M.SC ZOOLOGY

PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the various biochemical aspects of cell including molecular level regulation
PSO2	Analyse the developmental stages of organisms connecting their physiological reactions and immunological advancements
PSO3	Interpret the various interactions on ecological and ethological level; assess and classify them with biostatistical methods
PSO4	Identify and evaluate the growth and developmental aspects of microbes and utilize them in biotechnology through biophysical methods
PSO5	Develop knowledge in fishes by understanding their ecological habitats and culture practices.

COURSE OUTCOMES

PROGRAMME	PROGRAMME SPECIALIZATION	COURSES	OUTCOME
M.Sc	**ZOOLOGY**	ZOL1C01- Biochemistry and Cytogenetics	Analyze and understand the chemistry and functions of biomolecules
			Understand the metabolism and biosynthesis of biomolecules
			Understand the basic cellular, molecular and genetic concepts of development.
			Understand the structural organization and function of intra cellular organelles
		ZOL1C02- Biophysics and Biostatistics	Observe and understand the matter and mechanism of cells and study of functional systems, structural organization and physical basis of sound transmission in the ear
			Observe and understand the working principle of different separation techniques, biophysical methods, electrophysiological methods and microscopy
			Analyze and understand the applications of biostatistics in research and study about the various type of statistical methods

			Understand the basic concept of gravitation force, nanotechnology and radiation biology
		ZOL1C03- Ecology and Ethology	Analyze and understand the natural history of Indian subcontinent, various terrestrial biomes, biogeographical zones and island biogeography
			Understand the basic concepts and levels of organisation in ecology
			Study of animal behaviour and its evolution
			Observe and understand social behaviour of termites and primates
		ZOL2C04- Physiology	Interpret and analyse nutrition and utilization of energy from biomolecules
			Study of functional systems and disorders of nervous and cardiovascular systems
			Understand the structure and functions of sense organs
			Understand the thermoregulation mechanisms and acclimatization
		ZOL2C05- Molecular Biology	Understand the basic cellular, molecular and genetic concepts of development.
			Analyze and understand the developmental stages of various organisms along with the factors influencing them.
			Understand the structure of endocrine glands, synthesis and secretion of hormones, mode of action, control
			Understand the pathophysiology of hypo and hyper secretions of endocrine glands
		ZOL2C06- Systematics and Evolution	Understand the definition and basic concept of taxonomy, classification, procedures, species concept and different type of taxonomic characters of organisms.
			Study the zoological nomenclature, newer systematic trends, ethics in taxonomy and taxonomic impediments.
			Understand natural selection , mechanisms and tempo of evolution
			To study molecular evolution and evolutionary trends of organisms

		ZOL3C07 - Immunology	Explain the role of molecules involved in immune mechanism
			Understand maturation of immunological cells leading to immune response.
			Analyze the role of MHC in immune response.
			Explain immunological disorders
		ZOL3C08- Developmental Biology and Endocrinology	Understand the basic cellular, molecular and genetic concepts of development.
			Analyse and understand the developmental stages of various organisms along with the factors influencing them.
			Understand the structure of endocrine glands, synthesis and secretion of hormones, mode of action, control
			Understand the pathophysiology of hypo and hyper secretions of endocrine glands
		ZOL3E09- Fishery Science 1: Taxonomy, Biology, Physiology & Ecology	understand fish taxonomy
			Understand the fish biology
			Explain the physiology of fish
			Understand the ecology of sea
			Study on brackish and inland water
		ZOL4C10- Biotechnology and Microbiology	Study of history and scope of Microbiology and its taxonomy
			Understand bacteria, virus,its pathological effects and their control measures
			Understand bacterial metabolism
			Understand the role of microbes in fermentation, waste water treatment, bioremediation biogas plant and generation of energy sources
			Understand DNA sequencing, Genetic Engineering, gene silencing and cloning techniques
			Interpret biotechnology in animal health care and environment

		ZOL4E11- Fishery Science II: Capture & Culture Fisheries	Understand the capture and culture fishes, Designing of aqua farms
			Understand the nutrition of fishes and water quality management
			Understand the reproduction and genetic selection
			Explain different aqua cultural practices
			Study on aquarium and major fish diseases
		ZOL4E12-Fishery Science III: Harvesting, Post-harvesting Technology & Marketing	Understand commercial fishing methods
			Understand the nutritional value of fin fish and shell fish , its preservation and processing techniques
			Explain the post mortem changes and spoilage.
			Explain the role of fishery institutes in education, research, development , export and quality control
			Study on fishery management and international marketing.

B.Sc ZOOLOGY

PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand the biological diversity and grades of complexity of various animal forms through their systematic classification and process
PSO2	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
PSO3	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
PSO4	Perform laboratory procedures as per standard protocols in the areas of animal diversity, systematics, cell biology, genetics, biochemistry, molecular Biology, developmental environmental biology, ethology, evolution and Science methodology

COURSE OUTCOMES

Programme	Programme Specialization	Course code and Name of course	Courses outcomes
B.Sc	**Zoology**	ZOL1B01T Animal diversity: Non-Chordata Part- I	Describe the principles of classification and nomenclature
			Explain the five kingdom classification of living organisms
			Understand the concepts of classification of animals
			Explain the classification with examples and characteristic features of kingdom Protista and describe the morphology and structural organization of *Paramecium*
			Explain the classification of phylum Porifera and elucidate the salient features of each class
			Describe the characteristic features of phylum Cnidaria and Ctenophora,Ilustrate the classification of phylum Cnidaria down to classes
			Explain the salient features of phylum Platyhelminthes and illustrate its classification down to classes
			Explain the characteristic features and classification of super Phylum Aschelminthes and phylum Nematoda
			Elucidate the characters of Pseudocoelomate minor phyla Rotifera and Gastrotricha
		ZOL2B02T Animal Diversity-Non-Chordata Part II	Explain the classification with examples and characteristic features of phylum Annelida and describe the morphology and structural organization of *Neanthes*
			Describe the distribution, peculiarities and affinities of phylum Onychophora
			Explain the classification of phylum Arthropoda; elucidate the salient features of each class and describe the morphology and structural organizatio n of *Penaeus*

			Describe the characteristic features of phylum Mollusca, illustrate its classification down to classes and explain the structural organization of *Pila globosa*
			Explain the salient features of phylum Echinodermata and illustrate its classification down to classes
			Understand the salient features and affinities of phylum Hemichordata
			Elucidate the characters of coelomate minor phyla Phoronida, Ectoprocta and Echiura
		ZOL3B03T Animal diversity: chordata Part-I	Explain the characteristics of chordates and outline classification of the phylum Chordata
			Describe the salient features and affinities of subphylum Urochordata and its classification down to classes; elucidate the morphology and structural organization of *Ascidia*
			Explain the salient features and affinities of subphylum Cephalochordata with reference to *Branchiostoma*
			Describe the salient features of subphylum Vertebra ta, illustrate its classification down to classes and elucidate the characteristics of division Agnatha
			Enumerate the salient features of superclass Pisces and illustrate its classification down to orders and the morphology and structural organization of *Mugil cephalus*
			Describe the salient features and affinities of class Amphibia and its classification up to orders; explain the morphology and organ systems of *Hoplobatrachus tigerinus*
			Elucidate the characteristic features of the class Reptilia and its classification down to orders; describe the morphology and organ systems of *Calotes versicolor*
		ZOL4B04T Animal diversity: chordata part-II	Describe the classification of class Aves down to orders, salient features of each order with suitable examples
			Describe the external characters and functional systems of *Columba livia*

			Enumerate the salient features and classification of class Mammalia down to orders with suitable examples
			Elucidate the external characters and functional systems of *Oryctolagus cuniculus*
			Compare the circulatory, excretory and nervous systems of vertebrates
		ZOL4B05P **Zoology core course practical I: Animal diversity** (Practical I* A+ I*B+ I*C + I*D)	Identify and describe specified protists and acoelomate & pseudocoelomate non-chordates and perform the culture of selected protists; understand the histological features of coelenterate, platyhelminth and nematode
			Identify and describe specified coelomate non-chordates and the transverse sections of annelids; Perform mounting of the specified organs of selected non-chordates
			Identify and describe specified chordates and specified bones of chordates; Prepare key for identification of venomous snakes; Perform mounting and dissection of specified organ systems of chordates
			Identify and describe selected vertebrates and specified bones of vertebrates
		ZOL5B06T Cell biology and Genetics	Understand the principles and applications of various types of light microscopes, electron, scanning tunnelling and Atomic force microscope and illustrate histological and histochemical processing of tissues
			Explain the basic structure of a eukaryotic cell and the structure and functionsof plasma membrane, mitochondria, lysosome,cytoskeletal elements and interphase nucleus
			Illustrate the nucleosome organization of chromatin and Illustrate the nucleosome organization of chromatin
			Enumerate eukaryotic cell cycle and cell division by amitosis, mitosis and meiosis
			Explain the causes of transformation, characteristic s of transformed cells role of protooncogenes and tumor suppressor genes in malignant transformatio mechanism and significance of apoptosis
			Enumerate allelic and nonallelic gene interactions; supplementary, complementary,polymeric, duplicate

			and modifying genes and polygenic inheritance
			Illustrate multiple allelism and solve problems related to blood group inheritance
			Explain characteristics of linkage groups and linkag e map; crossing over sex-linked, sex-influened and sex-limited, sex differentiation and disorders of sexual development
			Describe the mechanisms of sex determination including chromosomalgenic, haploidiploid mechan isms; the hormonal and environmental influencegen ic, haploidploid mechanisms; the hormonal and environmental influence.
			Explain mutagenesis, mutagens and chromosomal and gene mutations
			Explain mutagenesis, mutagens and chromosomal and gene mutations, human autosomal and sex chromosomal anomalies; polygenic human traits and genetic counseling
		ZOL5B07T Biotechnolo gy, Microbiolo gy, Immunolog y	Illustrate the steps in genetic engineering and animal cell culture
			Explain transfection methods, transgenic animals and ethical issues of transgenic animals
			Enumerate the applications of biotechnology
			Understand the biological diversity of microbial for ms and the various techniques for handling microbes in the laboratory
			Enumerate the basic structure and life cycle of bacteria and virus
			Understand the industrial and medical importance of microorganisms
			Describe different types of immunity and the cells and organs of the immune system
			Explain antigen, antibody, immunity and major histocompatibility complex
			Enumerate autoimmune and immunodeficiency diseases and immunology of tumor and organ transplantation
		ZOL5B08T Biochemistr y and	Understand the elements of biological importance and the non-ovalent interactions that stabilize biomolecules

		Molecular Biology	
			Describe the classification, types, structure, reactions and biological roles of carbohydrates, and diabetes Type I and II
			Enumerate the properties and classification of amino acids andtheir standard abbreviations; hierarchial levels of protein structure, classification, separation, purification and sequencing of proteins
			Explain the classification and functions of lipids and fatty acids; chemistry and structure of nucleic acids and sequencing of DNA
			Understand the classification, nomenclature and properties of enzymes; enzyme action, cozymes, cofactors, isozymes, ribozymes and allosteric enzymes
			Explain glycolysis, Kreb's cycle, glycogenesis, glycogenolysis, gluconeogenesis, HMP pathway; amino acid and fatty acid oxidation and oxidative phosphorylation
			Describe the mechanism of DNA duplication and the role of enzyme
			Understand the concept of gene and gene expression genetic code and wobble hypothesis
			Explain the mechanism of transcription and post-transcriptional modification of hnRNA
			Enumerate the processes of translation and post-translational modification and targeting of peptides
			Describe the regulation of *trp* operon, C-value, repetitive DNA, satellite DNA selfish DNA, overlapping genes, pseudogenes, cryptic genes, transposons and retro transposons
			Explain the structure and life cycle of bacteriophage s and the gene transfer mechanisms in bacteria
		ZOL5B09T Methodology in Science, Biostatistics and informatics	Explain science, its importance, disciplines and the major steps in formulating a hypothesis, various hypothesis models, theory, law and importance of animal models, simulations and virtual testing
			Illustrate the principles and procedures in designing experiments and elaborate the requirements for carrying out experiments
			Describe the ethical concerns in practicing science
			Understand the Scope and role of statistics; methods and procedures of sampling; Construction of tables, charts and graphs

			Calculate central tendency and measures of dispersion and application of its Knowledge on hypothesis testing as well as in problem solving
			Enumerate major biological databases and database search engines
			Perform DNA and protein sequence analysis, including sequence alignment and sequence similarity search using BLAST, FASTA, CLUSTAL W and CLUSTAL X
			Understand molecular phylogenetics and tools and methods for construction of phylogenetic trees
			Explain genome sequencing technologies, functional genomics, proteomic technologies and molecular docking and drug design
		ZOL5D01T Reproductive Health and sex education	Understand the reproductive health, and importance of sex education for teen and youth
			Explain the chromosomal mechanism of sex determination and sex chromosomal anomalies
			Explain fertilization, implantation, pregnancy, gestation, placenta, parturition and lactation
			Explain the scope of reproductive technologies in fertility management and the assisted reproductive techniques
			Understand the different methods of prenatal diagnosis and associated ethical issues
			Describe the different methods of fertility control
			Understand the symptoms, mode of transmission, diagnosis and treatment of different sexually transmitted diseases and their socio economic dimensions
			Describe sexual orientation,sexual abuse and myths
			Understand the ethical aspects of sex
		ZOL6B15P Zoology [core course] practical – II (Practical II*A + Practical II*B)	Perform experiments in cell biology and genetics including demonstration of Barr body in buccal epithelial cells of man, polytene chromosome in the salivary glands of *D. Melanogaster* larva, mitotic division in onion root tip cells, micrometry of microscopic objects, prepare whole mounts of microscopic objects, and calculate mitotic and metaphase index from slides
			Enumerate the inheritance of major human genetic traits, pedigree chart, normal and abnormal human karyotypes, phenotypic differences of male and

			female Drosophila and solve problems on Monohybrid, dihybrid crosses, blood groups and sex-linked inheritance
			Understand electrophoresis, PCR, Northern blotting Southern blotting and Western blotting, DNA sequencing and fingerprinting and isolation of genomic DNA
			Perform gram staining and preparation of culture media for bacteria and demonstrate bacterial motility standard laboratory protocols
			Understand the detection of human blood groups and organs of immune system
			Perform standard biochemical tests for the detection of reducing and nonreducing sugars, polysaccharides, proteins and lipids
			Understand the staining of mitochondria, tissue homogenization and isolation of nuclei, effect of colchicines of cell division, extraction of DNA and polyacrylamide and agarose gel electrophoresis
			Solve basic problems in biostatistics and Bioinformatics
		ZOL6B10T Physiology and Endocrinology	Describe the regulation of digestion in man, nutrition in pregnancy and infancy, nutritional disorders, balanced diet, starvation, fasting and obesity
			Describe functions, composition, coagulation, transfusion, agglutination clinical analysis of blood, haemoglobinopathies, types of heart and common cardio-vascular problems
			Understand the osmoregulatory mechanisms in animals; excretion and its hormonal control and commonrenal disorders in man
			Explain the ultrastructure of skeletal muscles and biochemical events and energetics of muscle Contraction.
			Understand the different types of nerve cells, glial cells and nerve fibres, and the mechanism of nerve impulsetransmission
			Understand the types, physiology and significance of bioluminescence, and the structure and functions of electric organs
			Describe invertebrate neuroendocrine system and endocrine glands, their hormones and functions
			Understand the concept of neurosecretion and the

			mode of action of peptide and steroid hormones
		ZOL6B11T Reproductive and developmental biology	Explain the reproductive strategies in invertebrates and vertebrates and structural and functional features of human reproductive system
			Describe process of fertilization, pregnancy, gestation, placentation, parturition and lactation in humans
			Explain the scope of reproductive technologies infertility management; prenatal diagnostic techniques and methods of fertility control
			Understand the phases and theories of development, and classification of eggs
			Enumerate the types of cleavage, arrangement of blastomeres, germ layers and their derivatives, cell lineage in Planocera and different types of blastula
			Illustrate the early developmental process of egg in *Amphioxus*, frog, chick and man
			Explain the basics of cell differentiation and its genetic control, stem cells and applications of stem cell technology
			Describe parthenogenesis, types, and significance
			Explain fate map construction, Spemann's constriction experiments on amphibian embryos, organizers in development,embryonic induction, gradient experiments in sea urchin eggs, cloning experiments in sheep and teratogenesis
		ZOL6B12T Environmental and conservation Biology	Explain the structure of ecosystem and its functioning through energy flow and nutrient cycling
			Enumerate biogeochemical cycles and understand the concept of limiting factors
			Describe the ecology of population, community and habitat as a self regulating system
			Understand various types of population interactions and appraise the co-evolution
			Comprehend the diverse environmental and sustain ability challenges ranging from local to global and the establishment of perfect harmony between economic development, social issues and environmental conservation
			Enumerate the several tools and techniques employed for studies on populations, communities and ecosystems

			Understand the threats to biodiversity, and strategies adapted for the conservation of diversity of organisms
			Describe the various international strategies for conserving biodiversity
			Describe the toxic chemicals, their toxicity levels and the health hazards caused by them
		ZOL6B13T Ethology, Evolution and Zoogeography	Describe the patterns and mechanisms of animal behavior
			Illustrate biological rhythms and the chemical basis of communication
			Identify major evolutionary transitions over time, and explain the tools and evidences that support current hypotheses of the history of life on earth
			Describe the evidences for evolution and its required corollaries
			Explain the various theories of evolution
			Describe the mechanisms by which evolution occurs
			Recognize the significance of reproductive isolation in reducing gene flow between populations, biological and morphological species concepts and distinguish between prezygotic and postzygotic barriers to reproduction
			Review the events in human evolution
			Explain ecological and historical foundations for understanding the distribution and abundance of species, and their changes over time and comprehend the basic principles of biogeography as a discipline
		ZOL6B14BE02T Aquaculture Animal Husbandry and Poultry Science	Explain aquaculture and the process of prawn, mussel and pearl culture
			Illustrate the methodology of pisciculture and und erstand common culture fishes and ornamental fishes
			Identify major fishing crafts and gear and

			enumerate fish utilization and preservation
			Enumerate the poultry rearing techniques and understand major breeds of fowl
			Understand the major breeds of cattle, cattle feeds and diseases of cattle
			Illustrate the steps in dairy processing and identify the role of dairy development in rural economy
		ZOL6B16P Zoology [core se] practical -II (Practical III *A + Practi cal III*B)	Perform standard laboratory experiments for the estimation of Hb, presence of hCG/abnormal constituents in urine, detection of blood pressure, bleeding and clotting time and identification of formed elements in blood
			Carry out experiments of laboratory standards to estimate water quality parameters including, dissolved Oxygen, Carbon dioxide, hardness and pH; determination of adulteration of selected food items and identify marine planktons and soil organisms
			Demonstrate the behavioural response of earthworm/dipteran larva to selected stimuli
			Describe homologous , analogous and vestigial organs, connecting links, adaptive radiation and evolution of man
			Illustrate zoogeographical realms, Wallace line, Weber line, Wallacea and the distribution of *Peripatus*, lung fishes, *Sphenodon*, monotremes and marsupials
			Identify the normal and selected abnormal human karyotypes and inheritance of chosen traits from pedigree charts, ornamental and other culture fishes and chosen beneficial and harmful insects
B.Sc	**Zoology**	**Complementary course**	
		ZOL1C01T Animal diversity and wildlife conservation	Describe the general characters of protists and salient features of phylum Rhizopoda, Ciliophora, Dinoflagellata and Apicomplexa
			Enumerate the salient features and examples of Phylum – Porifera, Coelenterata, Platyhelminthes, AschelminthesAnnelida, Arthropoda, Onychophora, Mollusca and Echinodermata, and the structural organization of *Peneaus* sp

			Describe the characteristic features and classification of phylum Chordata with examples and, structural organization of *Oryctolagus cuniculus*
			Describe the characteristic features and classification of phylum Chordata with examples and structural organization of *Oryctolagus cuniculus*
		ZOL2C02T Economic Zoology	Explain parasitism and the major protist, cestode, trematode and nematode parasites of man and major insect vectors of human diseases and their control
			Understand major beneficial and harmful insects, damages caused to host plants and their control measures
			Understand pisciculture, prawn, mussel and pearl culture
		ZOL3C03T Physiology and Ethology	Describe the structure of plasma membrane and the various trans-membrane transport mechanisms
			Enumerate the constituents of normal diet and the mechanism of digestion and absorption of carbohydrates, proteins and lipids and the regulation of gastrointestinal function
			Explain the mechanism of transport of respiratory gases, control of respiration, respiratory problems and artificial ventilation
			Explain the structure and working of human heart and mechanism of regulation of heart beat; constituents of human blood and blood transfusion and cardiovascular problems
			Illustrate the structure of human kidney, the mechanism of urine formation, hormonal control of kidney function and kidney disorders; osmoregulation and urea cycle
			Enumerate the structure of myofibrils and myofilaments; muscle contractile and regulatory proteins and mechanism of muscle contraction
			Explain different types of nerve cells and glial cells, maintenance of resting membrane potential, generation and propagation of action potential and synaptic transmission
			Describe innate behavior, learned behavior, patterns of behavior and factors that affect behavior
			Enumerate biological rhythms, communication in animals and social organization in mammals
		ZOL4C04T Genetics and Immunology	Describe human karyotype , chromosomal anomalies and polygenic inheritance

			Explain the mechanisms of sex determination
			Enumerate the concept of genes, gene expression, genetic code, transcription and translation
			Illustrate the mechanism of recombinant DNA technology and its practical applications
			Explain the types of cancer, causes of transformation and characteristics of transformed cells
			Identify the cells and organs of immune system, antigens and antibodies
			Enumerate antigen-antibody interaction, generation of B-cell and T-cell response and major immuno-techniques