SUBJECT: ZOOLOGY(M.Sc.)	
PROGRAMME OUTCOME	PO STATEMENTS: On successful completion of this program ,students will be able to - PO–1 This curriculum is a fundamental unit of basic sciences studied at the undergraduate level to learn and understand different biological systems, their coordination and control, as well as the evolution, behavior, and biological roles of animals in the ecosystem. PO–2 This curriculum enables students to qualitatively and quantitatively analyze evolutionary parameters using various methods of bioinformatics and computational tools used in modern sciences, providing opportunities to explore different career avenues. PO–3 Knowledge gained through this curriculum will be helpful in serving industries, establishing industrial units, or designing public health strategies for social welfare. PO–4 This curriculum is designed to provide in-depth knowledge of applied subjects, ensuring the development of employment skills so that students can pursue careers and become entrepreneurs in diverse fields.
PROGRAMME SPECIFIC OUTCOME	PSO–1: Analyze the distribution or inheritance of different traits and diseases among populations and their ethnicity, correlating with contemporary and modern techniques such as genomics, metagenomics, genome editing, and molecular diagnostic tools. PSO–2: Develop practical skills in biotechnology, biostatistics, bioinformatics, and molecular biology to pursue a career as a scientist in the drug development industry in India or abroad. PSO–3: Examine the relationship or synchronization between structure and function at molecular, cellular, and evolutionary levels based on morphological, anatomical, and systemic organization, providing professional advantages in teaching, research, and taxonomist roles in various government organizations. PSO–4: Utilize skills in diagnostic testing, hematology, histopathology, staining procedures, etc., to work in diagnostic or research laboratories, or pursue careers as an Animal Behaviorist, Conservationist, Wildlife Biologist, Wildlife Educator, Zoology faculty, or Forensic expert.
COURSE OUTCOME	
SEMESTER-I	

PAPER: P-101: **Animal Diversity (Non Chordate and Chordate)**	CO1: Identify and describe the different non-chordate and chordate phyla, including their general and distinguishing characteristics. CO2:Analyze the evolution of various biological systems, examining how their complexity has developed over time. CO3:Compare and contrast the life processes across different phyla to understand their similarities and differences. CO4:Appreciate the evolutionary process from simple unicellular organisms to complex multicellular ones and classify both invertebrates and vertebrates up to the class level.
PAPER: P-102: **Cell Biology and Cancer Biology**	CO1:Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, focusing on macromolecules, membranes, and organelles. CO2**:**Examine how cellular components are utilized to generate and use energy within the cell. CO3:Identify the various genetic and molecular changes that occur in normal cells during malignant transformation. CO4: Analyze the relationship between defects in the cell cycle, apoptosis, signal transduction, and cancer biology, as well as their implications for human diseases.
PAPER: P-103: **Inheritance Biology**	CO1: Provide fundamental knowledge on genetics, including its laws, genes and chromosomes, inheritance, heredity, causes of genetic disorders, and methods of gene transfer. CO2: Describe how genetic information in DNA is selectively expressed as functional proteins in cells. CO3: Detail the fundamentals of genetics, Mendelian laws, the concept of alleles, linkage, and crossing over of genes. CO4: Familiarize with various types of genetic data (genotyping, expression, sequence data), chromosomal mapping, genetic composition of biological populations, and evolutionary factors that account for variations.
PAPER: P-104: **Bioististatcs and Taxonomy**	CO1: Learn key biostatistical concepts and efficient tools for summarizing and plotting data, and make decisions in the presence of uncertainty. CO2: Obtain a thorough understanding of the principles and

	practices of systematics, diversity, and relationships in the animal world, and develop a holistic appreciation of the geological time scale, phylogeny, and adaptation. CO3: Acquire knowledge of biostatistical approaches used for analyzing and presenting data in biological research and other fields. CO4: Gain methodological background and quantitative skills in the morphological and molecular phylogeny of taxonomy and systematics.
PAPER: P-104: Practicals	CO1: Gain knowledge to classify various animals based on morphological features, list invertebrate and vertebrate animals within a given class, and recognize various larval stages and development in both invertebrate and vertebrate groups. CO2: Recognize various stages of mitosis and meiosis in cells. CO3: Analyze pedigrees related to traits such as tongue rolling, widow's peak, color blindness, and blood groups. CO4: Provide knowledge of biostatistical approaches used for analyzing and presenting data in biological research and other fields.
SEMESTER-II	
PAPER: P-201: Biophysical Chemistry and Biochemistry	CO1:Understand the biophysical properties and functioning of life processes. CO2: Comprehend the chemical foundation of life processes, structure, and metabolism of biologically significant molecules. CO3: Apply knowledge of fundamental concepts in physical chemistry that underlie biological processes. CO4: Gain insight into fundamental biochemical principles such as biomolecules, metabolic pathways, and the regulation of biological processes.
PAPER: P-202: Enzyme Technology and Microbiology	CO1: Knowledge of enzyme nomenclature, characteristics, mechanisms of action, kinetics, and various applications. CO2: Understanding of microorganisms in soil and water, and their contributions to medicine, industry, and agriculture. CO3: Fundamentals of enzyme properties, nomenclature, characteristics, mechanisms, kinetics, production, purification, and immobilization. CO4: Description of bacterial cell structure, including the form,

	arrangement, and replication of genetic material.
PAPER: P-203: Molecular Biology	CO1: Comprehensive idea about the structure and function of nucleic acids and regulation of gene expression. CO2: Organization, replication, and repair of DNA in the genome, and the selective expression of genetic information as functional proteins. CO3: Familiarity with various types of genetic data (genotyping, expression, and sequence data), chromosomal mapping, genetic composition of biological populations, and evolutionary factors explaining variation. CO4: In-depth knowledge of chemical and molecular processes within cells, including the central dogma.
PAPER: P-204: Animal Physiology and Endocrinology	CO1: Understand fundamental scientific concepts related to animal physiology and endocrinology. CO2: Basic understanding of different physiological systems and their interaction to maintain homeostasis, and the role of chemical messengers or hormones, whether endocrine or neural. CO3: Detailed knowledge of various physiological organ systems and their importance to the integrative functions of the human body. CO4: Distinguish between endocrine and nervous control systems, and identify key events in hormone signaling, infertility, and birth control measures.
PAPER: P-205: Practicals	CO1: Principles involved in the quantitative and qualitative analysis of carbohydrates, proteins, and lipids from biological samples. CO2: Determination of free amino acid content in biological samples using chromatography techniques. CO3: Enzyme activity of salivary amylase and the effects of temperature, pH, and substrate concentration. CO4: Calculation of Vmax and Km of enzyme activity using the Lineweaver-Burk plot and supplied data. CO5: Principles of biomolecule isolation from various biological sources, including DNA from plants, microbes, and animals. CO6: RNA isolation from animal tissues/blood and mobility differences of nucleic acids like DNA through agarose gel

	electrophoresis. CO7: DNA quantification by the Diphenylamine method and RNA quantification by the Orcinol method. CO8: Hemoglobin measurement using Sahli's hemoglobinometer, and red and white blood cell enumeration using a hemocytometer. CO9: Microscopic preparation and histological techniques using microtomy, and study of various endocrine glands in animals.
SEMESTER-III	
PAPER: P-301: Immunology	CO1: Explore the immune system, focusing on its origin, development, and structure. CO2: Examine the complexities and mechanisms underlying various immune reactions. CO3: Detail the immune systems of vertebrates and their ability to recognize and respond specifically to foreign substances. CO4: Analyze the roles of antigens, antibodies, and immunocompetent cells in pathogenesis and immunity to infectious diseases.
PAPER: P-302: Developmental biology and Animal Biotechnology	CO1: Explore the basic concepts and experimental aspects of developmental biology. CO2: Gain in-depth knowledge of cell and tissue culture and its applications. CO3: Utilize knowledge of embryonic and postembryonic development. CO4: Learn step-by-step methods of cell culture and their applications in research.

PAPER: P-303: Bioinstrumentation	CO1: Present tools and techniques for studying the biochemical and biophysical nature of life. CO2: Prepare learners to use these tools and techniques for project work and research in biology. CO3: Outline the structural characteristics of nucleic acids and proteins, and examine parameters affecting their stability and functions. CO4: Explain the principles governing biomolecular interactions and recognize how established research methods are used to analyze different aspects of these interactions.
PAPER: P-304: Evolution and Animal Behaviour	CO1: Examine evidence of common ancestry among living species and how this explains traits and evolutionary changes in genetic composition of populations. CO2: Explore animal behavior through ethological, ecological, and evolutionary perspectives, and review basic concepts of behavior as a science. CO3: Present key concepts in evolutionary biology, the history of life on Earth, phylogenetic relationships among organisms, and structure/function relationships. CO4: Explain basic concepts of animal behavior using ethology and behavioral ecology approaches, including biological rhythms and instinctive behavior.
PAPER: P-305: Practical	CO1: Examine lymphoid organs through histological analysis of spleen, thymus, and lymph nodes using slides and photographs. CO2: Identify ABO blood groups through antigen-antibody interactions and prepare blood smears for differential counts and leukocyte types. CO3: Explore the life cycle of frogs and the embryological stages of chick embryos. CO4: Perform sterilization and prepare media (liquid and solid) for microorganism growth. Isolate and maintain organisms using plating, streaking, and serial dilution methods, as well as slants, stab cultures, and storage techniques. CO5: Analyze population genetics and the Hardy-Weinberg Law using traits such as blood groups, ear lobes, and tongue rolling.

	CO6: Investigate circadian functions in humans, including daily eating, sleep, and temperature patterns.
SEMESTER-IV	
PAPER: P-401: Genetic Engineering	CO1: Demonstrate the creative use of modern tools and techniques for manipulating and analyzing genomic sequences, covering versatile tools in genetic engineering and recombinant DNA technology. CO2: Explore the application of recombinant DNA technology in biotechnological research. CO3: Develop research methodologies using genetic engineering techniques. CO4: Utilize these techniques in basic and applied biological research and this course serves as a foundation for introducing advanced cutting-edge technologies that combine basic techniques in diverse modern applications.
PAPER: P-402: Ecology and Conservation Biology	CO1: Explain the structure and function of ecological systems and illustrate how ecological systems operate at different spatial and temporal scales. CO2: Analyze the interaction of organisms with their environment and evaluate conservation strategies for various animals. CO3: Illustrate ecological relationships between organisms and their environment. CO4: Explore key concepts in evolutionary biology, the history of life on Earth, and phylogenetic relationships among organisms, as well as the structure/function relationships in organisms.
PAPER:P-403: Fisheries Science	CO1: Describe the basic classification of fishes and detail the evolution of chondrichthyes, elasmobranchi, and bradyodonti. CO2: Identify the types of electric fishes, locate and explain the function of the electric organ and sound production mechanism, and assess the roles of bioluminescence and poison apparatus in fishes. CO3: Examine the natural breeding processes of Indian major carps, including the factors influencing it, and outline the mechanism of induced breeding in fishes, along with an overview of freshwater fish culture. CO4: Explore different types of sustainable aquaculture and various fish diseases, including their modes of treatment.
PAPER: P-404: Project	CO1: Cultivate research aptitude, scientific temper, and critical

Report	analysis among students. CO2: Acquire basic skills in project handling and report writing to prepare students for independent scientific work.
PAPER: P-405: Practical	CO1: Calculate population density in a natural or hypothetical community using the quadrate method and compute the Shannon-Weiner diversity index for the same community. CO2: Measure free carbon dioxide levels in water samples. CO3: Analyze COD and dissolved oxygen levels in sewage water samples. CO4: Explore different types of crafts and gears used in fisheries. CO5: Examine various types of fish scales through permanent slides and photographs. CO6: Identify various cyclostomes, chondrichthyes, and osteichthyes based on morphological features.
PAPER: ZOOL-IDC 406: Economic Zoology	CO1: Explore honey bee species and their social organization, as well as methods of beekeeping and honey extraction. CO2: Examine modern honey extraction techniques, the chemical composition of honey, and its economic significance. CO3: Identify the differences between exotic and indigenous silkworms, various types of silkworms, and detailed methods for extracting silk from cocoons, along with the nature of employment opportunities in the sericulture industry.