

MANGALORE UNIVERSITY

Department of Biosciences

Ph.D. course work in Environmental Science

Scheme of Assessment and Examination

Course	Particulars	Hours of Instruction per week	Duration of Examination (hrs.)	Marks			Credits
				IA*	Theory	Total	
Course 1	Research Methodology	4	3	30	70	100	4
Course 2	Research and Publication Ethics (RPE)	2	3	30	70	100	2
Course 3	Review of Literature	14	-	-	-		
	Review report*					150	4
	Viva					50	2
					Total	400	12

* Internal Assessment (30 marks) will be based on assignment (15 marks) and seminar (15 marks).

* Review report should contain introduction, review of literature of the proposed research, state of the art research work analysis, related implementation issues and motivation for the stated research work.

Programme outcomes:

After successful completion of the Ph.D. programme, students will be able to:

- PO1. Get jobs in areas like environment agencies, Department for environment, environment monitoring organizations, environmental consultancies, environmental ministries, NGOs, pollution control boards, waste management centers, colleges, Universities.
- PO2. Get more opportunities in private, public and government sectors with high salary packages.
- PO3. Gives knowledge to do post-doctoral degree in the field of Environment in abroad and in India.
- PO4. Prepares for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective.
- PO5. Initiate testing centers for the analysis of water and soil samples.
- PO6. Work in specified positions as Environment consultant, Environmental education officer, Environmental officer, Recycling officer, Marine biologist, Nature conservation officer, Sustainability consultant, Waste management officer, Wildlife filmmaker.

Programme specific outcomes:

- PSO1. Produce skilled, up-to-date, competent and adequately accomplished researchers in the domain of environmental science.
- PSO2. Learn to plan and conduct different experiments as well as to analyse and interpret the results.
- PSO3. Identify, analyse, and address an environmental problem to find out an adequate and sustainable solution.
- PSO4. Gain skill and knowledge to handle and maintain environmental instruments.
- PSO5. Develop scientific communication skills useful for publishing research findings.
- PSO6. Learn to use and apply different statistical and other software for the analyses of experimental data and interpretation.
- PSO7. Formulate relevant research questions, hypothesis, and objective to initiate research on environmental issues.

COURSE 1 – RESEARCH METHODOLOGY

60 hrs (15 hrs./unit)

Course Outcomes:

- CO1 Understand the concept of research including advanced literature survey methods.*
- CO2 Understand the principles, instrumentation, working and applications of different instruments.*
- CO3 Describe the role of microorganisms in the abatement of pollutants.*
- CO4 Discuss advanced technologies for soil analysis.*
- CO5 Describe various statistical methods and packages.*
- CO6 Learn research ethics.*

Unit 1: Basic research concepts

Identification of research problem: Methods of review of literature, data collection, preservation and analysis, method of writing research paper, project report and thesis.

Shodhganga. Laboratory and personnel safety measures: good laboratory practices, guidelines and ethics in animal experimentation: The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines and Institutional Animal Ethics Committee (IAEC) – Rules and regulations for breeding and maintenance of small laboratory animals; Institutional Bio Safety Committee (IBSC), Institutional Human Ethics Committee (IHEC).

Unit 2: Principles of instrumental analysis

Instrumental methods of Analysis: Principles, instrumentation, working and applications of UV-visible, Infrared, Atomic absorption spectrophotometry, Flame emission spectrophotometry, Nephelometry, Turbidimetry, Thermogravimetry, Radio-analytical techniques, Conductometry, Potentiometry, Polarography, Gas chromatography, fluorimetry, HPLC and Ion-exchange chromatography.

Unit 3: Analytical techniques

Biological analysis: Selection of sampling sites, quantitative analysis of plant communities, quadrat method, transect method, loop method, point-to-point method, staining techniques for identification of Microorganisms. Isolation and characterization of microorganisms. Advanced methods for maintenance of pure culture. Screening of potential isolates of bacteria and fungi for the abatement of pollutants. Microtome-preparation of samples, fixation, embedding and preparation of blocks, microslide preparation and staining techniques.

Soil analysis: Determination of particle size distribution and their bulk density, determination of nutrients in soil. Wastewater treatment using advanced techniques – catalytic treatment, membrane treatment, field study for identifying the contour and drainage systems, mapping of an area using remote sensing, evaluation of satellite image, approach of GIS for environmental management.

Unit 4: Bio-statistical methods

Graphical representation, mean, standard deviation, standard error. Theory of probability, normal distribution, parametric and non-parametric tests, independent/repeated measures design. Student's t-test. Analysis of variance (ANOVA, ANCOVA, MANOVA). Statistical packages.

References:

1. Beven, K., 2002. Rainfall-Runoff Modeling: The Primer.
2. David B. Rensik, 1998. The ethics of Science: An introduction, Routledge, New York and London.
3. Gurumani, N. 2006. Research Methodology for Biological Sciences, MJP Publishers, Chennai.
4. Jan A Pechenik, 1987. A Short Guide to Writing about Biology Little, Brown and Company, Boston, Toronto.
5. Janathan Anderson, Berry, H. Durston and Millicent Poole, 1987. Thesis and Assignment Writing, Wiley Eastern Limited.
6. Jane Roskams and Linda Rodgers, 2004. Lab Ref-A Handbook of Recipes, Reagents and other Reference Tools for use at the Bench, I.K. International Pvt. Ltd., New Delhi
7. John W. Best, 1983. Research in Education, Fourth Edition, Prantice Hall of India Pvt. Ltd., New Delhi.
8. Joseph Gibaldi and Walter S. Achtert, MLA. 1989. Handbook for Writers of Research Papers, Third Edition, Wiley Eastern Limited, New Delhi.
9. Karp, G. 1999. Cell and Molecular Biology – Concepts and Experiments. (Ed. John Wiley & Sons, New York.
10. Ketan Tatu, 1999. Remote sensing for Wetland monitoring & Waterfowl Habitat Management.
11. Khan and Irfan, 1994. Fundamentals of Biostatistics, Ukaae Publication, Hyderabad.
12. Khopkar, S.N. 1988. Basic Concepts of Analytical Chemistry. II Edition, New Age Publishers.
13. Martyn Hammersley and Anna Traianou, 2012. Ethics in qualitative research: Controversies and contexts, Thousand Oaks, CA:Sage, London.
14. Medicine, 2009. On being a scientist: A guide to responsible conduct in Research: Third Edition, National Academies Press, Washington, D.C.
15. Newbury Dale, E. 1988. Advanced Electron Microscopy and x-Ray Microanalysis. Plenum Publishers, New York.
16. Paul Oliver, 2010. The student's guide to research ethics, Second Ed., Open University Press, McGraw-Hill Education, England.
17. Rastogi, V.B. 2006. Fundamentals of Biostatistics. Ane Book India, New Delhi.
18. Robert A. Day, 1983. How to Write and Publish a Scientific Paper, First Indian Edition, 1983, Vikas Publishing House Pvt. Ltd., New Delhi
19. Satguru Prasad, 1995. Fundamentals of Biostatistics (Biometry), EMKAY Publications, New Delhi, University Press, New York.
20. <http://shodhganga.inflibnet.ac.in>

COURSE 2 – RESEARCH AND PUBLICATION ETHICS (RPE)

30 hrs.

Course Outcomes:

- CO1 Know the philosophy of research and publication.*
- CO2 Understand scientific conduct and misconducts.*
- CO3 Realise the ethics of research publication.*
- CO4 Know open access publishing of research articles.*
- CO5 Able to use various software tools to identify predatory publications and publication misconduct.*
- CO6 Learn different types of databases and research metrics.*

THEORY

MODULE 01: PHILOSOPHY AND ETHICS (3 hrs.)

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

MODULE 02: SCIENTIFIC CONDUCT (5 hrs.)

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

MODULE 03: PUBLICATION ETHICS (7 hrs.)

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

PRACTICE

MODULE 04: OPEN ACCESS PUBLISHING (4 hrs.)

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

MODULE 05: PUBLICATION MISCONDUCT (4hrs.)

A. Group Discussions (2 hrs.)

1. Subject specific ethical issues, FFP, authorship.
2. Conflicts of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

B. Software tools (2 hrs.)

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

MODULE 06: DATABASES AND RESEARCH METRICS (7 hrs.)

A. Databases (4 hrs.)

1. Indexing databases
2. Citation databases: Web of Science, Scopus etc.

B. Research Metrics (3 hrs.)

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.
2. Metrics: h-index, g index, i10 index, altmetrics.

References

1. Beall, J. 2012. Predatory publishers are corrupting open access. Nature, 489 (7415), 179.
2. Bird, A. 2006. Philosophy of Science, Routledge.
3. Chaddah, P. 2018. Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865.
4. Indian National Science Academy (INSA). 2019. Ethics in Science Education, Research and Governance. ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf
5. MacIntyre, Alasdair. 1967. A Short History of Ethics, London.
6. National Academy of Sciences, National Academy of Engineering and Institution of Medicine. 2009. On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition, National Academies Press.
7. Resnik, D.B. 2011. What is ethics in research & why is it important, National Institute of Environmental Health Sciences, 1-10, Retrieved from <http://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>

COURSE 3 - REVIEW OF LITERATURE

Course Outcomes:

- CO1 Understand the method of writing a report on literature review by focusing on the specialization/research problem.
- CO2 Gain the knowledge of current research findings year wise in the proposed research area.
- CO3 Build a confidence to initiate the research on the research topics/problem based on the secondary sources.

Model Question Paper

Ph. D Course Work in Environmental Science
COURSE

Time: 3 hrs.

Max. Marks: 70

1. Write short notes on any **Four** of the following (not exceeding 2 pages each):

4X4=16

- a.
- b.
- c.
- d.
- e.
- f.

Write brief answers on any **Four** of the following (not exceeding 4 pages each):

4X7=28

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Answer any **Two** of the following (not exceeding 8 pages each):

2X13=26

- 8.
- 9.
- 10.