



(SCHOOL OF SCIENCES AND HUMANITIES)

COURSE CODE	COURSE TITLE	L	T	P	C
40210SH101	RESEARCH METHODOLOGY	3	1	0	4

Course Category: Foundation Course

a. Preamble:

Today research is of immense importance in every field of life. Hence students need sound initiation in the world of research. Thus this syllabus is prepared to equip students with the basics of research methodology and also provide them acquaintance with the main ingredients of collection of data, analysis of data, quantitative methods, optimization IPR and report writing.

b. Prerequisite Courses:

This course has no prerequisites

c. Related Courses:

Research and Publication Ethics.

d. Course educational objectives:

To impart knowledge and skills required for research:

- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Be able to read and interpret statistical information
- Know the basics of different evolutionary algorithms.
- Patent drafting and filing patents.

e. Course Outcomes:

Upon the successful completion of the course, the scholar will be able to:

CO Nos.	Course Outcomes	Knowledge level (Based on revised Bloom's Taxonomy)
CO1	Formulate the research problem through fundamentals of research and literature review.	K3
CO2	Identify and apply research design principles and make use of data collection and analysis techniques.	K3
CO3	Apply quantitative methods to solve research problem.	K3
CO4	Make use of Computer and statistical software tools in solving research problem.	K3
CO5	Interpret the research problem into registering IPR and filing patents.	K2

f. Course Content

UNIT I – INTRODUCTION AND RESEARCH FORMULATION

L-9 + T-2

Introduction to Research: Definitions and Characteristics of Research, Motivation and Objectives, Research Methods *vs.* Methodology. Types of Research: Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical, Concept of Applied and Basic Research Process, Criteria of Good Research.

Defining and Formulating the Research Problem: Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

Literature Review: Objectives of Review of Literature, Importance of Literature Review in Defining a Problem, Primary and Secondary Sources, Reviews, Treatise, Monographs, Patents, Web as a Source, Searching in the Web, Critical Literature Review, Identifying Gap Areas from Literature Review and Research Database, Development of Working Hypothesis.

UNIT II – RESEARCH DESIGN, DATA COLLECTION AND ANALYSIS

L-9 + T-4

Research Design: Basic Principles, Need of Research Design, Features of Good Design, Different Research Designs, Experimental Designs, Research Databases, Development of Models, Developing a Research Plan, Exploration, Description, Diagnosis, and Experimentation.

Data Collection and Analysis: Primary and Secondary Data, Methods of Data Collection, Sampling Methods, Data Processing and Analysis Strategies and Tools, Data Analysis with Statistical Packages (Sigma STAT, SPSS for Student's t-test), Testing of Hypothesis (Student's t-test), ANOVA Technique.

UNIT III–QUANTITATIVE METHODS

L-9 + T-3

Basic statistical distributions and their applications (**No Derivations**): Binomial, Poisson, Negative Binomial, Geometric, Normal, Log Normal, Exponential, Weibull and Gamma distributions and their applications in research studies - Correlation and Regression analysis.

UNIT IV – COMPUTER APPLICATIONS

L-9 + T-4

Mathematical and Statistical analysis using software tools **MATLAB/SCILAB/SPSS/ R LANGUAGE**

Data preparation – Univariate analysis (frequency tables, bar charts, pie charts and percentages) bivariate analysis – cross validation – Measures of central tendency – Dispersion – Correlation and Regression.

Introduction – Data files and types – Operations on matrix – M files – Loops and conditional operators – Functions – 2D and 3D plots.

UNIT V – IPR AND REPORT WRITING

L-9 + T-2

IPR: Intellectual Property Rights and Patent Law, Commercialization, Copy Right, Royalty, Trade Related aspects of Intellectual Property Rights (TRIPS).

Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Oral Presentation, Design of Research Paper, Citation, Plagiarism, Basic Knowledge of funding agencies, Proposal Submission for Funding Agencies.

Total: 60 Hours

.Learning Resources

i. Text Books:

1. C.R. Kothari and Gaurav Garg, " Research Methodology: Methods and Techniques", New Age International (P) Ltd., Publishers, Fourth Multi Colour Edition, 2020.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical statistics, Sultan Chand & Sons, New Delhi, 12th Revised Edition: 2020.
3. Lawrence Leemis, Mathematical Statistics, Ascended Ideas, UK, 2020.
4. Paolo Brandimarte, Quantitative Methods: An Introduction for Business Management, John Wiley & Sons, 2011.
5. Krishnamoorthy, K., 2015. A Handbook of Statistical Distributions with Applications, Chapman and Hall/CRC; 2nd edition.
6. Peter I. Kattan., 2010. MatLab for Beginners: A gentle approach, Creates pace Independent Pub; Revised edition.
7. Sandeep Nagar., 2017. Introduction to Scilab: For Engineers and Scientists, Apress; 1st edition.
8. Priya Rai, R.K. Sharma, P.K. Jain and Akash Singh, Transforming Dimension of IPR Challenges for New Age Libraries, National Law University Delhi Press, 2015.

ii. Reference Books:

1. Dr P M Bulakh, Dr P. S. Patki and Dr A S Chodhary, Research Methodology, Expert Trading Corporation Dahisar West, Mumbai ,2010.
2. Fink, A., Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications, 2009.
3. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, An introduction to Research Methodology, RBSA Publishers, U.K., 2002.
4. Douglas C. Montgomery and George C. Runger. Applied Statistics and Probability for Engineers, (3rdEdn), John Wiley and Sons, Inc., New York, 2003.

iii. Online resources:

1. https://www.soas.ac.uk/cedep-demos/000_P506_RM_3736-Demo/module/pdfs/p506_unit_01.pdf
2. <https://repository.up.ac.za/bitstream/handle/2263/27704/01chapter1.pdf?sequence=2&isAllowed=y>
3. <http://egyankosh.ac.in/bitstream/123456789/41939/1/Unit-4.pdf>
4. <https://www.formpl.us/blog/data-collection-method>
5. <https://www.questionpro.com/blog/data-collection/>
6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4485510/>
7. <https://www.questionpro.com/blog/quantitative-research/>
8. https://hls.harvard.edu/content/uploads/2011/12/quantitative_methods.pdf
9. <https://libguides.usc.edu/writingguide/quantitative>
10. <https://mech.iitm.ac.in/nspch52.pdf>
11. <https://www.kdd.org/kdd2016/topics/view/optimization-techniques>
12. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217699/>
13. <https://iare.ac.in/sites/default/files/M.Tech-RM%20%26%20IPR%20%28ECE%29%20PPTS.pdf>