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DEPARTMENT OF ZOOLOGY

COURSE OUTCOME SEMESTER WISE

SEMESTER I

Major Course: ZOOL1011 (Non-Chordates)

The term begins with a deep dive into the rules of animal classification, focusing on the International Code of Zoological Nomenclature to understand how every living creature is systematically named. Once the groundwork is laid, the focus shifts to microscopic life, where we explore the locomotion of Amoeba and the genetic exchange processes in Paramecium. The middle of the semester is dedicated to the structural evolution of multicellular life, starting with the canal systems of sponges and the fascinating formation of coral reefs. We then move into the complex world of jointed-legged animals, studying the chemistry of insect hormones and the various types of metamorphosis. The final weeks are spent examining the soft bodies of mollusks and the intricate water vascular systems of starfish, culminating in an analysis of the evolutionary links between invertebrates and chordates.

Minor Course: ZOOL1021 (Non-Chordates)

For the minor paper, the lesson plan prioritizes a broad survey of invertebrate diversity and its biological significance. The initial phase of the course establishes the concept of a species and the Linnaean hierarchy that organizes the natural world. Early lectures explore how body symmetry and repeating segments evolved to allow for more complex movement in animals like earthworms. We spend time investigating the life cycles of parasitic organisms and the unique stinging mechanisms found in jellyfish. The second half of the term focuses on the sensory biology of insects, specifically looking at how their eyes function and the hormonal triggers for growth. The semester concludes with a study of the nervous systems in snails and the larval forms of sea urchins, which help students understand deep-seated evolutionary relationships.

Skill Enhancement Course: ZOOL1051 (Apiculture)

This course is structured as a professional training program that starts with the history of beekeeping and the systematic identification of Indian honeybee species. Students first learn the complex social dynamics of the hive, focusing on the division of labour among queens, drones, and workers. The mid-semester modules transition to the technical side of the industry, where we study the design of modern movable hives like the Langstroth and the tools required for honey extraction. A critical portion of the plan is dedicated to hive health, teaching students to identify parasitic diseases and the phenomenon of colony collapse disorder. The final weeks are focused on entrepreneurship, covering the chemical properties of honey and wax, and how to draft a business proposal for the Khadi and Village Industries Commission.

Skill Enhancement Course: ZOOL1051 (Vermiculture)

The vermiculture lesson plan is built around the commercial application of earthworms for sustainable waste management. We begin by examining the morphology and internal anatomy of the earthworm to understand how it functions as a biological recycler. The course categorizes various species based on their ecological niches, such as surface dwellers versus deep-burrowing types. The middle phase of the semester is highly practical, detailing the methods for setting up a wormery and the specific environmental prerequisites for successful breeding. Students learn the step-by-step process of converting organic waste into nutrient-rich vermicompost and vermiwash. The term ends with a focus on the marketplace, covering quality control, packaging, and the financial support available for starting a green enterprise.

SEMESTER II

Major Course: ZOOL2011 (Chordates)

Students who complete this course will gain a deep understanding of the evolutionary origin of chordates and the critical deuterostome links that connect them to simpler organisms. They will learn to distinguish between various subphyla, mastering the classification of vertebrates while decoding the fascinating process of retrogressive metamorphosis in organisms like *Ascidia*. Learners will become experts in the functional anatomy of diverse groups, from the osmoregulatory strategies of fish to the aerodynamic principles that allow birds to navigate the skies. A significant outcome is the ability to analyze complex mammalian adaptations, including the specialized mechanisms of echolocation in whales and the structural derivatives of the exoskeleton. Students will also develop professional technical skills through staining and mounting fish scales and identifying poisonous versus non-poisonous snakes. Furthermore, they will conduct market surveys to understand commercial fish diversity, bridging academic study with local economic realities. Ultimately, they will be able to explain how various organ systems have evolved to support life in aquatic, terrestrial, and aerial environments.

Minor Course: ZOOL2021 (Chordates)

By finishing this course, students will establish a solid foundation in the diversity and physiological functioning of the phylum Chordata. They will master the classification of urochordates and vertebrates, understanding the advanced biological features that distinguish higher vertebrates from their protochordate ancestors. Learners will explore the behavioural and physiological complexities of lower vertebrates, specifically focusing on parental care in amphibians and the biting mechanisms of venomous snakes. A key takeaway involves understanding the systemic physiology of mammals, particularly the adaptive radiation that allowed them to thrive in varied ecological niches. In the laboratory, students will gain proficiency in identifying species from both museum specimens and photographic records. They will also acquire the skills necessary to document fish species through market surveys and prepare detailed scientific reports. This curriculum ensures that students can connect anatomical structure with the evolutionary history and environmental adaptations of the vertebrate lineage.

Skill Enhancement: ZOOL2051 (Sericulture)

This program equips students with the specialized knowledge required to succeed in the silk industry, covering everything from mulberry cultivation to the final processing of raw silk material. Students will achieve a high level of competency in identifying various silk moth species and understanding the internal anatomy and silk gland function of the *Bombyx mori* larva. They will master the techniques for cultivating mulberry plants and managing the pests and diseases that can impact silk production. A core outcome is the ability to manage a modern rearing house, including disinfection protocols and the precise harvesting of cocoons. Learners will also gain hands-on experience with post-cocoon technologies like stifling, reeling, and dyeing. Beyond technical skills, the course emphasizes entrepreneurship, preparing students to utilize the support of the Central Silk Board to build sustainable livelihoods. Ultimately, participants will be ready to start their own enterprises or work in the industrial silk sector.

Skill Enhancement: ZOOL2051 (Aquarium Fish Keeping)

Students taking this course will enter the ornamental fish industry with a professional understanding of the biological and economic factors that drive it. They will master the setup and maintenance of various aquarium types, learning to manage complex filtration systems and water quality requirements. Learners will gain expertise in the breeding and feeding habits of popular freshwater and marine species, including the preparation of both live and formulated feeds. A critical outcome is the ability to diagnose and manage common fish diseases, from parasitic infections to nutritional deficiencies. Students will also learn the technical aspects of live fish transportation, including conditioning and packaging techniques that ensure survival during transit. The course provides a roadmap for setting up a small-scale aquarium business as a cottage industry, focusing on budget management and commercial viability. Finally, through farm visits, students will acquire practical experience in the operation of hatcheries and fish feed production plants.

SEMESTER III

Major Course: ZOOL3011 (Biochemistry)

Students finishing this course will gain a clear perspective on the foundational goals of biochemical studies within the field of zoology. They will identify the specific molecular structures and enzymatic reactions that drive biological systems. Participants will acquire the technical skills to prepare buffers and measure the pH of unknown solutions with precision. A significant outcome is the ability to analyze the metabolism of carbohydrates, proteins, and lipids to understand energy production. Learners will stay updated with emerging concepts in biological sciences to remain competitive in their field. They will also master qualitative and quantitative estimation techniques for biomolecules like proteins and sugars. Finally, this training prepares students for advanced research and various competitive examinations.

Major Course: ZOOL3012 (Cell Biology)

This program provides students with a detailed overview of cellular organization and the biochemical properties of subcellular components. Learners will master the architecture of the plasma membrane based on the fluid mosaic model. They will understand how organelles like the endoplasmic reticulum and mitochondria coordinate protein transport and ATP synthesis. A key achievement involves analyzing the dynamics of the cytoskeleton and various cell junctions. Students will examine the regulatory checkpoints of the cell cycle and the role of cyclins in vertebrates. They will also gain an outline knowledge of the molecular triggers behind cancer and programmed cell death. In the laboratory, they will become proficient in identifying stages of mitosis and meiosis using microscopy.

SEC: ZOOL3051 (Medical Diagnostics)

This course is designed to make students self-sufficient by teaching them how to evaluate the health status of patients. Learners will gain a foundational understanding of the human body structure for diagnostic purposes. They will master the ability to perform essential tests on blood and urine samples. A significant outcome is the capacity to identify the causes and prevention strategies for major non-communicable diseases. Students will grasp the principles behind modern imaging technologies like MRI and USG. They will also learn laboratory techniques for clinical microbiology and antibiotic sensitivity. Finally, this course provides the specialized knowledge required for economic self-sufficiency in the healthcare sector.

SEC: ZOOL3051 (Animal Husbandry and Management)

Students who finish this study will understand the significance and various types of modern animal husbandry. They will identify Indian and exotic cattle breeds and master the farming practices for dairy production. Participants will learn the nutritional components of milk and the methods for physical and chemical milk examination. A key achievement is the ability to utilize advanced breeding techniques like artificial insemination. Learners will become capable of managing viral and bacterial diseases in poultry and cattle. They will also gain practical exposure through field visits to animal husbandry farms. This program encourages students to pursue entrepreneurship for regular or additional income.

SEMESTER IV

Major Course: ZOOL4011 (Animal Physiology)

Students completing this course gain a thorough understanding of the biological machinery that keeps complex organisms alive and functioning. They learn to identify the intricate networks within the gastrointestinal tract and how hormones regulate the digestion of essential nutrients like lipids and proteins. A significant outcome involves mastering the respiratory system, where learners decode oxygen transport and the physiological impact of conditions like carbon monoxide poisoning. They also explore the mechanics of the mammalian heart and the regulatory pathways that control blood clotting and circulation. Beyond internal systems, students understand how animals maintain balance through osmoregulation and renal filtration, specifically focusing on the structure of the nephron. They gain the practical ability to identify diverse blood cells and perform diagnostic tests like determining blood groups and erythrocyte sedimentation rates. Ultimately, they grasp the molecular basis of nerve impulses and muscle contraction, providing a complete picture of animal life.

Major Course: ZOOL4012 (Disease Biology)

This program provides a scientific deep dive into the molecular triggers of illness and the body's sophisticated defense mechanisms. Participants learn to distinguish between endemic and pandemic patterns and understand the transmission routes of infectious agents like SARS and Malaria. A core achievement is the ability to explain how pathogens like bacteria and viruses evade the host immune system to cause disease. Students also examine the growing burden of non-communicable diseases, exploring the pathophysiology of diabetes, cardiovascular issues, and chronic obstructive pulmonary disorders. They gain a detailed understanding of how cellular growth deregulation leads to cancer and the complex role of inflammation in recovery. In the laboratory, they master the identification of parasitic helminths and perform quantitative glucose estimations to detect metabolic imbalances. By the end, they can evaluate the interactions between hosts and emerging infections within a broader ecological context.

Major Course: ZOOL4013 (Comparative Endocrinology)

Focusing on the chemical messengers of life, this course allows students to trace the evolution of hormone systems across diverse species. They learn to categorize hormones based on their chemical nature and understand the complex feedback loops that govern their secretion. A primary outcome is the mastery of both vertebrate and invertebrate endocrine systems, including the regulation of growth and metamorphosis in insects. Learners decode the molecular mechanisms of hormone action, specifically focusing on how steroid and peptide receptors trigger cellular responses. They also study the role of hormones in critical life stages such as gestation, lactation, and reproductive development. Beyond natural processes, students examine the impact of endocrine-disrupting chemicals and learn to perform advanced bioassays like ELISA for hormone detection. This knowledge enables them to connect hormonal balance with behaviour and adaptation in a changing environment.

Minor Course: ZOOL4021 (Wildlife Conservation)

This course empowers students with the knowledge required to protect the earth's biological heritage in an era of rapid biodiversity loss. They master the IUCN threat categories and understand the specific conservation needs of iconic Indian species like the Tiger and the Ganges River Dolphin. A significant achievement is the ability to analyze ecological pyramids and energy flow to manage natural habitats effectively. Students explore the roots of human-wildlife conflict and evaluate mitigation strategies like Project Elephant and joint forest management. They also gain a working knowledge of the legal frameworks protecting wildlife, including the Wildlife Protection Act and international treaties like CITES. Practical training includes the analysis of pugmarks, the calculation of population density using quadrat methods, and the evaluation of ecotourism's impact on forest ecosystems. Ultimately, students are prepared to contribute to the sustainable management of biosphere reserves and national parks.

SEMESTER V

Major Course: ZOOL5011 (Genetics)

Upon completing this genetics module, students establish conceptual clarity regarding Mendelian inheritance and the complex deviations, such as epistasis and pleiotropy, that modify traditional biological ratios. They become proficient in explaining the biological mechanisms behind sex determination and dosage compensation in both humans and fruit flies. A primary achievement is the ability to analyze genetic variability and identify the molecular triggers of gene mutations and chromosomal structural changes. Learners also explore how maternal effects and transposable elements contribute to non nuclear inheritance in various organisms. The course enables students to apply these concepts to human health by investigating the genetic roots of cancer and metabolic disorders like sickle cell anaemia. In the practical laboratory, they master the art of human karyotyping and pedigree analysis to track inherited traits across generations. Finally, they learn to use chi square analysis to validate biological data against predicted genetic models.

Major Course: ZOOL5012 (Molecular Biology)

This advanced study in molecular biology ensures that students fully understand the central relationship between DNA, RNA, and protein synthesis. They identify the specific enzymes and factors required for prokaryotic DNA replication and the critical maintenance of chromosome ends through telomeres. A significant outcome is the ability to decode the mechanisms of transcription and the intricate processing of primary transcripts, including splicing and RNA editing. Students gain deep insights into the genetic code and the wobble hypothesis while following the step by step process of translation in prokaryotes. They also learn to evaluate different levels of gene regulation, from the classic lac operon to sophisticated eukaryotic enhancers and gene silencing via microRNA. Another core competency is the understanding of molecular repair mechanisms, such as SOS and excision repair, that protect genomic integrity. Through laboratory demonstrations, they witness how agarose gel electrophoresis and DNA quantification are used to analyze genetic material.

Major Course: ZOOL5013 (Animal Biotechnology)

Students who finish this animal biotechnology course develop a professional grasp of gene manipulation as a primary tool in modern medical and forensic research. They master the selection and use of various cloning vectors, such as plasmids and phagemids, to insert foreign genetic material into host cells. A key outcome is the ability to construct and screen genomic and cDNA libraries to isolate specific genes of interest. Learners also gain proficiency in high tech applications like DNA fingerprinting, microarrays, and the Sanger method of sequencing. The curriculum provides deep knowledge on creating transgenic animals for molecular pharming and organ donation. Students also explore the culture of animal cells for vaccine development and the critical process of cryopreservation. In a laboratory setting, they enhance their skills by performing blotting techniques and calculating the efficiency of genetic transformations.

SEMESTER VI

Major Course: ZOOL 6011 (Evolutionary Biology and Ethology)

Students completing this course will attain a profound understanding of the biological history of our planet and the specific forces that drive evolutionary change. They will be able to scientifically analyze the reasons behind species extinction and the role genetics plays in the survival of populations. A primary goal is to comprehend the fundamental concepts of evolutionary biology as a foundational science. Beyond historical trends, learners will decode the complex ways animal behaviours like altruism or aggression facilitate survival and reproductive success. This behavioural knowledge is essential for fostering better coexistence between humans and wildlife rather than conflict. Furthermore, the course empowers students to design innovative strategies for the management and conservation of endangered species based on their natural instincts. Ultimately, they will recognize evolution as a dynamic process that continues to shape the natural world.

Major Course: ZOOL 6012 (Ecology and Conservation Biology)

This program ensures that students master the fundamental principles of ecological organization, from individual organisms to complex ecosystems. Learners will gain expertise in measuring biological diversity using various indices and identifying global hotspots for conservation. A significant outcome is the heightened awareness of how healthy ecosystems maintain the essential balance between human activity and the environment. Participants will learn specific management techniques and policies required to protect threatened species like the tiger or the great Indian bustard. They will also understand the intricate interactions that occur between organisms and their physical surroundings. The curriculum prepares students to investigate how populations grow and how communities change over time through ecological succession. Finally, students will be equipped to tackle modern biodiversity loss through effective conservation strategies and legal frameworks.

Major Course: ZOOL 6013 (Developmental Biology)

Studying developmental biology provides students with a detailed map of how a single cell transforms into a complex, multicellular organism. Learners will be able to explain the genetic and molecular signals that trigger cellular specialization and pattern formation. They will also trace the evolutionary history of these developmental pathways to understand the origins of life. A key achievement involves recognizing how external environmental factors can influence the growth and internal balance of developing cells. Students will examine the mechanics of early embryonic stages, such as cleavage and gastrulation, in various animal models. They will also explore advanced technologies such as in vitro fertilization and the therapeutic potential of stem cells in human welfare. Furthermore, they will understand the fascinating process of limb regeneration in certain vertebrates.

Major Course: ZOOL 6014 (Histology and Histochemistry)

Participants in this course will master the microscopic study of mammalian tissues and the structural organization that defines their function. They will learn to identify the specific morphological changes that occur in tissues during disease states. A primary outcome is the ability to link the causes of disease with the resulting histopathological alterations in organs. Students will become proficient in advanced bioanalytical techniques, including the preparation of permanent slides for scientific study. They will utilize immunohistochemistry and immunofluorescence to locate specific proteins within a cell. The course also provides specialized knowledge in enzyme histochemistry for detecting carcinomas and other health disorders. Finally, learners will understand the properties and classifications of biological dyes used to visualize the hidden architecture of life.