Course Code	Course Title	Credit Hours
ENS-810	**Research Methods in Environmental Sciences**	**3 (3+0)**

Course Description

The objective of this course is to equip the students with the skills to undertake a project by planning, designing and defining a research problem; and select indicators and parameters of research and its methodologies.

Course Outline

Introduction to Research: Nature of Research, Purpose of Research, Ethics in Research, Types of Research, Tools of Research, Scientific Methods, Techniques & Pre-requisites for Scientific Research, Types of Questions, Types of Relationships, Variables, Hypothesis, Types of Data.

Starting a Research Project/Research Proposal: Research Project Conceptualization, Elements of a Research Proposal, Critical Thinking and Developing the Research Question, Defining the Research Problem, Choosing the Research topics, Research Proposal: its importance - A pre-requisite for Research, Research Proposal Writing Techniques.

Research Design: Importance of Research Design, Formulation of Research Design Reliability, validity, generalization, Experimental design and use of indicators in research, Tradeoffs in design decisions.

Sampling Design: Introduction to sampling design, Logic of Sampling, Concepts and Terminologies, Types of Sampling Designs (Classifying experimental design, factorial design, randomized block design, covariance design, quasi experimental design) Relationship among pre-post design, Advances in Quasi Experimentation, Survey of Research, Questionnaires construction.

How to Put Things Together? Introduction, Objectives, Material and Methods, Review of Literature, Bibliography.

Literature Search: Database, Search Engines, Analytical tools in research: qualitative and quantitative methods, Evaluation Research: How to carry out evaluation research.

Data Collection and Analysis: Techniques in data collection: Quantitative & Qualitative Data, Experimental Research, Case Studies, Surveys, Interviews, Questionnaire, Data Analysis: Conclusion, Validity.

Statistical Analyses: Descriptive Statistics (Correlations), Inferential Statistics, Univariate Analysis, Bivariate Analysis, Multivariate Analysis (T-Test, Generalized linear model, Factorial design, randomized block analysis, Analysis of covariance, Regression Analysis)

Data Interpretation: Current data interpretation with comparative studies (Inter-laboratory comparison), Inference based on findings, Research Presentation Techniques – Data presentation.

Recommended Books

1. Frank, A. (1998). *Conducting research literature review: from paper to the internet.* Thousand Oaks: Sage Publications.
2. Gliner, J. A., and Morgan, G. A. (2000). *Research methods in applied settings: an integrated approach to design and analysis*. Lawrence Erlbaum.
3. Creswell, J. W., and Plano Clark V. L. (2007). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, Sage CA, USA.
4. Booth, W. C. (2003). *The Craft of Research (2nd ed.).* Univ. of Chicago Press. USA.
5. Moriarty, M. F. (1997). *Writing Science Through Critical Thinking (1st ed.).* Jones and Bartlett Publishers.
6. Yin, R. (2003). *Case Study Research: Design and Methods (3rd ed.).* Sage Publishers, USA.
7. Harrad, S., Batty, H., Diamon, M., and Arhonditsis, G. (2008). *Students project in Environmental Science*. John and Sons Ltd., Chichester, England.