

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
Department of Zoology
Syllabus of Ph.D. Course Work
As per Ph.D. Regulation 2016 Amended in 2019
Course Structure

Sl. No.	Paper Code	Paper Title	Credit
1.	ZL-DPH-01	Research Methodology	04
2.	Any one from following		04
	ZL-DPH-02(OP-1)	Behavioural Ecology and Conservation Biology	
	ZL-DPH-02(OP-2)	Sericulture and Seri-biotechnology	
	ZL-DPH-02(OP-3)	Parasitology	
	ZL-DPH-02(OP-4)	Fish and Fisheries	
3.	ZL-DPH-03	Instrumentations	04
4.	ZL-DPH-04	Biostatistics	04
Total Credits			16

**Department of Zoology
School of Life Sciences, B.B.A. University**

Syllabus for Ph. D. Course Work

ZL-DPH-01: Research Methodology

Unit 1:

Foundations of Research: Definition, Meaning, Objectives, Motivation, Utility. Types of Research, Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method in research. Problem Identification & Formulation- Research Question, Approaches and Methodology

Unit 2:

Measurement Issues-Hypothesis-Qualities of good hypothesis-Null Hypothesis & Alternative hypothesis. Hypothesis Testing-Logic & Importance. Research Design: Concept and Importance in Research- Features of a good research design- Exploratory research design-concept, types and uses. Experimental design: Concept of Independent & Dependent variables.

Unit 3:

Qualitative and Quantitative Research: Qualitative Research- Quantitative research- Concept, Measurement and outcome. Writing of research proposal, report and Research paper. Footnotes and Bibliography - Editing the final draft – Evaluating the final draft – Checklist for the good proposal / research / report.

Unit 4:

Ethical, legal, social and scientific issues in biological research. A brief idea of funding agencies such DST, DBT, ICMR, CSIR, ICAR, UP CAR, UPCST, BNHS, European Commission, DFID and UGC. Role of Intellectual Property Rights (IPR), Patenting, Copyright, Product development, Process development in Research and development.

ZL-DPH-02 (OP-1): Behavioural Ecology and Conservation Biology

Unit 1:

1. Principles of Animal Behaviour.
2. Natural selection.
3. Preset behaviour, learning and Habituation.
4. Aggregation in fishes, birds and mammals.
5. Group Selection and Altruism

Unit 2:

1. Communication: Functions and Complex Systems
2. Habitat Selection.
3. Foraging behaviour: food selection and optimal foraging theory.
4. Territoriality and dispersal.
5. Predator-Prey interactions: Prey-predator cycles and antipredator behaviour.

Unit 3:

1. Capture methods and handling devices: Hand nets, bucket traps, bag and funnel traps, mist nets, harp traps and holding devices.
2. Marking and recapture techniques: wing bands, necklaces, light tags and radiotransmitters.
3. Survey and census methods: Surveys and censuses at roosts, estimation of foliage roosting bats, visual counts of foraging bats, ultrasonic detectors.

Unit 4:

1. Age determination in bats: Tooth wear, incremental lines, size of pulp cavity, lengths of long bones, epiphyseal-diaphyseal fusing, body mass, pelage coloration.
2. Reproductive Ecology: Reproductive sites, Timing, Number of young, Age of reproduction, Mating system, Sex ratios and Brood parasitism.
3. Sexual selection: Mate choice, male-male competition, mating systems.

Suggested reading materials:

- (i) An introduction to animal behaviour by Aubrey Manning and Marian Stamp Dawkins.
- (ii) Animal behavior: Mechanisms, ecology, evolution by Drickamer, Vessey, Meickle.
- (iii) Animal behaviour: an introduction to behavioral mechanisms, development, and ecology by Mark Ridley.
- (iv) Biological rhythms by M. K. Chandrashekar.
- (v) Survival strategies: cooperation and conflicts in animal societies by Raghavendra Gadagkar.

ZL-DPH-02 (OP-2): Sericulture and Seri-biotechnology

Unit 1:

1. Applications of biotechnology in conservation of seri-biodiversity.
2. Gene transfer methods in plants; Target cells for transformation; Gene transfer techniques using *Agrobacterium*. Selectable and scorable markers; Agro infection and gene transfer; DNA mediated gene transfer (DMGT).
3. Transgenic plants for mulberry crop improvement, molecular farming and regulated gene expression.

Unit 2:

1. Insect cell and tissue culture: History and scope of animal cell and tissue culture; advantages and disadvantages.
2. Primary culture - cell lines and cloning: Disaggregation (enzymatic and mechanical) of tissue and primary culture - cultured cells and evolution of cell lines – maintenance of cultures – large scale cell cultures - somatic cell fusion.

Unit 3:

1. Polymerase chain reaction (PCR): Gene amplification, application of PCR in mulberry and silkworm biotechnology.
2. Molecular mechanism of silk protein synthesis and silk coding genes.

Unit 4:

1. Biophysical methods: Analysis of bio-molecules using UV-VIS spectroscopy, fluorescence spectroscopy, structure determination using X-ray diffraction and NMR.
2. Gel filtration, ion exchange & affinity chromatography; gas chromatography; High pressure liquid chromatography (HPLC) and LCMS-MS.

ZL-DPH-02 (OP-3): Parasitology**Unit 1:**

Parasitic protozoa: General characters and classification. Morphology, host range, location, life cycle, pathogenicity, treatment and prophylaxis of Visceral protozoa (*Entamoeba*, *Giardia*); Blood and tissue protozoans (*Trypanosoma*, *Plasmodium* and *Toxoplasma*).

Unit 2:

Trematoda: General characters and classification. Morphology, host range, location, life cycle, pathogenicity, treatment and prophylaxis of Visceral flukes (*Clonorchis*, *Fasciola*, *Fasciolopsis*), Lung fluke (*Paragonimus*), Blood fluke (*Schistosoma*).

Unit 3:

Cestoda: General characters and classification. Morphology, host range, location, life cycle, pathogenicity, treatment and prophylaxis of Intestinal tape worm (*Taenia*, *Hymenolepis*), Metacestodiasis (Cysticercosis, Coenurosis, Hydatid).

Unit 4:

Nematoda: General characters and classification. Morphology, host range, location, life cycle, pathogenicity, treatment and prophylaxis of Intestinal nematodes (*Ascaris*, *Hook worms*, *Enterobius*), Blood and tissue nematodes (Filarial worms, larval migrans).

Suggested Readings:

1. Cheng 1986. General Parasitology
2. Cox, 1994. Modern Parasitology
3. Kenneth and Schantz, 1986. Immunodiagnostic of parasitic Diseases, Academic press, Orlando.
4. A. C. Chandler. Introduction to parasitology (with special reference to parasites of man)
5. E.R. Noble. Parasitology (The biology of animal parasites)
6. Bothroyd and Komuniecki, 1995. Molecular approaches to parasitology.

Wiley- Liss, New York

7. Kenneth and Schantz, 1986. Immunodiagnostics of parasitic Diseases, Academic press, Orlando.
8. Smyth, 1994. Animal Parasitology, Cambridge University Press, London

ZL-DPH-02 (OP-4): Fish and Fisheries

Unit 1:

Anatomical Study: Histology and permanent or temporary slide preparation of different organs: brain with pituitary, Ovary, testis, Gill, liver, Kidney, Alimentary canal and Comparative study between normal and abnormal features.

Unit 2:

Breeding methods induced breeding, breeding by stripping methods, their developmental stage growth marker study, Breeding of indigenous fishes

Unit 3:

Gamete maturation Study: Oocyte maturation experimental design, sperm motility and Viability, Counters Specification and Parameters, Hormonal Study: Hormone synthesis pathway, Importance of kinase and their Study. Steroid estimation methods: ELSIA, HPLC, RIA Insitu hybridization

Unit 4:

Toxicology Study: Parameter, Study tools experimental design data interpretation. Analysis methods and concern software operation, Statistical Analysis and data presentation (graphical and pictorial)

Suggested Readings:

1. Hadley (2004), Endocrinology-pearson Education,
2. Hoard & Randall: Fish physiology,
3. Pearse AG Everson: Histochemistry: Theoretical & applied Technology,
4. Keith Wilson & John walker: Principles & Techniques of biochemistry & Molecular,
5. Pandey, shukla, Trivedi: Fundamentals Of Toxicology,
6. Daniel, Wayne W.: Biostatistics: A foundation for analysis in the health Sciences.

ZL-DPH-03: Instrumentations

Unit 1:

Analytical instruments: UV Spectrophotometer, colorimeter, FTIR, NMR spectroscopy and Mass Spectrometry.

Different types of microscopes: Compound Microscope, foldscope, Phase Contrast Microscope, Confocal Microscope, Fluorescence and Electron microscopes (TEM and SEM).

Unit 2:

Different types of microtomes: Rocking Rotary, Freezing microtomes. Cryotechniques of freeze drying and freeze substitution, fresh and fixed frozen sections, Ultratome and Cryocut.

Centrifuge: Homogenizers and Centrifuges, High speed centrifuge, Differential and Density gradient centrifuge, Ultracentrifuge, analytical ultracentrifuge.

Unit 3:

Electrophoresis: Principle of Electrophoresis types of electrophoresis, SDS and Native PAGE, Agarose Gel, Isoelectric Focusing, 2-D electrophoresis and their comparison. Blotting techniques,

Unit 4:

Chromatography: Principle of chromatography, types of chromatography, Thin layer chromatography (TLC), two dimensional and column chromatography, High Performance Liquid Chromatography (HPLC), Fast Performance Liquid Chromatography (FPLC), Gas liquid chromatography (GLC), Gas Chromatography (GC). Autoclave, Laminar Air flow, Lyophilizer, PCR and RT PCR

ZL-DPH-04: Biostatistics**Unit 1:**

Data collection, documentation and presentation of data, classification and tabulation of data. Diagrammatic and Graphical presentation of statistical data, Frequency distribution, Analysis and Interpretation of Data.

Unit 2:

Central tendency: Mean, Median and Mode. Standard Deviation and error. Concepts of population and sample, need for sampling, census and sample, surveys, sampling and non-sampling errors, sample size determination, finite population, sampling techniques-. Systematic sampling, stratified sampling etc. Probability.

Unit 3:

Level of significance, Simple Correlation, correlation coefficient, simple linear regression. Poisson Distribution. Student 't' test, Chi-square test, Fisher test, Z-test. Analysis of variance: One way ANOVA and Two way ANOVA. Statistical Packages and analysis: SPSS etc.

Unit 4:

Basic Computers: MS office including Word, Excel, Power Point and Internet. Use of tools/ techniques for Research: methods to search required information effectively. E-learning, Software for paper formatting like LaTeX/MS office, Software for detection of Plagiarism: Urkund, Turnitin/Ithenticate.