

**Mangalore University**  
**Ph.D. in Applied Zoology**  
**Course work Syllabus**

**Scheme**

Paper	Title	Hours of instructions per week	Duration of examination	Internal Assessment	Theory examination	Total	Credits
Paper-1	Research Methodology	4	3	30	70	100	4
Paper-2	Review of literature Review Report Viva	16				150	8
						50	2
						300	14

**Internal Assessment**

Internal Assessment to be based on one theory test (70marks), One objective test (10 marks) and seminar/Assignment (20 marks) in each paper. Total to be reduced to 30

**Theory Examination**

Pattern of question paper for theory examination of 70marks

Part A= 20 marks. Consisting of 15 questions carrying 2(two) marks each out of which 10(ten) are to be answered. All units of the syllabus to be equally represented.

Part B= 50 marks consisting of five questions to be answered from among 10(ten) questions. Each question carrying 10(ten) marks. All units of the syllabus to be equally represented.

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**APPLIED ZOOLOGY**  
**Ph.D. COURSE WORK**  
**PAPER -I: RESEARCH METHODOLOGY**

12hours/unit

Total: 60 hrs.

**COURSE OUTCOME**

1. Course is designed to understand basic and advanced biology concepts and techniques to define various research problems.
2. Understand the principles, operation and applications of different laboratory equipment in various fields of biology. So that candidate gets acquainted with the basics of each instrument.
3. To get skills of animal cell culture and their applications in zoology.
4. Gain an appreciation and knowledge of using animals for research, how to deal with animal handling and animal ethical issues.
5. Expertise on various statistical tools and soft wares to analyse the data obtained.
6. At the end of this course scholar should be able handle research instruments and develop scientific temperament.

**Unit 1-1 *Research Planning and Execution***

Defining of research problem, objective and its importance,  
Source of information, Journals, Books, Biological abstracts, Reviews, Data base, Search engines, INFLIBNET, Pubmed, Science direct, e journals, Bibliography,  
Background, preliminary observations; Data collection, recording the data, Methods of analysis, presentation of the data.  
Methods of writing the finding; Components of thesis, Structure of research article, Presentation of research findings, Plagiarism and software to detect plagiarism.

**Unit II –*Biostatistics and Computers Applications***

Statistical variables, Frequency distribution, Graphical representation of the data.  
Probability; ANOVA, Student 't' test; Chi Square test, Correlation and regression analysis;  
Nonparametric test-Wilcoxon signed rank test, Mann –Whitney U test, Kruskal Wallis test,  
Computer software statistical packages, MS EXCEL, SPSS, MINITAB Packages and their uses.  
Dun nets post –hoc test.  
Biodiversity Monitoring, sampling techniques and relevant software's.

### Unit III-Cell and Molecular Biology Techniques

*In vitro* animal cell culture systems, Primary and secondary cultures, requirements, methodology and applications of each culture systems.

Principle, Methods and applications of Cryopreservation, Histological and Histochemical techniques, flow cytometry

Principle, methods and applications of light and confocal microscopy, electron microscopy

Image analysis, Gel doc system-Methods and applications

Principle methods and application of polymerase chain reaction, DNA sequencing, Blot techniques

Autoradiography, DNA finger printing, FISH, RFLP-Principle, methods and applications.

### Unit IV- Biochemical and Physiology Techniques

Principle, methods and applications of various type of Chromatography; HPLC, GLC, LCMS Dialysis and precipitation technique; Ultracentrifugation, Electrophoresis, Electro focussing, organelle separation-Principle, Methods and applications.

Principle, methods and applications of Spectrophotometry, tracer Techniques, ELISA, RIA Immunodiffusion and Immunoprecipitation.

Electrodes, preamplifiers, DC and AC , Faraday cage oscilloscopy, Analog-digital conversion, Anatomical studies; use of antibodies, GFP Gal 4lines

### Unit V-Breeding and Maintenance of laboratory Animals

Introduction to experimental animals –mouse, rats and guinea pigs, hamsters, rabbits

Breeding and maintenance of small laboratory animals-mouse and rat CPCSEA Guidelines and IAEC –Rules and Regulations for animal breeding and maintenance. Human ethical committee Handling, treatment and collection of biological materials from experimental animal, good laboratory practice, Waste disposal

### Reference

1. Beaven, C. R. (1990) Hand book of the Fresh water fishes of India. Narendra's Pub. House, New Delhi
2. Celis J. E., (1994): Cell biology-a laboratory hand book, Vol. I, II and III Academic press.
3. Freshney R. I. (2000 &2005) Culture of animal cell: A manual of basic technique, IV & V Edition, Alan R. Liss, Inc. New York
4. Fox J.G and Cohen B. J. (Ed) (1984) Laboratory animal in medicine, Academic press. Inc.,
5. Gurmani N. (2004) An introduction to Biostatistics, MJP publishers, Chennai.
6. Jayaraman, K.C. (1981) The freshwater fishes of india-A Hand book

7. Kleinsmith L.J. and Kish V.M (1995) Principles of cell and Molecular Biology, II edition, Harper Collins College publishers.
8. Hassard T.H. (1991) Understanding Biostat. Mosby year book, London
9. Hawkins C. and M. Sorgi (Eds)(1985) Research how to plan, speak and write about it, Springer-Verlag, Hiedelberg.
10. Philip, Sheeler (1987) Cell molecular biology, III edition, John Wiley New York
11. Potts, G.W. and R.I. Wootton (1984) Fish reproduction strategies and tactics Academic press, pp 249-331.
12. Maciefowshi J. and Zieba J. (1982) Genetics and animal breeding, Elsevier-Scientific publishing company, Poland.
13. Norman T.J. Bailey (1994) Statistical methods in biology, 3<sup>rd</sup> edition, Cambridge University press.
14. Poole T. B. and Robinson R. (Ed) (1987) The UFAW handbook on the care and management of laboratory animals, VI edition, Longman scientific and technical and IBH publishing Co, Pvt. Ltd., New Delhi.
15. Prakash M., C.K. Arora (1998) Laboratory animals, Encyclopaedia of laboratory technique. Anmol Publication, New Delhi. Edition, Prentice Hall, New Jersey,



## PAPER -II: RESEARCH METHODOLOGY

### COURSE OUTCOME

1. Course allows aspirants to inculcate habit of stating and accumulating required data from earlier documentations.
2. Learn how to read and understand primary publications in their respective research fields.
3. Designing of research plans and understanding of research problems.
4. To know how to draw information and data from research institutes working on relative concepts.
5. Expertise on compilation and analysis of data, comparing results to connect to selected work.
6. Learn how to present relevant biology research data to an audience, comparing various results

### *Guidelines for Paper 2 (Review of literature)*

1. The review of literature shall be pertinent to the research problem being taken up by the candidate.
2. The title shall be adequate and indicative of the content.
3. The review shall have a summary

### References

Reference should be cited in the text by author and year, not by number. If there are more than two, should be written as author followed by *et al* in the text.

### Example:

Hong BC and Chang FL., 2004, Estrogen receptors alpha and beta in choroid plexus epithelial cells in Alzheimer's disease *Neurosci Lett.* 360: 113-116.

Peiter E, Fischer M, Sidaway K, Roberts SK and Sanders D., 2005, Multiple RNA surveillance pathways limit aberrant expression of iron uptake mRNAs and prevent iron toxicity in *S. Cerevisiae*. *Mol. Cell.* 19: 39 -51.

Ramanna MS and Hermsen JH., 1979, Genome relationships in tuber-bearing Solanums; in *Biology and taxonomy of Solanaceae* (eds) JG Hawkes, RN Laster and AG Skelding (London; Academic Press) pp 647-654.

Samiwala EB., 1987, DNA cloning in *Haemophilus influenzae*, PhD thesis, University of Bombay, Bombay.