Faculty of Engineering and Technology
Bachelor of Technology (Semester–VI/Third Year)
Effective in Academic Year 2023-24

Branch Name:	Civil Engineering
Program Code:	ET106
Course Name:	Research Methodology
Course Code:	2ET1060607T
Pre-requisite Subject:	Basic of research and technical writing

Course Objective:

- To understand the fundamentals of research methodology and its significance in solving engineering problems.
- To develop the skills necessary to formulate research problems and design research strategies.
- To learn techniques for data collection, analysis, and interpretation for engineering applications.
- To introduce ethical principles in research and methods for effective research communication.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
					SEE		CCA		SEE		CCA		
	L	T	P	Total	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
2	2	-	-	2	-	-	16	40	-	-	4	10	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weightage (%)**
1	**Introduction to Research Methodology:** Definition, objectives, types of research (quantitative, qualitative, applied, and fundamental). Importance of research in engineering. Characteristics of good research.	4	15
2	**Research Problem Formulation:** Problem identification, understanding the research gap, formulation of objectives and hypotheses, research scope and limitations.	6	20
3	**Research Design and Methods:** Types of research designs, experimental and observational studies, sampling techniques, and error minimization.	4	15
4	**Data Collection and Analysis:** Methods of data collection (surveys, experiments, case studies). Statistical tools for data analysis, software applications, and presentation of data.	6	20
5	**Technical Writing and Research Communication:** Structure of technical reports, research papers, and theses. Use of reference management tools. Effective presentation techniques.	4	15
6	**Research Ethics:** Importance of research ethics, plagiarism, copyright laws, and intellectual property rights (IPR).	4	15

List of Text Books:

1. Kothari, C. R., *Research Methodology: Methods and Techniques*, New Age International, 4th Edition, 2020.
2. Kumar, R., *Research Methodology: A Step-by-Step Guide for Beginners*, Sage Publications, 5th Edition, 2021.

List of Reference Books:

1. Creswell, J. W., *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, Sage Publications, 5th Edition, 2018.
2. Panneerselvam, R., *Research Methodology*, PHI Learning, 2nd Edition, 2014.
3. Dawson, C., *A Practical Guide to Research Methods: A User-Friendly Manual for Mastering Research Techniques and Projects*, How To Books, 4th Edition, 2019.
4. Montgomery, D. C., *Design and Analysis of Experiments*, Wiley, 9th Edition, 2019.
5. Cooper, D. R., & Schindler, P. S., *Business Research Methods*, McGraw Hill, 14th Edition, 2022.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Understand the principles and significance of research methodology in engineering applications.
2. Formulate research problems and design effective research strategies.
3. Apply appropriate data collection and analysis techniques.
4. Develop technical writing skills for effective research communication.
5. Adhere to ethical practices in research and understand intellectual property rights.

List of Tutorials:

1. Select a research topic in engineering, identify its problem statement, and define objectives.
2. Conduct a literature review for a given topic and present the findings in a structured manner.
3. Design a sampling strategy for a specific engineering research scenario.
4. Analyze sample data using statistical software or tools such as MS Excel/SPSS.
5. Prepare a concise technical report for a research study.

Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the principles and significance of research methodology in engineering applications.	L2
CLO2	Formulate research problems and design effective research strategies.	L3, L4
CLO3	Apply appropriate data collection and analysis techniques.	L3
CLO4	Develop technical writing skills for effective research communication.	L6
CLO5	Adhere to ethical practices in research and understand intellectual property rights.	L4

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CLO1		**M**								**M**		**M**			
CLO2		**M**								**M**		**M**			
CLO3		**M**								**M**		**M**			
CLO4										**M**		**M**			
CLO5								**H**		**M**		**M**			

H: High, M: Medium, L: Low