Master of Science in Zoology

Programme Outcomes (POs):

PO1: Undertake classes on biology to undergraduate and post graduate students.

PO2: Carry out laboratory related experiments or analysis.

PO3: Will be able to frame statements related to assessment of biological diversity.

PO4: Will be able to identify and classify animal organisms for documentations.

PO5: Qualify competitive examinations effectively

PO6: Assist as junior supervisors at industrial set up

Course Outcomes (Cos):

Semester	Couse code	Course name	Course Outcomes
I	ZOO-1014	Biosystematics and Biostatistics	1. Students have acquired knowledge to identify the major groups of organisms with an emphasis on animals and be able to classify them within a phylogenetic framework also using bioinformatics tools. Students can compare and contrast the characteristics of animals that differentiate them from other forms of life. 2. Students have acquired knowledge to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They can use specific examples to ex plicate how descent with modification has shaped animal morphology, physiology, life history, and behavior. 3. Students will learn about how organisms function at the level of gene, genome, cell, tissue, organs and organ-systems. Drawing upon this knowledge, they can provide specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life 4. To explicate the ecological interconnectedness of life on earth by tracing energy and nutrient flows through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems

			5. Students will gain proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology 6. Students will have proficiency in aquaculture management practices, induced breeding, insect culture etc.To use current biochemical and molecular techniques to plan and carry out experiments. They can generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.
	ZOO-1024	Bioinformatics and instrumentation	1. Students have acquired knowledge to explain which type of data is available from the most common protein sequence and structure databases (UniProt, GenBank, Protein Data Bank, CATH). 2. Students will learn the theories underlying the most common methods for sequence searches and sequence alignments, and in particular knows the principle and main steps for pairwise and multiple sequence alignments, alignments of short sequences 3. Students will learn about the principles of computational methods for the prediction of secondary structure elements from protein sequence, prediction and modeling of three-dimensional protein structures (homology modeling, threading and ab initio methods). 4. Students can select and apply the most appropriate method for aligning sequences, visualizing and analyzing protein structures, predicting secondary structure elements and modeling protein structures from sequence. 5. Students will understand the principle and uses of the instrument in the analysis of different biological samples.
	ZOO-1034	Evolution and chronobiology	1. Students have acquired knowledge to understand the biological evolution of the organisms that inhabit the Earth today are different from those that inhabited it in the past. 2. Students will understand that natural selection is one of the several processes that can bring about evolution, although it

			can also promote stability rather than change. 3. Students will understand that the four propositions underlying Darwin's theory of evolution through natural selection are: (1) more individuals are produced than can survive; (2) there is therefore a struggle for existence; (3) individuals within a species show variation; and (4) offspring tend to inherit their parents' characters. 4. Students will handle chronobiological terminology. 5. Students will apply chronobiological principles in biological and medical-biological science.
	ZOO-1044	Genetics and cytogenetics	1. Students have acquired knowledge to get a broad understanding of core molecular genetics concepts including molecular biology, genetics. 2. Students will acquire working knowledge in a defined skill set of molecular biology and biotechnology protocols, including PCR, genetic mapping, gene isolation and cloning, DNA sequencing, and sequence analysis. 3. Students will get key concepts of genome organization and manipulation in depth, such as assembly of physical maps of genomes, sequencing methods and strategies, genome annotation and bioinformatics, comparative genomics, global gene expression profiling.
	ZOO-1054	Ecology and environmental biology	1. Students have acquired knowledge to understand how individuals interact with members of their own species and with organisms of another species 2. Students will learn about how populations of a species grow, change and are distributed across the range of their suitable habitats 3. Students will apply the underlying theory and basic principles of ecology learned throughout the course to understand the changes that are occurring as a result of human activity 4. Students will demonstrate that understanding biological and ecological principles can be used to solve real-world problems that we are facing

	ZOO-1064	Biochemistry	1. Students will acquire knowledge on the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation. Regulation by non-coding RNAs will be tied to the developmental and physiological functioning of the organism. 2. Students will understand the mechanism of Enzyme acrtion and their regulation in biochemical pathway. 3. Students will understand the thermodynamic principle of biological systems and bioenergetics.
	ZOO -1072 (PRACTICAL)	Biosystematics, biostatistics and biochemistry	Students will acquire practical knowledge and get the hands on practice in the subject of biosystematics, biostatics and bioinformatics
	ZOO-1082 (PRACTICAL)	Genetics, cytogenetics, evolution, chronobiology and Bioinformatics	Students will acquire practical knowledge and get the hands on practice in the subject of genetics,cytogenetics, bioinformatics
II	ZOO-2014	Biodiversity	1. Students have acquired knowledge to understand the concepts and theory in biodiversity science and management from interdisciplinary perspectives and at an advanced level; assess the modes through which conservation builds and extends power and describe in detail the factors that explain the emergence and performance of different governance modes;appreciate the role of ethics, values and norms in producing culturally attuned and effective conservation interventions. 2. Students will understand new technological forces for the future of biodiversity science and management; link theory, hypothesis, methods, data and field work so as to identify and develop advanced research questions and design dissertation research that is identifiable with a professional research approach
	ZOO-2024	Endocrinology	1. Students have acquired knowledge to understand the role, metabolic function of various endocrines, its specific secretions

			and also the disorder and pathophysiology. 2. Students will understand the mechanism of hormone action, signal transduction system 3. Students will understand the role and function of neurosecretory hormones of insects and crustacean
	Paper-ZOO-2034	Development biology	1. Students have acquired knowledge to understand and master basic concepts of developmental biology 2. Students will understand how fertilization and cleavage occur 3. Students will understand the process and consequence of gastrulation 4. Students will understand mesoderm induction and neural induction 5. Students will understand basic concepts of organogenesis 6. Students will understand basic concepts of growth, regeneration and aging 7. Students will understand basic concepts of gene expression and regulation
	Paper-ZOO-2044	Animal cell culture, And genetic engineering	1. Students are able to Understand theoretical concept to maintain cultures of animal cells and established cell lines with good viability, minimal contamination and appropriate documentation. 2. Students will understand the episodic tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth/health. 3. Students will able to recognize and troubleshoot problems common to routine cell culture. 4. Students will understand the importance of plasmids and viruses to genetic engineering. 5. Students will know the natural function of restriction endonucleases and how a normal bacterial cell protects its DNA from their activity. 6. Students will understand how “sticky ends” are formed and their importance to gene technology. 7. Students will know about chimeric genome is constructed. 8. Students will learn about the four steps of genetic engineering experiments.

			9. Students will distinguish between the techniques of selection and screening of clones. 10. Students will know how to screen for clones that contain a desired gene fragment. 11. Students will understand the value of and the processes involved with the polymerase chain reaction (PCR).
	Paper-ZOO-2054	Animal Behaviour	1. Students will set a comprehensive understanding of the behavior of animals. They will understand the proximate controls of behavior including the role of hormones, the animal's genotype and the animal's environment in the development of behavior. 2. Students work will take an evolutionary approach, consequently, students will have a comprehensive understanding of the adaptive significance of behavior, emphasizing animal communication, social behavior, territoriality, sexual selection and mating systems.
	Paper-ZOO-2064	Animal physiology	1. Student sets knowledge on Cellular mechanisms of solute and water transport used by animals living in different environments 2. Students will learn about different energy requirements of an animal at rest and during exercise, and how this is reflected in the functioning of the oxygen transporting systems;how the cardiovascular and respiratory systems are integrated and controlled; how animals use aerobic and anaerobic forms of metabolism for ATP production; how animals move with muscles and navigate their movement by the neural control and basic control processes of the nervous and endocrine systems 3. Students will know about animals have adapted to their environment with different ways of urine formation to excrete nitrogen wastes and water 4. Students will carry out physiological studies in the laboratory and interpret physiological data and phenomena critically

	Paper-ZOO-2072 (Practical)	Biodiversity, animal behaviour & developmental Biology	Students will acquire the practical knowledge and get the hands on practice in the subject of biodiversity, Animal behavior and developmental biology
	Paper-ZOO-2082 (Practical)	Endocrinology, animal physiology, Biotechnology and tissue culture	Students will acquire practical knowledge and get the hands on practice in the subject of endocrinology, animal cell culture and genetic engineering.
III	Paper-ZOO-3014	Cell biology	This course help to understand the biology of cells of prokaryote and higher organisms;the structure, function, and biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure, cell cycle, regulation of cell cycle, apoptosis, regulation of gene expression in prokaryotes and eukaryotes and RNA editing.
	Paper-ZOO-3024	Immunolgy, microbiology and parasitology	1. Students will understand the structural features of the components of the immune system as well as their functions, lymphoid organs, monoclonal antibody, structure of antibody, antigen antibody interaction 2. Students will understand the microbial diversity, microbial pathogeneses and applied microbiology 3. Students will understand the concept of parasitism, life cycle of economically important parasites of man and domesticated
	Paper-ZOO-3034	Reproductive Biology	1. Students will understand the comparative structure and function of the male and female reproductive systems 2. Students will understand the physiology of gametogenesis, embryogenesis, pregnancy, parturition and lactation 3. Students will understand the endocrine, neuro-endocrine and environmental factors regulate reproduction strategies for the management of reproduction and fertility in animals; including the application of assisted reproductive technologies
	Paper-ZOO-3044	Entomology and aquatic Biology	1. Students will understand the economic importance of insects, Insect vectors, pest, role of insects in ecosystem, concept of pest management. 2. Students will understand the limnology, aquatic resources of North East India,

			major threats of fresh water ecosystem, fish germplasm diversity of North East India.
	PAPER Z-3056	Integrative biology	Students will understand the concept NET/SLET and Gate oriented question and approach to tackle the question and their concepts.
	Paper-ZOO-3063 (Practical)	Cell biology, histology, histochemistry, Immunology and reproductive biology	Students will acquire practical knowledge and get the hands on practice in the subject of histology, histochemistry, immunology and reproductive biology
	Paper-ZOO-3073 (Practical)	Aquatic biology & fisheries, entomology and Parasitology	Students will acquire practical knowledge and get the hands on practice in the subject of aquatic biology, entomology and parasitology.
IV Animal Ecology and Wildlife Biology	Z-4014	Ecosystem Functions and Stability	1. Students will get general knowledge about ecological sustainability, resilience and human utilization of nature and natural resources to secure well-being and security. 2. Knowledge about environmental policy and sustainable development. 3. Specific knowledge for applying knowledge on ecological sustainability, planetary biophysical boundaries, ecosystems services and values associated to technology. 4. Specific knowledge about national and global environmental status connected to biodiversity, climate, pollution, environmental toxins, land use, resource economy, and distribution of species and organisms. 5. Specific knowledge about global initiatives, models and indicator systems for integration of ecological knowledge, driving forces, governance and green production systems.
	Z-4024	Wildlife and Wildlife Habitat Relations	1. Students will acquire knowledge in the characteristics and habitat requirements of wildlife species normally associated with forested ecosystems. Gather information of common forest wildlife species and their associated habitat requirements. 2. Students will also acquire knowledge in the conservation practices, program guides, and technical guidance tools that aid in the planning for these species.

	Z-4034	Wildlife Population Ecology and Methods	1. Students will have a thorough understanding of various models of population dynamics. 2. Students will become familiar with the application of concepts and models in population ecology to conservation and management of wildlife populations and become familiar with concepts and models of species interaction, population regulation and population cycles
	Z-4044	Wildlife Conservation	1. Students have acquired knowledge to apply knowledge to solve problems related to wildlife conservation and management. 2. Students will know how wildlife conservation and management relates to the economy and environment, both currently and in the future. 3. Students will find detailed information on a topic from print as well as online information sources. 4. Students will critically evaluate current events and public information related to wildlife conservation and management as being scientifically-based or opinion-based and contribute to the knowledge base of information. 5. Students will be able write in a style appropriate for technical or informative publications for various audiences related to wildlife conservation and management.
	Z-4054	Wildlife Management	Students will critically evaluate current events and public information related to wildlife management as being scientifically-based or opinion-based and contribute to the knowledge base of information.
	Z-4066	Dissertation	1. The student will be able to find, analyze, evaluate, select and integrate information using various sources, from fields of knowledge and from critical judgments for planning his own studies. 2. Students will learn about research questions and hypotheses, and operate them. Can create a research plan adequate to the research question. 3. Present research questions with statistical concepts and translates them to hypotheses, which he then verifies using

			appropriate methods of statistical inference. 4. Advance research skills encompassing construction of research tools and conducting experiments, use computer programs: statistical packages, calculation spreadsheets, text editors, to perform calculations and describe results from empirical studies. 5. Students will determine the ethical value of his own research and scientific pursuits.
	PAPER- Z-4072 Practical	Fish taxonomy, Fish biology & Aquaculture	1. Students will acquire the practical knowledge and get the hands-on practice in the various aspect of Wildlife science and its management. 2. Students have developed their knowledge on ecosystem concepts, Structure and types of ecosystems, adaptations of the organism in different ecological factors, limiting factors of organisms in the environments, ecological modelling and ecological, system analysis. 3. Functional attributes of ecosystems, Quantitative study of biogeochemical cycles,
Fish Biology & Fishery Science	Z-4014	Fish Taxonomy & Study of Fish Growth & Population	1. This paper will develop the students' knowledge on the identification of major groups of freshwater fish species with special reference to NE India; their interrelationships, phylogeny, diversity through morphological, anatomical, ecological and molecular approaches 2. This paper will provide an elementary knowledge on fish stock assessments with specific techniques, and knowledge on growth analysis and designing well-being of naturally available fish populations.
	Z-4024	Fish Physiology & Fish Genetics	This paper will help a student to understand fish as a physiological and genetic unit; by giving stress on the detailed physiology of a fish and the scope of genetics in fish breeding programmes for stock enhancement in fisheries.
	Z-4034	Capture Fisheries & Post harvest technologies	This paper will provide students with an idea on the fisheries resources of India, the scopes these can offer, various fish harvesting techniques, management of sustainable fisheries, and the principle and processes of post-harvest technologies.
	Z-4044	Aquaculture & Fish Biotechnology	This paper will present the students with a plan on responsible fish farming, the

			scientific management of different species in aquaculture, aquarium keeping, and fish nutrition and health management.
	Z-4054	Fish Pathology & Post harvest technology	1. This paper will help the students to diagnose various fish diseases, their prophylaxes, and probable cure through updated scientific techniques. 2. The paper will provide the students with an overview on the impact of environment on aquaculture. 3. The paper will also provide an overview on emerging biotechnological tools and techniques to get improved fish varieties and better outputs in aquaculture systems.
	Z-4066	Dissertation	The students will have hands-on-practice in various disciplines of choice under Fish Biology and Fishery Science.
	Z-4072 (Practical)	Taxonomy, Fish Biology & Aquaculture	The students will acquire practical knowledge on various aspects of Fish Biology and Fishery Science.
Entomology	Z-4014	Insect structure and function	Students understand details of insect morphology, origin, locomotion and molecular phylogeny.
	Z-4024	Insect Ecology	1. Students set knowledge to apply the basics of insect ecology to the development of the research. 2. Students will be able to identify insect specimen up to their order and able to use identification keys for further to more detail levels.
	Z-4034	Insect Physiology	1. Students able to describe the influence of the exoskeleton on physiological functions of insects. 2. Students will be able to describe the hormonal and neuronal regulatory systems. 3. Students will be able to describe the communication and sensory system of insects. 4. Students will be able to acquired knowledge gained in the course for designing experiments in insects.
	Z-4044	Agricuture and Forest entomology	At the end of the course, the student knows the bases of the insect morphology and anatomy and the biology and behaviour of the most harmful insects for different plant species. Can understand the agro-forestry environment in the view of the management of the insect populations and plant protection.

	Z-4054	Pest and pest control, Medical and Forensic entomology Medical and Forensic entomology	Students learn to identify and understand the life cycles, morphology, and behavior of mosquitoes, ticks, mites, lice, flea s, and other disease vectors. Students also learn about major arthropod-transmitted disease cycles, including malaria, Lyme disease, leishmaniasis. The interaction between the disease-causing pathogen and the arthropod vector discovered, including biological and mechanical transmission of pathogens as well as the mechanical damage that a parasite inflicts on its host.
	Z-4066	Dissertation	The students will have hands-on-practice in various disciplines of choice under insect biology and entomology as a whole.
	Z-4072 Practical	Insect Ecology, Insect physiology	Acquire practical knowledge and get the hands on practice in the various aspects of insect biology and entomology as a whole.