UNIVERSITY OF DELHI

CNC-II/093/1/Misc./2025/ 11
Dated: 03.04.2025
04

NOTIFICATION

Sub: Amendment to Ordinance V

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

Add the following:

The syllabus of a Discipline Specific Elective (DSE) paper titled "Research Methods in Environmental Science" to be offered in Semester-VI, by the Department of Environmental Studies under Faculty of Science, based on Undergraduate Curriculum Framework-2022, is notified herewith for the information of all concerned as per ***Annexure-1.***

REGISTRAR

Revised. Syllabus

Annexure-1

DISCIPLINE SPECIFIC ELECTIVES (DSE-EVS-19): RESEARCH METHODS IN ENVIRONMENTAL SCIENCE

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
DSE-EVS-19: RESEARCH METHODS IN ENVIRONMENTAL SCIENCE	4	2	0	2	Class XII pass	NA

Learning objectives

The Learning Objectives of this course are as follows:

- Provide basic principles, techniques, and methods in environmental science research
- Impart training on designing, planning, and executing research on environment
- Develop skill to collect, analyze, interpret, write, and present different types of environmental data ethically
- Encourage students to undertake independent research for different sectors

Learning outcomes

After successful completion of this course, students will be able to:

- Design research programmes following suitable principles, techniques, and methods in environmental science
- Execute research projects on different compartments of the environment
- Collect, analyze, interpret, write, and present environmental data ethically at different fora
- Undertake independent research on different environmental compartments for different sectors

SYLLABUS OF DSE-EVS-19

Theory (02 Credits: 30 lectures)

UNIT – I Foundations of Environmental Research (5 Weeks) (10 lectures) Introduction to scientific research in environmental science; Types of research: exploratory, descriptive, analytical, and experimental; Literature review: sources, strategies, and synthesis; Framing research questions, setting objectives, hypothesis formulation and testing; Research ethics and integrity

UNIT – II Data Acquisition and Analytical Techniques (4½ Weeks) (9 lectures)
Types of environmental data: quantitative and qualitative; Variables, sampling design and techniques, experimental approaches; Data quality assessment, safety in field and lab; Descriptive and inferential statistics (t-test, ANOVA, correlation)

UNIT – III Applied Research in Environmental Domains (3 Weeks) (6 lectures)
Research in Atmospheric, Aquatic and Terrestrial Domain: Data sources, methods, and analysis; Case studies from each domain illustrating methodologies and tools used

UNIT – IV Communication, and Research Dissemination (2½ Weeks) (5 lectures)
Scientific writing: structure of a paper (IMRAD), referencing and citation styles; Data visualization and presentation tools

Teaching and learning interface for theoretical concepts
To achieve the course objectives and match with the contents, a wide range of teaching and learning tools will be employed, including (a) Formal lectures; (b) Interactive sessions using visual aid; (c) Case study analyses; (d) Hypothetical scenario building; (e) Group discussion on key topics; and (f) documentary screening and critical analyses.

Practicals/Hands-on Exercises – based on theory (02 Credits: 60 hours)

Familiarization with Environmental Science Research:

1. Survey and review literature to identify a relevant research question on a desired thematic area of environmental science.
2. Formulate a relevant hypothesis and develop a suitable experimental design (based on practical 1).

Data Collection and Analysis Techniques:

3-6. Using and choosing different methods, techniques, instruments, software, and databases for the analysis of soil, vegetation, landscape, ecosystems, and wildlife.

7-9. Familiarize with environmental databases and software for research.

Understanding Environmental Models

10-11. Understand the basics of environmental models, their outputs, variations, and limitations using climate models

Research Proposal and Paper Development:

12. Practice developing a research proposal in environmental science.
13. Practice different steps of writing a research paper and develop an effective presentation.
14. Identify a suitable journal based on the research theme and learn the process of review feedback.

Teaching and learning interface for practical skills

To impart training on technical and analytical skills related to the course objectives, a wide range of learning methods will be used, including (a) laboratory practicals; (b) field-work exercises; (c) customized exercises based on available data; (d) survey analyses; and (e) developing case studies; (f) demonstration and critical analyses; and (h) experiential learning individually and collectively.

Essential/recommended readings

- Thomas, D.C., 2009. Statistical methods in environmental epidemiology. OUP Oxford.
- Emetere, M.E., 2022. Numerical Methods in Environmental Data Analysis. Elsevier.
- Mengist, W., Soromessa, T. and Legese, G., 2020. Method for conducting systematic literature review and meta-analysis for environmental science research. MethodsX, 7, p.100777.
- Gotelli, N. J., & Ellison, A. M. (2013). A primer of ecological statistics. Sinauer Associates.
- Bivand, R.S., Pebesma, E.J., Gómez-Rubio, V. and Pebesma, E.J., 2013. Applied spatial data analysis with R (Vol. 2). New York: Springer.

Suggestive readings

- Barnett, V., 2005. Environmental statistics: methods and applications. John Wiley & Sons.
- Chandler, R. and Scott, M., 2011. Statistical methods for trend detection and analysis in the environmental sciences. John Wiley & Sons.
- Fortin, M.J., James, P.M., MacKenzie, A., Melles, S.J. and Rayfield, B., 2012. Spatial statistics, spatial regression, and graph theory in ecology. Spatial Statistics, 1, pp.100-109.
- Helsel, D. R. (2012). Statistics for censored environmental data using Minitab and R. John Wiley & Sons.
- O'Neill, P. D., & Roberts, G. O. (2021). Bayesian hierarchical models: With applications in ecology and environmental statistics. CRC Press.
- Pede, E., 2020. Planning for Resilience: New Paths for Managing Uncertainty (pp. 33-60). Berlin/Heidelberg, Germany: Springer.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.