

# MSC ZOOLOGY

## PROGRAM OUTCOME

Student will be able to develop knowledge and understanding of living organisms at several levels of biological organization from the cellular through molecular to whole organisms level and at ecosystem level in an evolutionary perspective. Student will be able to acquire knowledge related to concepts like ecology, evolution, taxonomy, biochemistry, molecular biology etc. and apply the knowledge in new situations. The student will develop skills in experimental techniques in the subjects of study. The student will be able to develop scientific way of thinking and scientific attitude pertaining to the concepts in ecology, evolution, taxonomy, biochemistry, molecular biology etc.

### Course Outcomes

<p style="text-align: center;"><b>Semester I</b> <b>Paper name: BIOCHEMISTRY AND CYTOGENETICS</b> <b>Code: ZOL1C01</b></p>
<p style="text-align: center;"><b>Course Outcomes</b></p>
CO1. The student will describe the importance of various chemical interactions in the biological system
CO2. The Student develops the ability to analyze the structure, classification, and biochemical properties of carbohydrates from other organic molecules
CO3. The student develops the ability to describe classification, structural organization, and purification techniques of proteins.
CO4. The student acquire knowledge regarding the classification and functions of lipids and fatty acids
CO5. The student develops appreciation on the mechanisms of enzyme action, inhibition, and acquire knowledge regarding classification of enzymes that facilitate the functioning of enzymes
CO6. The student develops appreciation on Watson and Crick model of DNA
CO7. The student will explore various anabolic and catabolic pathways of biomolecules such as glucose, nucleic acids, amino acids and lipids.
CO8. The student develops a conceptual knowledge regarding the principles of energetics in biological systems.
CO9. The student acquire knowledge about the structure and functions of Cellular components, plasma membrane and its models, membrane transport mechanisms and properties , cytoskeletal elements and Intracellular trafficking.
CO10. The student gain knowledge of Chromatin structure and chromosomal alterations, Interrupted genes, gene families and extra chromosomal inheritance.
CO11. The student explore and appreciate the importance of cellular adhesion molecules, cell-cell and cell - matrix interactions, intercellular communications along with noted signal transduction pathways and intracellular signaling mechanisms and their significance.
CO12. The student will describe the process and significance of necrosis and apoptosis and, its regulation in the cellular level
<p style="text-align: center;"><b>Semester I</b> <b>Paper name: BIOPHYSICS AND BIOSTATISTICS</b></p>

**Code: ZOL1C02**

**Course Outcomes**

CO1. The student develops conceptual knowledge regarding the basic principles of physics involved in biological processes.

CO2. The student appreciate the biological aspects and implications of sound energy

CO3. The student appreciate the biological aspects and implications of sound energy

CO4. The student may familiarize with various biophysical and electrophysiological methods

CO5. The student gain conceptual knowledge on the principles of microscopy and apply

CO6. The student explore the possibilities of the applications of separation techniques.

CO7. The student will describe gravity 'G' force and its multi-faceted applications.

CO8. The student will explore and appreciate nano technology as a highly promising arena in biological investigations

CO9. The student skills in various methods of data collection, tabulation and presentation of data for biological research

CO10. The student develops ability to apply measures of central tendency and dispersion in biological research, and various types of probability distribution.

CO11. The student analyze and apply parametric and non parametric tests and its applications in biological research

CO12. The student learn how to apply different types of ecological indexes in biological research

**Semester I**

**Paper name: ECOLOGY AND ETHOLOGY**

**Code: ZOL1C03**

**Course Outcomes**

CO1. The student develops ability to differentiate between the concepts of Habitat, Niche.

CO2. The student explain the concepts of, Ecosystem energetic sand Mineral cycling.

CO3. The student learns to appreciate nature's way to maximize efficiency in utilization of energy and resources; to reduce competition.

CO4. The student will be able describe the characteristics of population growth and species interaction.

CO5. The student will explain the components of Ecological community, the process of Ecological succession, Biomes etc.

CO6. The student will appreciate the complexity of relationship between organisms.

CO7. The student will be able to describe the characteristics of various biogeographically realms, and Indian biodiversity.

CO8. The student will be able to give explanation to the differential distribution of organisms across the world.

CO9. The student will describe the characteristics of various biogeographically realms, and Indian biodiversity

CO10. The student will explain the concept of Carbon credit, Carbon trading etc.

CO11. The student will learn to analyse various aspects of Green building technology and interlinking of rivers.
CO12. The student learn to appreciate the richness of Indian biodiversity and various strategies of Wildlife conservation
CO 13. The student will be able to describe the components of animal behaviour, factors of motivation and conflict behaviour, properties of instinctive behaviour, types of learning, adaptiveness of behaviour, importance of biological rhythms and parental care, influence of hormones on behaviour.
CO 14. The student develops appreciation about the importance of nature watch and field study.
<b>Semester I</b>
<b>Paper name: BIOCHEMISTRY (Practicals)</b>
<b>Code: ZOL2L01</b>
<b>Course Outcomes</b>
CO1. The student develops skills to perform and compare the importance of pH in biological processes.
CO2. The student familiarize with qualitative tests to identify and distinguish various carbohydrates.
CO3. The student learn to conduct qualitative analysis to identify proteins and nonprotein nitrogenous substances
CO4. The student acquires skills to perform quantitative tests for carbohydrates, lipids, proteins and non- protein nitrogenous substances.
<b>Paper name: CYTOGENETICS (Practicals)</b>
<b>Code: ZOL2L02</b>
<b>Course Outcomes</b>
CO1. The student develops skills on the basics of differential centrifugation
CO2. The student explores the knowledge to process and visualize salivary gland polytene chromosome from drosophila larva
CO3. The student gain hands own training in preparing squash preparation of grass hopper testis , to visualize stained chromosomes to identify meotic stages
CO4. The student will be able to compare and evaluate the karyotypes and abnormalities
<b>Paper name: Biophysics and Biostatistics (Practicals)</b>
<b>Code: ZOL2L01</b>
<b>Course Outcomes</b>

CO1. The student familiarize with the instruments/ techniques in biophysics; PH meter, Paper chromatography, TLC, Gel electrophoresis
CO2. The student learns the applications of colorimetry in quantitative analysis
CO3. The student gathers knowledge regarding collection, grouping and graphical representation of data with special emphasis on Microsoft Excel.
CO4. The student learns to calculate measures of dispersion and their applications in data analysis.
CO5. Familiarising with data interpretation in statistics; ANOVA, Correlation and Regression analysis.
<b>Semester II</b>
<b>Paper name: PHYSIOLOGY</b>
<b>Code: ZOL2C04</b>
<b>Course Outcomes</b>
CO1. The student create an awareness among the society to promote balanced lifestyle and improve people's diet
CO2. The student will be able to explain the role of nutrition in health
CO3. Discuss the physiology of various organ systems in the body
CO4. The student will be able to differentiate the structure and functions of various organs in the human body
CO5. The student will describe different functional areas of cerebral cortex
CO6. The student will describe the cardiac cycle
CO7. The student will be able to discuss the physiology and mechanisms of respiration
CO8. The student will Identify and define neuro-anatomical structures
CO9. The student will summarize the various neurological disorders
CO10. Discuss different types of excretory organs in different animal groups
CO11. Explain the role of excretory system in the regulation of water balance, ,acid base balance and electrolyte balance
CO12. Identify the symptoms of life style diseases and suggest ways to control them
CO13. Explain the environment's influence on the physiological function and performance of living organisms
<b>Semester II</b>
<b>Paper name: MOLECULAR BIOLOGY</b>
<b>Code: ZOL2C05</b>
<b>Course Outcomes</b>



CO1. The student will acquire knowledge regarding the mechanism of DNA replication- both chromosomal and extra chromosomal, enzymes involved, models of replication, inhibitors and the significance of DNA replication.
CO2. The student learn to know the safeguard systems of DNA, restriction enzymes and their significance, mechanisms involved in damage and repair of eukaryotic DNA and its importance.
CO3. Learn to explain the general features of genetic code, special features of the genetic code in mitochondria, and variations in genetic code.
CO4. The student gain in-depth knowledge regarding the structural organization of mRNA in prokaryotes and eukaryotes, the mechanism of transcription, translation, post transcriptional and translational modifications, structure , biogenesis and role of ribosomes in protein synthesis ; and RNA editing.
CO5. The student will gain knowledge regarding the regulation of gene expression in Phages, Bacteria, and in Eukaryotes ; recent research findings like antisense RNA strategies and role of si RNA and mi RNA in the regulation of eukaryotic gene expression and their applications.
CO6. The components , organization and special features of eukaryotic genome, interrupted genes and their evolution; concept of gene families, and molecular evolutionary clock.
CO7. Introduction to transposition mechanisms in prokaryotes and eukaryotes , and their significance.
CO8. Molecular mechanisms of genetic recombination,models, and significance.
CO9. Special features of microbial genetics, and organelle genome, their replication and mapping.
CO10. The student gain an in depth knowledge regarding the events and regulation of cell cycle, its alteration and causes of cancer. Genes involved in the regulation of cancer and modern therapeutic interventions like immunotherapy and gene therapy.
<b>Semester II</b>
<b>Paper name: SYSTEMATICS AND EVOLUTION</b>
<b>Code: ZOL2C06</b>
<b>Course Outcomes</b>
CO1. The student develops skills in the identification and taxonomic classification of organisms based on their characters
CO2. The student will be able to describe different levels of taxonomy
CO3. Aware about Place, importance, applications and goals of taxonomy
CO4. Learn about purpose of classification, use of classification, theories of biological classification and types classification
CO5. Explain taxonomic procedures like Taxonomic collections,Curation, Recording of field data, storage of collection, labelling and cataloguing of collection Identification- methods of identification, Use of keys,Taxonomic descriptions, Taxonomic and ecological publication and their difference.
CO6. The student will acquire knowledge regarding Species concept and the taxonomic diversity within species, different kinds of species, sub species and other infra specific categories, hybrids
CO7. Recognize the importance of Zoological nomenclature, International Code of Zoological Nomenclature

CO8. Interpret Principle of priority, Homonymy and Synonymy and Different kinds of types in descriptive taxonomy
CO9. Use new trends in Systematics especially Chemo and Serotaxonomy, Cytotaxonomy, Numerical taxonomy, Cladistics, Molecular systematics and DNA bar coding vs traditional taxonomy
CO10. Recognize the ethics related to taxonomic collections and publication
CO11. Realize the taxonomic impediments
CO12. Describe the mechanism of natural selection and the evolutionary mechanisms
CO13. Explain tempo of evolution
CO14. Describe molecular evolutionary theories like Neutral theory of molecular evolution, Molecular clocks- genetic equidistance- human mitochondrial molecular clock and Phylogenetic relationships
CO15. Recognize Evolutionary trends in Biochemical evolution and primates evolution
CO16. An enhanced knowledge about the Mechanism of natural selection
CO17. The student develops conceptual understanding on Hardy-Weinberg law, founder principle, bottleneck effect and genetic drift, process of Isolating mechanisms-Prezygotic and Postzygotic isolating mechanisms; speciation-allopatric, peripartric-parapatric-heteropatricsympatric speciation; ecotypes etc.
CO18. The student develops appreciation about the major processess involved in the Co-evolution; Microevolution, Macroevolution etc.
CO19. The process involved in the Gradualism and punctuated equilibrium along with anagenesis and cladogenesis will be acquired
CO20. An enhanced level of conceptual learning regarding Neutral theory of molecular evolution; molecular divergence; molecular drive, Molecular clocks- genetic equidistance- human mitochondrial molecular clock , Phylogenetic relationships- DNA barcoding vs traditional taxonomy etc
CO21. An elevated understanding of the Biochemical evolution- Collapse of Orthogenesis along with Stages in primate evolution ; African origin for modern humans, Y-chromosomal Adammitochondrial Eve, the process of Communication, speech, language and self awareness in Primates etc.
<b>Semester II</b>
<b>Paper name: PHYSIOLOGY (Practical)</b>
<b>Code: ZOL2L02</b>
<b>Course Outcomes</b>
CO 1 The student gain practical knowledge regarding the methods of analysis of enzyme activity and its dependent factors
CO2 The student will compare the effects of biotic and abiotic factors on aquatic life
CO3 The student gain a thorough practical knowledge related to the analysis of various blood parametrs
<b>Semester II</b>

<b>Paper name: MOLECULAR BIOLOGY (Practical)</b> <b>Code: ZOL2L02</b>
<b>Course Outcomes</b>
CO1 The student develops practical knowledge to isolate genomic DNA from animal tissues.
CO2 The student acquire hands own training in the Quantification of DNA, RNA and Proteins by colourimetric methods
CO3 As a Core curriculum course, students completing this course along with the practical sessions will demonstrate competence in gathering, analyzing, synthesizing, evaluating and applying information gathered.
<b>Semester II</b> <b>Paper name: SYSTEMATICS AND EVOLUTION (Practical)</b> <b>Code: ZOL2L03</b>
<b>Course Outcomes</b>
CO 1 The student may gather basic knowledge regarding Collection and Identification of animals up to species level
CO2 Scientific handling of specimens collected, preservation and museum curation
<b>Semester III</b> <b>Paper name: IMMUNOLOGY</b> <b>Code: ZOL3C07</b>
<b>Course Outcomes</b>
CO1. An in depth knowledge in the process of immune cell synthesis and maturation, antigen receptor structure and the mechanisms of antigen recognition by B-cell and T-cells.
CO2. The student will explore the Structure and diversity of immunoglobulins, antigens and its classification, production and clinical uses of monoclonal antibodies and antigen antibody interactions.
CO3. The student gain conceptual knowledge regarding key principles, procedure and applications of different Immunetechniques used in the biomedical field and to develop new methods and techniques on the basis of the earned knowledge.
CO4. Mechanisms of humoral and cellular immunity, immune cell receptor and intracellular signal cascades related to immune system activation and response.
CO5. The student explore the fundamentals of Immune effector mechanisms, chemical signaling through cytokines, its therapeutic uses and cytokine related diseases.
CO6. The complement system and its components, hypersensitivity and allergic responses, diseases related to hypersensitivity, autoimmune disorders and complement deregulation.
CO7. The student will appreciate the scientific principles behind vaccination, types of vaccines and their role in fighting diseases.

CO8. The student will be able to describe the mechanisms of autoimmunity and immune deficiency diseases.

**Semester III**  
**Paper name: DEVELOPMENTAL BIOLOGY & ENDOCRINOLOGY**  
**Code: ZOL3C08**

**Course Outcomes**

CO1: The student will gain knowledge on basic concepts in development.

CO2: The student will explain the process of gametogenesis, fertilization and embryonic development.

CO3: The student will appreciate the genetic, cellular and molecular basis of development.

CO4: The student will describe the process of ageing and mechanisms.

CO5: The student realize the impact of environment on development.

CO6: Describe different classes of chemical messengers and their physical characteristics.

CO7. Explain how the secretion of hormone is regulated through positive and negative feedback mechanisms.

CO8: Summarize the anatomy, regulation, and physiological functions of the hormones of the hypophysis, thyroid, parathyroid, pancreas adrenal, hypothalamus and adrenal glands.

CO9: Describe the anatomy of male and female reproductive systems including hormonal functions and pathophysiology.

**Semester III**  
**Paper name: Developmental Biology & Endocrinology (Practical)**  
**Code: ZOL4L04**

**Course Outcomes**

CO1: The student gain knowledge about the identification of different developmental stages of frog.

CO2: The student will identify common larval forms.

CO3: The student gain skills in the vital staining technique.

CO4: The student will be able to perform the whole mount preparation of different developmental stages of chick embryo.

CO5: The student will be trained to do the mounting of various larval forms.



CO6: The student learn the stages of insect development.
CO7: The student compare morphological and histological details of different types of placenta in mammals.
CO8. The student appreciate the effects of hormones in amphibian metamorphosis.
<b>Semester IV</b> <b>Paper name: BIOTECHNOLOGY&amp;MICROBIOLOGY</b> <b>Code: ZOL4C10</b>
<b>Course Outcomes</b>
CO1. The student learn the features of various types of cloning vectors
CO2. The student explore different steps involved in molecular cloning
CO3. The student will describe the techniques involved in the production of molecular probes, Genomic and CDNA library
CO4. The student evaluate and compare various types of PCR techniques
CO5. The student will analyze techniques involved in isolation, sequencing and synthesis of genes
CO6. The student explore and appreciate the applications of biotechnology in animal health care, agriculture and environmental protection.
CO7. The student get familiar with the biotechnological techniques involved in animal cell tissue culture, gene silencing and cloning.
CO8. The student ethical and social implications of biotechnology.
CO9. The student understand taxonomy, structure, nutrition, growth of various microbes
CO10. The student analyze various types of microbial diseases and its control measures,
CO11. The student appreciates beneficial effects of microbes.
<b>Semester IV</b> <b>Paper name: BIOTECHNOLOGY (Practical)</b> <b>Code: ZOL4L04</b>
<b>Course Outcomes</b>
CO1 The student secure hands own training to isolate plasmid DNA and RNA from bacteria and other tissues
CO2 The student know how to separate DNA /RNA by electrophoresis
CO3 The student acquire practical knowledge to work with PCR machine in order to amplify DNA and experience on cell immobilization
<b>Semester IV</b> <b>Paper name: MICROBIOLOGY (Practical)</b> <b>Code: ZOL4L04</b>

<b>Course Outcomes</b>
CO1. The student gather hands own experience in isolation, staining and counting of bacteria
CO2. The student gain better knowledge regarding various sterilization tecniques and bacterial culture
<b>Semester IV</b>
<b>Paper name: MICROTECHNIQUE AND HISTOCHEMISTRY (Practical)</b>
<b>Code: ZOL4L04</b>
<b>Course Outcomes</b>
CO 1 The student attian skills in Tissue fixation and staining
CO 2 Student will demonstrate the differential staining

