

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Ph.D. – I (Physics), Semester – I / II Research Methodology in Science PH601/ PH602	Scheme			
	L	T	P	Credit
	4	0	0	4

1.	Course Outcomes (COs):
CO1	To identify and formulate a research problem for a given specialisation with good research ethics.
CO2	To perform statistical analysis of the sample data collected using various sampling techniques and statistical softwares.
CO3	To apply hypothesis testing techniques using different sampling distributions/tests.
CO4	To compile information to prepare an effective research report and paper.
CO5	To prepare and present a research poster and oral presentation effectively to the peers.

2.	Syllabus	
	Foundation of Research	06 Hours
	Meaning of research, Objectives, Motivation, Utility, Characteristics and Types. Characteristics of scientific methods, understanding the language of research: Concept, Construct, definition, Variable. Scientific Research Process. Steps of research, methods of research, research ethics, Introduction to Intellectual Property Rights (IPR).	
	Problem Identification & Formulation:	12 Hours
	Definition and formulating the research problem, Necessity of defining the problem, Importance of literature review in defining a problem. Literature survey: primary and secondary; web sources; critical literature review. Research question, Investigation question, Hypothesis testing, Qualities of a good hypothesis, Null hypothesis and Alternative Hypothesis.	
	Research Design:	08 Hours
	Concept and importance in research, features of a good research design, Exploratory Research Design: Concept, types and uses, Descriptive Research Design: Concept, types and uses. Experimental Design: Concept of independent and dependent variables. Biased and unbiased research design.	
	Sampling Fundamentals:	08 Hours
	Need for sampling, Steps in sampling design, Different types of sample designs, Complex random sampling designs, Important sampling distributions (of mean, proportion, t-, F-, and Chi-square distribution), Central limit theorem, Concept of standard error, Estimating population mean and proportion, Determination of sample size through confidence level, probability estimation and probability distributions.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

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	Measurement, Data, and Analytics	08 Hours
	Structured and unstructured data, Scales of measurement, Population and sample, Descriptive statistics, Data visualization. Probability and random variables, Sampling and estimation, Hypothesis testing, Analysis of variance (ANOVA), Correlation, and Regression analysis. Data Analytics: Elements of association, Clustering, and Classification. Brief introduction to various open-source/commercially available software packages, e.g. MINITAB, ORIGIN, MS Office, etc.	
	Interpretation of Results, Research Documentation and Presentation	06 Hours
	Understanding of interpretation of results, Steps of interpretation; Elements of preparing a research paper and a thesis: Abstract, Keywords, Symbols and Abbreviations, Introduction, Materials and Methods (Theoretical/Experimental), Results and Discussion, Conclusions, Citations and References/Bibliography, Table of Content (ToC), Scope of future work and Appendixes. Elements of good English writing. Ethical issues related to publishing, Plagiarism and Self-plagiarism, Plagiarism detection software's (Turnitin, etc.). Types of presentation: Poster, Oral and Invited talk.	
	Students Assignments, Discussion and Review	08 Hours
	(a) Read, evaluate and present a good journal paper in relevant field of research; (b) Conduct literature review for a specific research topic and prepare a report with citations; (c) To write a sample research paper and thesis proposal.	
	(Total Contact Time: 56 Hours)	

3.	Books Recommended
1	C. R. Kothari and G. Garg. Research Methodology: Methods and Techniques, 4th Edition, New Age International, 2019.
2	D. Napoleon and B. B. S. Narayanan. Research Methodology – As Theoretical Approach, Laxmi Publications, 2014.
3	Garg, B. L. Karadia R. Agrawal, F. and Agrawal U. K., 2002. An Introduction to Research Methodology, RBSA Publishers
4	Data Reduction and Error Analysis for the Physical Sciences 3rd Ed by Philip R Bevington & D Keith Robinson, McGraw – Hill (2003)
5	H. S. Asthana and B. Bhushan. Statistics for Social Sciences (With SPSS Applications), 2nd Edition, PHI Learning, 2016.

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