ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT,
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Research Methodology for Engineers
Course Code : 26CMEC0TT
Course offered to : CE, EE, ME, ECE and CSE
Credits : 2

Course Objectives:

1. To develop the ability to identify and formulate research problems in engineering.
2. To train scholars in systematic literature review and proposal development.
3. To equip scholars with research design, data collection, and ethical practices.
4. To provide statistical and optimization tools for research data analysis.
5. To enable effective research communication through publications, presentations, and patents.

Course Outcomes:

After completion of the course, the scholar will be able to:

1. Identify research gaps and formulate structured research problems with ethical considerations.
2. Conduct systematic literature review and prepare a comprehensive research proposal.
3. Design experiments/surveys and implement appropriate data collection strategies
4. Apply statistical and optimization techniques for data analysis and interpretation.
5. Prepare technical papers, conference presentations, and patent documents effectively.

Unit 1 Foundations of Engineering Research 10

Introduction to engineering research: types, objectives, Research process and formulation of research questions, Hypothesis development and defining research outcomes, Engineering ethics and research integrity, Plagiarism, authorship, ethics approval procedures, Research planning and documentation.

Unit 2 Literature Review and Research Planning 9

Literature search strategies and archival literature, Types of publications: journals, conferences, patents. Keywords, indexing databases, citation metrics (h-index, impact factor). Measures of research impact. Literature review methodology. Elements of a research proposal, Problem statement and design for outcomes.

Unit 3 Research Design and Data Collection 10

Experimental design fundamentals-Hypothesis formulation, data collection and testing, Standard research methods in engineering-Analytical, Experimental and simulation-based methods. Selection of research tools-software tools for data collection and analysis. Survey research methods.

Unit 4 Statistical Analysis and Optimization 9

Sources of error and uncertainty, One-dimensional, two-dimensional, and multi-dimensional statistics, Statistical inference and reporting. Introduction to optimization. Two-parameter and multi-parameter optimization methods., Cost function formulation.

Unit 5 Research Communication and Professional Development 10

Standard research terminology, Paper writing: title, abstract, structure, Peer review process, Conference and poster presentations, Patent drafting basics and intellectual property, Publication trends and research career development.

Prescribed Textbook:

1. Research Methods for Engineers" by David Thiel. Cambridge University Press. ISBN: 9781139542326

Reference Books:

1. C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International.
2. Montgomery, D.C., *Design and Analysis of Experiments*, Wiley.
3. Box, G.E.P., Hunter & Hunter, *Statistics for Experimenters*, Wiley.
4. Creswell, J.W., *Research Design*, Sage Publications.