

**University of Calicut**  
**Department of Botany**

**Ph.D. Course work (Environmental Science)**  
**SYLLABUS**

**Paper I: Research methodology**

**Unit 1:**

Purpose, characteristic and types of research. Process of research-formulation of objectives-formulation of hypothesis-types of hypotheses-methods of testing hypothesis-research plan and its components.

**Unit 2:**

Methods of research (survey, observation, case study, experimental, historical and comparative methods) Methods of literature collection, experimental design, planning and execution of investigation

**Unit 3:**

Photography: principles and methods of digital photography, photo micrography and image analysis

**Unit 4:**

Micrography and micrometry: principles and applications of bright field microscopy, dark field microscopy, UV microscopy, fluorescence microscopy, polarized microscopy, phase contrast microscopy and interference contrast microscopy. Electron microscopy-principles and methods of SEM and TEM. Tools and techniques in micrometry.

**Unit 5:**

Principles and applications of spectrophotometer, (UV visible spectrophotometry), titrimetry, gravimetry, colourimetry, NMR, ESR, centrifugation and chromatographic techniques.

**Unit 6:**

Environmental monitoring: methods of sampling and analysis of air, water and soil.

**Unit 7:**

Environmental toxicology: assessment of toxicity, indices of toxicity, exposure risk assessment-types, criteria and problems. Bio monitoring of environmental quality

**Unit 8:**

Environmental impact assessment (EIA) and cost benefit analysis (CBA)-methods of EIA, developmental activities requiring EIA.CBA-relationship between cost of damage and cost of control.

**Unit 9:**

Remote sensing and GIS-applications in natural resource management

#### Unit 10:

Analysis of numerical data-central tendencies, dispersions, testing significance of variations, analysing co relation of variables, regression analysis, study of factor loading and its implications, cluster analysis, study of factor loading and its implications, cluster analysis and its use in biological research. Computer applications in data analysis.

#### Unit 11:

Writing of research proposal, report and research paper: meaning and types-stages in preparation-characteristics-structure-documentation: footnotes and Bibliography, editing the final draft-checklist for a good proposal/report/research paper

#### References

- APHA/AWWA. Standard method for examination of water and wastewater.
- Environmental chemical analysis: M.S Cess& Mar, amrical publications.
- Environmental impact assessment: Lary W. Canter, Mc Graw hill, NY.
- Handbook of environmental health and safety: Herman Koren and Michel Biseri. J publishing house, Delhi.
- Instrumental methods of chemical analysis: Willard H.H and Merit L.L.
- Principles of remote sensing: A N Patel and S. Singh, scientific publisher, Jodhpur.
- Principles of biophysical Chemistry: Uppadahay –Uppadahay.
- Research methodology-G.R Basotia and K.K Sharma.
- Research methodology-C.H. Chaudhary, RBSA publications.
- Statistical methods for research: S. Singh et al., Central publishing, Ludhiana.

\*\*\*

**Model question paper**  
**Paper I: Research Methodology**

Time: 3 Hrs.

Max.marks:70

Part A. Answer any 10 questions. Each question carries 2 marks

(10 x 2 = 20)

1. R f value
2. Thin layer chromatography
3. Types of hypothesis
4. High volume sampler
5. LC 50
6. Micrometry
7. Bibliography
8. Methods of literature collection
9. BOD
10. Cost benefit analysis
11. Soil porosity
12. GPS
13. ESR
14. Phase contrast microscopy

Part B. Answer any 10 question .Each question carries 4 marks

(10 x 4 = 40)

15. Explain cluster analysis and its application in biological research
16. Write an account of layout of research publication.
17. Write an account of layout of a project proposal
18. Write an account of computer applications in data analysis
19. Differentiate between microphotography and photomicrography
20. Discuss the basis of exposure risk assessment
21. Explain methods employed in bio monitoring of environmental quality
22. Differentiate between dark field microscopy and bright field microscopy
23. Write a brief account of types of surveys.
24. Explain the principle underlying NMR spectroscopy
25. What is neutron activation analysis? Discuss its utility in assessing environmental quality.
26. Explain the principle underlying HPLC

Part C. Answer any 1 question. Each question carry 10 marks

(10 x 1=10)

27. Briefly explain the applications of remote sensing in natural resource management
28. Elucidate few physico-chemical methods employed in assessment of water quality
29. What is EIA? Comment on various methods employed in EIA
30. Outline the method of operation of a transmission electron microscope with suitable diagram

\*\*\*