# Syllabus for Ph.D. Course work in Zoology:

**Ph.D. Course Work**
**Department of Zoology**
**Visva-Bharati**

**Ordinance**

**Paper I**

| | | |
|---|---|---|
| Research Methodology | 8 credit points | Full Marks-100 |
| A. Computer Application | 2 credit points | Marks - 25 |
| B. Subject concerned | 6 credit points | Marks -75 |

**Paper II (Optional)**

| | | |
|---|---|---|
| Advanced fields of the subject | 8 credit points | Full Marks-100 |

**Rules pertaining to Conduct of Course and Examination :**

1. The course will be completed in One Semester.
2. The course and examination will be conducted by the department in which a student intends to register for PhD.
3. The course and examination on Computer Application will be conducted by the Department of Computer Science.
4. The MCQ pattern will be followed in Papers I and III. Time of written examination will be three hours

**Paper III**

| | | |
|---|---|---|
| Review work of the relevant field and presentation | 8 credit points | Full Marks-100 |
| (i) Report- | 60 marks | |
| (ii)Presentation & Viva Voce | 40 marks | |

# Ph.D. Course Work
# (Detailed syllabus)
# ZOOLOGY

**Paper I (Research Methodologies)** **8 Credit points** **Full Marks 100**

*Subject concerned:*

A. Computer Applications: 2 credit points, marks 25

**A. Computer Applications** **25 Marks**

[To be framed by the Department of Computer System & Science Department]

**B. Zoology :**

1. Study of structure of tissues and cells: light microscopy; electron microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy.
2. Methods to study properties of Protein and purification : Native and SDS- PAGE of proteins, iso-electric focusing.
3. Analysis and quantification of biomolecules: spectrophotometric, gravimetric and titrimetric estimations.
4. Principles of Radioimmunoassay, ELISA, Radio Receptor assay, Immunoblotting, DOT blotting and Immuno electrophoresis.
5. Separation of biological compounds: column chromatography, paper chromatography, affinity chromatography and HPLC.
6. Molecular Biology techniques: Genomic and plasmid DNA isolation; Identification of DNA binding region by Electrophoretic mobility shift Assay; PCR and Real time PCR.
7. Animal Cell Culture: aseptic handling procedures; types of media used in animal cell culture; preparation of primary and secondary culture systems; maintenance of cell culture and subculture ; dissociation of cells from culture plates for further analyses.
8. Biostatistics: Testing of hypothesis, t – test, F – test, Z – test, Correlation, Regression, Goodness of fit test, ANOVA, Dispersion

**Paper II (Optional)** **8 credit points** **Full Marks 100**

[Any **one** of the following papers opted by the candidate]

## ZCO-201: ENVIRONMENTAL TOXICOLOGY

1. Toxicants in the environment: Food additives and contaminants; Air pollutants, Water pollutants and Soil pollutants
2. General principles of Toxicology: Toxicologic evaluation; Absorption distribution and excretion of toxicants; Metabolism of toxic substances; Factors influencing toxicity
3. Systemic Toxicology: Brief analysis of toxic responses of the Liver, Kidney, Central Nervous System, Blood, Reproductive System.
4. Applications of Toxicology: Forensic Toxicology; Occupational Toxicology; Regulatory Toxicology

## ZCO-202: CELL BIOLOGY, GENETICS & MOLECULAR BIOLOGY

1. Process of transcription, formation of initiation complex, RNA polymerases, transcription factors; transcription activators and repressors, capping, elongation and termination.
2. Process of translation, ribosomes, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code.
3. Unit of replication, enzymes involved, replication origin and fork, fidelity of replication.
4. Signal transduction pathways, second messengers, regulation of signaling pathways.
5. The human chromosomes, chromosomal abnormalities and human disorders.
6. Recombinant DNA technology, Polymerase chain reaction (PCR), genomic and cDNA libraries, genome analysis- Southern Blot hybridization and northern hybridization, DNA sequencing

## ZCO-203: FISH BIOLOGY AND FISHERIES

1. Fish anatomy and Physiology: Digestive system and digestion; Chemosensory and mechano-sensory system.
2. Fish nutrition: Bio energetic of fish, feed formulation, probiotics..
3. Fish reproduction, induced breeding and genetic manipulation.
4. Fish immunology.
5. Fish endocrinology.
6. Present status of fisheries and scope of development.
7. Carp culture.
8. Overview of fish diseases and their control
9. Limnological studies: Soil and water parameters, plankton and periphytons and feeding ecology of fish.

## ZCO-204: MOLECULAR ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY

1. Hypothalamic control of pituitary function.
2. Chemical nature and functions of pituitary hormones – LH, FSH, Growth hormone, TSH.
3. Strategies of reproduction in tropical freshwater fish.
4. Gonadal steroids and their action in fish reproduction.
5. Environmental control of reproduction, photo receptors, pineal and circannual circadian rhythm.
6. Molecular mechanisms of hormone action:
    a) Transduction of endocrine signals; target organs, genomic and non-genomic receptors, receptor-ligand interaction, nature of response elements, control of genomic action- transcription.
    b) GPCR ($G_s$ & $G_i$), role of second messengers (cAMP, cGMP), kinases, phosphatases, polyadenylation and post-translational modifications.
7. Bio-assays & Immuno-assay of hormones.

## ZCO-205: ECOLOGICAL MODELLING

1. Basic concepts of modeling, deterministic vs. stochastic models.
2. Theoretical models – local and global stability, equilibrium or steady state condition, limit cycle, phase doubling, Chaos, self organization
3. Simulation models:
    a) Static models (Network analysis) – Basic concept of Network analysis, concept of flow matrix, respiration, export and import vectors, throughflow, contribution and dependency coefficients, Finn cycling index, development capacity, ascendency and redundancy
    b) Dynamic and structural dynamic models – Model elements (State variables, control variables, forcing functions, parameters, constant), Methodology of modeling (conceptualization, transformation of conceptual model into mathematical model, calibration and sensitivity analysis, validation and verification).

## ZCO-206: PARASITOLOGY

1 Introduction to parasitism, basic principles and concepts, host parasitic interaction.
2. Parasites and diseases-its epidemiology and control
3 Helminth eggs - types, structure and formation of egg shell, hatching.
4 Nutrition in helminth parasites, uptake and energy metabolism.
5 Antigenic diversity of protozoas and helminths.
6 Diagnosis of protozoa and helminthic diseases through RFLP, in situ hybridization and Southern Blot technique.

## ZCO-207: ENTOMOLOGY

1. Classification of insects up to families of selected orders : Coleoptera, Hemiptera, Orthoptera, Diptera, Hymenoptera and Lepidoptera.
2. Integument : Structure and functions of cuticle, Moulting and Sclerotization.
3. Structure and modification of Mouth parts, Legs, Antennae and wings in insects;
4. Tools and Techniques of Collection , Preservation and Identification of Insects.

## ZCO-208: SOIL ECOLOGY AND ECO-TOXICOLOGY

1. Soil types and classification, soil as a habitat, physicochemical properties of soil, detritus based food web in soil, leaf litter decomposition, factors affecting litter decomposition with special reference to non-nutrient components of litter.
2. Soil biota, classification of major groups of soil animals, ecological importance of soil biota, extraction and rearing of major groups of soil fauna, biological indices like soil enzymes, soil respiration, MBC, SIR, etc.
3. Eco-toxicology, major types of soil pollutants (pesticides, heavy metals, fly ash), different types of toxicity evaluations, dose-response relationship, impact of xenobiotics on soil animal populations, biological functions and soil ecosystem.
4. Environmental risk assessment, ecologically safe use of pesticides and waste disposal, concept of biomarkers, biomarker parameters in soil animals like digestive and metabolic enzymes, anti-oxidants, HSP, metallothioneins, AChE

**Paper III (Literature survey)** **8 Credit points** **Full Marks 100**

A Review of literature to be conducted by the candidate based on research area of his/her interest followed by a one hour seminar and viva voce in presence of one external expert and faculty members.