

## **Course work for PhD in Zoology**

### **Course one: Research Methodology (5 Credits)**

01. Research Methodology: Literature review, Defining the research question, Approaches and Methodology, Documentation and presentation of data, Analysis and interpretation of data, manuscript preparation (8L)
02. Quantitative methods: Biostatistics used for analysis of data (7L)
03. Computer application: bioinformatics, databases and their applications ( 10L)
04. Tools and techniques: Biochemical and Biophysical techniques, Microscopic techniques, Histology and histochemistry, Cell biology, molecular biology, Genetic engineering techniques (20L)

Techniques used for purification and characterization of biomolecules: Centrifugation, Ultrafiltration, Chromatography, electrophoresis, spectrophotometry, GC-MS, LCMS, NMR, MALDITOF, X-ray crystallography, CD

Microscopic techniques including Fluorescence microscopy, Confocal microscopy, Atomic force microscopy and live cell imaging

FACS analysis

Histology and histochemistry: Fixation and sectioning of tissue, embryos and cells.

Immunohistochemistry, immunofluorescence, histochemical staining for characterization of cell type.

Real time PCR, DNA microarray, New generation DNA sequencing, Protein Microarray, protein sequencing, FRET analysis

05. Review writing (1 C = 15L): Topic of the review should be different than that of the PhD topic.

### **Course two: Subject specific course (10C)**

#### **Course one: Advances in Biology I (5C)**

01. Biodiversity, genetic diversity, molecular diversity and taxonomy, DNA bar-coding, population genetics, conservation of diversity and endangered species. Evolution, Modern tools of Taxonomy (alpha beta and gamma level taxonomy), Application of molecular and computational tools for phylogeny, Effects of man made alteration on biosphere (20 L)
02. Field studies: Assessment of biodiversity in different types of ecosystems, sampling techniques and quantitative methods for biodiversity assessment (10 L)

03. Animal behavior: Questions and patterns of behavior, genetic and neural basis of behavior, biological rhythms, Exploitation of resources, communication, social behavior, mate selection and parent caring (10 L)

04. Stem Cell Biology and Regenerative medicine (10L)

05. Guidelines for Bio-safety, functioning of Institutional Bio-safety committee, Institutional Animal ethics committee, and Institutional ethical committee , CPCSEA guidelines for animal experimentation , ICMR guidelines for experiments involving humans, DBT guidelines for Bio-safety practices to be followed (5L)

06. Patents and Intellectual property rights, Licensing of technologies (5L)

### **Course two: Advances in Biology II (5C)**

01. Advances in Molecular Biology and Genetic Engineering (25L)

01. Genome projects- Human Genome project
02. Gene therapy: Introduction, vectors in gene therapy, advances in gene therapy, safety assurances
03. DNA analysis and diagnostics: Methods of DNA analysis, Diagnosing infectious diseases, Identifying genetic disease Transgenic animals: custom made animals, Animal bioreactors
04. Medical forensics: DNA fingerprinting, - genetic identification, Use of technology in anthropological studies
05. Pharmaceutical products of DNA technology: Human protein replacements, Human therapies, Vaccines- traditional vaccines and DNA vaccines
06. Agriculture: Enhancing resistance in plants to pathogens, Genetically modified foods

02. Genomics and Proteomics (15L)

01. Genome mapping- Genetic mapping, Physical mapping, Resolution of mapping
02. Strategies for Sequencing whole genome and sequence data analysis
03. Comparative Genomics
04. Global expression profiling : whole genome analysis of mRNA and protein expression, microarray analysis and their applications
05. Importance of proteomics
06. Strategies in proteomics: 2D PAGE and Mass spectrometry
07. Database and search engines in proteomics
08. Mapping of protein interactions: two hybrid, phage display
09. Applications of proteomics: Understanding mechanism of pathogenesis, Drug discovery, Disease diagnosis, identification and characterization of novel proteins

03. Drug design and delivery (5L)

04. Simulation and modeling (5L)

**Course three: Field work, Seminar and other academic activities**

01. Writing research proposal: (1C)
02. Communication skills (Writing and Oral): (2C)
03. Seminar presentation (1C)
04. Design and teach one practical to the students: (1C)