MECHANCIAL ENGINEERING DEPARTMENT

I YEAR – I SEMESTER

Research Methodology

(Mandatory Non-Credit course)

Course Code: MECMD117	**L**	**T**	**P**	**C**
	2	**0**	**0**	**0**

Course Objective:

To familiar the students with research fundamental concepts, identification of research areas, development of objective, study of experimental design procedures, analyze and interpretation of results and thereby writing the research paper in concern areas.

COURSE OUTCOMES:

The students will be able to:

CO1	Explain the fundamentals of research
CO2	Identify the research area and testing of its validity and reliability
CO3	Calculate sample size, design experiments with single factor and analyze the variance.
CO4	Analyze the results based on uni-variate and bi-variate methods
CO5	Write a research paper based on the results

Unit-1: Introduction, Problem Identification & Formulation

Introduction to Research: Foundation, Objectives, Motivation, Concept of Utility theory, empiricism, deductive and inductive theories. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Research Process. Problem Identification & Formulation – Research Questionnaires – Investigation Questionnaires – Measurement Issues – Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.

Unit-2: Research Design & Qualitative, Quantitative Approaches

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept

of measurement, causality, generalization, replication. Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

Unit-3: Experimental Design & Sampling

Concept of Independent & Dependent variables. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size. Guidelines for designing experiments, Experiments with single factor: Analysis of Variance, Analysis of the fixed effects model, Model adequacy checking, sample computer output, Regression approach to the Analysis of Variance.

Unit-4: Data Analysis

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Unit-5: Interpretation and Writing of Paper

Layout of a Research Paper, Journals in Mechanical Engineering, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Data bases for Mechanical Engineering Discipline. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

REFERENCE BOOKS:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari