

Name of the Programme: Ph.D. (Engineering)

Course Code: PGG-700

Title of the Course: Research Methodology

Number of Credits: 4

Effective from AY: 2022-23

Pre-requisites for the Course:	Post graduate in any branch of Engineering	
Course Objectives:	After undergoing the course, the students will be able to: 1. Understand the nature of problem and identify the related area of knowledge. 2. Demonstrate the ability to choose appropriate research aims and objectives. 3. Use appropriate analytical technique to arrive at meaningful conclusions.	
Content:	<p>Problem Identification</p> <p>1. Research: Meaning and Objectives of Research, Motivation, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.</p> <p>2. Research Design Defining the Research Problem, Necessity, Selecting the Problem, Technique Involved in Defining a Problem, and examples. Research Design - Meaning, Need, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs.</p> <p>Sampling Measurement and Data Collection</p> <p>3. Sampling Design -Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample? Measurement and Scaling Techniques - Measurement in Research, Measurement Scales, Sources of Error in Measurement. Methods of Data Collection - Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection.</p> <p>4. Processing and Analysis of Data - Processing Operations, Some Problems in Processing, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression.</p> <p>5. Sampling Fundamentals - Need for Sampling, Some Fundamental Definitions, Important Sampling Distributions, Central Limit Theorem, Sampling Theory, Sandler's A-test, Concept of Standard Error, Estimation, Estimating the Population Mean.</p> <p>Data Analysis techniques</p> <p>6. Hypothesis Testing - What is a Hypothesis? Basic Concepts Concerning Testing of Hypotheses, Procedure for Hypothesis Testing, Flow Diagram for Hypothesis Testing, Measuring the</p>	<p>No of hours 07 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>07 Hours</p> <p>06 Hours</p> <p>06 Hours</p>

	<p>Power of a Hypothesis Test, Tests of Hypotheses, Important Parametric Tests, Hypothesis Testing of Means.</p> <p>7. Analysis of Variance and Covariance - Analysis of Variance (ANOVA), What is ANOVA, basic principle of ANOVA, ANOVA Technique, Setting up Analysis of Variance Table, Short-cut Method for One-way ANOVA, Coding Method, Two-way ANOVA.</p> <p>Paper and Report Writing</p> <p>8. Research paper - Layout of a Research Paper, International and SCI Journals, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.</p> <p>9. Report Writing - Significance of Report Writing Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions.</p>	<p>06 Hours</p> <p>06 Hours</p> <p>06 Hours</p>
Pedagogy:	Constructivist, collaborative, integrative and inquiry-based approach. Innovation-conducive pedagogy, digital pedagogical competency.	
References/ Readings:	<p>Books Recommended:</p> <ol style="list-style-type: none"> Cooper, D. R., Schindler, P. S. and Sharma, J. K.: Business Research Methods, 12th Edition, Tata McGraw Hill Publishers, 2018. Bryman, A. and Bell, E.: Business Research Methods, 4th Edition, Oxford University Press, 2015. Kothari, C. R. and Garg, G.: Research Methodology, 4th Edition, New Age International Publishers, New Delhi, 2019. Examples <p>Reference Books</p> <ol style="list-style-type: none"> Sriwastava, S. C.: Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990. Chou, Ya-Lun : Statistical Analysis with Business and Economics Applications, 2nd Eds., New York, Hold Rinchart and Wrintston, 1974. Clover, Vernont and Balsely, Howerd L : Business Research Methods, Colombus O. Grid, Inc, 1974. Sharma H.D. and Mukherji S. P. : Research Methods in Economics and Business, New York : The Macmillan Company, 1992. Carlos, C.M.: Intellectual property rights, the WTO and developing countries: The TRIPS agreement and policy options. Zed Books, New York, 2000. Coley, S.M. and Scheinberg, C. A.: Proposal Writing, Sage Publications, 1990. Day, R.A.: How to Write and Publish a Scientific Paper, Cambridge University Press, 1992. Research publications from reputed journals 	
Course Outcomes:	<p>After undergoing the course, the students will be able to:</p> <ol style="list-style-type: none"> Understand and formulate the research problem. Analyse the problem using suitable analytical tools on the collected data. Evaluate the solutions obtained using various analytical tools, comparative methods and arriving at logical conclusions. Present the findings of research through a well written report and publications. 	