

**DEPARTMENT OF ANIMAL SCIENCE MANONMANIAM SUNDARANAR
UNIVERSITY, TIRUNELVELI**

M. SC. ZOOLOGY (With effect from the academic year 2019-2021 onwards)

Course Structure under Choice Based Credit System

Programme Objectives

Programme Objectives	Title of the Programme	
	M.Sc. Zoology	To Impart knowledge on Animal diversity, biosystematics, genetics and Immunology.
		To Enrich knowledge on Environment, Nutrition and Animal interaction
		To Provide knowledge on significance and economic value of animals

Programme Specific Outcomes

Title of the programme	
	Identify the diversity of organisms, differentiate them phylogenetically, morphologically and understand their habit and habitat, evolutionary significance, and their economic importance
M.Sc. Zoology	Understand the cellular and molecular mechanisms of organisms, know the microbial interactions and biochemical modifications in various organisms.
	Understand the cell differentiation, genetic inheritance, developmental process of an organism, and know the modern techniques viz. rDNA, Tissue engineering and the Artificial Reproductive Technology process.
	Learn the basics of the animal physiology, know the immune cells and immune organs, process of innate and acquired defence mechanisms and their role in allergy and organ transplantation.
	Design the experiments, know the methods of data collection and execute the experiments with modern instruments and interpret the data with recent statistical tools.
	Acquire knowledge on computational biological tools, know the biological database and sequence analysis methods, able to do molecular modelling and pharmacophore generation.
	Understand the structure and functional properties of manmade ecosystems, impact of climate change and global warming on living organisms, and conservation of natural resources, able to do EIA analysis.
	Acquire skill based aquaculture techniques, value added post harvest storage methods of fishery biology, employable animal husbandry techniques, and entrepreneurial apiculture and sericulture methods. Economic importance of animal species.

Course outcome

Sl.No	Nature of Course	Title of the subject/course	Course outcome
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1	CORE PAPER 1	STRUCTURE AND FUNCTION OF INVERTEBRATES	<ul style="list-style-type: none"> ➤ Understand the classification of animal kingdom. ➤ Learn the ecology, ethology and reproductive system of invertebrates. ➤ Know about the coral reefs and sponges and their biological significance. ➤ Understand the medical importance of various classes of invertebrates. ➤ Know the morphological features and reproductive biology of Pseudocoelomates, Eucoelomates and molluscs. ➤ Learn about the adaptive feature of invertebrates. ➤ Understand the origin and evolution of invertebrates.
	CORE PAPER II	COMPARATIVE ANATOMY OF CHORDATES	<ul style="list-style-type: none"> ➤ Understand the classification of animal kingdom. ➤ Learn the ecology, ethology and reproductive system of chordates. ➤ Understand the medical importance of various classes of chordates. ➤ Learn about the adaptive feature of chordates. ➤ Understand the origin and evolution of chordates ➤ Appreciate the economic importance of each phylum of chordates.
	CORE PAPER III	ENVIRONMENTAL BIOLOGY	<ul style="list-style-type: none"> ➤ Understand the structure and functional properties of natural and manmade ecosystems. ➤ Realize the unique features of marine natural resources ➤ Acquire knowledge on habitat ecology, population ecology and growth. ➤ Know the importance of conservation tools. ➤ Learn laws related to environmental pollution. ➤ Enable to understand the impact of climate change and global warming on living organisms and conservation of natural

			resources.
	CORE PAPER IV	ANIMAL BIODIVERSITY	<ul style="list-style-type: none"> ➤ Understand the ecosystem, diversity of organisms and their ecological relationship. ➤ Know the genetic relationship of an animals, animal distribution and biological hotspot areas. ➤ Realize the importance of animal classification and taxonomy; species concept and their evolutionary significance. ➤ Inculcate conservation strategies of ecosystem and various enactments relating to conservation policy at national and international status. ➤ Learn the measurement of biodiversity richness, species evenness and geometric analysis.
	ELECTIVE PAPER 1	ANIMAL CELL BIOTECHNOLOGY (E-PATHSALA – 1)	<ul style="list-style-type: none"> ➤ Understand the various cell culture,, organ culture methods, equipments for animal cell culture. ➤ Understand the r DNA methods and Vectors and recombinant selection methods ➤ Know the Concepts of Assisted reproductive Technologies Ethical Issues related to the Animal Cell Culture.
	CORE PRACTICAL I	Structure and function of Invertebrates & Comparative Anatomy of Chordates	<ul style="list-style-type: none"> ➤ Understand the energy production, energy flow and energy utilization in the ecosystem. ➤ Acquired Knowledge on the water sample analysis and waste water treatment. ➤ Learnt the sterilization process and preparation of culture media for microbial culture. ➤ Learnt the isolation and purification of

			DNA, RNA and chromosome.
	Practical II	Environmental Biology & Animal Biodiversity	<ul style="list-style-type: none"> ➤ Analysis the biodiversity of phytoplankton and zooplankton. ➤ Learn the biodiversity indices ➤ Enable to understand the TLC, UV-Spectroscopy, Electrophoresis and Centrifuge. ➤ Learn the physiological process of digestive, nervous and reproductive systems of fish, insects and prawn. ➤ Learn the structure of polytene chromosome. ➤ Learn the mitosis process in onion.

SEMESTER – II

Sl.No	Nature of Course	Title of the subject/course	Course outcome
1	CORE PAPER V	BIOCHEMISTRY	<ul style="list-style-type: none"> ➤ Know the structure of atoms, bonding nature of molecules, pH and their molecular interactions. ➤ Understand the energy production, metabolism and catabolism of biological molecules, ATP synthesis and energy utilization of organisms. ➤ Learn the biosynthesis pathway, structure and function of proteins. ➤ Know the metabolism and catabolism of protein. ➤ Realize the classification, structure and function of carbohydrate and lipids. ➤ Learn the Glyconeogenesis, Glycolysis and oxidation of lipids and bioenergetics. ➤ Imbibe the knowledge on enzymes

			<p>classification, biocatalytes and kinetics of enzymes.</p> <ul style="list-style-type: none"> ➤ Enable to know the structure, function and classification of hormones, ➤ Know the biological mechanism of hormones.
2	CORE PAPER VI	CELL AND MOLECULAR BIOLOGY	<ul style="list-style-type: none"> ➤ Understand the chemical composition of biomembranes. ➤ Acquire knowledge about function of cytoskeleton. ➤ Enable to know the cell signalling pathways. ➤ Structure and regulation of gene and chromosome. ➤ Understanding the sequencing of proteins and softwares used in sequencing.
3	CORE PAPER VII	DEVELOPMENTAL BIOLOGY	<ul style="list-style-type: none"> ➤ Understand the structural and functional differentiation of eukaryotes and prokaryotes. ➤ Know the structure and function of various cell organelles. ➤ Acquire knowledge about the structure and function of chromosomes. ➤ Imbibe the knowledge about the cell cycle and related diseases. ➤ Enable to know the chemical and biological nature of DNA. ➤ Understand DNA repairing mechanism and protein synthesis. ➤ Know the construction method and application of rDNA. ➤ Learn the regulation of gene expression in prokaryotes and eukaryotes. ➤ Know the gene rearrangement and reversible protein phosphorylation.

4	CORE PAPER VIII	MICROBIOLOGY	<ul style="list-style-type: none"> ➤ Identify standard protocol for the isolation, identification, culturing and characterization of microorganisms ➤ Enable to know the isolation, identification of microbes for commercial application. ➤ Carry out experiments to evaluate microbial quality of food products, water and soil.
5	CORE PRACTICAL III & IV	BIOCHEMISTRY & CELL AND MOLECULAR BIOLOGY	<ul style="list-style-type: none"> ➤ Enable to understand the TLC, UV-Spectroscopy, Electrophoresis and Centrifuge. ➤ Learn the structure of polytene chromosome. ➤ Learn the mitosis process in onion.
6	Practical IV	DEVELOPMENTAL BIOLOGY & MICROBIOLOGY	<ul style="list-style-type: none"> ➤ Understand the growth and metamorphosis of an organisms. ➤ Acquire Knowledge on the identification of blood group and blood cells counting. ➤ Understand the function of gene and their hereditary mechanisms <p style="text-align: center;">Microbiology</p> <ul style="list-style-type: none"> ➤ Understand the structural peculiarities and adaptive characteristic of organisms. ➤ Acquire Knowledge on the identification and taxonomy of microbes. ➤ Learn the antibiotic and enzymatic assay of microbes. ➤ Understand the physiological functions of animals (Osmoregulation, excretion and respiration etc.)

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1	CORE PAPER IX	COMPARATIVE ANIMAL PHYSIOLOGY	<ul style="list-style-type: none"> ➤ Understand the structure and function of muscles. ➤ Know the biological functions, structural arrangement of nervous system. ➤ Enable to know the structure and function of various systems of human body. ➤ Know the biological significance of hormones. ➤ Acquired knowledge on the respiration, circulatory process and BMR. ➤ Learn to maintain the cardiac rhythm and maintain, measure the blood pressure. ➤ Understand the excretory system and eliminate the metabolic byproducts. ➤ Enable to understand the biological clock mechanism of organisms. ➤ Know the mechanism of hormonal action.
2	CORE PAPER X	IMMUNOLOGY	<ul style="list-style-type: none"> ➤ Understand the function of immune system. ➤ Enable to know the Antigen – Antibody interaction. ➤ Learn the synthesis, transport and mode of action of Immunoglobulins. ➤ Know the Hybridoma technology and their use in cancer treatment. ➤ Realize the principle for vaccine production and vaccination for

			<p>various kinds of diseases.</p> <ul style="list-style-type: none"> ➤ Imbibe the knowledge on disease diagnosis and treatment.
3	CORE PAPER XI	GENETICS	<ul style="list-style-type: none"> ➤ Understand the transmission of hereditary characters in populations. ➤ Know the phenotypic and genotypic expression of gene. ➤ Learn the structure and function of genome of organisms. ➤ Enable to know the mutagenic substance and their biological impacts. ➤ Realize the structural and numerical aberrations of chromosomes. ➤ Understand the concept sex determination pattern of organisms. ➤ Know the gene expression for protein synthesis and post transcriptional modifications of protein products.
4	Core Paper XII	BIOINSTRUMENTATION	<ul style="list-style-type: none"> ➤ Understand the working mechanism of major and advanced instruments and microscopes. ➤ Know the macro and micromoles separation techniques by using advanced instrumentations (TLC, HPLC, CCMS, LCMS and FPLC) ➤ Learn the electrophoresis technique, PCR amplification, SDS-PAGE, Blotting techniques. ➤ Know to isolate and analyze the DNA and RNA molecules. ➤ Understand the instrumentation and application of spectroscopy. ➤ Enable to know the radio isotope and their medical applications.
5	CORE PRACTICAL V & VI	PRACTICAL V : COMPARATIVE ANIMAL	<ul style="list-style-type: none"> ➤ Understand the structural peculiarities and adaptive characteristic of organisms.

		PHYSIOLOGY & IMMUNOLOGY	<ul style="list-style-type: none"> ➤ Acquire Knowledge on the identification and taxonomy of microbes. ➤ Learn the antibiotic and enzymatic assay of microbes. ➤ Understand the physiological functions of animals (Osmoregulation, excretion and respiration etc.)
6		IMMUNOLOGY	<ul style="list-style-type: none"> ➤ Understand the growth and metamorphosis of an organisms. ➤ Acquire Knowledge on the identification of blood group and blood cells counting. ➤ Understand the function of gene and their hereditary mechanisms
		PRACTICAL VI : GENETICS & BIOINSTRUMENTATION	<ul style="list-style-type: none"> ➤ Understand the Mendelian inheritance. ➤ Acquire knowledge about Buccal smear to show squamous epithelial cells. salivary glands of Drosophila larvae or Chironomous larvae. ➤ Clear knowledge on Human pedigree construction for a family data. ➤ Understand the hereditary disorders with the aid of chromosome and karyotyping (Klienfelter's syndrome, Turner's syndrome, Down's syndrome)

Optional Papers

Sl.No	Nature of	Title of the	Course outcome
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	Course	subject/course	
1	Optional I	AQUACULTURE	<ul style="list-style-type: none"> ➤ Learn the scope and importance of aquaculture at national and international level. ➤ Know the methods for construct the pond and different fish culture systems. ➤ Know the economic importance of fishes. ➤ Understand the hybridization technique and sex reversal process of fishes. ➤ Learn the method for the preparation of artificial fish feed and their storage technique. ➤ Know the preparation and maintenance of live feed culture. ➤ Understand the diseases diagnosis and management of fishes. ➤ Imbibe the post harvest process and marketing of fishes.
2	Optional II	LZOEB-POULTRY FARMING	<ul style="list-style-type: none"> ➤ Learn the poultry farm management practices ➤ Know the disease diagnosis and prophylactic measures. ➤ Understand the poultry feed preparation and feed management. ➤ Enable to know the post harvest technology and value added poultry products
3	Optional III	FISHERY BIOLOGY	<ul style="list-style-type: none"> ➤ Understand the life history of fishes, classification, morphometry and taxonomy of fishes. ➤ Know the growth performance of fishes and the spawning season of fishes. ➤ Learn the inland estuarine management strategies. ➤ Enable to address the problems in fish grafting technology

			<ul style="list-style-type: none"> ➤ Understand the post harvest process of fish.
4	Optional IV	ECONOMIC ENTOMOLOGY	<ul style="list-style-type: none"> ➤ Enable to formulate the holistic package for pests and disease management for field crops. ➤ Learn to know beneficial, harmful aspects of insects and their management.

SEMESTER – IV

Sl.No	Nature of Course	Title of the subject/course	Course outcome
	CORE PAPER XIII:	EVOLUTION	<ul style="list-style-type: none"> ➤ Understand the Emergence of evolutionary theories ➤ Role of gene in evolution ➤ Knowledge about the molecular phylogeny, Amino acid sequences ➤ Understanding the concept of population genetics
	CORE PAPER XIV-	BIostatISTICS AND COMPUTER APPLICATION	<ul style="list-style-type: none"> ➤ Learn the sampling pattern, collection, maintenance and analysis of data. ➤ Enable to construct the experimental design before starting the experiments. ➤ Know the needs and handling of statistical package with the aid of computer. ➤ Acquire the knowledge on computer operations and database management by using statistical software packages.

ELECTIVE PAPER

Sl.No	Nature of Course	Title of the	Course outcome
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		subject/course	
1	ELECTIVE PAPER III	COMPUTATIONAL BIOLOGY (E-PATHSALA -2)	<ul style="list-style-type: none"> ➤ Understand the various biological and chemical databases. ➤ Learn the sequence analysis and multiple sequence alignment. ➤ Know about the Pharmacophore generation and Molecular Modelling.

Practical

Sl.No	Nature of Course	Title of the subject/course	Course outcome
1	CORE PRACTICAL VII	EVOLUTION & BIostatistics AND COMPUTER APPLICATION	<ul style="list-style-type: none"> ➤ Understand the structural peculiarities and adaptive characteristic of organisms. ➤ Acquire Knowledge on the identification and taxonomy of microbes. ➤ Learn the antibiotic and enzymatic assay of microbes. ➤ Understand the physiological functions of animals (Osmoregulation, excretion and respiration etc.)