

Name of the Programme: M.Sc. Zoology (NEP 2020)

❖ Program outcomes (POs) :

After successfully completing the M. Sc. Zoology program students will be able to :

1. Identify a range of invertebrates and vertebrates and justify their conservation.
2. Analyse the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will be able to identify the species based on molecular taxonomy.
3. Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.
4. Identify, review research literature and analyse complex situations of living forms.
5. Design concepts that meet the specified needs with appropriate consideration for the public health, safety, cultural, societal, and environmental considerations.
6. Propose hypothesis, formulate tests, use various modern instruments for biological analysis, data collection, field surveys, interpret the data and find answers.
7. Distinguishes different ecosystems based on biological, chemical and physical features; correlates the morphology, physiology and behaviour with the properties of habitat.
8. Utilize research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions in real situations.
9. Create, select and apply appropriate techniques, resources and ICT tools for understanding of the subject.
10. Illustrate the impact of natural and anthropogenic activities in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.
11. To sensitized regarding the ethical principles, professional ethics, responsibilities and norms of permission from the concerned agencies regarding animal experimentation and collection of biological resources.
12. Exhibits management skills in applied branches of Zoology like Vermiculture, Apiculture, Sericulture, Aquaculture, Agriculture & Entomology.
13. Elaborate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

❖ **Course Outcomes:**

Name of the Class	Course Code	Course Title	Course Outcomes	
SEMESTER I				
M.Sc. I	ZOO 501 MJ	Advanced Biochemistry	CO1	Understand the basic terminologies of Biochemistry.
			CO2	Describe the concepts and regulation of metabolism.
			CO3	Describe the oxidation of fatty acids and its significance.
			CO4	Illustrate the reactions, energetic and regulation of glycolysis, glycogen biosynthesis, TCA cycle, purine and pyrimidine metabolism.
			CO5	Draw the general reactions of various metabolic pathways.
			CO6	Justify the role of enzymes and their regulation in metabolism.
M.Sc. I	ZOO 502 MJ	Advanced Cell Biology	CO1	The learner will understand the preparation of staining methods and nuclear organization.
			CO2	Demonstrate the ability to use discipline specific research techniques.
			CO3	Organization of cytoskeleton and their associated protein.
			CO4	The learner will understand the application and pluripotency of stem cell.
			CO5	The learner will be aware about the cell culture & its applications.
			CO6	To understand the organization of cell signaling and their receptors.
M.Sc. I	ZOO 503 MJ	Comparative Embryology	CO1	The course gives detailed idea about advantage in the area of clinical embryology.
			CO2	Basic definitions and concepts in embryology.
			CO3	Concept of fertilization and how internal and external fertilization ensures species specificity.

			C04	Different types of egg and cleavage patterns according to developmental need of embryo and processes of blastulation.
			C05	To understand the mechanism of gastrulation resulting into separation of germ layers.
			C06	To understand the mechanism of regeneration and metamorphosis in organisms.
M.Sc. I	ZOO 504 MJ	Medical Entomology	C01	Understand, classify, and identify insects of medical and veterinary importance.
			C02	Incorporate the subject knowledge in designing innovative techniques of vector control.
			C03	Better prepared to contribute to the field of public and community health.
			C04	Understand molecular aspects of diseases of medical importance.
			C05	Capable of joining the research areas pertinent to vector borne diseases.
M.Sc. I	ZOO 505 MJ	Biosystematics & Biodiversity	C01	Explain Fundamental concepts and principles used in Systematics and Biodiversity.
			C02	Assess the current status of animal biodiversity of our Nation & the World and threats to biodiversity.
			C03	Identify and classify major groups of animal kingdom.
			C04	Apply techniques of animal collection, preservation, and identification.
			C05	Explain and perform basic Taxonomic procedures employed by animal taxonomists.
			C06	Explain and use Zoological nomenclature during taxonomic research.
			C07	Explain and Discuss the basic concepts in molecular phylogenetics.
			C08	Explain and apply Techniques used in Phylogenetic analysis and Calculation of biodiversity indices.

M.Sc-I	ZOO 506 MJP	Laboratory Exercises in Biochemistry and Cell Biology	CO1	Make the buffers of known pH and molarity.
			CO2	Estimate protein & carbohydrates from the given sample.
			CO3	Assess the enzyme activity and factors affecting it.
			CO4	Perform paper chromatography, thin layer chromatography.
			CO5	Analyse samples using thin layer and paper chromatography
			CO6	Isolate subcellular organelles and perform marker enzyme assays.
			CO7	Identify various stages of mitosis and meiosis.
			CO8	Understand and differentiate between dead and live cells.
			CO9	Isolate nuclei, lysosomes & mitochondria from cells.
M.Sc-I	ZOO 507 MJP	Laboratory exercises in Biosystematics, Biodiversity and Medical Entomology	CO1	Apply and perform the techniques of animal collection, preservation, and identification.
			CO2	Apply and perform the techniques of animal specimen storage and curation of preserved specimens.
			CO3	Apply and perform the calculation of biodiversity indices.
			CO4	Apply and Perform Phylogenetic analysis using MEGA software.
			CO5	Conduct biodiversity survey with scientific and non-invasive collection techniques and understand role as biodiversity protector, preserver and promotor of life of animals.
			CO6	Understand the medical importance of insects and their role as vector. Know the causes of arthropod-borne diseases.
			CO7	Know the role of insects in forensic investigations.
			CO8	Apply knowledge of prophylaxis or preventive measures against diseases caused by insect vectors.
M.Sc-I	ZOO 512 MJ	Fresh Water Zoology	CO1	Get introduced to the freshwater ecosystems.
			CO2	Illustrate the physical and chemical properties of water.
			CO3	Acquire skills to critically evaluate scientific aspects of Freshwater Zoology.
			CO4	Acquire skills to critically evaluate scientific aspects of Freshwater Zoology.

			CO5	Get aware with the threats and an opportunity to resolve the issues related to freshwater habitats.
			CO6	Introduced with the current issues of the subject.
M.Sc-I	ZOO 513 MJP	Laboratory Exercises in Freshwater Zoology	CO1	Get hands on training experience in limnological techniques.
			CO2	Will be able to identify freshwater invertebrates.
			CO3	Understand the relevance of freshwater fauna to the aquatic ecosystems.
			CO4	Able to culture zooplanktons.
			CO5	Understand the aquatic adaptations in freshwater fauna.
M.SC-I	ZOO 541 RM	Research Methodology	CO1	Explain concept of research methodology.
			CO2	Define research problem.
			CO3	Explain need of literature review in research.
			CO4	Prepare research designs and explain their characteristics.
			CO5	Collect and present the data.
			CO6	Analyse data by using appropriate tests.
			CO7	Write research report and research paper.
M.Sc-I	ZOO 542 RMP	Laboratory Exercises in Research Methodology	CO1	Suggest suitable title for a research article
			CO2	Write the abstract, key words, result, discussion, conclusion and citations of references.
			CO3	Write a research project proposal to seek funding.
			CO4	Use MS excel in presentation and analysis of data using common statistical tests.
			CO5	Conduct a scientific survey.
SEMESTER II				
M.Sc-I	ZOO 551 MJ	Molecular Biology	CO1	Discuss the basic features of chromatin essentially to get insight of gene.
			CO2	To study the structure and types of DNA and RNA, physical properties and topology of DNA and genome organization.
			CO3	Understand the details of DNA replication in prokaryotes and eukaryotes, enzymes involved in the

				process of replication, significance of replisome and primosome.
			CO4	Understand the process of transcription both in prokaryotes and eukaryotes with reference to enzymes involved in details, transcriptional unit.
			CO5	Understand the genetic code; ribosome structure.
M.Sc. I	ZOO 552 MJ	Comparative Endocrinology	CO1	Discuss the chemical signals & bioregulation of endocrine gland in vertebrates.
			CO2	Explain the synthesis, secretion, metabolism & mechanism of action of vertebrate hormone.
			CO3	Describe the hypothalamus - pituitary system.
			CO4	Justify the comparative aspects of hormones and their physiological functions / role in vertebrates.
			CO5	Describe the adrenal glands of mammalian and non - mammalian vertebrates.
			CO6	Explain the hormonal control of calcium and phosphate homeostasis.
			CO7	Discuss the comparative endocrinology of feeding, digestion and metabolism in vertebrates.

M.Sc-I	ZOO 553 MJ	Comparative Animal Physiology	CO1	Explain digestive system, concept of digestion and enzymes involved digestion.
			CO2	Understand the process of respiration and importance of O ₂ and CO ₂ .
			CO3	Illustrate the structure of the skeletal muscle, proteins involved in muscle contraction and role of Calcium ions in contraction.
			CO4	Justify the concepts of osmole, osmolarity, tonicity and ionic regulation in different environment.
			CO5	Explain process of excretion, functions of mammalian kidney and role of Renin - Angiotensin system in excretion.
			CO6	Understand different thermo-biological terminology and mechanism of thermoregulation in different animals.
			CO7	Explain different types of sense organs and their functions.
M.Sc. I	ZOO 554 MJ	Biochemical Techniques	CO1	Understand the principle of light, fluorescence, scanning, transmission electron microscope.
			CO2	Understand the principle of centrifugation, various types of Centrifugations, rotors and its applications.
			CO3	Understand the principle and differences between various types of chromatography techniques.
			CO4	Know about agarose and polyacrylamide gel electrophoresis.
M.Sc. I	ZOO 555 MJ	Integrated Pest Management	CO1	Understand basics of IPM, principles, tools, ethics & significances.
			CO2	Detect and diagnose different insect pests, their diseases & calculate economic injury level, economic threshold level.
			CO3	Understand pesticides, fungicides, herbicides, bio-herbicides and different methods used for pest control.

			CO4	Know different Entomopathogenic organisms.
			CO5	Apply advanced technology for pest control.
MSC 1	ZOO 556 MJP	Laboratory Exercises in Biochemical & Molecular Techniques	CO1	Understand various components of light, fluorescence, scanning, transmission electron microscope.
			CO2	Perform density gradient centrifugation.
			CO3	Perform thin layer chromatography.
			CO4	Perform paper chromatography.
			CO5	Perform sterilization of lab equipment.
			CO6	Isolation and quantification of prokaryotic and eukaryotic nucleic acids.
			CO7	Understand how to extract and quantify DNA from samples.
			CO8	Understand how to extract and quantify RNA from samples.
			CO9	Understand how to extract and quantify proteins from samples.
			CO10	Know the in-depth knowledge about agarose and polyacrylamide gel electrophoresis.
MSC 1	ZOO 557 MJP	Laboratory Exercises in Comparative Animal Physiology & Endocrinology	CO1	Perform estimation of amylase from human saliva.
			CO2	Demonstrate oxygen consumption in relation to body size.
			CO3	Demonstrate rate of salt loss / gain in fish.
			CO4	Demonstrate effect of different physiological conditions on red blood cells.
			CO5	Perform detection of nitrogenous waste products in different animal groups.
			CO6	Perform estimation of sugar in rat / crab / human blood.
			CO7	Demonstrate bleeding & clotting time of human blood.
			CO8	Understand structural and functional difference between invertebrate and vertebrate neurosecretory and endocrine

				organs.
			CO9	Demonstrate location of endocrine glands
			CO10	Illustrate blood sugar regulation in the crab - role of eye stalk.
			CO11	Demonstrate alloxan diabetes introduction in mouse / rat
			CO12	Demonstrate pancreatectomy and thyroidectomy in experimental animals.
			CO13	Demonstrate effect of epinephrine on blood sugar level and liver glycogen.
		Economic Zoology	CO1	To gain knowledge about economically important branches of zoology.
			CO2	To gain knowledge about aquaculture.
			CO3	To acquaint knowledge about the culture techniques of fish.
			CO4	To acquaint the knowledge about biofloc fish farming.
			CO5	To learn concepts of sponge cultivation and related practices.
			CO6	To motivate the students for starting their self-employment.
			CO1	To gain knowledge about economic importance of prawn species.
			CO2	To gain knowledge about economic importance of molluscs.
		Laboratory Exercises in Economic Zoology	CO3	To acquaint knowledge about the culture techniques of pearl.
			CO4	To acquaint the knowledge about biofloc fish farming.
			CO5	To learn tank design and construction.
			CO6	To motivate the students for starting their self-employment.
		On Job Training OR Field Project	CO1	Develop problem-solving skills.
			CO2	Demonstrate knowledge of research processes.
			CO3	Develop hands-on experience in a specific field of zoology.
MS.c-I	ZOO 562 MJ			
M.Sc-I	ZOO 563 MJP			
M.Sc-I	ZOO 581 OJT/FP			

			C04	Perform literature review using print and online databases.
			C05	Select and define appropriate research problem and parameters to prepare a project report.
			C06	Identify, explain, compare, and prepare the key elements of a research proposal.
			C07	Compare and contrast quantitative and qualitative research paradigms.
			C08	Use sampling methods, measurement scales and instruments, and appropriate uses of each.
			C09	Develop awareness about biodiversity conservation.