RES701	RESEARCH METHODOLOGY	L	T	P	C
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(Common to SCE, SCHEME, SCOPE, SELECT, SENSE, SITE, SMEC)

Course Objectives:

1. To gain insights into how scientific research is conducted.
2. To help in the critical review of the literature and assessing the research trends, quality and extension potential of research and equip students to undertake research.
3. To learn and understand the basic statistics involved in data presentation.
4. To identify the influencing factors or determinants of research parameters.
5. To test the significance, validity and reliability of the research results.
6. To help in the documentation of research results.

Expected Course Outcome:

On the completion of this course, the student will be able to:

1. Ability to critically evaluate current research and propose possible alternate directions for further work.
2. Ability to develop hypotheses and methodology for research.
3. Ability to comprehend and deal with complex research issues to communicate their scientific results clearly for peer review.

Module:1	Introduction	3 Hours

Introduction to research; Definitions and characteristics of research; Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Main components of any research work.

Module:2	Research Formulation	4 Hours

Defining and formulating the research problem: Selecting the problem - Necessity of defining the problem, Literature review: Importance of literature review in defining a problem, Primary and secondary sources –reviews, treatise, and monographs-patents – web as source – searching in the web - Critical literature review – Identifying gap areas from literature review.

Module:3	Research Design	3 Hours

Essentials of Research Design, Need for Research Design, Classifications of Research Design: causations and Experimental Design, Errors in Research Design, Types of Research Errors.

Module:4	Data Collection	7 Hours

Observation and Collection of data, Methods of data collection, Different types of variables, Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages, Hypothesis-testing, Generalization and Interpretation.

Module:5	Quantitative Methods	8 Hours

Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis.

Module:6	Optimization	10 Hours

Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Particle Swarm Optimization, Simulated Annealing, Introduction to Neural Networks, Neural Network-based optimization, Introduction to Fuzzy sets and Fuzzy Logic, Optimization of fuzzy logic.

Module:7	Ethics	3 Hours

Ethical issues - Copy right - Intellectual property rights and patent law - Reproduction of published material - Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

Module:8	Research Report Writing & Latex	7 Hours

Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, Latex Commands, Latex Styles Files, Presentations in Latex,

Report writing on Latex.

Reference Books

1. Ranjit Kumar," Research Methodology: A Step-by-Step Guide for Beginners", SAGE Publications Ltd; Fourth edition, 2014.
2. C.R. Kothari, " Research Methodology: Methods and Techniques", NEW AGE; Second Edition, 2014.
3. Peter Pruzan, "Research Methodology: The Aims, Practices and Ethics of Science", Springer; First Edition, 2016
4. Andries P. Engelbrecht "Computational Intelligence: An Introduction", Wiley-Blackwell; 2nd Edition, 2007.
5. Anthony J. Hayter "Probability and Statistics for Engineers and Scientists", CENGAGE Learning Custom Publishing; 4th edition, 2011.
6. Bernard C. Beins and Maureen A. McCarthy "Research Methods and Statistics" Pearson, 2011
7. Colin Neville "The Complete Guide to Referencing and Avoiding Plagiarism", Open University Press, 2007.
8. Dinesh Kumar, Research Methods for Successful PhD, River Publishers Series in Innovation and Change in Education – Cross-Cultural Perspective, 2017 (ISBN: 9788793609181).
9. Marc van Dongen, LaTeX and Friends, Springer, Feb. 29, 2012 (ISBN 978-3-642-23815-4).

Tutorial work (1 hour per week)

Training on software packages such as Latex, MATLAB and other domain-specific software.
Review Paper writing in Latex

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Approved by Academic Council	**48th**	**Date**	**24/12/2017**

Approval			
Sl. No.	**Name of the Member**	**Role**	**Signature**
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