

Department of Zoology

M.Sc. Zoology

Upon completion of the Post Graduate programme, the student will attain the ability to:

- PO1: Profound Knowledge:** Attained profound expertise in their discipline
- PO2: Critical Thinking:** Engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.
- PO3: Research and Innovation:** Expertise in practicing the research intelligence and analytical skill in the field of research and innovation.
- PO4: Communication and problem solving:** Demonstrate skills such as effective communication, decision making and problem solving in day-to-day affairs.
- PO5: Problem Solving:** Understand the tools, techniques, models and methodologies to solve problems.
- PO6: Employability:** Demonstrate skills for higher education, professional development and employability.
- PO7: Ethics:** Committed to ethical principles and professional ethics.

Programme Specific Outcome (PSO):

Student enrolled in M.Sc. degree program in Zoology will study and acquire complete knowledge of disciplinary as well as allied biological sciences. After completion of their degree, a Zoology Post graduates can find jobs in numerous sectors. They can work as professors of zoology, work as researchers, animal trainers, wildlife experts and contributes their knowledge for Nation building.

Upon completion of B.Sc. Degree Programmes, the graduate will be able to

- PSO1:** Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology and analyse the relationships among animals, plants, microbes and environment. Gain the Concept and Dynamics of ecosystem, Principles pertaining to limiting factors, Population Growth, Predation and Regulation, Global Environmental Issues and Pollution Biology.
- PSO2:** Get the concept of Bio-membrane, Cytoskeleton, the Organization of Chromosomes, Microbial genetics, Cell cycle, Sex determination and dosage compensation and Techniques and Methods in genetics. DNA replication, Transcription, translation and intra cellular protein trafficking. Acquire the

knowledge of multiple ovulations, embryo transfer and assisted reproduction technologies, basic concept of development, differentiation, morphogenesis, organogenesis and understanding of stem cell biology.

- PSO3:** Understand the Principles and uses of analytical instruments, microscopy, separation and immunological techniques and biostatistics. Acquire the knowledge of Bioenergetics, Biochemistry of macro and micro molecules. Gain the concept of Biosystematics, Pattern of genetic variation and natural selection, Molecular evolution, Mechanism of speciation and Population genetics.
- PSO4:** Understand the innate and acquired immunology, Nature of Antigens, Structure and functions of Antibodies, Antigen- antibody interaction, Complement system, Cytokines, Organization and expression of immunoglobulin genes and immune diseases. - Gain the knowledge of hormones, its biosynthesis, hormone receptors and principles of hormone action. Acquire the knowledge about basics of animal, social and reproductive behaviour biological rhythms and control of behaviour.
- PSO5:** Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Entomology, Nematology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology, Chemical biology, Genetic engineering and Research Methodology.
- PSO6:** Gains knowledge about research methodologies, effective communication and skills of problem-solving methods.

Semester – I

Course Code: MZOCC- 101

Course Name: Functional Biology of Invertebrates and Chordates

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Comprehend the concept and organization of coelom and its significance

CO2: Learn and appreciate the invertebrate larvae, their types and significance; feeding pattern, mode of nutrition, mechanism and the organs associated in

digestion; concept of respiration, respiratory pigments, and the mechanism of respiration in invertebrates.

CO3: Understand and describe the modes of excretion, organs involved in excretion and the mechanism of osmoregulation in invertebrates.

CO4: Understand and describe the neurotransmitters, conduction of nerve impulse, muscle contraction and mechanism of thermoregulation in invertebrates.

Semester – I

Course Code: MZOCC- 102

Course Name: Molecular Cell Biology

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Describe the concept of bio-membrane system i.e., their composition, structural arrangement, their types and mechanism of transport.

CO2: Describe the structure and function of microtubules and microfilament in cytoskeleton, role of kinesin and dynein, axonal transport and cell movement etc.

CO3: Understand the concept of DNA replication in Prokaryotes and Eukaryotes, DNA damage and repair mechanism; Transcription in Prokaryotes and Eukaryotes; Regulatory elements and DNA binding domains of transcription apparatus; Processing of primary transcript and RNA editing in eukaryotes.

CO4: Describe the mechanism of Gene Regulation in Prokaryotes and Eukaryotes.

Semester – I

Course Code: MZOCC -103

Course Name: Genetics

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Differentiate between organization of prokaryotic and eukaryotic chromosomes; explain heterochromatin and functional significance of polytene and Lampbrush chromosomes.

CO2: Understand microbial genetics and reproduction in bacteria; construct linkage map in bacteria.

- CO3:** Understand and explain the concept of cell cycle, sex determination and dosage compensation.
- CO4:** Understand different techniques used in DNA sequencing, DNA amplification and DNA finger printing and analyze the genome expression.

Semester – I

Course Code: MZOO CC-104

Course Name: Practical

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Prepare and demonstrate polytene chromosomes from Chironomus/ Drosophila larvae.
- CO2:** Calculate mitotic index by preparing slides from onion root tip and study stages of meiosis by preparing slides from grasshopper testes.
- CO3:** Enumerate RBC and WBC (TC and DC) by preparing blood smear and prepare slides of invertebrate larvae to show detailed structure.
- CO4:** Solve problems related to concept of Mendelian principle of inheritance, sex-linked inheritance and pedigree of human.

Semester – I

Course Code: MAECC-101

Course Name: Ability Enhancement Compulsory Course

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the sustainable development and ecosystem and discuss the environmental pollution, climate change, ozone layer depletion, threats of encroachment on habit and habitat of flora and fauna.
- CO2:** Understand biodiversity and its conservation, three 'R', environmental education, awareness programme and ecological economics.
- CO3:** Understand the importance of swachhata, sanitation and hygiene. Describe the Gandhian approach towards social and environmental moral values.
- CO4:** Study the case of sanitation and effect of cleanliness.

Semester – II

Course Code: MAECC -2

Course Name: Ability Enhancement Compulsory Course

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the variety of moral issues, principles of ethics and morality and duties and rights of employees and employers.
- CO2:** Understand the vedantic ethics, ethics in finance, intellectual property rights, computer and professional ethics, management patterns.
- CO3:** Study the case of typical holistic technologies.
- CO4:** Define gender and understand the gender spectrum, gender-based division of labour- domestic work and use value. and know about the gender justice, human rights, constitutional and legal perspectives, emerging issues and challenges.

Semester – II

Course Code: MZOO CC-205

Course Name: Environmental Science

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the concept and dynamics of ecosystem, abiotic and biotic factors and different energy flow models. Describe biogeochemical and hydrological cycles.
- CO2:** Discuss the principles pertaining to limiting factors such as Liebig's law of minimum and Shelford's law of tolerance.
- CO3:** Understand demography, population growth and its regulation mechanism and gain the concept of niche, resource partitioning and character displacement.
- CO4:** Understand the global environmental issues and importance of wild life conservation. Define pollutants, its source and classification, biomagnification and eutrophication and bio-indicators as index of pollution.

Semester – II

Course Code: MZOO CC-206

Course Name: Bio-instrumentation & Biostatistics

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the principles and uses of analytical instruments, microscopy and different separation and immunological techniques.
- CO2:** Understand the basic concepts in biostatistics.
- CO3:** Learn to calculate mean, standard deviation, standard error, correlation and regression.
- CO4:** Understand the rules of probability and test of significance.

Semester – II

Course Code: MZOO CC-207

Course Name: Biochemistry

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the laws of thermodynamics, enthalpy, entropy, concept of free energy, redox potential, energy rich compounds, mitochondrial electron transport chain and oxidative phosphorylation.
- CO2:** Explain different types of carbohydrates, glycolysis, HMP shunt, glyconeogenesis and glycogenolysis.
- CO3:** Understand the biochemistry of proteins and lipids, peptide conformation, synthesis and importance of fatty acids. Discuss enzymes, its mechanism of action, enzyme kinetics, free radicals and antioxidants.
- CO4:** Explain the general principles of histochemistry of carbohydrate, protein, lipid, nucleic acids and enzymes. Understand the general principles of fixation and staining.

Semester – II

Course Code: MZOO CC-208

Course Name: Biosystematics and Evolution

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Understand the basic concept of biosystematics and taxonomy, its importance and application in biology, hierarchy of categories, species concept, International code of Zoological nomenclature (ICZN) and trends in taxonomy.
- CO2:** Understand the pattern of genetic variation and natural selection (Darwinian and neo- Darwinian) and mode of its operation, mechanism of molecular evolution, neutral theory of molecular evolution and origin of new genes and evolution of multi gene family.
- CO3:** Explain the mechanism of speciation, reproductive isolation and its role in evolution and different models of speciation.
- CO4:** Understand the concept of gene pool, allele frequency and genotype frequency, Hardy-Weinberg principle of genetic equilibrium and its destabilizing forces such as Natural selection, Mutation, Migration, Meiotic drive and Genetic Drift.

Semester – II

Course Code: MZOO CC-209

Course Name: Practical

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Determine the salivary amylase activity. Estimate glucose, urea, uric acid or albumen in a given sample by colorimetry. Separate amino acids by paper chromatography.
- CO2:** Identify and comment upon the spots of evolutionary significance.
- CO3:** Use the reagents such as PAS, Alcian Blue, Sudan Black B, Sudan III/IV, Feulgen, Methyl green- Pyronin and Mercury bromophenol for histochemical demonstration.
- CO4:** Measure pH and estimate dissolved O₂, free CO₂, carbonate & bicarbonate alkalinity and total hardness. To understand the composition & assess taxonomic diversity or biodiversity in a habitat (of grassland, arid & wetland).

Semester – II

Course Code: MZOO SEC-201

Course Name: Solid Waste Management

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Describe the components of solid waste management and the laws governing it.
- CO2:** Discuss the solid waste collection systems, route optimization techniques and processing of solid wastes.
- CO3:** Outline the design, operation, and maintenance of different methods of treatment.
- CO4:** Describe the safety environmental issues. To conclude the recent trends in reuse of solid waste.

Semester – II

Course Code: MZOO SEC-201

Course Name: Solid Waste Management (Practical)

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Know about disposal of different wastes in waste-bin.
- CO2:** Learn method of composting and vermicomposting.
- CO3:** Learn methodology of Autoclaving.
- CO4:** Learn methodology of Biogas production.

Semester – III

Course Code: MZOO CC-310

Course Name: Vertebrate Immunology

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Describe the evolution of immunology, historical perspective.
- CO2:** Describe the fundamental concept of Innate and adaptive immunity.
- CO3:** Develop the basic concepts of Antigenicity and immunogenicity.

CO4: Describe the molecular structure and function of major histo- compatibility complex and to describe the types of hypersensitivity and mechanism of tolerance.

Semester – III

Course Code: MZOO CC-311

Course Name: Gametes and Developmental Biology

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Develop the basic concepts of development.

CO2: Explain the fundamental concept of embryogenesis.

CO3: Explain the fundamental concept of Organogenesis.

CO4: Describe the developmental model systems- invertebrates and vertebrates.

Semester – III

Course Code: MZOO CC-312

Course Name: Vertebrate Endocrinology

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Understand basic principles of homeostatic regulation of biological systems.

CO2: Familiar with the tools and techniques used in the study of hormones and chemical messengers.

CO3: know the structures and biosynthetic pathways of major families of chemical messengers.

CO4: Recognize the diversity of hormone receptor systems and transduction pathways. To acquire a systems-based working knowledge of important hormonally regulated physiological processes.

Semester – III

Course Code: MZOCC-313

Course Name: Animal Behaviour

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Explain the relationship of behaviour and Cognition.

CO2: Explain Rhythmic behaviours.

CO3: Explain Social behaviours.

CO4: Understand feeding and Reproductive behaviour and describe behaviour assessment.

Semester – III

Course Code: MZOO CC-314

Course Name: Practical

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Develop skill of determination of blood group, preparation of blood film and identification of blood cells of immunological importance.

CO2: Perform hormonal assessment of T3/Testosterone/Oestrogen by ELISA reader.

CO3: Identify and comment on endocrinological slides, embryological slides and endocrine glands in a mammal.

CO4: Prepare a permanent mount of chick embryo and identification to embryonic stages of chick. To learn behavioral aspects in animals such as parental care, caste system of given laboratory specimen and also learn methodology of communication in honey bees.

Semester – IV

Course Code: MZOO DSE-401

Course Name: Entomology

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Compare and differentiate the morphology and anatomy of Insects.

- CO2:** Summarize the histological importance of the following systems: digestive, respiratory, nervous, circulatory, excretory and reproductive system.
- CO3:** Explain the importance of following systems: The Sense organs, Endocrine glands and Exocrine glands.
- CO4:** Discuss the importance of Integrated Pest Management, fundamentals of agricultural, veterinary and forensic entomology.

Semester – IV

Course Code: MZOO DSE-402

Course Name: Entomology (Practical)

Course Outcomes: On completion of the course student will be able:

- CO1:** Dissect grasshopper or honey bee or wasp to expose and investigate its general anatomy and nervous system.
- CO2:** Prepare permanent slides of different parts of insects.
- CO3:** Identify and comments upon morphological and histological slides of insects.
- CO4:** Summarize the life history of pests.

Semester – IV

Course Code: MZOO DSE-401

Course Name: Chemical Biology

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Discuss the basic principles of organic, medicinal, structural and biophysical chemistry of molecules, and their interactions in biological systems.
- CO2:** Demonstrate the basic concepts of drug discovery, drug designing and protein engineering using various techniques related to biochemistry.
- CO3:** Outline the basics of nanotechnology and its application in drug delivery for understanding diseases like cancer.
- CO4:** Simplify the functional genomic approaches in chemical biology.

Semester – IV

Course Code: MZOO DSE-402

Course Name: Chemical Biology (Practical)

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Perform experiments on chromatography.

CO2: Perform experiments to synthesize nanoparticles.

CO3: Perform experiments on isolation and purification of DNA and RNA from a given sample.

CO4: Perform experiments on esterification/hydrolysis reaction.

Semester –IV

Course Code: MZOO DSE-401

Course Name: Cell and Molecular Biology

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Outline the mechanisms of gene expression and various regulatory pathways involved in both prokaryotes and eukaryotes at molecular level.

CO2: Summarize the cell cycle and proteins involved in the regulation and molecular defects leading to cancer.

CO3: Discuss various signal transduction pathways and their regulation at molecular level in a cell.

CO4: Investigate the new developments in molecular biology and its implications in human welfare using Recombinant DNA Technology.

Semester – IV

Course Code: MZOO DSE-402

Course Name: Cell and Molecular Biology(Practical)

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Perform experiments on vital staining of secretory granules and mitochondria.
- CO2:** Demonstrate cytochemical properties of proteins, lipids, carbohydrates and nucleic acids.
- CO3:** Identify and comment upon cytological slides.
- CO4:** Identify and analyze Barr body from buccal epithelial cells. To estimate sperm, count from epididymal wash of laboratory mammals and study abnormal sperms

Semester – IV

Course Code: MZOO DSE–401

Course Name: Cytogenetics

Course Outcomes: On completion of the course student will be able:

- CO1:** Summarize the cell cycle and proteins involved in the regulation and genetic basis of cancer.
- CO2:** Explain and compare the molecular mechanism of mutation and recombination and disease related to them.
- CO3:** Discuss and perform experiments on various tools and techniques in molecular biology used for genetic analysis.
- CO4:** Explain the genetics of development in model organism: *Caenorhabditis elegans*.

Semester – IV

Course Code: MZOO DSE–402

Course Name: Cytogenetics (Practical)

Course Outcomes: On completion of the course student will be able:

- CO1:** Examine meiosis in grasshopper testis.
- CO2:** Investigate polytene chromosomes and its banding pattern.
- CO3:** Detect micronuclei in cheek cell/fish erythrocytes.
- CO4:** Solve genetic problems related to Mendelian laws, linkage & crossing over, sex linked inheritance.

Semester – IV

Course Code: MZOO GE-401

Course Name: Genetic Engineering

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Summarize various types of bacterial vectors (e.g., pBR322, pUC), Phage vectors (e.g., Lambda, M13) and Plant vectors (e.g., Ti, Ri) relevant to genetic engineering.
- CO2:** Apply the concept of cDNA and genomic libraries and various blotting techniques.
- CO3:** Demonstrate various molecular biology tools and techniques used in genetic engineering.
- CO4:** Apply the principles and techniques of molecular biology for further education and employment.

Semester – IV

Course Code: MZOO GE-402

Course Name: Genetic engineering (practical)

Course Outcomes:

After completion of the course, the student will be able to:

- CO1:** Learn to perform experiments for isolation of genomic DNA and plasmid from given sample.
- CO2:** Determine molecular weight of DNA.
- CO3:** Prepare competent bacterial cell by calcium chloride method.
- CO4:** Perform experiments X Ray diffraction of macromolecules.