2.6.1 PROGRAM OUTCOMES, PROGRAM SPECIFIC OUTCOMES AND COURSE OUTCOMES

M.Sc. ZOOLOGY: PROGRAMME OUTCOMES

Programme Specific Outcomes

- Developing deeper understanding of biology at biochemical, molecular and cellular level, physiology and reproduction at organism level.
- Subjects such as embryonic development in mammals, ageing, Recombinant DNA technology and Bio-techniques will facilitate advances in medicine to prevent disease amongst both animals and human beings.
- Ability to connect and apply the knowledge of zoological science for its application in medical entomology, agriculture and modern medicine.
- Development of theoretical knowledge and practical skill in handling the animals and using them as model organism.
- Gains knowledge about research methodologies, effective communication and skills of problem solving methods.
- Maintenance of high standards of learning in animal sciences and individuals will have in-depth knowledge of the subject Zoology.
- Employable candidates will able to choose careers related to teaching in Zoology, especially in schools and colleges, can opt for higher studies (NET, SET, GRE, Government exams like IFS, Biodiversity Boards etc).
- Individuals with aptitude and skill in research can conduct basic scientific research and provide inputs for societal benefits.

COURSE OUTCOME
SEMESTER-I

Paper-IT1, Structure and function of Invertebrates

- Understanding of the universal common ancestor and tree of life, three domain concept of living Kingdom.
- Illustration of nomenclature, modern scheme of animal classification and classical and molecular taxonomic parameters.
- Conceptualization of mode of speciation, evolution, systematics, biological classification,
- Origination, extinction, and causes of differential rates of diversification.

Paper-IT2, General Physiology

- Understanding the concept of regulation of heart-beat and blood pressure.
- Perception of Osmoregulation, Concept of thermoregulation, Heat balance in animals, Adaptations to temperature extremes, torpor, Aestivation and hibernation, Counter current heat exchangers.
- Understanding of adaptations to Stress- basic concept of environmental stress, acclimatization, avoidance and tolerance, stress and hormones
- Conceptualization of metabolic pathways.
- Description of nature of enzymes – kinetics, reaction mechanism of chymotrypsin and lysozyme, purification and physico – chemical characterization, regulation of enzyme activity.
- Understanding of enzyme catalysis and allosterism.

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- Developing concept of metabolic basis of nutrition, metabolic basis of specialized tissue function chromatophores and bioluminescence.

Paper-IT3, Cell Biology and Genetics

- Understanding the morphology and functional characteristics at cellular and sub-cellular (molecular) level.
- Identify link between genetics and cancer with emphasis on oncogenes, chromosome rearrangement and cancer, tumor suppressor genes and genetic pathways to cancer.
- Description of internal transport.
- Description of transport across the plasma membrane.
- Understanding transepithelial transport, maintenance of cellular pH, cell excitation, bulk transport, receptor mediated endocytosis, protein sorting and targeting to organelles.
- Description of cellular shape, motility and energetics- cytoskeletal elements in cell shape and motility, structure and dynamics, role in cell locomotion and mitosis.
- A study of intercellular communication, extracellular matrix, cell- cell and cell-matrix adhesion, gap junctions, cellular energetics, oxidation of glucose and fatty acids, the proton motive force, F0F1 ATP synthase, mechanism and regulation of ATP synthesis.
- Description of life cycle of a cell - cell cycle and its regulation, checkpoints in the mammalian cell cycle.
- Understanding of Mendel's principle, its extension and chromosomal basis.
- Determination of gene action from genotype to phenotype including gene interaction, epistasis, pleiotropy; nature of the gene and its functions.
- A study of Microbial genetics and Human genetics.
- Developing skills in human genetics with capability for karyotyping and nomenclature of metaphase chromosome bands.

Paper-IT4, Advanced Reproductive Biology

- Information about basic concepts of developmental biology.
- Understanding the concepts of organogenesis.
- Elucidation of early embryonic development of invertebrates and vertebrates.
- Illustration of postembryonic development.
- Understanding of process of regeneration in *Hydra, Dugesia* and Annelid worms.
- Familiarity with the process of spermatogenesis, oogenesis, fertilization, with a account of different events involved in it.

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SEMESTER II

Paper-2T1, Structure and Function of Vertebrates

- Description of origin of chordates.
- Description of sensing the environment- photoreception, chemoreception, mechano-reception, kidney development– development of ureteric bud and mesenchymal tubules.
- Illustration of Human origin and evolution.

Paper-2T2, Comparative Endocrinology

- Detailed study of anatomical and structural organization of neuroendocrine organs and nervous system in invertebrates.
- Developing a concept of endocrine system, its function and phylogeny.
- Description of evolution and comparative aspects of endocrine physiology in vertebrates.
- A detailed study of hormones and functions of Pineal organ, Pituitary ,Parathyroid ultimobranchial glands, thyroid gland structure, Adrenal gland, Hypothalamo hypophysial system, Gastro-entero-pancreatic endocrine system and Gonadal hormones.

Paper-2T3, Molecular Biology and Biotechnology

- Imparting knowledge regarding gene mutation, types of gene mutations, DNA damage and repair.
- Developing concept of regulation of gene activity in prokaryotes and eukaryotes at transcriptional and posttranscriptional level.
- Describing structural and functional organization of a typical eukaryotic gene, transcription factors, enhancers and silencers, and non-coding genes.
- Imparting knowledge of basic recombinant DNA techniques, preparation of restriction maps and mapping techniques.
- Understanding of method and applications of nucleic acid probes, blotting techniques,
- DNA fingerprinting and polymerase chain reaction.
- Developing skill to understand biology of cloning and expression vectors.
- Description of gene cloning strategies by transformation of *E. coli* and other cells with rDNA; methods of selection and screening of transformed cells.
- Exposure to principles of DNA sequencing, automated sequencing methods; synthesis of oligonucleotides, primer design.
- Conceptualizing the Micro-arrays techniques along with its application.
- Understanding role of plasmid and transposons.
- Description of siRNA and miRNA basics, regulation of transcription and translation of proteins by miRNA.

Paper-2T4, Advanced Developmental Biology

- Understanding different types of placenta and foetal membranes.
- Concept of aging genes involved in alteration in timing of senescence.
- Understanding of process of regeneration in vertebrates.
- Detailed view of cell death.
- Explanation of embryonic stem cells and their applications.
- Familiarise with various Techniques and tools of Embryology.

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SEMESTER- III

Paper- 3T1, Parasitology and Immunology

- Overview of toxins and antitoxins.
- An overview to the parasitology, animal associations and host – parasite relationship.
- Understanding the mode of infection of parasite and detailed understanding of parasites and their management.
- Importance of immunity in health and disease.
- An overview of the immune system, principles of innate and adaptive immunity. Evolution of innate and adaptive immune system.
- Understanding of antigen recognition by immune cells, role of TLRs.
- Conceptualization of generation of diversity in immunoglobulins and T- cell receptor gene rearrangement.
- Illustration of antigen processing and presentation to T lymphocytes by antigen presenting cells and understanding the role of MHC complex.
- An overview of development and survival of lymphocytes, humoral immune response, production of effector T- cells and effector mechanisms.
- Description of effector mechanisms, NK and NKT cell functions.
- Conceptualization of regulation of immune response, mucosal immunity, immunological memory, cytokines and chemokines. T- cell mediated regulation of immune response, Immunological tolerance and anergy.
- Illustration of allergy and hypersensitivity diseases, autoimmunity, transplant rejection and responses to alloantigens.

Paper-3T2, Special Group-Entomology-I

Insect Morphology and Physiology

- A comparative and detailed study of Insect Morphology and Physiology.
- Study of Integument, Mouth parts, Morphology of head, thorax, abdomen, antennae, legs and genitalia.
- Description of Wing structure and mechanism of flight.
- Detailed study of various system of class Insecta.

Paper-3T3, Special Group-Entomology-II

Classification and Industrial Insects

- Study of insect classification and general characters of various Orders.
- Detailed studies of economically important insects i.e. honey bee and silkworm.

Core (Subject Centric)- I

Paper-3T4 Wild Life and Avian Biology

- Description of nature of ecosystem, production, food webs, energy flow, biogeochemical cycles, resilience of ecosystem and ecosystem management.
- Illustration of Predatory-prey relationship, predator dynamics, optimal foraging theory and predatory dynamics.
- An overview of the Avian Systematic.
- Understanding the diversity and breeding biology of bird.
- Description of biodiversity assessment and conservation of bird.

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SEMESTER-IV

Paper-4T1, Biotechniques, Biostatistics, Ethology, Toxicology and Bioinformatics

- Description of mean, median, mode and SD, Student't' test and probability z- test, Chi square test.
- Understanding the requirements for cell culture; aseptic technique; primary culture; cell lines.
- Detailed study of toxicants related to Environment .
- Familiarizing with various Applications of Bioinformatics.
- To get an insight into the advancement in computerized biology information, introduction to genomics and proteomics databases.
- Construction of phylogenetic trees using molecular data,
- Illustration of protein data bases.
- An introduction to Genbank, UCSC, ENSEMBL, EMBL, DDBJ, protein sequence databases: Swissprot, PDB, BLAST, PSI- BLAST (steps involved in use and interpretation of results), BLAST vs. FASTA, file formats- FASTA and ClustalW.
- An overview of databank search- data mining, data management and interpretation, multiple sequence alignment, genes, phylogenetic analysis.
- Developing compassion towards other animals through animal ethics.

Paper-4T2, Special Group-Entomology-I

Sense organs, social life and Agriculture pests

- Learning and understanding of different sense organs.
- To understand social life and social behaviour of insects.
- Importance and control measures of Agriculture pests.
- Identifying pests of agricultural crops by analyzing ecology, pest status, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest.
- An overview of identification, seasonal history, biology, nature of damage and control measures of pests, of cereals, pulse crops, cotton, vegetables, oil seeds, fruit crops, sugarcane and stored grains.
- To devise cropping pattern to minimize crop loss by a detailed understanding of agro-ecosystem, phases of population

Paper-4T3, Special Group-Entomology-II

Pest control measures and Insects vectors

- To get thorough knowledge about the pest control measures *i.e.* from biological to the chemical.
- Understanding the basic of Integrated Pest Managements techniques used in farming.
- To develop understanding about the various insect vectors *i.e.* life cycle, mode of transmission of pathogen and control measures.

Core (Subject Centric)- II

Paper- 4T4 Radiation and Chronobiology

- Description of milestones in clock research, biological rhythms, advancement in Chronobiology.
- Learning and understanding of entrainment, masking and zeitgeber cycles, organization of circadian system in multicellular animals.

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- Understanding the central and peripheral clock system, circadian pacemaker system in invertebrates and vertebrates.
- To develop understanding of diversity and complexity of the clock system, molecular Biology of the circadian pacemaker system.
- Illustration of the relevance of biological clocks for human welfare - Clock function (dysfunction).
- Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.

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