



# GUJARAT TECHNOLOGICAL UNIVERSITY

Doctor of Philosophy

Subject Code: PHD2401

Subject Name: Research Methodology

WEF Academic Year :	2024-2025
Semester :	1
Category of the Course :	Ph. D.

## Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
5	0	0	5	70	30	0	0	100

## Course Objective:

The objective of the course is to introduce the basic methods of conducting research, explore ideas in formulating research hypotheses and objectives, and sample framework for taking up research studies in a structured manner. Research Methodology as a subject should help researchers to prepare the literature in chronological order and should logically analyze the concerns. This subject should help in framing the research problems to enhance the scale of understanding. It should also help researchers to use tools, techniques, concepts and world's best practices to present unique research. It is intended to facilitate for the development of an insight into different statistical tools for data analysis, interpretation and presentation of reports. It also helps students to make aware about Intellectual Property Rights (IPR).

## Course Outcome:

At the end of the course students will be able to –

1. Prepare literature review report
2. Identify and formulate research problem
3. Prepare appropriate research design for his/her own research
4. Apply concepts of statistics, data interpretation and representation for his/her own research
5. Write research report, thesis, and project proposal
6. Prepare documents related to his/her own IPR



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## Syllabus:

Module	Particulars	Teaching Hours
1	<b>Introduction to Research</b> <ul style="list-style-type: none"><li>• Definition and importance of research, role of research, various classifications of types of research, objectives of research, research process, phases of research</li><li>• Characteristics of scientific research</li></ul>	02
2	<b>Research Problem Formulation</b> <ul style="list-style-type: none"><li>• Sources of literature, review of research literature, purpose and use of literature review, preparation and presentation of literature review.</li><li>• Identification of research gaps, formulation of research problem and identification of research objectives</li></ul>	04
3	<b>Research Design</b> <ul style="list-style-type: none"><li>• Inductive reasoning, deductive reasoning, types of research design: qualitative (grounded theory, ethnographic, narrative, historical, case study and phenomenology), quantitative (descriptive, correlational, experimental, quasi-experimental), mixed method</li><li>• Data Collection: sources of data – primary and secondary, types of data – categorical (nominal and ordinal), numerical (discrete, continuous, ratio and interval) and methods of data collection: survey, interviews, group discussion, observation, records or experimental observations.</li><li>• Methods for qualitative research: types of questionnaire, design and validation of questionnaire.</li><li>• Statistical aspects in research design selection - mean, standard deviation, variance, Chauvenet's criterion, uncertainty analysis, Kline and McClintock method.</li></ul>	10
4	<b>Statistical methods for quantitative and qualitative research</b> <ul style="list-style-type: none"><li>• Probability and standard distribution: Meaning of probability and standard</li><li>• distributions, types of probability distribution, concept of random variables, discrete probability distribution, priori and posteriori probabilities, the binomial and Poisson distributions, the normal distribution, divergence from normality: skewness, kurtosis.</li></ul>	08



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	<ul style="list-style-type: none"><li>Hypothesis Testing: hypothesis, types of hypotheses, level of significance, type I and type II errors, p-value and its interpretation, degrees of freedom, chi square test, student's t test, one way and two-way ANOVA, correlation, Karl-Pearson's coefficient of correlation, simple and multiple linear regression, non-parametric test: Kolmogorov - Smirnov one sample and two sample test, Wilcoxon signed rank test, Mann- Whitney U test, Kruskal-Wallis test. Basics of survival analysis. Exploring statistical software tools that are commonly used for data analysis and statistical modelling.</li></ul>	
5	<b>Data interpretation and presentation:</b> <ul style="list-style-type: none"><li>Various types of graphs, and charts and their uses</li><li>Reporting of qualitative research using COREQ guidelines, presenting qualitative data with the use of matrices, diagrams, and thematic maps</li></ul>	04
6	<b>Technical Writing:</b> <ul style="list-style-type: none"><li>Report and thesis writing: significance, different steps for preparing the reports/thesis, structure, and components of report and thesis in detail</li><li>Types of illustrations/figures and tables</li><li>Preparation of the project proposal: title, description of problems, challenges and constraint, description of proposal including current knowledge and methodology, time frame and work plan, output/impact of project, budget and justification, references (list of experts working in this area)</li></ul>	04
7	<b>Intellectual Property Rights (IPR):</b> <ul style="list-style-type: none"><li>Types of IPR, Overview of latest National IPR policy, International Scenario</li><li>Patents: Definition, Need for patenting, scope and importance of patents, Types of Patents, Condition to be satisfied by an invention to be patentable, Introduction to patent search and important websites, The essential elements of patents, Drafting of patent claims and forms to be submitted along with Indian patent application, Introduction to PCT (Patent Cooperation Treaty)</li><li>Copyrights, Trademark, and Geographical Indications: Introduction and process of Application</li></ul>	08
<b>Total Teaching hours</b>		<b>40</b>



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# Student are required to carry out 35 hours of self-study work applying the theoretical aspects he/she studies in the course.

## Reference Books:

- Research Methodology, Methods & Techniques, C.R. Kothari, Viswa Prakashan.
- Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by John W. Creswell
- Essentials of Research Design and Methodology by Geoffrey Marczyk, David DeMatteo, and David Festinger; Publisher – John Wiley & Sons, Inc
- Research Methodology from Philosophy of Science to Research Design by Alexander M. Novikov, and Dmitry A. Novikov; Publisher – CRC Press
- Qualitative Research: A Guide to Design and Implementation by Sharan B. Merriam, Elizabeth J. Tisdell
- The Craft of Research by Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams
- Research Methods- A Process of Inquiry, Graziano, A. M., Raulin, M.L, Pearson Publications
- The Research Methods Knowledge Base by William M. K. Trochim (Author), James P. Donnelly
- Qualitative Inquiry and Research Design: Choosing Among Five Approaches by John W. Creswell
- Probability and Statistical Inference by Robert V. Hogg, Elliot a. Tanis and David L. Zimmerman , Pearson
- Testing Statistical Hypothesis by Lehmann, E and Romano, J.P., Springer
- Time Series by Kendall, M.G., Charles Griffin
- Introduction to Time Series Analysis and Forecasting by Peter J. Brockwell and Richard A. Davis, Springer
- Introduction to Statistical Time Series by Fuller, John Willy
- Multivariate Data Analysis- in practice, An Introduction to Multivariate Data analysis and Experimental Design by Kim H. Esbensen, Aalborg University, Esbjerg
- Introduction to Multivariate Analysis by Anderson, T.W., John Willy
- Applied Multivariate Statistical Analysis by Hardle, W. and simar, L., Springer
- How to Write a Thesis: Murray, R. Tata McGraw Hill
- Writing For Academic Journals, Murray, R., and McGraw Hill International.
- Writing for Publication, Henson, K.T., Allyn & Bacon
- Intellectual Property, A primer for Academia, By Prof. Rupinder Tewari and Ms. Mamta Bhardwaj, Publication Bureau, Punjab University, Chandigarh. [<https://dst.gov.in/sites/default/files/E-BOOK%20IPR.pdf>]