal Physiology

Students will be able to:

- Understand the structure, classification, and functions of major tissue types, including epithelial, connective, muscular, and nervous tissues.
- Describe the types and structure of bones and cartilage and explain the process of ossification.
- Explain the structure and function of neurons, including the origin of action potentials and their propagation in both myelinated and unmyelinated nerve fibers. Understand synaptic transmission, the types of synapses, and the functioning of neuromuscular junctions. Describe reflex actions and their types, understanding how the nervous system responds to stimuli.
- Explain the ultra-structure of skeletal muscles, muscle fiber characteristics, and the molecular mechanisms of muscle contraction.
- Understand the physiology of respiration, including the mechanics of breathing, gas transport, respiratory volumes, and the factors affecting oxygen and carbon dioxide dissociation curves. Explain the role of respiratory pigments and understand conditions like carbon monoxide poisoning and how respiration is regulated.

- Describe the composition and function of blood components, and explain haemostasis, blood clotting, and the fibrinolytic system.
- Understand the physiology of the heart, including coronary circulation, myocardial fibers, cardiac impulses, ECG interpretation, cardiac cycle, cardiac output, and blood pressure regulation.
- Explain thermoregulation and osmoregulation, including adaptations in homeotherms, osmoregulation in aquatic vertebrates, and the role of extra-renal organs in osmoregulation.
- Describe the renal physiology, including the histology of kidneys, the nephron, and the mechanisms involved in urine formation, glomerular filtration, tubular secretion, and the counter-current mechanism.

ZOOLOGY MINOR

SEMESTER-I

Course Code: ZOO-IDC/DC-MN-101

Title of the Course: Biology of Non-Chordates

Students will be able to:

- Understand and explain the general characteristics and classification of non-chordates, contributing to a deeper knowledge of animal evolution and diversity.
- Classify and describe the unique features of protochordates, agnathans, fishes, amphibians, reptiles, birds, and mammals, enhancing their ability to identify different vertebrate species.
- Analyze important physiological processes such as retrogressive metamorphosis in Ascidia, respiration in amphibians, and echolocation in bats, gaining insights into adaptations and survival strategies in various environments.
- Understand the evolutionary transitions in chordates, from water-based life to terrestrial adaptations in amphibians, reptiles, and mammals, providing a foundation for studying evolutionary biology.
- Gain practical knowledge of structural features like scales, poison apparatus in snakes, and the exoskeleton of birds, which will help in fields such as wildlife conservation and zoology research.
- Recognize the ecological roles of chordates, including their migrations, feeding habits, and parental care behaviors, providing insights into biodiversity conservation efforts.
- This course will also prepare students for advanced studies and careers in zoology, veterinary science, evolutionary biology, and wildlife conservation, enabling them to apply their knowledge in various biological and ecological fields.

SEMESTER-II

Course Code: ZOO-IDC/DC-MN-201

Title of the Course: Biology of Chordates

Students will be able to:

- Identify and explain the general characteristics and classification of the phylum Chordata and its subgroups.
- Understand the biology of protochordates, including their classification, life processes, and the significance of retrogressive metamorphosis in Ascidia and feeding mechanisms in Branchiostoma.
- Classify and describe the characteristics of agnathan (jawless) chordates, including Cyclostomes.
- Analyze the structural and functional adaptations in fishes, including scales, respiratory organs, and swim bladders, along with understanding fish migration.
- Explain the classification, parental care, respiration, and metamorphosis in amphibians, emphasizing their adaptation to dual life forms (aquatic and terrestrial).
- Describe the classification of reptiles, focusing on their poison apparatus and biting mechanisms in snakes.
- Understand the classification of birds, their exoskeleton structures, and migratory behaviors, emphasizing their adaptation to flight and diverse habitats.
- Upon completing this course, students will gain insights into key physiological adaptations, such as fish respiration, amphibian metamorphosis, snake venom mechanisms, and bird migration. This knowledge will be invaluable for students pursuing careers in zoology, wildlife conservation, evolutionary biology, and veterinary sciences. Understanding chordate diversity and evolutionary traits will also provide a solid base for advanced studies in comparative anatomy, physiology, and ecology, preparing students for research and academic roles in the biological sciences.

SEMESTER-III

Course Code: ZOO-IDC/DC-MN-301

Title of the Course: Ecology and Evolutionary Biology

By the end of this course, students will be able to:

- Understand the basic principles of ecology, including levels of organization, population growth models, and community dynamics, helping them analyze real-world environmental issues.
- Explain population interactions and ecological succession, enabling students to assess the sustainability of ecosystems and conservation initiatives.
- Grasp the structure and functioning of ecosystems through the study of food chains, food webs, and energy flow, which will prepare them for careers in environmental management and conservation.
- Apply knowledge of wildlife conservation methods, laws, and management strategies, such as those for tiger conservation, which can be directly applied in conservation programs and policy-making.
- Comprehend the origin of life and evolution theories, providing insight into the biological processes that drive diversity and adaptation.
- Analyze genetic variations and their role in evolution, preparing students for research in genetics, evolutionary biology, and biodiversity conservation.
- Understand species concepts and mechanisms of speciation, enabling them to contribute to species preservation efforts, particularly in areas of high biodiversity.
- Learn the distribution of fauna in different zoogeographical realms, which will be beneficial in fields like biogeography, wildlife biology, and conservation planning.
- These skills will be invaluable for students aiming to pursue careers in environmental sciences, wildlife management, evolutionary biology, conservation, and ecology, equipping them to address global challenges related to biodiversity and sustainability.

SEMESTER-IV

Course Code: ZOO-IDC/DC-MN-401

Title of the Course: Cell Biology and Genetics

By the end of this course, students will be able to:

- Differentiate between prokaryotic and eukaryotic cells and understand their structural and functional characteristics, laying a foundation for studies in microbiology, molecular biology, and biotechnology.
- Explain the structure and function of cell organelles, such as mitochondria, nucleus, and ribosomes, which are essential for understanding cellular processes and metabolic functions relevant to biomedical research.
- Understand the fluid mosaic model of the plasma membrane and its role in cell transport, which is critical for future studies in physiology, cell signaling, and pharmacology.

- Describe the stages of mitosis and meiosis and their significance in growth, development, and reproduction, preparing students for careers in genetics and developmental biology.
- Grasp the principles of Mendelian inheritance and its extensions, which will enable students to analyze genetic traits and variations, a skill essential in genetic counseling, agriculture, and medical genetics.
- Explain genetic linkage and the molecular basis of crossing over, providing a foundation for genetic research, gene mapping, and biotechnology applications.
- Understand the mechanisms of sex determination and the genic balance theory in Drosophila, which will aid in further studies of developmental biology and evolutionary genetics.
- Classify and understand various types of gene mutations and chromosomal aberrations, equipping students to engage in research on genetic disorders and the development of therapeutic interventions.
- These skills will be crucial for students pursuing careers in biological research, genetics, biotechnology, healthcare, and pharmaceuticals, as well as in fields such as agriculture and forensic science, where genetic analysis and cell biology are integral.

ZOOLOGY MDC

SEMESTER- I

Course Code: ZOO-MDC-101

Title of the Course: Health and Disease Prevention

By the end of this course, students will be able to:

- Students will understand basic human anatomy and physiology, including the body plan, organ locations, and their functions.
- Students will be able to define key epidemiological terms such as sporadic, endemic, epidemic, and pandemic, and relate these to real-world health issues.
- Students will be able to describe bacterial, viral, and fungal diseases, such as pneumonia, influenza, AIDS, and mycosis, and understand their prevention and control.
- By the end of this course, students will be able to explain helminth infections, as well as arthropod-borne diseases spread by mosquitoes and ticks, including vector control strategies.
- By the end of this course, students will be able to identify the causes, symptoms, prevention, and control of specific communicable diseases (e.g., SARS, tuberculosis, cholera) and non-communicable diseases (e.g., cancer, diabetes, obesity, alcoholism).

SEMESTER- II

Course Code: ZOO-MDC-201

Title of the Course: Challenges to Biodiversity and Conservation Approaches

Students will be able to:

- Understand and describe different types of pollution (air, water, and soil), their sources, harmful effects on human health and the environment, and appropriate control measures.
- Analyze the health impacts of heavy metals and explain the relationship between pollution, climate change, and public health issues such as global warming, acid rain, and ozone layer depletion.
- Define biodiversity, identify global and Indian biodiversity hotspots, and understand the significance of mega-biodiversity countries.
- Explain the causes of wildlife depletion and evaluate various wildlife conservation strategies, including in-situ and ex-situ methods, wildlife protection laws, and the role of protected areas.
- Identify endemic species of West Bengal and explain the role of conservation efforts in protecting these species.
- Develop a basic understanding of ecotourism planning and management, the role of media in promoting tourism, and the use of wildlife protected areas in West Bengal as ecotourism venues.

SEMESTER- III

Course Code: ZOO-MDC-301

Title of the Course: Applied Zoology

Students will be able to:

- Define and differentiate between major and minor pests, and describe their impact on crops like paddy, jute, and stored grains.
- Understand and apply various pest control methods, including chemical, mechanical, cultural, and biological techniques, as well as Integrated Pest Management (IPM) for sustainable pest control.
- Explain the principles and economic importance of sericulture, apiculture, pisciculture
- Explain and differentiate between major and minor carps and analyze the concepts, advantages, and disadvantages of composite fish farming and induced breeding techniques.
- Explore the potential of economic zoology as a source of livelihood and employment by visiting relevant farms or start-ups and preparing a report on their operations and practices.