



चौधरी महादेव प्रसाद महाविद्यालय
C. M. P. DEGREE COLLEGE
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Course Structure for Master's Programme in Zoology

Choice-Based Syllabus (Zoology)

Semester-wise Titles of the Papers in M.Sc. (Zoology)

Year	Semester	Course Code	Paper Title
M.SC. I	I	ZOO 501:	Non-Chordata
		ZOO 502:	Non-Chordata
		ZOO 503:	Chordata
		ZOO 504:	Evolution
		ZOO 505:	Biostatistics

Year	Semester	Subject Code	Paper Title
M.SC. I	II	ZOO 506:	Ecology
		ZOO 507:	Methodology & Instrumentation
		ZOO 508:	Animal Physiology
		ZOO 509:	Biochemistry
		ZOO 554: Elective (Any one of the following from the list may have opted)	Sericulture



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Year	Semester	Subject Code	Paper Title
M.SC. II	III	ZOO 510:	Formal and Experimental Embryology
		ZOO 511:	Animal Behavior
		ZOO 512:	Biotechnology
		ZOO 513:	Molecular Biology
		Elective (Any one-off following from the list may have opted)	
		ZOO 560:	Fish & Fisheries
		ZOO 561:	Environmental Biology
		ZOO 562:	Cell Biology



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Year	Semester	Subject Code	Paper Title
M.SC. II	IV	ZOO 514:	Bioinformatic
		Elective: 1 Fish & Fisheries	
		ZOO 569:	Fish & Fisheries
		ZOO 570:	Fish & Fisheries
		ZOO 571:	Fish & Fisheries
		Elective: 2 Environmental Biology	
		ZOO 572:	Environmental Biology
		ZOO 573:	Environmental Biology
		ZOO 574:	Environmental Biology
		Elective: 2 Environmental Biology	
ZOO 575:	Cell Biology		
ZOO 576:	Cell Biology		
ZOO 577:	Cell Biology		



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Course Outcomes Master of Science in Zoology

Semester I

Course: ZOO 501: non-Chordata I

CO1: students will be able to attain knowledge about, different Non-Chordate Phyla from Protozoa to Annelida.

CO2: Develop a critical understanding of how animals changed from primitive cells to a collection of simple cells to form a complex body plan. Critical understanding of basic concepts of coelom, Protostomia, and Deuterostomia.

CO3: Elucidating the role of maintenance, support, control, and development systems in identifying non-chordates.

Course: ZOO 502: non-Chordata II

CO1: students will be able to attain knowledge about the characteristics and classification of phylum Arthropoda with special reference to different types of Mouth parts, mode of feeding, Insect metamorphosis, and hormonal control.

CO2: Students will be well versed with phylum Mollusca in special reference to Archimollusca, Segmentation, and Molluscan ancestry

CO3: Able to understand the Evolution of the Nervous System among Invertebrates, and the complexity of the Cephalopod's Nervous system, associated with complex behavior and cognition.

CO4: Understand phylum Echinodermata with special reference to symmetry, larval form, and its significance.



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Course: ZOO 503: Chordata

CO1: Able to attain knowledge about **the** Origin of Chordates and develop an understanding of the evolution of vertebrates thus integrating structure, functions, and development.

CO2: Understand the evolution of animals from non-chordates to chordates.

CO3: Students will be able to understand and differentiate Ostracoderms, Devonian fish, and Lung fishes (Dipnoi) and their peculiar features.

Course: ZOO 504: Evolution

CO1: Enable the students to understand the evolution of the universe and life and understand the process and theories in evolutionary biology.

CO2: concepts involved in the process of evolution such as mutation, selection, genetic drift, migration, isolation and hybridization, etc.

CO3: Students will be able to understand the concepts of molecular evolution and population genetics. Concept of Gene, Gene frequency and Hardy- Weinberg Law.

CO4: The students will attain knowledge about concepts of species and speciation and their types.

CO15: Develop an interest in the debates and discussions taking place in the field of evolutionary biology



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Course: ZOO 505 Biostatistics

CO1: Understand the concepts of biostatistics such as sampling, representation of data, mean and standard deviation, probability, and distribution.

CO2: Describe statistical methods and probability distributions relevant to molecular biology data.

CO3: Perform and interpret statistical analyses with biology data.

CO4: Students will be able to calculate various biostatistical tests such as the test of significance, f-test, chi-square test, the test of goodness of fit, and analysis of variance and application of these tests.



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SEMESTER II

Course: ZOO 506 Ecology

CO1: Students will be able to know the evolutionary and functional basis of animal ecology.

CO2: understand the concepts of patterns of population growth, Lotka- Volterra Model of interspecific competition, and modern concepts of Niche.

CO3: Analyze a biological problem, derive testable hypotheses, and then design experiments and put the tests into practice.

CO4: Solve environmental problems involving the interaction of humans and natural systems at local or global levels.

CO5: Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.

Course: ZOO 507 Methodology & Instrumentation

CO1: Understand the purpose of the technique, its proper use, and possible modifications/ improvement.

CO2: Learn the theoretical basis of the technique, its principle of working, and its correct application.

CO3: Learn the maintenance of laboratory equipment/ tools, safety hazards, and precautions.

CO4: know various methodologies and instruments used in research such as fluorescence and electron microscopes, UV-Vis Spectrophotometry, Spectrofluorometric, Flame Photometer, Nephelometer, Autoradiography, Radioactive labeling, and counting.

CO5: Students will acquire knowledge about the principles of chromatography, electrophoresis, centrifugation, and ultracentrifugation and their application in scientific research.

CO6: Students will be well-versed with Hydro biological techniques for the determination of inorganic ions in water.



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Course: ZOO 508 Animal Physiology

CO1: Understand the physiology at cellular and system levels.

CO2: Understand the organization of a nervous system, the process of nerve conduction, the role of neurotransmitters, the process of muscle contraction, and Different types of receptors and their role in the perception of the environment.

CO3: Understand Male and female reproductive physiology.

CO4: Students will be able to build concepts of Active transport across membranes, Signal Transduction Homeostasis, Endocrinology, high altitude and deep-sea physiology, and bioluminescence.

Course: ZOO 509 Biochemistry

CO1: Explain the Biochemical components of the body, Structure, chemistry, properties, biosynthesis, and metabolism of different biological macromolecules such as proteins, carbohydrates, lipids, and nucleic acids.

CO2: correlates the pathways and chemicals that are responsible for the energy production body.

CO3: Students will be able to understand and apply the concepts of Thermodynamics, Electrolytes: Concepts of buffers, and the Henderson-Hasselbalch equation.

CO4: Students will be aware of some special concepts about peptidoglycan, Ramachandran plot, protein isolation, solubilities, and protein targeting.

CO5: Students will acquire detailed information about Enzyme Kinetics.

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Course: ZOO 554 Elective: Sericulture

CO1: Understand definition, history, and present status. Silkworms: Types, food plants, distribution, and Silk production.

CO2: Understand Prospects of Sericulture in India., Sericulture Centers. Research Training, extension. Seed production, reeling, re-reeling, twisting, doubling, weaving, processing, trading centers. Central Silk Board (CSB): Role in Extension and Development. Directorate of Sericulture:

CO3: Understand Mulberry plant morphology: Mulberry species, Mulberry cultivation, harvesting & management

CO4: Generation of skilled manpower in the field of sericulture.

CO5: trained for extension management and transfer of technology in Post Cocoon Technology, and provide field exposure



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Semester III

Course: ZOO 510 Formal and Experimental Embryology

CO1: Understand the concepts of embryology concerning frogs and chicks. Fate maps, morphogenetic movements, formation of germ layers, Fetal membranes and Gastrulation, Placentation, etc.

CO2: Understand organizer concepts, Induction, neurulation, and a variety of interacting processes.

CO3: Students will acquire knowledge about hormonal regulation, and molecular mechanisms involved in Metamorphosis, Regeneration, and Teratogenesis.

CO4: Students will be well versed with standard techniques and methods of experimental embryology such as experiments on the analysis of early development and differentiation.

CO5: Understand how a cell behaves in response to an autonomous determinant or an external signal.

Course: ZOO 511 Animal Behavior

CO1: Acquire knowledge of Modern concepts, general mechanisms, and Methods of study of animal behavior.

CO2: Attain knowledge about the Development of Innate and Learned behavior.

CO3: Understand types of fixed action patterns (FAPs); the Neuro-genetic mechanism of instinct, classification, and the Neural mechanism of learning and memory.

CO4: Aware of the process of Evolution of behavior and the role of Hormones in behavior



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Course: ZOO 512 Biotechnology

CO1: understand and apply the concepts of Recombinant DNA technology, Restriction endonucleases, and other useful enzymes for molecular cloning.

CO2: Explain the importance and applications of cloning vectors & cloning technologies in the manipulation of the gene. Understand gene probes as diagnostic tools and the concept of gene therapy.

CO3: Understand the process of tissue culture, hybridoma technology, cell culture, organ cultures, embryonic stem cell transfer, targeted gene transfer, in vitro fertilization, etc.

CO4: Build a concept of biosensors, biochips, DNA fingerprinting, immobilized enzymes, bioenergy, and genomic DNA libraries.

Course: ZOO 513 Molecular Biology

CO1: Develop an understanding of concepts, mechanisms, and evolutionary significance and relevance of molecular biology in the current scenario.

CO2: A clear understanding of the processes of central dogma viz. transcription & transcription apparatus, translation, etc. underlying survival and propagation of life at the molecular level.

CO3: Students will be able to understand the Molecular biology of cancer, Genetic and metabolic disorders, and Principles and methods involved in gene targeting and gene silencing.

CO4: Apply their knowledge in problem-solving and the future course of their career development in higher education and research.



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Elective (Any one-off following from the list may have opted)

Course: ZOO 560 Fish & Fisheries

CO1: Understand the classification, characteristics, Origin, and evolution of major groups of fish. including, Elasmobranchs, Holocephalians, Dipnoans, and Actinopterygians including the ancestral groups of Acanthodians. Placoderms and Crossopterygians.

CO2: Attain knowledge about hill-stream and deep-sea adaptation of fishes.

CO3: Understand the characteristics and features of the skin, scales, and fins of teleost.

CO4: Understand the Fish migration regarding Salmon and Eel, and be able to Explain the concept of Hormonal regulation of fish migration.

Course: ZOO 561 Environmental Biology

CO1: Understand the meaning and Scope of Environmental Biology and apply Practical application of Environmental Biology in daily life and present scenarios.

CO2: Understand environmental Problems: Local, regional, and global, and take necessary steps for their solutions.

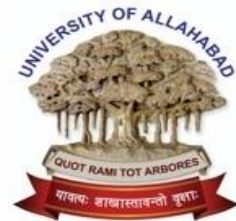
CO3: Understand the environmental problems associated with resource exploitation and energy utilization in developing and developed countries.

CO4: Explain the concept of Environmental Biochemistry and Environmental Toxicology.

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Course: ZOO 562: Cell Biology

CO1: Understand the functioning of the nucleus, and extranuclear organelles and understand the intricate cellular mechanisms involved.

CO2: Understand the ultrastructure and functions of the plasma membrane with special reference to transport across cell membranes and the internal organization and function of the nuclear pore complex.

CO3: Attain knowledge about the structure and functions of cell organelles. with special reference to protein uptake and modification, proteins, sorting, and Oxidative phosphorylation.

CO4: Students will acquire information about the structure and functions of Ribosomes, Lysosomes, and Peroxisomes.



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Semester IV

Course: ZOO 514: Bioinformatics

- CO1:** Understand the Concept of Bioinformatics, in life sciences and Medicine, Genomics and Proteomics, etc.
- CO2:** Manage to use and understand biological sequence data banks (GENBANK, EMBL, SWISSPORT, PDB) Sequence alignment (Global & Local), Algorithms used (Dynamic & Heuristic) - Needleman Wunsch, Smith Waterman BLAST and FASTA.
- CO3:** Understand and be able to construct different types of phylogenetic trees using different Construction Methods and analyze biological data and phylogenies.
- CO4:** Understand the Fitch- Margoliash method and distance-based methods (Least squares, Neighbor-joining, UPGMA), Bootstrapping, and its application in tree construction.

Course: Elective: 1 - ZOO 569 Fish & Fisheries

- CO1:** Understand General features, anatomy, physiology, and function of internal organs of teleost including
- CO2:** Aortic arches. Alimentary canal, Digestion, Respiration, Swim bladder, Accessory respiratory organs
- CO3:** Excretion and Osmoregulation Reproduction and Reproductive organs
- CO4:** Understand Endocrine glands and Caudal neurosecretory system, Sense Organs, and Lateral line organs. Electric Organs and Electroreception in Fishes



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Course: Elective: 1 - ZOO 570 Fish & Fisheries

CO1: Understand Marine fishery in the states of India. Productivity of west coast and east coast, Problems of inshore fishery, offshore and deep-sea fishery.

CO2: Attain knowledge of sea Ecology and Oceanography about fishery, Exclusive Economic Zone (EEZ) Fishery of Sardine, Mackerel Past, present, and prospects of marine fishery in India.

CO3: Understand various aspects of Inland Fishery

CO4: Understand various aspects of Estuarine Fishery: Ecology Present and prospects Estuarine fishery of India. attain knowledge about Applications of Crafts and Gears.

Course: Elective: 1 - ZOO 571 Fish & Fisheries

CO1: Understand the Definition, types, resources, and prospects of aquaculture in India.

CO2: Understand Principal methods used in different types of fish and non-fish organisms' cultures.

CO3: Attain knowledge about Pond preparation and management of pond.

CO4: Understand the use of fertilizers, aquatic vegetation, and their control.

CO5: Understand the basics of Carp seed raising: Natural spawning and seed collection of fish seeds, the technique of induced breeding, and natural and synthetic drugs for fish breeding.

CO6: Understand about Freshness of fish: Features of raw fish, decomposition of fish, state of rigor mortis, Fish diseases and their control



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Course: Elective: 2 - ZOO 572 Environmental Biology

CO1: Understand Air pollution, its effects, and control.

CO2: Understand Water pollution sources, effect and control, and Water quality criteria standards. Physico-chemical and biological monitoring of water quality

CO3: Gain knowledge about Wastewater treatment and associated problems with Marine pollution, and the source, effect, and control of Soil pollution

CO4: Attain knowledge about the Biodegradation of pesticides, the Bio-geochemical cycle of pesticides Hazards of pesticides.

CO5: Understand Sources, Effects, and control of Noise pollution and radioactive pollution. Knowledge of Bio-concentration & Bio-magnification Indian legislation for pollution control.

Course: Elective: 2 - ZOO 573 Environmental Biology

CO1: Understand the Diversity of environmental habitats, Animal resource management, Vermiculture, Forest management (policies and problems) Wetland and Wasteland management

CO2: Attain knowledge about integrated pest management and biological control with the help of natural enemies. Management and Treatment of municipal and industrial waste.

CO3: Understand Soil monitoring and management of soil erosion

CO4: Understand the concept of Recycling non-degradable substances, the role of NGOs in Environmental Management and Conservation, and Basic knowledge of the use of computers in Environmental Management.



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Course: Elective: 2 - ZOO 574 Environmental Biology

CO2: Understand Land use classification and practices Land use planning and management, Environmental impact assessment Purposes of environmental assessment methods

CO3: Understand: the purpose, monitoring, ambient source-linked, activities directions, design, and applications of Environmental Monitoring

CO4: Explain the applications, methods Role of remote sensing in environmental management.

Course: Elective: 3 - ZOO 575 Cell Biology

CO1: Understand the concepts of chromosome compaction, and importance and types of heterochromatins, and the structural and functional significance of specialized chromosomes such as polytene and lampbrush chromosomes.

CO2: Acquire knowledge about the process of Cell signaling and communication between cells and their environment.

CO3: Get knowledge about the cytoskeleton, the Cell Cycle, its regulation, and Cell Aging.



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Course: Elective: 3 - ZOO 576 Cell Biology

CO1: understand and apply the concepts of Bioenergetics to various cellular processes.

CO2: Explain various concepts of immunology such as immunocompetent cells, humoral and cellular immune response, Antigen processing and presentation, and major histocompatibility complex.

CO3: Students will also be able to attain knowledge about the structure and functions of monoclonal and polyclonal antibodies and a detailed account of cancer.

Course: Elective: 3 - ZOO 577 Cell Biology

CO1: Well-versed with various principles, tools, techniques, and methodologies involved in Cell Biology.

CO2: understand and apply the concepts of Microscopy, Tissue preparation, Histochemical techniques, Autoradiography, and radioisotope tracer techniques.

CO3: Well-versed with various principles, tools, techniques, and methodologies involved in Various immunocytological techniques.
