

## ZOOLOGY

### M Phil/PhD Course Work

Code	Title	Credits
ZOO-RS-C101	Research Methodology (School Level)	4
ZOO-RS-C102	Preparation of Research Proposal and review of literature	4
ZOO-RS-E103	Recent advances in biodiversity and conservation biology	4
ZOO-RS-E104	Recent advances in Immunobiology and Parasitology	

#### MIC-RS-C101: Research Methodology (Common for School of Life Sciences)

Credits: 4

Full Marks: 100

##### Unit I- Research Design and Data Collection

Research methodology- definition, different types of research design. Basic principles of experimental designs. Sampling design- sample survey, steps in sample design, criteria of selecting a sampling procedure and different types of sample designs. Methods of Data Collection: Primary and secondary data.

Literature collection and citation, bibliography. Writing skills - Preparation of research report, presentations, and writing scientific paper. Impact factor, Citation factor, Plagiarism, ISBN, ISSN.

##### Unit II- Processing and Analysis of Data and Sampling

Processing operations, elements/types of analysis, statistics in research, measures of central tendency, dispersion, asymmetry, relationships. Simple regression analysis, multiple correlation and regression, partial correlation, association in case of attributes and other measures.

##### Unit III- Testing of Hypotheses

Basic concepts of testing of hypothesis, procedures for hypothesis testing. Hypothesis testing for differences between means, hypothesis testing for comparing two related samples, hypothesis testing of proportions. Testing the equality of variances of two normal populations, hypothesis testing of correlation coefficient. Chi square test

##### Unit IV- Analysis of Variance and Covariance

Analysis of Variance and Covariance (basic principles of one-way ANOVA, two-way ANOVA and ANCOVA). Multivariate analysis techniques (Characteristics and applications, classification of Multivariate analysis, important multivariate techniques, important method of factor analysis).

Ethics in research.

##### Reading List:

1. Bernard Rosner, B. 2005. *Fundamentals of Biostatistics*, 6<sup>th</sup> edition Duxbury Press.
2. Gerry, Q. P and Keough, M. J. 2002. *Experimental Design and Data Analysis for Biologists*. Cambridge Univ. Press.

3. Kothari, C.R. 2004. *Research Methodology, Methods & Techniques*. 2<sup>nd</sup> Revised Edition. New Age International Publisher, India.
4. Norman, N. G. and Streiner, D. 2008. *Biostatistics: The Bare Essentials*. 3<sup>rd</sup> edition, BC Decker Inc.
5. Paulson, D. S. 2008. *Biostatistics and Microbiology*. Springer.
6. Sokal, R. R. and Rohlf, F. J. 2008. *Introduction to Biostatistics*. Dover Publication.
7. Laake, P., Benestat, H.B. and Olsen, B.R. 2007. *Research Methodology in the Medical and the Biological Sciences*. Academic Press, UK.

## **ZOO-RS-C102: PREPARATION OF RESEARCH PROPOSAL AND REVIEW OF LITERATURE**

### **Preparation of research proposal**

Students have to prepare Research Proposal in any standard format (UGC, DBT, DST, etc) in the chosen field of research. The proposal should have clear objectives with identification of gaps in the knowledge, review of literatures, expected outcome, potential application, real time budget and time line.

### **Review of Literature**

An extensive review work is to be undertaken in the proposed area of research. It should have appropriate citation and well formatted references using any of the standard journal formats approved by UGC.

## **ZOO-RS-E103: RECENT ADVANCES IN BIODIVERSITY AND CONSERVATION BIOLOGY**

### **Unit I: Sampling techniques**

Sampling technique of fauna: aquatic and terrestrial; Population estimation: distance sampling, occupancy studies, enumeration of morphometry; Enumeration of habitat and micro-habitat parameters; Reproductive ecology: nest characteristics, estimation of nesting and reproductive success; Feeding ecology: feeding guild, feeding rate, manoeuvre

### **Unit II: Taxonomy and biodiversity**

Taxonomy: principles of taxonomy; Type specimens: holotype, lectotype, paratype, neotype. Description of new species, cataloguing and submission to museums; Role of taxonomy in biodiversity conservation; Introduction to species 2000: catalogue of life

### **Unit III: Biodiversity management approach**

Management of protected areas; Conservation Zones, Important Bird Areas, Man and Biosphere reserve, Conservation programs of rare, endangered and threatened species, Conservation outside protected areas, management of urban biodiversity; Citizen Science: roles of community in conservation; Funding mechanism for promoting conservation

### **Unit IV: Application of Molecular Techniques in biodiversity**

DNA and RNA extraction, designing of primers, Gene amplification and PCR, DNA and protein sequencing, Molecular markers: RAPD, PCR-RFLP, VNTR; DNA barcoding: process, application, barcode of life data systems; Phylogenetic analysis: construction of phylogenetic trees

## Suggested Readings

1. Allendorf, F.W., Luikart, G.H. and Aitken, S.N. (2012) Conservation and the Genetics of Populations 2e. Willey-Blackwell.
2. Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. (2000) Bird census techniques. Academic Press, London.
3. Frankham, R., Ballou, J.D. and Briscoe, D.A. (2010) Introduction to Conservation Genetics. Cambridge University press.
4. Heyer, W.R., Donnelly, M.A., Mcdiarmid, R.W., Hayek, L.C. and Foster, M.S. (1994) Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press. Washington.
5. Magurran, A.E. and McGill, B.J. (2011) Biological Diversity: frontiers in measurement and assessment. Oxford University Press.
6. Primack, P.B. (2014) Essentials of Conservation Biology. Sinauer Associates Inc.
7. Southwood, T.R.E. and Henderson, P.A. (2000) Ecological methods. Blackwell Science, London.
8. Watson, M.F., Lyal, C. and Collin, P. (2015) Descriptive Taxonomy: The foundation for biodiversity Research. Cambridge University Press

## ZOO-RS-E104: IMMUNOBIOLOGY AND PARASITOLOGY

### **Unit I: Immunogenetics and transplantation immunology**

Evolution of MHC; Determination of HLA allele frequency, haplotype estimation, linkage disequilibrium, Relative Risk, P-value; Role of MHC; Transplantation immunology: Types of graft rejections- hyper acute rejection, acute rejection, chronic rejection; Types of cell-mediated immune responses in transplantation, prevention of graft rejection in transplantation

### **Unit II: Immunological methods**

Experimental animal models, inbred strains of mice and its uses; Cell culture systems: types and forms of cell culture, methods and strategies for cell culture, examination of cells of suspension cultures, application of cell culture; Flow cytometry and fluorescence, DNA isolation: phenol chloroform method, salting out method, ARMS-PCR SSP typing, SSOP, SBT typing of HLA, RFLP

### **Unit III: Parasitic protozoa and helminthes**

Emerging and re-emerging parasitic diseases; problems and prospects of control; Neglected tropical diseases; molecular biology and immunopathology of important parasites: protozoan (*Entamoeba*), trematode (*Opisthorchis*), cestode (*Echinococcus*) and nematode (*Wuchereria*); parasite control strategies: drugs and vaccines

### **Unit IV: Parasitology techniques**

Laboratory diagnosis of parasitism: old and new approaches; in vitro cultivation of parasites; Proteomics; Transcriptomics with reference to parasitic infections; Application of NGS technology in identification of drug targets and vaccine candidates; Biological databases (nucleotide, protein and natural products)

## Suggested Readings

1. Abbas, A. K., Lichtman, A. H. And Pillai, S. (2006). Cellular and molecular Immunology. W.B. Saunders.
2. Boothroyd, J. C. and Komuniecki, R. (1995) Molecular approaches to Parasitology. Wiley-Liss, New York.
3. David, Brostoff and Roitt (2006) Immunology. Elsevier Publication.
4. English, L. S. (1994). Technological Applications of Immunochemicals (*BIOTOL*). Butterworth-Heinemann, Oxford Freeman & Co.
5. Green, M. R. and Sambrook, J. (2012) Molecular cloning: a laboratory manual. Cold Spring Harbor Laboratory Press, New York.
6. Janeway, Travers, Walport and Shlomchik (2005). Immuno Biology- The immune system in health and disease. Garland Science Publishing, New York, USA.
7. Schmidt, G. D. and Roberts, L. S. (2001). Foundation of Parasitology. McGraw Hill Publishers.
8. Smyth, J. D. (1994). Animal Parasitology. Cambridge University Press.