

**CO & PO FOR M.Sc. IN ZOOLOGY,
POST GRADUATE DEPARTMENT OF ZOOLOGY
DARJEELING GOVERNMENT COLLEGE,
LEBONG CART ROAD, DARJEELING – 734101
UNDER UNIVERSITY OF NORTH BENGAL**

w.e.f. 2017-2018

Program Name: M.Sc. in Zoology

Programme Outcomes (PO)

After the completion of M.Sc. in Zoology, the students will be able to achieve the following outcomes:

PO1: Inculcate critical thinking to carry out scientific investigation objectively.

PO2: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results and draw reasonable conclusions thereof.

PO3: Provide knowledge of a wide range of scientific techniques and applications of methods/tools in related fields.

PO4: Imbibe effective scientific and/or technical communication in both oral and writing.

PO5: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in Animal Sciences.

PO6: Provide advanced knowledge on topics in latest developments in the fields of Animal Sciences, empowering the students to pursue higher degrees at reputed academic institutions.

PO7: Prepare students for pursuing research or careers in industry in Animal Sciences and applied fields.

PO8: Prepare students for pursuing teaching careers in Schools, Colleges and Universities.

PO9: Assist students in preparing for competitive exams such as NET, SET, GATE, etc.

PO10: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities to the society and the Country at large.

Programme Specific Outcomes (PSO)

Students with M.Sc. in Zoology will be able to:

PSO1: Understand the biological diversity and grades of complexity of various animal forms through their systematic classification (taxonomy) and comparative structural and functional studies.

PSO2: Learn about evolution of primates on earth and population genetics and population ecology.

PSO3: Understand the structure and functioning of ecosystem, issues and management of environmental resources, deterioration of environment due to anthropogenic activities and protection of environment through sustainability.

PSO4: Understand the basic principles and concepts of genetics, biochemistry, developmental biology, endocrinology, immunology, physiology, neurobiology, cell and molecular biology.

PSO5: Delve into the wonderful world of parasites, insects and fishes, their diversity and economic importance (both beneficial and harmful aspects).

PSO6: Acquire knowledge on ecology, ethology, biodiversity, wildlife biology, conservation biology and climate change biology which will help them to protect diverse life forms and mitigate effects of climate changes.

PSO7: Develop technical skills in biotechnology, bioinformatics, biostatistics and biophysical techniques and apply these skills in research and industry.

PSO8: Perform laboratory procedures as per standard protocols in the areas of animal diversity, biochemistry, cytogenetics, ecology, developmental biology, taxonomy, biometry, biophysical techniques, entomology, parasitology, fisheries and environmental sciences.

Course Outcome (CO)

Programme Name: M.Sc. in Zoology			
Semester	Course Code and Course Name	Course Unit	Course Outcome CO
Sem-I	DZOO-CT-101: Functional biology of Non-chordates and Insect Biology	Unit 1: Non-chordates	❖ Students will learn about feeding pattern, digestion, respiration, excretion and nervous system of non-chordates.
		Unit 2: Insect Biology	❖ Students will gain knowledge regarding taxonomy, reproduction of insects, concept of pest, pesticides and pest control including IPM.
	DZOO-CT-102: Functional biology of Chordates and Fish Biology	Unit 1: Chordates	❖ Students will learn about nervous system, urogenital system, respiratory system, circulatory system, skeletal system and integument of chordates.
		Unit 2: Fish Biology	❖ Students will acquire knowledge regarding migratory behaviour, osmoregulation, parental care in fishes, different types of fish farming along with prawn and pearl culture.
	DZOO-CT-103: Genetics and Biochemistry	Unit 1: Genetics	❖ Students will learn about basic concept of gene, sex determination, human karyotype, extra-chromosomal inheritance, chromosomal aberrations and genetic disorders.

	Unit 2: Biochemistry	<ul style="list-style-type: none"> ❖ Students will come to know about biomolecules and biomolecular interactions, with emphasis on protein structure, folding, function and enzymology including bioenergetics and biotransformation.
DZOO-CT-104: Ethology and Wildlife Biology	Unit 1: Ethology	<ul style="list-style-type: none"> ❖ Students will come to know about innate and learnt behaviour, ecological aspects of behaviour, group selection, sexual selection, cooperation, conflict and reproductive behaviour in animals.
	Unit 2: Wildlife Biology	<ul style="list-style-type: none"> ❖ Students will understand about wildlife; importance, classification and habitats of wildlife, significance of wildlife conservation, different conservation strategies, wildlife conservation and management in India.
DZOO-CP-105: Non-chordates and Chordates	Unit 1: Non-chordates	<ul style="list-style-type: none"> ❖ Students will learn to identify non-chordate and chordate specimens based on taxonomic characters. ❖ Students will gain knowledge about dissection of nervous system, nephridium, spermatheca and setae of earthworm, sting apparatus and mouth parts of honey bee, pituitary gland, swim bladder, Weberian ossicles and scales of carp, cranial nerves of <i>Gallus</i>.
	Unit 2: Chordates	

	DZOO-CP-106: Biochemistry and Cytogenetics	Unit 1: Biochemistry	❖ Students will be able to estimate glucose, proteins, DNA (by colorimetry /spectrophotometry method) and sugars (by Somogyi-Nelson method) and check effect of substrate concentration and temperature on enzyme activity.
		Unit 2: Cytogenetics	❖ Students will learn how to estimate gene and genotype frequencies, analyse pedigrees, prepare sex chromatin, identify mutant varieties of <i>Drosophila</i> sp. and ABO blood grouping of their own blood.
	DZOO-CP-107: Choice Based Seminar		This is to evaluate the knowledge, presentation technique, communication skill, presence of mind and overall smartness of a student.
Sem-II	DZOO-CT-201: Developmental Biology and Endocrinology	Unit 1: Developmental Biology	❖ Students will come to know about spermatogenesis, oogenesis, fertilization events and developmental events in detail.
		Unit 2: Endocrinology	❖ Students will get to know about hormones--- their regulation, classification, chemical nature, mode of action, neuroendocrine regulation and endocrine glands of the body.

DZOO-CT-202: Environmental Physiology and Neurobiology	Unit 1: Environmental Physiology	❖ Students will accumulate knowledge about environmental stress, homeostasis, thermoregulation, physiological adaptations and biochemical adaptations of organisms in response to different environments.
	Unit 2: Neurobiology	❖ Students will come to know about structure and function of CNS, nerve impulse generation and propagation, synaptic function, neuromuscular junction and different aspects of some common neuronal disorders.
DZOO-CT-203: Cell and Molecular Biology	Unit 1: Cell Biology	❖ Students will gain knowledge about biomembranes, cytoskeleton, cell cycle, genetic code and chromosomes in detail.
	Unit 2: Molecular Biology	❖ Students will learn about basic concepts of cancer that are required for medical and research purposes.
DZOO-CT-204: Ecology and Climate Change Biology	Unit 1: Ecology	❖ Students will gain knowledge about community structure, habitat fragmentation, ecotone dynamics, ecological efficiency, population growth, energy transfer, species richness and species diversity.

	Unit 2: Climate Change Biology	<ul style="list-style-type: none"> ❖ Students will get introduced to the concepts of greenhouse effect, ozone layer depletion, global warming, carbon sequestration and carbon footprint, REDD, IPCC, climate change conservation policies, ecological impact of El nino, La nina and Southern oscillation as well as climate change impact on physical environment and ecosystem processes.
DZOO-CP-205: Ecology and Developmental Biology	Unit 1: Ecology	<ul style="list-style-type: none"> ❖ Students will gather knowledge about different types of species diversity indices. ❖ Students will learn how to estimate BOD of any water sample and the importance of BOD.
	Unit 2: Developmental Biology	<ul style="list-style-type: none"> ❖ Students will understand about the different developmental stages of chick embryo and toad embryo and their significance.
DZOO-CP-206: Histology and Histochemistry	Unit 1: Histology	<ul style="list-style-type: none"> ❖ Students will develop an idea about cytochemical staining and microtechniques.
	Unit 2: Histochemistry	<ul style="list-style-type: none"> ❖ Students will gather knowledge about histochemical staining and identification of different histological tissues.
DZOO-CP-207: Review of a Scientific Paper		<ul style="list-style-type: none"> ❖ Students will be exposed to world of research work

			<p>through the review of scientific paper.</p> <ul style="list-style-type: none"> ❖ Students will learn to analyse a scientific paper.
Sem-III	DZOO-CT-301: Taxonomy and Biodiversity	Unit 1: Taxonomy	<ul style="list-style-type: none"> ❖ Students will gather information about recent trends in taxonomy, numerical taxonomy, phylogenetic trees, dimension of speciation and taxonomic characters.
		Unit 2: Biodiversity	<ul style="list-style-type: none"> ❖ Students will learn to evaluate biodiversity indices and know about basics of biodiversity along with global pattern of biodiversity and importance of agrobiodiversity.
	DZOO-CT-302: Biotechnology and Biophysical Technique	Unit 1: Biotechnology	<ul style="list-style-type: none"> ❖ Students will come to know about tools and techniques applied in biotechnology, cloning techniques, rDNA technology and bioinformatics along with cell culture methods and applications.
		Unit 2: Biophysical Technique	<ul style="list-style-type: none"> ❖ Students will learn about principles and applications of microscopy, spectrophotometer, spectrofluorometer, mass spectrophotometer, cryotechnologies, electrophoresis, centrifugation, chromatography and FACS.

DZOO-CT-303: Population Genetics and Evolution	Unit 1: Population Genetics	❖ Students will get a brief idea about basic concepts of population genetics along with molecular aspects of population genetics.
	Unit 2: Evolution	❖ Students will gather in-depth knowledge about speciation, molecular evolution, micro and macroevolution, co-evolution, heterochrony, origin and evolution of primates.
DZOO-ET-304: Parasitology and Medical Entomology	Unit 1: Parasitology	❖ Students will learn life-cycle, physiology, biochemistry, immunology, pathology and molecular biology of the covered parasites.
	Unit 2: Helminthology	❖ Students will learn life-cycle, physiology, biochemistry, pathology and molecular biology of the parasitic helminths.
	Unit 3: Medical Entomology	❖ Students will gain knowledge regarding biology of arthropod parasites and myiasis.
DZOO-ET-305: Environmental Biology		<p>❖ Students will get to know about dynamics of natural population, ecological modelling, structure and function of ecosystem, natural resources of the environment and their management.</p> <p>❖ Students will learn how to overcome environmental crisis and protect the</p>

		environment through sustainable development.
DZOO-ET-306: Cytogenetics and Molecular Biology		<ul style="list-style-type: none"> ❖ Students will learn about DNA damage and repair mechanisms, cell-cell signalling, cell-cell adhesion and communication, cell matrix adhesion, intracellular protein trafficking and cancer. ❖ Students will be able to understand about different types of gene manipulation techniques and their strategies and applications.
DZOO-ET-307: Entomology (Basic)		<ul style="list-style-type: none"> ❖ Students will study about integument, body parts and appendages, feeding and digestion, metamorphosis and locomotion of insects. ❖ Students will get to know about nervous and sensory system, blood and circulatory system, excretory system, reproductive system and endocrine system in insects.
DZOO-ET-308: Fish and Fisheries (Basic)		<ul style="list-style-type: none"> ❖ Students will come to know about classification of fishes (upto order) with features and examples. ❖ Students will get an idea about anatomy and physiology (respiration, digestion, circulation, reproduction and development) of fishes and specific adaptations and organ evolutions in fishes.

	DZOO-CP-309: Taxonomy and Biophysical technique	Unit 1: Taxonomy	❖ Students will learn to prepare taxonomic key of invertebrate and vertebrate specimens.
		Unit 2: Biophysical technique	❖ Students will get to know how to handle different types of microscopes and about chromatographic techniques and gel electrophoresis techniques.
	DZOO-CP-310: Choice Based Seminar		This is to evaluate the knowledge, presentation technique, communication skill, presence of mind and overall smartness of a student.
	DZOO-CP-311: Scientific Excursion		The main objective of scientific excursion is to provide first hand observation and experience to the students. A trip outside the classroom helps to bridge the relation between theoretical and practical knowledge.
Sem-IV	DZOO-CT-401: Biometric Analysis and Conservation Biology	Unit 1: Biometric Analysis	❖ Students will be able to perform statistical tests related to central tendency, probability distribution, sampling distribution, regression and correlation as well as compute t-test,

	Unit 2: Conservation Biology	<p>chi-square test and Analysis of Variance.</p> <p>❖ Students will learn the basics of conservation biology, legal foundations and Conservation Acts in India, conservation ethics and sustainable use of bioresources, principles, practices and applications of remote sensing techniques and GIS.</p>
DZOO-CT-402: Parasitology and Immunology	Unit 1: Parasitology	❖ Students will learn the impacts of parasitic diseases on human and non-human communities.
	Unit 2: Immunology	❖ Students will acquire knowledge regarding components of immunity, immune responses and applied immunology.
DZOO-ET-403: Parasitology and Medical Entomology	Unit 1: Parasite Systematics	❖ Students will learn the life-cycle, epidemiology, pathology and molecular biology of the medically important parasites.
	Unit 2: Microbes	❖ Students will understand host's immunity against parasites and immune evasion strategies of parasites as well as immunological control of parasitic diseases.
	Unit 3: Parasite Immunology	❖ Students will gain knowledge regarding biology of virus, bacteria and zoonosis.
DZOO-ET-404: Environmental Biology		❖ Students will learn about different types of environmental pollution, effects of heavy metals,

		<p>xenobiotics, endocrine disruptors, bioaccumulation, biomagnification and biotransformation.</p> <p>❖ Students will explore about environmental bioremediation and biosensors along with the concepts of EIA and ERA.</p>
DZOO-ET-405: Cytogenetics and Molecular Biology		<p>❖ Students will come to know about protein-nucleic acid interaction, genome analysis, genome mapping strategies, gene function analysis, genome imprinting and somatic cell genetics.</p> <p>❖ Students will acquire knowledge about human genetics and genetic counselling and can choose profession such as Genetic Counsellor.</p>
DZOO-ET-406: Entomology (Applied)		<p>❖ Students will understand the concepts of economic entomology and forest entomology.</p> <p>❖ Students will know about insect pest status in agriculture and their controlling measures.</p> <p>❖ Students will learn facts about insect vectors, their role in disease transmission and epidemiology.</p>
DZOO-ET-407: Fish and Fisheries (Applied)		<p>❖ Students will study about different types of fishes, fish culture ponds, pond water management,</p>

		<p>modern techniques related to fisheries in India.</p> <ul style="list-style-type: none"> ❖ Students will get an idea regarding processing, preservation, transport, marketing and management sector of fisheries in India, which will help them in self-employment. ❖ Students will be able to understand which fish cultures are practiced in India and accordingly can plan their own start-ups.
DZOO-CP-408: Biometry, Parasitology and Conservation Biology	Unit 1: Biometry	<ul style="list-style-type: none"> ❖ Students will be able to solve problems related to SD and SE, correlation, normal and binomial distribution.
	Unit 2: Parasitology	<ul style="list-style-type: none"> ❖ Students will be able to determine population size using different methods and solve problems related to conservation biology.
	Unit 3: Conservation Biology	<ul style="list-style-type: none"> ❖ Students will get hands-on experience to observe, collect and identify gut parasites of insects, amphibians and mammals.
DZOO-EP-409: Parasitology and Medical Entomology		<ul style="list-style-type: none"> ❖ Students will learn to demonstrate the common parasitic diseases and life-cycle stages of helminths and protozoa. ❖ Students will learn the staining methodologies of parasites and histological samples. ❖ Students will learn to report on observations of

		biological specimens such as parasites through different diagnostic techniques.
DZOO-EP-410: Environmental Biology		<ul style="list-style-type: none"> ❖ Students will learn to analyse free CO₂, dissolved O₂, hardness, alkalinity, salinity in water sample and organic carbon in soil sample; isolate bacteria from soil or water sample, gram stain them and identify the bacteria. ❖ Students will be able to determine primary productivity of a water sample (using light and dark bottle method) and diversity indices of different communities. ❖ Students will learn about SDS-PAGE and evaluation of LC₅₀ and probit analysis.
DZOO-EP-411: Cytogenetics and Molecular Biology		<ul style="list-style-type: none"> ❖ Students will learn how to do karyotyping of chromosome and isolation of DNA. ❖ Students will be able to decipher blotting techniques and SDS-PAGE technique. ❖ Students will be able to understand how to prepare mitotic, meiotic and polytene chromosomes.
DZOO-EP-412: Entomology		<ul style="list-style-type: none"> ❖ Students will learn the technique of dissecting insect body and mounting of body parts of insects and

		<p>study about life cycle of any pest or vector insect.</p> <ul style="list-style-type: none"> ❖ Students will learn how to identify common orders of insects and preparation of taxonomic keys (upto order level), how to compute insect population density and insect diversity, how to prepare insect box during field trips. ❖ Students will know about determination of LC50/LD50 of insecticides, insect control measures and associated instruments.
	<p>DZOO-EP-413: Fish and Fisheries</p>	<ul style="list-style-type: none"> ❖ Students will be able to dissect any teleost fish; mount organs, girdles, ossicles, scales, fins, vertebral column; analyse gut content of fishes. ❖ Students will be able to do identification of freshwater fishes, marine fishes, museum specimens, bones, embryo and histological specimens of fishes as well as fishing devices. ❖ Students will learn how to identify common orders of fishes and preparation of taxonomic keys (upto order level) and two fishes of economic importance (upto species level).
	<p>DZOO-CP-414: Dissertation/ Review/ Project</p>	<ul style="list-style-type: none"> ❖ Students will be exposed to the research world through

			<p>dissertation/ review/ project.</p> <ul style="list-style-type: none"> ❖ Students will gain intense knowledge in a particular field.
	<p>DZOO-CP-415: Comprehensive Viva-voce</p>		<p>Viva-voce on overall syllabus to evaluate a student's intelligence, learning capacity, thinking ability, answering attitude and the skill to overcome unfamiliar situations.</p>