

Pre- Ph.D. Course of Zoology Department will consist of four papers and each paper will be of 100 marks of which 20 marks will be of internal assessment. The outline of the course structure will be as follows.

Paper – Z001 - Research methodology

Paper – Z002 - Computer application, Biostatistics and Bioinformatics

Paper – Z003 - Optional

Paper – Z004 - Review writing with Seminar presentation and Practical

Details of Syllabus

Paper – Z001 - Research methodology

Part A

1. Principles of light microscopy, Phase contrast microscopy, Fluorescent microscopy, Confocal microscopy, Electron microscopy ---SEM and TEM.
2. Colorimetry - Principles and methodology, chromatography, spectrophotometry.
3. pH-meter – principles and objectives of study, dialysis and liophilisation, Centrifugation.
4. Electrophoresis: Principles, types, techniques and applications.
5. Nucleic acids – isolation, purification, Southern, Western and Northern hybridization techniques.
6. Colony hybridization.
7. Polymerase Chain Reaction (PCR).

Part B

1. Field study – basic principles, objectives and kinds.
2. Methodologies of field studies – variety and application.
3. Samples – nature, variety and fundamental scope of sample collection.
4. Habitat – kinds and their characteristic features.
5. Physical and chemical features of soil.
6. Physico-chemical characteristics of fresh water, brackish water and marine water.
7. Multivariate analysis of field studied samples.

Paper ZOO2

Biochemistry and Bioinformatics

Part A: Biochemistry

1. Chemical Basis of Life: Elements found living organisms, importance of carbon, importance of water, structure, and function of macromolecules –
 - carbohydrates - reducing sugars, polysaccharides, mucopolysaccharides;
 - lipids - fatty acids, waxes, phospholipids, steroids and terpenes, lipoproteins, glycolipid;
 - amino acids, peptide bonds, disulphide bonds, hydrogen bonds;
 - proteins
 - nucleic acids
2. Enzymes – Classification, properties, catalysis requirements, mechanism of enzyme action, enzyme cofactors, prosthetic groups, coenzymes, rate of enzyme reaction, enzymes as biosensors; concept of entropy.
3. Membrane Physiology – Physiological solutions, buffers, osmotic pressure, ionic concentration and electrical potentials across membranes, membrane transport, mechanism of active transport, diffusion.
4. Cell Physiology: DNA replication, transcription and translation, nuclear enzymes, histones and non histones protein

Part B: Bioinformatics

1. Bioinformatics – application, major database, data operations along with the bioinformatics tools, molecules participating in information flow and the functional sites.
2. Information search and data retrieval – tools for web search, Entrez database and their description, data mining of biological databases.
3. Genome analysis and gene mapping – sequence assembly problem, restriction fragment length polymorphism, variable number tandem repeats, sequence tagged sites.
4. Tools for similarity search and sequence alignment – role of FASTA and BLAST.
5. Profiles and Hidden Markov models – using profiles.
6. Gene identification and prediction – methods and tools, clustering gene expression profiles.
7. Protein structure visualization – database and tools, domain architecture databases,
8. Computational methods for pathways and system biology.
9. Computer aided drug design – approaches, methods, ADME-Tox, property prediction.

Paper: ZOO3

Optional – I

Systematics and Biodiversity

Part A: Systematics

1. Taxonomic Procedure: Pre-classification groupings.
2. Taxonomic Procedure: ALPHA, BETA and GAMA stages.
3. Kinds of classification.
4. Taxonomic characters: A) selection of characters
B) Kinds of characters.
5. Polytypic species and subspecies.
6. Methods of taxonomic collection – Example – Insect collection.
7. Preparation of identification key.
8. Zoological nomenclature.
9. Describing new taxa.

Part B: Biodiversity

1. Landscape Ecology and Biogeography.
2. Distribution pattern of Animals on Earth.
3. Types of diversity.
4. Species diversity according to geographical scale.
5. Methods of measuring biological diversity.
6. Methods of sampling animals.
7. Methods of determining population characteristics.
8. Methods of determining biological function of animals.
9. Methods of determining ecological function of animals.

Paper: ZOO3

Optional – II

Part A: Fish Physiology and Biochemistry

1. Reproductive physiology, gametogenesis- hormonal regulation and environmental control, determination of sex.
2. Energy pathway related to Carp-metabolism of lipids, proteins, carbohydrates.
3. Physiological adaptation- related to environmental characteristics.
4. Growth – potential growth rate, caloric value of growth, dietary energy requirement.
5. Protein requirement, evaluation criteria, dietary protein composition, non-protein nitrogen, PUFA.
6. Larval diet – composition
7. Other essential nutrients regulating growth.
8. Biochemical characteristics of fish tissue-features related to species.

Part B: Fish Biotechnology

1. Selective breeding
2. Sex reversal – hormonal regulation and practical use
3. Hybridization
4. Androgenesis
5. Gynogenesis
6. Polyploidy
7. Transgenesis and genesis engineering
8. Cryopreservation

Paper: ZOO3

Optional – III

Insect Physiology and Biochemistry

Part A

1. Structure physiology and biochemistry of sclerotization and tanning in cuticle chemistry and function of various component of cuticle.
2. Structure and chemistry of insect eye, mechanism of vision.
3. Digestive organs, physiology of digestion and assimilation of nutrients.
4. Excretory organs, physiology of excretion, synthesis of uric acid.
5. Circulatory system, anatomy, physiology and biochemistry of haemolymph, haemocytes and their functions.
6. Respiratory system, mechanism of respiration.
7. Intermediary metabolism of carbohydrates, lipids and nitrogen compounds.

Part B

1. Types and structure of muscles, flight muscles.
2. Types of nervous system, structure of nerve, physiology of nerve impulse conduction.
3. Reproductive organs, structure, vitellogenesis and its hormonal control.
4. Role of hormones in growth, differentiation and metamorphosis, diapauses and reproduction, mode of action of various insect hormones.
5. Pheromones and their types, molecular mechanism of action of pheromones.
6. Defensive mechanism in insects.

Paper Z004

Optional - IV

Mammalian Endocrine Physiology

Part A

1. Mechanism of hormone action
 - 1.1. Protein hormones
 - 1.1.1. Membrane receptors
 - 1.1.2. G-proteins
 - 1.1.3. Cyclic AMP signaling cascade
 - 1.1.4. PKC signaling pathway
 - 1.2. Steroid hormones (genomic and nongenomic pathways)
2. Hypothalamo-hypophysial System
 - 2.1. General organization
 - 2.2. Neurohypophysial octapeptides (oxytocin and vasopressin)
 - 2.3. Hypophysiotropic hormones: chemistry, localization and actions
 - 2.4. Adenohypophysial hormones: chemistry and physiological roles of
 - 2.4.1. Somatotropin and prolactin
 - 2.4.2. Glycoprotein hormones (FSH, LH and TSH)
 - 2.4.3. Pro-opiomelanocortin (ACTH, MSH, β -LPH and β -endorphin)
 - 2.5. Neural control of adenohypophysis

Part B

1. Thyroid hormones: biosynthesis, control of secretion and physiological roles
2. Steroid hormones: biosynthetic pathways
3. Testis: organization and physiological roles of androgens
4. Ovary: organization and physiological roles of estrogen, progesterone, relaxin and inhibin
5. Adrenal cortex: organization, biosynthesis and physiological roles of mineralocorticoid and glucocorticoid hormones
6. Adrenal medulla: catecholamine biosynthesis, release and physiological role
7. Role of parathormone, calcitonin and vitamin D in calcium homeostasis
8. Endocrine pancreas: biosynthesis and physiological actions of insulin and glucagon

9. Gastrointestinal hormones (secretin, gastrin and cholecystokinin)

Paper ZOO4

Laboratory Exercise, Review writing and Presentation

Part A: Laboratory Exercise

1. Detection of aldehyde, nucleic acids, PAS reaction.
2. Protein isolation, estimation and electrophoresis
3. DNA isolation and quantification
4. BOD analysis of soil and water sample.
5. Analysis of PO_4P of soil and water sample
6. Analysis of NO_3N of soil and water sample
7. PCV analysis of aquatic fauna
8. Microtome sectioning and staining
9. Microscopic observation of samples by using Phase Contrast and Fluorescent Microscope.
10. Digital Microphotography and Image Analysis

Part B: Review writing and Presentation