Ph.D., ZOOLOGY
COURSE WORK
(With effect from the Academic Year 2020-21)

Department of Biology
The Gandhigram Rural Institute -Deemed to be University
(Ministry of Education, Govt. of India)
Accredited by NAAC with 'A' Grade (3rd Cycle)
Gandhigram – 624 302 Dindigul District
Tamil Nadu, India

Ph.D ZOOLOGY
SCHEME

FIRST SEMESTER							
	Course Code	**Course title**	**C**	**L**	**E**	**ESE**	**Total**
Core Courses	21ZOOR0101	Research Methodology	4	4	3	100	100
	21ZOOR0102	Recent Trends in Zoology (BasicCourse in the Subject Area)	4	4	3	100	100
	21ZOOR0103	Area of Specialization*	4	4	3	100	100
	21ZOOR0104	Research and Publication Ethics	2	2	3	100	100
		Total Credits	**14**				

21ZOOR0103* Detailed Syllabus for Area of Specialization will be prepared by the respective Doctoral Committee

21ZOOR0101 RESEARCH METHODOLOGY Credit: 4

Objectives:

- To understand the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.
- To expose the students on the basic understanding of research concepts and learn the art of thesis &paper writing, publication and scientific ethics.
- To apply a variety of statistical procedures and tests.

Learning outcomes:

On completion of the course, the scholars should be able to

- realize importance of pH meter and various Microscopes.
- understand the working principle, operation system and importance of centrifuge, photometers and chromatography.
- develop skills on molecular techniques.
- acquire knowledge on the overall concepts of research, writing Thesis,articles and projects.
- understand and critically assess data collection and its representation

Unit I : pH meter, microscopic and polarimetric techniques:

pH meter - types, basic principle, operation and application; Buffers-principle, standards and preparation of buffer; pH determination & pH indicators. Microscopy – Principle, operation and application - simple, compound, light-field, dark-field, phase–contrast, fluorescence, confocal and electron microscopy. Micrometry-principle and application. Polarimetry -principle and application.

Unit II: Centrifuge, Photometric and Chromatographic techniques:

Centrifugation-types, principle and application. Photometry - Principle, operation and application-colorimeter, spectrophotometer, flame photometer, bomb calorimeter, UV-Visible spectroscopy, atomic absorption spectroscopy, mass spectroscopy and FTIR spectroscopy. Chromatography– types, principle and application: paper chromatography, thin layer chromatography, column chromatography, Ion Exchange, GC-MS and HPLC.

Unit III: Molecular techniques:

Electrophoresis - Principle and applications, paper electrophoresis, agarose gel-Polyacrylamide gel electrophoresis (PAGE and SDS- PAGE) and immuno electrophoresis. Molecular techniques- Microarray, MALDI-TOF,Amino acid sequencing-DNA sequencing (Enzymatic & Chemical methods) Blotting techniques-southern, northern and western blottings and PCR techniques. RAPD, RFLP and ARDRA techniques.

Unit IV : Research, Thesis writing, Publication and Project Writing:

Research –definition, objectives, types and importance – Research methods in biological Sciences –Research process – Literature survey – sources – scientific databases – Research report writing – Parts of thesis and Dissertation – Writing scientific paper- Publication on research journals – Standards of research journals – peer review – impact factor –citation index. Proof correction – proof correction marks –Methods of proof correction. Writing chapters in books. – Preparation of Research proposal and funding agencies – Research fellowships

Unit V: Statistical Methods

SampleMethods – Sampling Techniques, Determination of Sample size- Merits and demerits of sampling – student's test,chi-square test – Correlation Techniques – Simple correlation and Regression – Multiple correlation and Regression Analysis – Types of data – Measures of central value- Variability of Measures, Skewness measures and ANOVA- Computational Tools: SPSS, MATLAB and DMRT.

Text Books:

1. C.R. Kothari and Gaurav Garg.2019. Research Methodology- Methods and Techniques. New Age International Publishers, New Delhi.pp.1-25.
2. N.Gurumani.2019. An Introduction to Biostatistics. MJP Publishers, Chennai
3. Pranab Kumar Banerjee.2018. Introduction to Statistics.S.Chand Publishing Company Ltd. New Delhi
4. David.T Plummer. 2009. An Introduction to Practical Biochemistry, Tata Mc Graw Hill Pub.Co.Ltd, New Delhi.
5. N.Grumman. 2009.Research Methodology for Biological Sciences. MJP Publishers, Chennai.

Reference Books:

1. P. Mariappan.2013. Biostatistics. Pearson, Chennai
2. P.S.S.Sundar Rao and J.Richard.2012. Introduction to Biostatistics and Research Methods.PHI Learning Pvt. Ltd. New Delhi.
3. P.Asokan. 2002.Analytical Biochemistry-Biochemical techniques. First Edn. China Publications, Melvishoram, Vellore.
4. Keith Wilson and John Walker.2002. Practical Biochemistry-Principles and techniques. 5thEd.Cambridge Univ.Press, London.
5. S.Palanichamy and M.Shanmugavelu.1997. Research methods in biological sciences. Palani Paramount Publications, Palani.

Web resources:

1. PubMed search engine for database of references and abstracts on life sciences and biomedical topics: https://en.wikipedia.org/wiki/PubMed.
2. Plagiarism Software: Online plagiarism checker for checking articles: https://www.plagiarismsoftware.net/and www.urkund.com/en/

21ZOOR0102 RECENT TRENDS IN ZOOLOGY Credits-4

Objectives:

- To acquire broad knowledge on basic and recent trends in genetic engineering
- To understand the comprehensive overview of all major aspects of nanotechnology and its applications in various fields
- To understand the threats and uses animal diversity in India
- To understand the nature and components of defense mechanism of human body.
- To know the tools used in bioinformatics

Learning Outcomes:

On completion of the course, the scholars should be able to

- Understand cloning,gene therapy, genetic disorders
- Understand Human Genome Project and the importance of transgenic animals
- Appreciate the importance, scope and current scenario of nanotechnology and its applications in medicine, agriculture, live-stock and environment
- Understand the threats of animal diversity in India
- Understand the issues, approaches, values and uses of biodiversity and threatened species
- Understand the antigen structure and function
- Understand the different classes of immunoglobulins
- To know the types of databases, sequences, information sources and Use of Bioinformatics Tools in analysis

Unit I: Genetic Engineering

Cloning- Cloning vectors- Cloning strategies and DNA Libraries, cDNA cloning & cDNA libraries- Gene therapy- Pharmaceutical products of DNA technology- Human therapies- Vaccines- Treatment of genetic disorders- Alzheimer, Thalassemia & Phenylketonuria- Human Genome project- Current status, ethical and Legal issues- Transgenic animals and their importance.

Unit II: Nanotechnology

Importance of Nanoscience and Nanotechnology- Milestones in Nanotechnology- Scope and Current Scenario of Nanotechnology- Types and applications of Nanoscience in the field of Medical, agriculture, livestock and aquaculture.

Unit III: Biodiversity

Treats to animal diversity in India- Issues, approaches, values and uses of biodiversity and threatened species- Measuring status of species in the wild- IUCN Red list- status of Indian animals.

Unit IV: Immunology

Antigen, structure and functions - Different classes of immunoglobulins and generation of immunological diversity; Humoral and cell- medicated immunity, Primary and Secondary immune response- lymphocytes and accessory cells; MHC, Complement Fixation.

Unit V: Bioinformatics

Historical background- Databases- types of database- primary, secondary and composite- Data structure- Database management- Sequences- Types of Sequences used in Bioinformatics- Information Sources- NCBI, MGD- Date Retrieval Tools- Entrez, OMIM Pubmed, Locus Link- Use of Bioinformatics Tools in analysis.

References:

Text Books:

1. R.C. Dubey.2019. A Textbook of Biotechnology. S. Chand and Company. New Delhi
2. N.M. William.2019. Biodiversity. CBS Publishers & Distributors Pvt.Ltd. New Delhi
3. Akhilesh Kumar Sahu.2019. Foundations of Bioinformatics. Random Publications, New Delhi.
4. Ajoy Paul. 2016. Text book of Immunology, Books and Allied (P) Ltd, Kolkotta.
5. Rishabh Anand. 2017.Essentials of Nanotechnology. First Edition.MEDTECH -A Division of Scientific International, New Delhi

Reference Books:

1. G.Tyler Miller and Scott E. Spoolman. 2019. Environmental Science.Cengage Learning India Pvt.Ltd.Delhi.
2. Shyamasree Ghosh.2017. Immunology and Immunotechnology. Books and Allied (P) Ltd. Kolkotta
3. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C., Gelbart W.M and J.H. Miller (2003) Introduction to genetic analysis. W.H.Freeman and Company, New York.
4. Reka, M.L, D.E.Wilson and E.O.Wilson (1997) Biodiversity II: Understanding and protecting our Biological Resources. Joseph Henry Press, Washington, D.C.
5. Vinay Sharma, Ashok Munjal and Ashish Shanker(2017) Bioinformatics, Rastogi Publications, Meerut

Web resources:

1. https://www.researcggate.net/publication/264934129
2. booksc.org/dl/10142905/205224
3. booksc.org/book/14846478/28220b

21ZOOR0104RESEARCH AND PUBLICATION ETHICSCredits : 2

Objectives:

- To learn about nature, scope,and concept of philosophy and ethics
- To learn about scientific conduct and publication ethics
- To learn open access publishing, Misconduct,Databases and Research Metrics

Learning Outcomes

On completion of the course, the scholars should be able to

- Understand the scope and concepts in philosophy and ethics
- Recognize the scientific misconducts
- Realize the importance of publication ethics
- Understand open access publication
- Create awareness on the importance of scientific data bases and research matrices

Unit I Philosophy and Ethics

Introduction to philosophy: Definition,nature and scope,concept,branches. Ethics: Definition,moral philosophy, nature of moral judgements and reactions.

Unit II Scientific conduct

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

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

Unit IV Open Access Publishing

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 Finder, Springer Journal Suggester, etc

Unit V Publication Misconduct,Databases and Research Metrics

Subject specific ethical issues,FFP,authorship- Conflicts of interest-Complains and appeals: examples and fraud from India and abroad- Use of plagiarism software like Turnitin,Urkund and other open source software tools. Databases-Indexing databases-Citation databases: Web of Science,Scopus etc- Impact factor of journal as per Journal Citation Report,SNIP,SJR,IPP,Cite Score- Metrices: h-index,i10 index,almetrics.

References:

Text Books:

1. Indian National Science Academy(INSA)2019. Ethics in Science Education, Research and Governance.ISBN:978-81-939482.1- 7.
2. Chaddah, P 2018 Ethics in Competitive Research: Do not get scooped; do not get plagiarized,ISBN:978-9387480865.
3. Resnik,D.B.2011. What is ethics in research &Why is it important. National Institute of Environmental Health Sciences,1-10.Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
4. Bird,A.2006. Philosophy of Science.Routledge.http://www.insaindia.res.in/pdf/Ethics_Book.pdf
5. Beall,J.2012.Predatory publishers are corrupting open access. Nature,4089(7415),179.https://doi.org/10.1038/48917a

Reference Books:

1. National Academy of Sciences,National Academy of Engineering and Institute of Medicine.2009.On being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academy Press
2. MacIntyre,Alasdair.1967.A Short History of Ethics.London