

Department of Zoology
Program Outcomes, Program Specific Outcomes and Course
Outcomes of
B.Sc. in Zoology Programme

The Department of Zoology, Loknete Vyankatrao Hiray College,
Nasik offers Zoology as a core subject for undergraduate, post
graduate and Ph. D. courses for students.

Program Outcomes: B. Sc. Zoology

- PO1 - Aware students about knowledge and skill in the fundamentals and systematics of animal kingdom.
- PO2 - Gain knowledge of anatomical structure and various metabolic functions of organisms.
- PO3 - Understand various physiological processes at molecular level of animals from different phyla.
- PO4 - Information and skill of advanced biological techniques for experimental purpose.
- PO5 - Awareness about environment and its conservation processes, pollution control and its importance and.
- PO6 - Gain knowledge of protection of vulnerable and endangered species
- PO7 - Information and skill of applied zoology including sericulture, apiculture, fisheries, poultry, vermiculture, agricultural pests and their control etc.
- PO8 - Understand about various concepts of genetics and its importance in social wellbeing.
- PO8 - Aware students about ethical principles and commit to professional ethics and responsibilities.
- PO9 - Apply the knowledge and understanding of Zoology to one's own and social life.
- PO10 - Gain knowledge of communicable and non-communicable diseases to improve personal and public health.

Program Specific Outcomes: B. Sc. Zoology

- PSO1. Acquire knowledge on the various aspects of life sciences, cell biology, genetics, taxonomy, physiology, applied zoology, general embryology and public health.

- PSO2. Understand good laboratory practices and safety, Carry out experimental techniques and methods of Physiology, Cell biology, pathology, Genetics, Applied Zoology, Biological techniques, Toxicology, Entomology, Sericulture, Biochemistry, microtomy.
- PSO4. Understand the applications of biological sciences in Biotechnology, Apiculture, Poultry, Fisheries, Aquaculture, Agriculture and vermiculture.
- PSO5. The students gained the knowledge to use modern sophisticated equipments and tools.
- PSO6. Recognize the scientific facts behind natural phenomena.

Course Outcomes:

B.Sc. Zoology is an undergraduate THREE years Program in Zoology.

B. Sc. (Zoology) First Year B.Sc.

F. Y. B. Sc. (Zoology) Implemented from June, 2019

Course Code-ZO-111 and ZO-121: Animal Diversity I & II

- CO1: The student will be able to understand classify and identify the diversity of animals.
- CO2: The student understands the importance of classification of animals and classifies them effectively using the six levels of classification.
- CO3: The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life.
- CO4: The student will be able to understand the morphology, habit and habitat. Systematic position and various systems in *Paramecium* and frog.
- CO5: The student will be able to understand classify and identify the diversity of animals.
- CO6: The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life.

Course Code: ZO 112 Animal Ecology

- CO1: The student will be able to identify and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics and its impact on ecosystem and biosphere due to the dynamics in population.
- CO2: The learner will be able to link the intricacies of food chains, food webs and link it with human life for its betterment and for non-exploitation of the biotic and abiotic components.

- CO3: To understand anticipate, analyse and evaluate natural resource issues and act on a lifestyle that conserves nature.
- CO4: The working in nature to save environment will help development of leadership skills to promote betterment of environment.
- CO5: The Learner understands and appreciates the diversity of ecosystems and applies beyond the syllabi to understand the local lifestyle and problems of the community.

Course Code: ZO122: Cell Biology

- CO1: The learner will understand the importance of cell as a structural and functional unit of life.
- CO2: The learner understands and compares between the prokaryotic and eukaryotic system and extrapolates the life to the aspect of development.
- CO3: The dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life.
- CO4: The cellular mechanisms and its functioning depends on endo-membranes and structures. They are best studied with microscopy.

Course Code: ZO113 and ZO123: Zoology Practical Paper

- CO1: Gain knowledge to identify various animals based on morphological features.
- CO2: Prepare the culture of *Paramecium*
- CO3: understand the principle and use of microscopes and micrometry.
- CO4: List the various invertebrate and vertebrate animals in a given class.
- CO5: Identify various larval stages and development in invertebrate and vertebrate groups.
- CO6: Understand blood cells as differential and total count with normal range.

B. Sc. (Zoology) Second Year B.Sc.

S. Y. B. Sc. (Zoology) Implemented from June, 2014

ZY-211and ZY- 221: Animal Systematics and Diversity – III & IV

- CO1: The student will be able to classify various animals in a given phylum of invertebrates and vertebrates.
- CO2: Gain knowledge to identify various larval stages and development in invertebrate and vertebrates groups.
- CO3: Explain various modifications in these groups and the need of the modification for survival.
- CO4: Explain various adaptations in insects including mimicry and metamorphosis

- CO5: Describe the morphology, habit and habitat, systematic position and various systems in Star fish and *Scoliodon*
- CO6: State the outline of animal classification of non-chordates and chordates.
- CO7: Classify the higher invertebrate and vertebrates groups.
- CO8: Categorize the diversity found in the invertebrate groups of animals like Arthropoda, Mollusca and Echinodermata.
- CO9: Categorize the diversity found in the vertebrate groups of animals like reptiles, birds and mammals.
- CO9: Explain various adaptations in avian group as well as migration and flight in birds.

Course ZY 212: Applied Zoology I

- CO1: Gain knowledge to define the concepts of the applied subjects like Fisheries, Aquaculture and Pest Control.
- CO2: The student will be able to identify, freshwater, marine water fishes.
- CO3: Gain knowledge to explain the tools and techniques used in aquaculture and agricultural practices.
- CO4: The student will be able to describe the fish species commonly used in fishery business.
- CO5: Describe the common agricultural pests from nearby area.
- CO6: Illustrate the diseases in aquaculture and agriculture.
- CO7: Classify freshwater and Marine water fishes.
- CO8: Categorize economically important fish species.

Course ZY 222: Applied Zoology II

- CO 1: Gain knowledge to define the concepts of the applied subjects like Apiculture and Sericulture.
- CO 2: Identify different species and casts of honeybees and species of silkworm.
- CO 3: Explain the tools and techniques used in apiculture and sericulture.
- CO 4: The student will be able to explain the important pests of apiculture and sericulture.
- CO 5: Describe the economic importance of honeybee and silkworm.
- CO 6: Illustrate management of the apiary and sericulture units.
- CO 7: Classify of *Apis*, *Bombyx* and *Anthereria*.
- CO 8: Select economically important species of *Apis* for uni-floral and multi-floral honey production.

Course: ZY-223: Practicals in Zoology (Annual Course)

- CO1: Gain knowledge to identify various animals based on morphological features.
- CO2: Gain knowledge to distinguish between poisonous and non-poisonous snakes
- CO3: Observe the various tools, crafts and gears used in Apiary, Fishery, Sericulture and Pest control.
- CO4: Identify the pests in agriculture and enemies in Apiary.
- CO5: The student will be able to describe the morphology, habit and habitat. Systematic position and various systems in starfish and *Scoliodon*.
- CO6: Explain the modifications and adaptations in animals
- CO7: Explain the use of tools in Apiary, Sericulture and appliances in Pest control.
- CO8: Describe External features and economic importance of freshwater and Marine water fishes and other aquaculture organisms

B. Sc. (Zoology) Third Year B.Sc.

T. Y. B. Sc. (Zoology) Implemented from June, 2015

Course ZY 331: Animal Systematics & Diversity V

- CO1: Outline the systematic position of *Pila globosa*. and *Calotes versicolor*
- CO2: The student will be able to label the organs and systems of *Pila globosa*. and *Calotes versicolor*
- CO3: Describe the major features in the Phylum Protozoa, Porifera, Coelenterata and Hemichordata and the reason of their success in the ecosystem.
- CO4: Explain the functional anatomy of *Pila globosa*. and *Calotes versicolor*
- CO5: Illustrate the morphological peculiarities of Integument, Heart, Kidney and Brain of vertebrates
- CO6: Categorize the Accessory respiratory organs in fish.
- CO7: Classify the dentition in mammals.
- CO8: Gain knowledge to justify the need of electric organs in fish.

Course ZY 341: Biological techniques

- CO1: Gain knowledge to prepare solutions of different concentrations
- CO2: Learn various separation techniques.
- CO3: Gain knowledge to describe the techniques used in haematology.

- CO4: Learn the procedure of preparing permanent histological slides.
- CO5: Student is able to illustrate the working of microscopes.
- CO6: Student is able to analyse the dimensions of the biological samples.
- CO7: Gain knowledge of PAS and Feulgen staining methods.

Course ZY 332: Mammalian Histology

- CO1: Knowledge of basic terms in histology.
- CO2: The student will be able to Understands all four types of tissues.
- CO3: Identify the histological structure and function of of various organs.
- CO4: Explain the location, structure and functions of various organs.
- CO5: Illustrate the histology of endocrine glands.
- CO6: Diagrammatically represent the various organs.

Course ZY- 342: Mammalian Physiology & Endocrinology

- CO1: Knowledge of basic terms in physiology.
- CO2: Understood about the composition of food and mechanism of digestion absorption and assimilation.
- CO3: The student will be able to understand the physiological processes in mammals.
- CO4: Explain the anatomy of various systems.
- CO5: Illustrate the reproductive cycles with hormonal control.
- CO6: Gain knowledge of working of kidney.

Course ZY – 333: Biological Chemistry

- CO1: Knowledge of basic terms in biochemistry.
- CO2: The student will be able to explain the structure, functions and reactions of the various biomolecules.
- CO3: Correlate the changes in the levels of these biomolecules with the diseases in human
- CO4: Calculate pH of buffer solution.
- CO5: Attained the knowledge of macromolecule such as carbohydrates, protein and fat, their types and significance.
- CO6: Described the enzymes, mechanism of enzyme action and factors affecting the enzyme activity
- CO6: Understood the types and importance of vitamins.
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Course ZY 343 Genetics & Molecular biology

- CO1: Described the genetic variation through linkage and crossing over, gene frequency, chromosomal aberrations and sex determination.
- CO2: Understood the theories of classical genetics and blood group inheritance in man
- CO3: Explain the concept of mutation.
- CO4: Explain DNA structure.
- CO5: Paraphrase the Central dogma of molecular biology. Understood the molecular structure of genetic materials and understood the mechanism of gene expression and regulation character formation.
- CO6: Illustrate the mechanism of replication, transcription and translation.
- CO7: Justify the post transcriptional and post translational modifications.

Course ZY- 334 Environmental Biology & Toxicology

- CO1: Understood and appreciate the environment and ecological services of life on earth..
- CO2: Describe the nature of ecosystem, productivity, food webs, energy flow,
- CO3: Describe the resilience of ecosystem and ecosystem management.
- CO4: Explain Biosphere, biomes and impact of climate on biomes.
- CO5: Explain wildlife management in India and conservation of wildlife.
- CO6: Explain the three necessary and sufficient conditions i.e. struggle for existence; variation; and inheritance.
- CO7: Illustrate the toxic effects of chemicals in the environment on human and his livestock.
- CO8: Imparted knowledge of habitat ecology, pollution and bioremediation of polluted environment.

Course ZY 344: Organic Evolution:

- CO 1: Understood the theories of evolution and highlighted the role of evidences in support of evolution
- CO 2: Explain the theories of organic evolution.
- CO 3: Describe the concept of origin of life and theories of origin of life.
- CO 4: Describe evolution of man.
- CO 5: Illustrate the presence of organisms at various geological time scale.
- CO 6: Apply the knowledge in relevant experimentations.
- CO 7: Categorize different zoogeographical realms.
- CO 8: Compare animal distribution in different zoogeographical realms.

- CO 9: Described the evolutionary knowledge through the concepts of coloration and mimicry.

Course ZY 335 Parasitology

- CO 1: Explain the basic biology and lifecycle of parasites including epidemiology, diagnosis and treatment.
- CO2: Recognize morphological characteristics for identification of parasites and their developmental stages.
- CO3: Explain animal associations and their types.
- CO4: Discuss the life cycle and importance of major parasites.
- CO5: Illustrate transmission routes of animal and zoonotic parasites
- CO6: Analyze the medical and public health aspects of human parasitic infections.
- CO7: Justify the control measures of arthropod vectors.
- CO8: Understand the importance of hygiene with respect to epidemic diseases.

Course ZY – 345: General Embryology

- CO1: Explain the principles and process of fertilization and cleavage.
- CO2: Prepare the flow chart of gametogenesis process.
- CO3: Identify the developmental stages
- CO4: Understood the process of development of animals.
- CO5: Describe the process of gametogenesis.
- CO6: Understood the process of organogenesis of selected organs, development of extra embryonic membrane and the nature and physiology of placenta.
- CO7: Explain the theories of preformation, and concepts like growth, differentiation and reproduction.

Course ZY - 336: Cell Biology

- CO1: Understood the structure of cells and cell organelles in relation to the functional.
- aspects and understanding of the working principles and applications of microscopes.
- CO2: Described the composition of prokaryotic and eukaryotic cells.
- CO3: Understood the structure and functions of chromosome; mitotic and meiotic cell divisions and their significance.
- CO4: Describe the three primary components of the cell's cytoskeleton and how they affect cell shape, function, and movement.

- CO5: Differentiate between rough and smooth endoplasmic reticulum both in structure and function. Structure and functions of plasma membrane, nucleus, Golgi complex, lysosomes.
- CO6: Knowledge of cell transportation, gap and tight junctions.

Course ZY 347 Practical Paper I

- CO1: Identify the organs by studying the histological slides.
- CO2: Identify hormonal disorders using pictures.
- CO3: Use techniques like chromatography, spectrophotometry in biological experiments.
- CO4: Explain the anatomical features of brain, heart, kidney and skin of vertebrates.
- CO5: Demonstrate the importance of modifications in animal for their survival.
- CO6: Demonstrate the structure of tissues by making temporary slides.
- CO7: Demonstrate haemin crystals and effect of osmolarities on RBCs.
- CO8: Sketch and label the various systems and organs of *Pila*, *Balanoglossus* and *Calotes*.
- CO9: Prepare blood smear and identify the various cells.
- CO10: Draw exact figures of structures/organism using camera lucida.
- CO11: Measure the cell/organism dimensions (Micrometry).
- CO12: Prepare blood smear and identify the various cells.
- CO13: Process animal tissues and prepare permanent histological slides.
- CO14: Count total leucocytes from blood samples.
- CO15: Estimate blood glucose level, BT and CT.

Course ZY 348 Practical Paper II

- CO1: Identify the fossil types/ adaptations in animals.
- CO2: Explain the stages of human evolution.
- CO3: Demonstrate the effect of physical and chemical factors on enzyme activity.
- CO4: Explain the evidences of evolution
- CO5: Demonstrate physical and chemical properties of water and soil samples.
- CO6: Illustrate the application of Hardy –Weinberg law
- CO7: Detect given carbohydrates using biochemical tests.
- CO8: Measure the pH of given samples.
- CO9: Isolate protein from milk.

- CO10: Prepare acid and base solutions and titrate them.
- CO11: Collect and identify freshwater planktons.
- CO12: Determine LD50 and LC50.
- CO13: Estimate nucleic acids in given samples.
- CO14: Prepare temporary mounting of Giant chromosome.
- CO15: Prepare paper model of DNA.
- CO16: Record zoogeographical distribution of animals.

Course ZY 349 Practical Paper III

- CO1: Identify the life cycle stages of few parasites.
- CO2: Identify and explain the types of eggs, blastulae and gastrulae
- CO3: Identify the age of chick embryo.
- CO4: Identify the phases of cell division.
- CO5: List the household Pest and social insects.
- CO6: Explain the pathogenicity and morphology of few ectoparasites.
- CO7: Explain the diseases spread by vectors.
- CO8: Explain the interrelationship of insects and human with examples.
- CO9: Explain the effects of household insects on human health.
- CO10: Demonstrate rectal parasites in cockroach.
- CO11: Demonstrate Mitochondria/ mitotic and meiotic stages by stained preparations.
- CO12: Illustrate the social organization in insects.
- CO13: Prepare temporary slide of chick embryo to identify the stage and age.
- CO14: Prepare mounting of mouth parts of few common insects.
- CO15: Justify the effect of colchicine on cell division.

Program Outcomes, Program Specific Outcomes and Course Outcomes of M.Sc. in Zoology

After successfully completing **M. Sc. (Zoology)** Programme students will be able to:

- PO1. Recognize the scientific facts behind natural phenomena.
- PO 2: Relate the theory and practical knowledge to solve the problems of the society.
- PO 3: Prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms.
- PO 4: Face and succeed in high level competitive examinations like NET, SET, MPSC and UPSC.
- PO 5: Carry out internship programme and research projects to develop scientific skills and innovative ideas.
- PO 6: Utilize the obtained scientific knowledge to create eco-friendly environment.
- PO 7: Prepare expressive, ethical and responsible citizens with proven expertise.

Program Specific Outcomes:

After successfully completing **M. Sc. Zoology (Physiology)** Programme students will be able to:

- **PSO1:** Acquire knowledge on the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Genetics, Physiology, Developmental Biology, Endocrinology, Mammalian reproductive physiology, Biotechnology and bioinformatics.
- **PSO2:** Explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system and develop theoretical and practical knowledge in handling the animals and using them as model organism
- **PSO3:** Illustrate physiological adaptations, development, reproduction and behaviour of different forms of life.
- **PSO 4:** Develop personal and key transferable skills such as group work, presentation and report writing.

- **PSO 5:** Develop personal and key transferable skills such as group work, presentation and report writing.
- **PSO 6:** Acquire skills in Zoology in a global, economic, environmental, and societal context.
- **PSO7.** Develop proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization and relate concepts of comparative biology to explain evolution and success to live in varied environment.
- **PSO7:** Pursue M. Phil/ Ph. D, compete in national eligibility test (NET) and select an independent professional career.
- **PSO8:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice.

**M. Sc. (Zoology) First Year, Semester I.
Implemented from June, 2019**

ZOUT 111 Biochemistry and Biochemical Techniques.

After successfully completing this course, students will be able to:

- CO1: Define basic terms in biochemistry and biochemical techniques.
- CO2: Explain the applications of the various biochemical techniques.
- CO3: Explain the importance and applications of techniques in biochemistry.
- CO4: Explain the principle and applications of various chromatographic techniques with examples.
- CO5: Explain the structure and functions of various biomolecules.
- CO4: Explain the importance of tools and techniques in biology.
- CO6: Explain the principle, working, materials used and applications of electrophoresis.
- CO7: Describe the concept of light, electromagnetic spectrum and its application in absorption spectroscopy.
- CO8: Draw the structures of various carbohydrates and amino acids.
- CO9: Classify enzymes with examples.
- CO10: Justify the applications of radioactivity compounds in biology.
- CO11: Compare the various separation techniques

ZOUT 112 Cell Biology and Developmental Biology

After successfully completing this course, students will be able to:

- CO1: Recognize and describe the structural and functional organization of cell organelles.
- CO2: Described the composition of prokaryotic and eukaryotic cells.
- CO3: Understood the process of development of animals.

- CO4: Understood the process of organogenesis of selected organs, development of extra embryonic membrane and the nature and physiology of placenta.
- CO5: Came to know the inducer and inductor role in embryogenesis and knowledge about metamorphosis and the process of regeneration.
- CO6: Understood the structure and functions of chromosome; mitotic and meiotic cell divisions and their significance.
- CO7: Explain the concept of mesoderm induction and pattern formation with examples.
- CO8: Compare and contrast spermatogenesis and oogenesis.

ZOUT 113 Genetics and English in Scientific Communication

After successfully completing this course, students will be able to:

CO1: Understood the theories of classical genetics and blood group inheritance in man

CO2: Described the genetic variation through linkage and crossing over, chromosomal aberrations and sex determination.

CO3: Understood the genetic defects and inborn errors of metabolism and genetic counselling and role of inbreeding and outbreeding.

CO4: Understood the molecular structure of genetic materials and understood the mechanism of gene expression and regulation character formation.

CO5: Solve the problems based on gene frequency.

CO6: CO1: Write the outline of a scientific paper.

CO7 Critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.

CO8: Justify the importance of plagiarism check and Proof-read given article.

ZODT – 114: Freshwater Zoology

After successfully completing this course, students will be able to:

- CO1: Enlist the diagnostic features of shrimps.
- CO2: Explain the types of aquatic habitats.
- CO3: Discuss the aquatic adaptations of common freshwater forms.
- CO4: Explain the adaptations in freshwater Turtles and Crocodiles.
- CO5: Illustrate the physicochemical properties of water.
- CO6: Demonstrate the effect of pollutants on freshwater bodies
- CO7: Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

ZODP – 114: Practical Freshwater Zoology.

After successfully completing this course, students will be able to:

- CO1: Identify commercially important freshwater fish.
- CO2: Identify the aquatic adaptations in common freshwater forms.
- CO3: Prepare the culture of *Paramecium* and *Daphnia*.
- CO4: Estimate the hardness and chloride content in water samples.
- CO5: Analyze the Zooplanktons from local freshwater bodies.
- CO6: Evaluate the bio-indicators of pollution in freshwater.

ZOUP 115 Basic Zoology Lab-1.

After successfully completing this course, students will be able to:

- CO1: Identify the developmental stages of chick embryo, cell structures and phases of cell division
- CO2: Identify the grammatical mistakes from the given paragraph and common errors in written and spoken presentations.
- CO3: Write a scientific project and research article along with its proof reading.
- CO4: Demonstrate the working of different microscopes, colorimetric and spectrophotometric methods, cell fractionation and ligature in *Drosophila* larvae,
- CO5: Determine the gene distance and order, genotype and phenotype ratios and allelic frequencies from the given data.
- CO6: Estimate sugar and protein by suitable biochemical method, and isolate protein from biological source.
- CO7: Prepare acid and base solutions of desired strength, buffers, bacterial Culture, chick embryo culture and *Drosophila* culture.
- CO8: Prepare temporary slide of various cells to demonstrate the cell morphology and cell division, giant chromosome and pedigree analysis chart.

M.Sc. Zoology First Year, (Semester - 2)

ZOUT 121: Molecular Biology and Bioinformatics.

After successfully completing this course, students will be able to:

- CO1: Explain the DNA structure & types, topology, Physical properties; chromatin structure and organization.

- CO2: Discuss genome organization, DNA and Protein sequencing with their application in evolutionary studies.
- CO3: Explain the mobile DNA elements.
- CO4: Explain mechanism of DNA damage and repair.
- CO5: Illustrate the process of DNA replication, transcription, translation and their regulations.
- CO6: Illustrate the database tools with their significance.
- CO7: Schematically represent the processes of central dogma.
- CO8: Justify the post translational and post transcriptional modifications.

ZOUT - 122: Endocrinology and Parasitology.

After successfully completing this course, students will be able to:

- CO1: Discuss the roles of Pituitary gland and pineal body.
- CO2: Explain hormonal regulation of biomolecules and mineral metabolism.
- CO3: Define the terminologies of parasitology.
- CO4: Explain the concepts of animal association with examples.
- CO5: Describe the role of osmoregulatory and gastrointestinal hormones.
- CO6: Explain the role of hormones in moulting, change in body colour of crustaceans; yolk synthesis in amphibians; insect development.
- CO7: Describe the role of parasites in public health and hygiene.
- CO8: Explain the morphology and life cycle of common parasites
- CO9: Justify hormones as coordination molecules.
- CO10: Justify the significance of biological clocks and rhythms.
- CO11: Justify the importance of control strategies against parasitic infections.
- CO12: Justify the significance of vectors and disease transmission

ZOUT 123 Comparative Animal Physiology & Environmental Biology.

After successfully completing this course, students will be able to:

- CO1: Explain the physiology of processes like digestion, respiration, muscle contraction and excretion.
- CO2: Describe the mechanism of thermoregulation in both poikilotherms and homeotherms.
- CO3: Explain the mechanism of chemical communication in vertebrates.
- CO4: List the endangered, endemic and extinct animal species of India.
- CO5: Identify various types of natural resources, human impact on these resources, and common resource management practices.
- CO6: Explain the structure and impact of biogeochemical cycles, ecosystems and energy transformation across trophic levels.
- CO7: Comment on the structure and functions of various sense organs.

- CO5: Illustrate the concept of osmotic regulation in various animals with suitable examples.
- CO8: Compare the physiology of regulatory mechanisms in various groups of animals.
- CO9: Justify the survival strategies of organism in varied climatic conditions.
- CO10: Justify the evolution of various life processes in living forms.
- CO11: Analyze the impact of lifestyle on the environment and animal life.
- CO12: Discuss environmental hazards and risks and the socio-economic implications.
- CO13: Illustrate the impact of climate and anthropogenic factors on biodiversity with reference to India.

ZODT 124: Metabolic Pathways

After successfully completing this course, students will be able to:

- CO1: Define basic terminologies of metabolic pathways.
- CO2: Explain the laws of thermodynamics, concept of free energy and ATP as currency molecule.
- CO3: Describe the Concepts and regulation of metabolism.
- CO4: Discuss the oxidation of fatty acids and its significance.
- CO5: Illustrate the electron transport chain and oxidative phosphorylation.
- CO6: Illustrate the reactions, energetics and regulation of glycolysis, glycogen biosynthesis, TCA cycle, Purine and Pyrimidine metabolism
- CO7: Write the general reactions of various metabolic pathways.
- CO8: Justify the role of enzymes in metabolism

ZODP 124: Practical in Metabolic Pathways

After successfully completing this course, students will be able to:

- CO1: Identify the common diseases/conditions caused due to errors in metabolism.
- CO2: Explain the principle of Colorimetry and Spectrophotometry.
- CO3: Use the basic equipment in biochemistry lab.
- CO4: Illustrate the enzyme activity from suitable material.
- CO5: Demonstrate the effect of various physical and chemical factors on enzyme activity.
- CO6: Demonstrate the absorption studies of biomolecules.
- CO7: Separate biomolecules by chromatographic methods.

ZOUP 125 Basic Zoology Lab-2

After successfully completing this course, students will be able to:

- CO1: Identify the various parasites and parasitic stages of common parasites, nitrogenous wasteproducts of animals, freshwater planktons and slides of endocrine glands.
- CO2: Explain the principle and significance of gonadectomy, thyroidectomy and pancreatotomy.
- CO3: Demonstrate the role of eye stalk and insulin in sugar level in crab.
- CO4: Demonstrate the retro cerebral complex in cockroach.
- CO5: Demonstrate the RBCs of common vertebrates and effect of various osmolarities.
- CO6: Demonstrate the effect of body size, oxygen consumption and Insulin on aquatic animal.
- CO7: Determine the bleeding and clotting time, heartbeat of crab, species richness in selected area, physico- chemical properties of soil and water.
- CO8: Perform Sterilization of lab equipment, prepare microbial culture, Isolate Bacterial, liver DNA and RNA from given sample, quantify and resolve them using electrophoretic procedures, analyse protein sample by PAGE and SDS PAGE and construct phylogenetic tree using tool in bioinformatics.

M. Sc. (Zoology) Second Year, Semester III. Implemented from June, 2015

Course ZY 301T Animal Physiology I (special):

After successfully completing this course, students will be able to:

- CO1: Describe the anatomy of different physiological systems at the tissue and cellular levels.
- CO2: Evaluate the physiological functioning of different organs.
- CO3: Analyze the physiological changes in relation to environmental conditions.
- CO4: Identify different tissues related to anatomy and physiology from an evidence-based perspective.
- CO5: Carry out physiological studies in the laboratory, Interpret data and graphs and write a report.
- CO6: Correlate the organisms Internal and external environments with homeostasis and biological clocks.
- CO7: Justify energy utilization in physiological and metabolic activities.\

Course ZY 303T Aquaculture:

After successfully completing this course, students will be able to:

- CO1: Identify the fish diseases and the causative organisms.
- CO2: Mention the various composite fish culture with significance of each type.
- CO3: Describe the methods of freshwater prawn culture and its management.
- CO4: Explain the methods of pearl culture and pearl harvesting.
- CO5: Illustrate the preparation and management of fish culture ponds.
- CO6: Demonstrate the methods of packaging and transport of fish and brood fish.
- CO7: Illustrate techniques of fish harvesting, preservation & processing.
- CO8: Compare the techniques used in fishery development.

Course ZY 303P Practicals in Aquaculture:

After successfully completing this course, students will be able to:

- CO1: Identify Indian oysters.
- CO2: Identify the common freshwater fish used in culture farming.
- CO3: Demonstrate the processing and storing methods for fish and prawn.
- CO4: Test the freshness of fish/prawn by histological methods
- CO5: Test the freshness of fish/prawn by biochemical methods.
- CO6: Prepare the culture of Daphnia and rotifers
- CO7: Estimate the productivity of water bodies.

Course ZY 304T Insect physiology and biochemistry:

After successfully completing this course, students will be able to:

- CO1: Explain the structure, Chemistry of integument and sclerotization.
- CO2: Describe the process of digestion and metabolism.
- CO3: Explain the characteristics of haemolymph and types of haemocytes.
- CO4: Illustrate the structure, physiology and biochemistry of flight muscle.
- CO5: Demonstrate the process of excretion, detoxification and water balance.
- CO6: Justify the role of insect hormones in physiological processes.

Course ZY 304P Practicals in Insect physiology and biochemistry:

After successfully completing this course, students will be able to:

- CO1: Demonstrate the heart and haemocytes of cockroach.
- CO2: Demonstrate the effect of starvation on glycogen in insects.
- CO3: Demonstrate the effect of temperature on water loss in cockroach.
- CO4: Detect the amino acids in insect haemolymph by chromatographic method.
- CO5: Determine the oxygen consumption in dragon fly nymph.

- CO:6: Perform the assay of amylase activity in midgut of insect.

Course ZY 307T Fundamentals of Systematics

After successfully completing this course, students will be able to:

- CO1; Explain principles, methods of biological classification and diversity in kingdom Animalia.
- CO2: Explain the importance of taxonomic keys and taxonomic characters.
- CO3: Explain the principles of zoological classification and nomenclature
- CO4: Discuss the various taxonomic procedures and molecular phylogenetics & phylogeography.
- CO5: Illustrate the methodologies used in systematics.
- CO6: Differentiate between Species, subspecies, sibling species race and deme.
- CO7: Justify the inclusion of a given organism in a given phylum.

Course ZY 307P Practicals in Fundamentals of Systematics

After successfully completing this course, students will be able to:

- CO1: Identify museum specimen/pictures of minor phyla, Invertebrates, Protochordates and Vertebrates.
- CO2: Identify animals with the help of taxonomic keys.
- CO3: Collect and preserve animal samples using common methods.
- CO4: Write scientific report of field/ institutional visit.
- CO5: Categorize animals according to the phylogeny.
- CO6: Compare the methods of collection and preservation of insects.

Course ZY 308 P Research Project:

After successfully completing this course, students will be able to:

- CO1: Identify and reflect on where further training or skill acquisition is necessary for selfimprovement
- CO2: Develop professional work habits, including those necessary for effective collaboration and cooperation with other students, instructors, and Service.
- CO3: Write effective scientific and technical communication based on the project
- CO4: Report research clearly, concisely, logically, and ethically;
- CO5: Represent interpretations of research data within scientific and technical communities.
- CO6: Prepare research proposal to seek financial aid.

M. Sc. (Zoology) Second Year, Semester IV.

Course ZY 401T Animal Physiology II (special):

After successfully completing this course, students will be able to:

- CO1: Explain the concept of nutrition and digestion.
- CO2: Explain the composition of blood, types of blood cells, vascular dynamics and clotting mechanism.
- CO3: Discuss the neuronal physiology and various potentials.
- CO4: Explain the structure, contraction and types of contraction of muscle.
- CO5: Illustrate the anatomy and physiology of heart and cardiac cycle.
- CO 6: Diagrammatically represent the mechanism of respiration, gas exchange and transport of O₂ and CO₂
- CO7: Justify the location and structure of eye, ear and taste buds to their functions.

Course ZY 401P Practicals in Animal Physiology II (special):

After successfully completing this course, students will be able to:

- CO1: Demonstrate the effect of exercise on breathing, pulse rate and blood lactate level.
- CO2: Determine the bleeding and clotting time of human blood.
- CO3: Demonstrate the invertebrate heart.
- CO4: Demonstrate the effect of pH, temperature and inhibitors on salivary amylase.
- CO5: Map the taste buds on human tongue.
- CO6: Calculate the heartbeats of *Daphnia/Drosophila* larva.
- CO7: Determine serum urea and protein and glucose in human blood and urine.
- CO8: Justify the effects of various physical and chemical factors on frog heart and muscle.

Course ZY 402 T Economic Zoology:

After successfully completing this course, students will be able to:

- CO1: Explain coral reef and its significance.
- CO2: Explain parasitic roundworms of animal and plants.
- CO3: Explain the role of insects of economic importance.
- CO4: Illustrate the lac culture, apiculture, prawn culture, vermiculture, Poultry, dairy industry and Piggery.
- CO5: Signify the role of parasitic and soil protozoan in human welfare.
- CO6: Justify the use of animals in pharmaceutical research.

Course ZY 402 P Practicals in Economic Zoology:

After successfully completing this course, students will be able to:

- CO1: Identify the poultry breeds
- CO2: Identify edible freshwater fish from nearby area.
- CO3: Demonstrate the apiculture equipment.
- CO4: Demonstrate the methods of prawn culture.
- CO5: Compare various fishing tools, crafts and gears.
- CO6: Design animal farm.

Course ZY 403T Mammalian Reproductive physiology:

After successfully completing this course, students will be able to:

- CO1: Explain the male and female reproductive systems and sexual dimorphic characteristics.
- CO2: Explain the sexual cycles with examples.
- CO3: Illustrate the reproductive dysfunctions.
- CO4: Diagrammatically represent the hormonal regulation of reproductive processes like pregnancy, lactation and parturition.
- CO5: Prepare the flow chart to demonstrate the hormonal coordination of reproductive processes.
- CO6: Justify the artificial control of reproduction.

Course ZY 405T Pollution biology:

After successfully completing this course, students will be able to:

- CO1: Explain the organization of biosphere.
- CO2: Explain in details the types of pollution.
- CO3: Describe the pollution monitoring strategies.
- CO4: Illustrate the bioassay methods.
- CO5: Elucidate the methods to study the impact of pollutants.
- CO6: Justify the importance of biomedical waste management.

Course ZY 405P Practicals in Pollution biology:

After successfully completing this course, students will be able to:

- CO1: Identify the bioindicators from given water sample.
- CO2: Write a report on eutrophication of water body.
- CO3: Determine the LC50 value for the given compound.
- CO4: Determine the biomass of given sample.
- CO5: Analyze pH and salinity of given sample.
- CO6: Estimate calcium and magnesium, sulphate from polluted water.

Course ZY 406T Apiculture:

After successfully completing this course, students will be able to:

- CO1: Explain the basic concepts of apiculture like systematics, colony organization, polymorphism, morphology and foraging.
- CO2: Explain the tools and management of apiary.
- CO3: Explain the importance of institutions pertinent to apiculture.
- CO4: Discuss the setup of beekeeping business.
- CO5: Illustrate the bee keeping as occupation.
- CO6: Justify the presence of bees to increase the agriculture productivity.

Course ZY 308 P Research Project:

After successfully completing this course, students will be able to:

- CO1: Explain the importance of material and methods used in research
- CO2: Illustrate the research work.
- CO3: Write effective scientific and technical communication based on the project
- CO4: Design experimentation to prove the hypothesis
- CO5: Represent interpretations of research data within scientific and technical communities.

Research Centre in Zoology offers Doctor of Philosophy (Ph.D.) program

Program Outcomes: Doctor of Philosophy Program in Zoology

After successfully completing this course, students will be able to:

- PO 1: Student can understand the concepts and methods of research.
- PO 2: Student will able to develop research proposal and can work with problems.
- PO 3: Gain knowledge of computer applications in research.
- PO 4: Student will able to use softwares and their applications in research.
- PO 5: Learn various research methods for research work.
- PO 6: Students with a PhD degree can continue for post-doctoral research.

Program Specific Outcomes: Doctor of Philosophy Program in Zoology

- PSO1: The Doctor of Philosophy program is designed to prepare each student to actively participate in research and teaching in the field of Zoology along with other fields of Life Sciences and in a University or a Research organization.

- PSO2: Students are exposed to advanced experimental and theoretical techniques, encouraged to attend National and International conferences as well as workshops during the program.
- PSO3: Several research areas of Zoology are interdisciplinary in nature and are funded by various funding agencies, giving students a flavour for both applied and basic research.
- PSO4: Students in this programme acquire knowledge, critical thinking skills, and experience in conducting cutting-edge research. Students would gain proficiency in research methodology and assessment techniques in animal science.
- PSO5: Students with a PhD degree either pursue a post-doctoral position aiming for an academic career or find employment in industrial R&D laboratories.

Doctor of Philosophy Program in Zoology: Course Outcomes

- CO1: Identification and formation of research problem
- CO2: Gain knowledge of Ethical, legal, social and scientific issues in Biological Research.
- CO3: A brief idea about the funding agencies such as DST, DBT, ICMR, CSIR and UGCCO4: Student able to Writing of Research Proposal, Report and Research Paper.
- Co5: Understand Meaning of Research in Biological Sciences
- CO6: Use of advanced technologies, patents for social wellbeing.