

**Department of Applied Animal Sciences
School for Bioscience and Biotechnology, B. B. Ambedkar University**

Syllabus for Ph. D Course Work

Compulsory Paper: AAS – 01: Research Methodology

Unit 1: General research

1. Defining research question, Approaches and Methodology, Documentation and presentation of data, Analysis and Interpretation of Data, 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.
2. A brief idea of funding agencies such DST, DBT, ICMR, CSIR, ICAR, UPCAR, UPCST, BNHS, European Commission, DFID and UGC. Role of Intellectual Property Rights (IPR), Patenting, Copyright, Product development, Process development in Research and development.
3. Ethical, legal, social and scientific issues in biological research.

Unit 2: Biostatistics

1. Variables in biology, collection, classification and tabulation of data. Frequency distribution, Diagrammatic and Graphical presentation of statistical data, sampling techniques.
2. Identification and formation of research problem (Hypothesis). Elements in research methodology. Research design (CRD, RBD).
3. Level of significance, Simple Correlation, correlation coefficient, simple linear regression. Student's 't' test, Chi-square test, Fisher test, Z-test.
4. Analysis of variance: One way ANOVA and Two way ANOVA. Statistical Software

Unit 3: Principle and uses of different instruments

1. Analytical instruments like UV-VIS Spectrophotometer, colorimeter, Gel Electrophoresis System, Paper chromatography system, and FTIR spectrometers.
2. Different types of microscopes: Phase Contrast Microscope, Fluorescence and Electron microscopes, TEM, SEM. Microscopic techniques: Visualization of cells and sub cellular components of light microscopy, resolving powers of different microscopes, microscopy of living cells, different fixation and staining techniques for Electron microscope.
3. Different types of microtomes: Rocking Rotary, Freezing microtomes. Cryotechniques of freeze drying and freeze substitution, fresh and fixed frozen sections and Ultratome.
4. Centrifuges, High speed centrifuge, Ultracentrifuge, pH meter, PCR machine.

5. Electrophoresis: Principle of Electrophoresis types of electrophoresis, paper and gel electrophoresis and their comparison. Blotting techniques.
6. 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 Chromatography (GC).

Unit 4: Use of computer in Biological Research

1. Computer basics: MS Office including Word, Excel, Powerpoint and internet.
2. Tabulation and graphical presentation of data.
3. Statistical Packages and analysis: Sigma Stat, Sigma Plot, KyPlot, SPSS, and Simply Growth.

Optional Papers

AAS – 02 (OP 1): Behavioural Ecology and Conservation Biology

Unit – I

1. Principles of Animal Behaviour: Natural selection, preset behaviour and learning.
2. Capture methods and handling devices: Hand nets, bucket traps, bag and funnel traps, mist nets, harp traps and holding devices.
3. Marking and recapture techniques: wing bands, necklaces, light tags and radiotransmitters.
4. Survey and census methods: Surveys and censuses at roosts, estimation of foliage roosting bats, visual counts of foraging bats, ultrasonic detectors.
5. Age determination in bats: Tooth wear, incremental lines, size of pupp cavity, lengths of long bones, epiphyseasl-diaphyseal fusing, body mass, pelage coloration.

Unit – II

1. Ecology of Behaviour: Habitat Selection, food selection and optimal foraging theory, aggression, territoriality and dispersal.
2. Predator-Prey interactions: Prey-predator cycles, host-parasite interaction and antipredator behaviour.
3. Interspecific competition and Mutualism, types of competition, commensalism and evolution of competitive relationships.

Unit – III

1. Reproductive Ecology: Reproductive sites, Timing, Number of young, Age of reproduction, Mating system, Sex ratios and Brood parasitism.
2. Sexual selection: Mate choice, good genes and mate choice, male-male competition, mating systems.

Unit – IV

1. Population Genetics: The Hardy-Weinberg law, Mutation and Migration, Mating preference, Differential mortality and fecundity.
2. Population growth: Exponential and logistic growth, Life tables and the evolution of birth and death rates.

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.

AAS – 02 (OP 2): Sericulture and Seri-biotechnology

Unit I:

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 scanable 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 II:

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 III:

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 IV:

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.

AAS – 02 (OP 3): Parasitology

Unit 1

Major Tropical parasitic diseases of man and domesticated animals and their socio-economic consequences; Emerging and newly emerging infections; Problems and prospects of control.

Unit 2

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 3

Helminths: 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*); Intestinal tape worm (*Taenia*, *Hymenolepis*), Metacestodiasis (Cysticercosis, Coenurosis, Hydatid); Intestinal nematodes (*Ascaris*, *Hook worms*, *Enterobius*), Blood and tissue nematodes (Filarial worms, larval migrans).

Unit 4

Methods of collection, preservation and preparation of protozoan, helminth and arthropod parasites. Laboratory diagnosis of parasitism: blood and stool examination, cultural examination and examination of biopsy material for parasitic infection, Methods of *in vitro* cultivation of parasites. Identification and Diagnosis: Morphological, Serological, DNA-based and *in silico* methods; Advancement in vaccine development; Control strategies.

AAS – 02 (OP 4): Fish and Fisheries

Unit: 1

1. Fish identification, understanding of standard terminology, Variation according to change in habitat.
2. Morphology study: Pigmentation scale arrangement, Photography, Electron microscopy, Length and weight measurement.
3. Breeding methods induced breeding, breeding by stripping methods, their developmental stage growth marker study. Ornamental fish culture. Breeding of indigenous ornamental fishes

Unit: 2

1. Anatomical Study: Histology and permanent or temporary slide preparation of different organs: brain with pituitary, Olfactory bulb ovary, testis. Gill ,liver, Kidney, Alimentary canal and Comparative study between normal and abnormal features.
2. Biogeochemical Study: Estimation by Colorimeter, ELISA, Commercial KITS to different biochemical Parameters, enzyme estimation analysis, data interpretation methods.

Unit: 3

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

Unit: 4

1. Toxicology Study: Parameter, Study tools experimental design data interpretation. Analysis methods and concern software operation.
2. Fish nutritional studies. Growth studies and proximate analysis. Nutritional requirement and color enhancement in ornamental fishes.
3. Statistical Analysis and data presentation (graphical and pictorial)

Suggested Readings:

1. Cheng 1986. General Parasitology
2. Cox, 1994. Modern Parasitology
3. Kenneth and Schantz, 1986. Immunodiagnosics 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. Immunodiagnosics of parasitic Diseases, Academic press, Orlando.
8. Smyth, 1994. Animal Parasitology, Cambridge University Press, London