

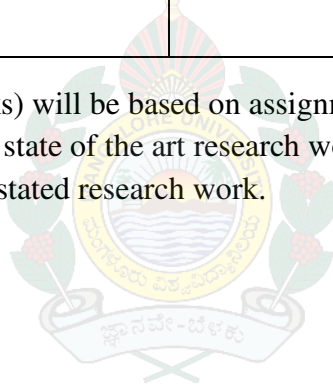
MANGALORE UNIVERSITY

Department of Biosciences
Ph.D. course work in Environmental Science
Scheme of Assessment and Examination

Papers	Particulars	Hours of Instructions per week	Duration of Examination (Hrs)	Marks			Credits
				IA	Theory	Total	
Paper 1	Research Methodology	4	3	30	70	100	4
Paper 2	Review of Literature	16	-	-	-		
	Review Report Viva					150 50	6 2
	Total					300	12

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

* Review report should contain state of the art research works 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 get:

PO1. **Job opportunities:** Environmental Science Ph.D. degree holders 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, etc.

PO2. After completing Ph.D. get more opportunities in private, public and government sectors with high salary packages.

PO3. **Post-Doctoral Fellow:** This program gives knowledge to do post-doctoral degree in the field of Environment in abroad and in India.

PO4. This programme prepares for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective.

PO5. Environmental Science Ph D holders can initiate testing centers for the analysis of water, soil etc.

PO6. **More opportunities:** Ph D holders can work in specified positions as Environment consultant, Environmental education officer, Environmental officer, Recycling officer, Marine biologist, Nature conservation officer, Recycling officer, Sustainability consultant, Transport Planner, Waste management officer, a Wildlife filmmaker, etc.

Programme specific outcomes:

PSO1. Produce skilled, up-to-date, competent and adequately accomplished researchers in the domain of environmental science.

PSO2. Use and apply different statistical and other software for analyses of experimental data and interpretation.

PSO3. Identify, analyse, and address an environmental problem to find out an adequate and sustainable solution.

PSO4. Handle and maintain instruments.

PSO5. Develop scientific communication skills useful for publishing research findings.

PSO6. Plan and conduct experiments as well as analyse and interpret the results.

PSO7. Formulate relevant research questions, hypothesis, and objective to initiate research on environmental issues.

PAPER I –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 technology for soil analysis.

CO5 Describe bio-statistical methods and statistical packages.

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.

Plagiarism, Shodhganga, Laboratory and personnel safety measures: good laboratory practices. guidelines and ethics in animal experimentation: CPCSEA Guidelines and IAEC – Rules and regulations for breeding and maintenance of small laboratory animals; Human ethical Committee.

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 method, Staining techniques for identification of Microorganisms. Isolation and characterization 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. Students t-test. Analysis of variance (ANOVA, ANCOVA, MANOVA). Statistical packages.

References:

- 1) Beven, K., 2002. Rainfall-Runoff Modeling: The Primer.
- 2) Gurumani, N. 2006. Research Methodology for Biological Sciences, MJP Publishers, Chennai.
- 3) Jan A Pechenik, 1987. A Short Guide to Writing about Biology Little, Brown and Company, Boston, Toronto.
- 4) Janathan Anderson, Berry, H. Durston and Millicent Poole, 1987. Thesis and Assignment Writing, Wiley Eastern Limited.
- 5) 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
- 6) John W. Best, 1983. Research in Education, Fourth Edition, Prantice Hall of India Pvt. Ltd., New Delhi.
- 7) Joseph Gibaldi and Walter S. Achtert, MLA. 1989. Handbook for Writers of Research Papers, Third Edition, Wiley Eastern Limited, New Delhi
- 8) Karp, G. 1999. Cell and Molecular Biology – Concepts and Experiments. (Ed. John Wiley & Sons, New York.
- 9) Ketan Tatu, 1999. Remote sensing for Wetland monitoring & Waterfowl Habitat Management.
- 10) Khan and Irfan, 1994. Fundamentals of Biostatistics, Ukaae Publication, Hyderabad.
- 11) Khopkar, S.N. 1988. Basic Concepts of Analytical Chemistry. II Edition, New Age Publishers.
- 12) Newbury Dale, E. 1988. Advanced Electron Microscopy and x-Ray Microanalysis. Plenum Publishers, New York.
- 13) Rastogi, V.B. 2006. Fundamentals of Biostatistics. Ane Book India, New Delhi.
- 14) Robert A. Day, 1983. How to Write and Publish a Scientific Paper, First Indian Edition, 1983, Vikas Publishing House Pvt. Ltd., New Delhi
- 15) Satguru Prasad, 1995. Fundamentals of Biostatistics (Biometry), EMKAY Publications, New Delhi, University Press, New York.
- 16) <http://shodhganga.inflibnet.ac.in>

Ph. D Course Work in Environmental Science

Model Question Paper

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.

