

DEPARTMENT OF ZOOLOGY
UNIVERSITY OF DELHI
DELHI-110007

Syllabus for Ph.D. course work

The students admitted to the department of Zoology for Ph.D. programme have to complete the Course work as per the guidelines laid down in the Ordinance VI B.

The department will offer two courses in one semester as follows.

Paper I (ZOOLPHD- I) : Research Methodology
Paper II (ZOOLPHD- II) : Advances in Zoology
Paper III (ZOOLPHD- III) : Writing a proposal on a relevant research topic

Paper I and II are common to all students. These papers are aimed at introducing the students to the salient features of research and recent research techniques, several model systems highlighting their applications.

Paper III will be specific proposal finalized in consultation with the respective supervisor. The students will write a proposal and defend it by power-point presentation.

The students should complete these papers following provisional registration as per university calendar.

Evaluation:

The students will be evaluated at the end of the semester, and they need to pass all the papers with 50 marks in each. The distribution of marks will be as follows:

| Papers | Written Examination | Internal Assessment | Total Marks |
|---------------|----------------------------|----------------------------|--------------------|
| ZOOLPHD - I | 80 | 20 | 100 |
| ZOOLPHD - II | 80 | 20 | 100 |
| | | | |
| | Proposal Manuscript | Presentation | |
| ZOOLPHD - III | 50 | 50 | 100 |
| | | | 300 |

Ph. D. Course Work

Course A

Paper 1: RESEARCH METHODOLOGY

Students are exposed to a variety of methods and principles which they could employ in research. The goal is to impart students the knowledge and skills which are contemporary and useful to them. The following themes are included, to be taught in 40 lecture hours. The inclusion of the topic in a theme (as reflected in the accompanied content) is by no means restrictive.

1. **Introductory:** Researching a scientific problem
2. **Scientific Literature**
 - a. Reading and critical analysis of scientific literature;
 - b. Communicating research results in peer-reviewed journals
3. **Writing and presentation skills:**
 - a. Communication skills (Poster and oral);
 - b. Review on a relevant research topic and presentation of the same in a seminar.
4. **Experimental design and data analysis**
 - a. Experimental design
 - b. Concept of sampling, Standard Deviation, Standard Error of Mean
 - c. Probability Distribution – Binomial, Poisson and Normal
 - d. Data analysis including use of statistical analysis software
5. **Model systems and Model Organisms**
 - a. Prerequisites of a model system, In vitro systems
 - b. Prokaryotic model organisms
 - c. Eukaryotic model organisms: *C. elegans*, *Drosophila*, Zebra fish, *Xenopus* and Mouse
6. **Experimentation on Animals**
 - a. Animal Handling and Animal ethics
 - b. Maintenance of animals
 - c. Various routes of injections and sample collection
 - d. CPCSEA guidelines
7. **Working in Laboratory**
 - a. Good laboratory practice; Safety and biohazards; IPR; Scientific ethics
 - b. Accuracy of liquid transfer
 - c. Preparation of Reagents, chemicals, buffers,
 - d. General safety and precautions
 - e. Handling of instruments in the CIF

Paper II: ADVANCES IN ZOOLOGY

1. Molecular Biology Techniques

- a. Cloning and sequencing of genes and genomics, PCR techniques
- b. Microarrays and gene expression
- c. Metagenomics and Epigenomics
- d. Gene targeting and its application

2. Microscopy and Image Analysis

- a. Bright field; Fluorescence; Confocal
- b. SEM and TEM
- c. Image Acquisition and Analysis Microscopy and Image analysis

3. Bacterial and Animal cell culture

- a. Aseptic technique and Preparation of media
- b. Bacterial culture
- c. Types of cell culture
- d. Insect cell culture
- e. Applications of cell culture

4. Bioinformatics and its application

- a. Databases, sequences, sequence alignment-pair wise/multiple, global/local protein family, domain, sequence conservation
- b. Introduction to software used for proteomics data analyses.

5. Analytical Techniques and Instrumentation

- a. Colorimetry; Spectrophotometry
- b. Preparative Centrifugation
- c. Chromatography; GC; FPLC; HPLC
- d. Electrophoresis; MALDI-TOF; LCMS
- e. Immunological Techniques
- f. FACS

6. Tracer Techniques

- a. Use of high energy radiation
- b. Isotopic and non- isotopic Techniques

Course B

Writing a Proposal on a relevant research topic

Under this course, each student will write a project proposal and defend it through power point presentation. The student will consult the respective supervisor to select the topic and collect the relevant literature, collate the information and write a research proposal with proper incorporation of references using appropriate software like Reference Manager or EndNote or Mendeley.

The student will identify a problem on which he/she would be able to work, identify the scope of research on the chosen topic and will frame the objectives to be addressed in the project through a work plan. The student will write the standard operating protocols (SOPs) and identify requirement for equipment and reagents. Each student will be required to make a presentation and defend the proposed project including literature available, objective sought and work plan as described above.