**Ph.D. Programme in Environmental Science**

**Course Structure and Syllabus**

**SEMESTER-I**

**AS 601: RESEARCH METHODOLOGY**

**CREDIT: (L-T-P): 4 (4-0-0)**

**OBJECTIVE**

To explain the concept of research, steps in and methods of research, report writing, presentation and research ethics

**OUTCOME**

The knowledge of research and research methodology could be applied by the learners for doing research and presentation of research output in an ethical manner

**CONTENTS**

**Unit-I Basics of Research**

Research: Definition, Objectives, Types and Characteristics; Hypothesis: Meaning and types; Research methods vs Methodology. Positivism and post- positivistic approaches to research

**Unit –II Research Formulation**

Research Formulation – Defining and formulating the research problem; Characteristics of a good research problem; Selecting the problem; Literature review: Primary and secondary sources; Web as a literature source, searching the web; Organizing the literature and identifying gap areas from literature review; Research proposal or synopsis

**Unit –III Research Design and Methods**

Research Design: Basic principles, Need of research design, Features of a good research design; Important concepts relating to research design; Observations and Facts; Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models; Developing a research plan-Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs

**Unit –IV Data Collection and Analysis**

Observations and collection of data; Sample and sampling methods; Data processing and analysis, Statistical packages of data analysis; Mean, Median, Mode and One way Annova, Two way Annova, Hypothesis testing (t-test, chi test), Correlation Regression, Data Analysis and presentation.

**Unit –V Research Report (Practice)**

Types of report-Technical reports and thesis; Structure and components of a scientific report, Steps in report writing; Layout, structure and language of typical reports, illustrations and tables; Bibliographic entries, referencing and footnotes; Oral presentation: Planning and practice, use of visual aids, Importance of effective communication

Commercialization of knowledge and technologies.

**SUGGESTED READINGS**

Anthony, M., Graziano, A.M. and Raulin, M.L. 2009. *Research Methods*: *A Process of Inquiry*, Allyn and Bacon, New York.

Banerjee, S. and Ramendu, Roy. 2017. *Fundamentals of Research Methodology*, (3rd Edition), Kitab Mahal, New Delhi.

Cooper, D. R. and Schindler, P. S. 2006. *Business Research Methods*, Tata McRraw Hill Publishing P. Ltd., New Delhi.

Fisher R. A. 2004, *Statistical Methods for Research Workers*, Cosmo Publications, New Delhi.

Freedman, D., Pisani, R. and Purves, R. 2007. *Statistics,* 4th Edition, W. W. Norton and Company, New York.

Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K. 2002. *An Introduction to Research Methodology*, RBSA Publishers., New Delhi.

Gupta, S.P. 2014*. Statistical Methods*. S. Chand and Sons, New Delhi.

Hart, C. 2015. *Doing Your Masters Dissertation*, Sage Publication India P. Ltd., New Delhi-, 481 p.

Kothari, C.R. 1990. *Research Methodology*: *Methods and Techniques*. New Age International, New Delhi, 418p.

Kumar, R. 2014. *Research Methodology: A Step – by – Step Guide for Beginners*, Sage Publications India P. Ltd., New Delhi.

Montgomery D.C. 2001. *Design and Analysis of Experiments*, John Wiley and Sons, New York.

Sinha, S.C. and Dhiman, A.K. 2002. *Research Methodology*, 2 Volumes, Ess Ess Publications, New Delhi.

# Snedecor, G.W. and Cochran, G.W. 1989. *Statistical Methods,*8th Edition; Iowa State University Press, Ames, Iowa.

Trochim, W.M.K. 2005. *Research Methods*: *The Concise Knowledge Base*, Atomic Dog Publishing, New Delhi, 270p.

Wadehra, B.L. 2000. *Law Relating to Patents, Trade-marks, Copyright, Designs and Geographical indications*. Universal Law Publishing, New Delhi.