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

Program Outcome

PO 1. The PhD in Applied Zoology program is designed to foster human resources with discernment in intellectual advances.

PO 2. This program nurtures the scholars through furnishing required guidelines and allows them to critically evaluate their study's authenticity.

PO 3. It is also intended that the scholar should be able to explore corporeal enigmas in science and provide ingenious ideas which results in fruitful publications.

Program Specific Outcomes

PSO 1. Scholars get adept in various fields of Zoology inquisitions.

PSO 2. Develop equally dexterous proficiency in research and analysis.

PSO 3. Innovative methods to study biodiversity and conservation strategies.

PSO 4. Competent to explore epidemiology of zoonosis and control measures.

PSO 5. Expertise in propelling the use of animals to promote sustainable research.

Scheme

Courses	Title	Hours of instructions per week	Duration of examination (Hrs)	Internal Assessment	Theory examination	Total	Credits
Course-I	Research Methodology	4	3	30	70	100	4
Course -II	Research and Publication Ethics	2	3	30	70	100	2
Course-III	Review of literature Review Report Viva	14				150 50	6 2
					Total	400	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
COURSE I- RESEARCH METHODOLOGY

Course outcomes:

Students will be able to

CO 1. Understand basic and advanced biology concepts and techniques to define various research problems.
CO 2. Learn 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.
CO 3. Get skills of animal cell culture and their applications in zoology.
CO 4. Gain knowledge of using animals for research, animal handling and animal ethical issues
CO 5. Expertise on various statistical tools and soft wares to analyse the data obtained.
CO 6. At the end of this course scholar should be able develop scientific temperament.

Unit I. *Research Planning and Execution* (12 Hours)

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, presentatior of the data.
Methods of writing the finding; Components of thesis, Structure of research article, Presentation of research findings,

Unit II. *Biostatistics and Computers Applications* (12 Hours)

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, Kruskel 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* (12 Hours)

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* (12 Hours)

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 Immunodiffusionand Immunoprecipitation.

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

Unit V. *Breeding and Maintenance of laboratory Animals* (12 Hours)

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

References

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 Biostatistcs, 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, 3rd 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 Je

COURSE II–RESEARCH AND PUBLICATION ETHICS (RPE)

Course Outcomes:

Students will be able to:

CO1. Understand the philosophy of science, ethics and research integrity
CO2. Aware about the publication ethics, intellectual honesty and plagiarism
CO3. Inculcate best practices and publication ethics .
CO4. Learn about types of research publications and conflict of interest in publication.
CO5. Expertise in data bases, concept of impact factor and research metrics.

Theory

Unit I. *Philosophy and Ethics* (4 Hours)

Introduction to philosophy: definition, nature and scope ,concept, branches, Ethics: definition, moral philosophy, nature of moral judgment and reactions

Unit II. *Scientific Conduct* (4 Hours)

Ethics with respect to science and research, Intellectual honesty and research integrity
Scientific misconducts: falsification ,fabrication, and plagiarism(FFP), Redundant publications: duplicate and overlapping publications, salami slicing, selective reporting and misrepresentation of data

Unit III. *Publication ethics* (7 Hours)

Publication ethics: definition, introduction and importance
Best practices/standards setting initiatives and guidelines: COPE,WAME.etc.
Conflicts of interest
Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa types
Violation of publication ethics, authorship and contributorship
Identification of publication misconduct, complaints and appeals
Predatory publishers and journals

Practice

Unit IV. *Open access publishing* (4 Hours)

Open access publications and initiatives
SHERPA/RoMEO online resource to check publisher copyright &self-archiving policies
Software tool to identify predatory publications developed by SPPU
Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Unit V. *Publication misconduct* (4 Hours)

A. Group discussions (2hrs.)
Subject specific ethical issues, FFP, authorship
Conflicts of interest
Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2 Hours)

Unit IV. *Databases and research metrics* (7 Hours)

A. Databases (4hrs.)
Indexing databases
Citation databases: Web of Science, Scopus, etc.

B. Research metrics (3hrs.)
Impact factor of journals per journal citation report, SNIP, SJR, IPP, Citescore

Metrics: h-index, g index, i 10index, altmetrics

References:

1. Bird,A.(2006).*Philosophyof Science*.Routledge.
2. MacIntyre,A.(1967)*AShortHistory ofEthics*.London.
3. P.Chaddah,(2018)EthicsinCompetitiveResearch:DOnotgetscooped;donotgetplagiarized,ISBN:978-9387480865
4. NationalAcademyofSciences,NationalAcademyofEngineeringandInstituteofMedicine.(2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*.NationalAcademies Press.
5. Rensik, D. B. (2011). What is ethics in research & why is it important. *National Institute ofEnvironmental Health Sciences*, 1-10. Retrieved fromhttps://www.niehs.nih.gov/resources/biothics/whatis/index.cfm
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.https://doi.org/10.1038/489179a
7. Indian national Science Academy (INSA), Ethics in Science Education, Research andGovernance(2019),ISBN:978-81-939482-1-7.https://www.insaindia.res.in/pdf/Ethics_Book.pdf

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COURSE III - REVIEW OF LITERATURE

Course outcomes:

CO 1. Course allows aspirants to inculcate habit of referring and accumulating required data from earlier documentations.
CO 2. Learn how to read and understand primary publications in their respective research fields.
CO 3. Designing of research plans and understanding of research problems.
CO4. To know how to draw information and data from research institutes working on relative concepts.
CO 5. Expertise on compilation and analysis of data, comparing results to connect to selected work.
CO 6. Learn how to present relevant biology research data to an audience, comparing various results

Guidelines for Course III (Review of literature)

1. The review of literature shall be pertinent to the research problem being taken up by the candidate. Review report should contain a detailed research work done in the area, methodologies to be adopted, gaps in the work done so far, objectives and expected outcome of the stated research work.
2. The title shall be adequate and indicative of the content of the work.
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 two author followed by *et al* in the text.

Example:

Hong BC and Chang FL 2004 Estogen 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 2005a Multiple RNA surveillance pathwayslimit aberrant expression of iron uptake mRNAs and prevent iron toxicity in *S. Cerevisiae. Mol. Cell* 19 39 -51

Ramanna MS and HermsenJHTh 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 *Haemophilusinfluenzea*, PhD thesis, University of Bombay, Bombay

Jar JH 1974 Biostatistical analysis (New Jersey: Prentice Hall)