Course Code: ED 3101.Course Title: Research Methodology

Course: Research Methodology (RM) Credits: 04 Hours: 60

Course Context and Overview (100 words): The course is designed to meet the essential objectives of providing to the Ph.D. students across all the Departments at LNMIIT, strong research motivation, research objectives and well planned research goals. The course covers every facet of research methodology: research & research process, characteristics, identification of the problem, research design, analysis techniques and research reporting. It provides specific coverage of the statistical methods of analysis of research data, weather qualitative or quantitative in nature pertaining to science & technology, humanities & social sciences and other fields of study. Statistical methods such as descriptive measures, scaling methods, probability and probability distributions as base of statistical inference, designs of experiment, sampling designs, sample size problem, sampling distributions, theory of estimation, large and small sample tests of hypothesis, Stochastic models, and theory of attributes to be discussed in details.

Prerequisites Courses: NIL

Course outcomes (COs):

On completion of this course, the students will be able to
CO1:appreciate the philosophy, significance and importance of the research process and will be able to recognize and evaluate research process models
CO2: understand the concept of research design, sampling design and comprehend the components of research design; also will be able to choose a suitable sampling design and to decide about sample size.
CO3: identification of variables, methods of collection of data, measurement scales, and the measures of quantitative and qualitative data.
CO4: formulation of the hypothesis and identification of suitable test procedure, parametric / nonparametric in nature, for given research problems. Also, students will be able to learn to develop a suitable stochastic model for prediction under bivariate and multivariate data setup.
CO5. Comprehend the characteristics of research communications and appreciate the significance of reporting research findings.

Topics	Lecture hours	Total hours
Unit-1 **Research and Research Process**		**10**
1.1 Research: **Research Motivation,Objectives,Goals,** Research methods and Research Methodology, Challenges to its application, , Science and Scientific thinking, **1.2 Conceptualization of research problem**, Types of Research: Induction & Deduction, Applied and Theoretical.	2	
1.2 Research Process: Various steps of research process, **Literature Review**. Models: SCM,ABCDE,multi-step functional-sequential.	4	
1.3 Observations, Measurement, Data: significance, methods, data mapping. quantitative & **quality data and collection methods** ,scales:,nominal,,ordinal,interval,ratio,Thurstone, ,Likert,Guttman.	4	
Unit-2 **Research Designs**		**10**
2.1 Experimental design: variables, error, internal and external validity.	2	
2.2 Statistical Designs: principles, models, basic experimental designs, degrees of freedom, Dunne's test, multi-comparison test.	4	
2.3 Sampling Designs: simple and complex, sample size problem, Sampling and Non-sampling errors and their measures, Standard error and its estimation.	4	
Unit-3 **Topic: Data Analysis, Probability and Probability distributions**		**12**
3.1 Data analysis : **Classification and presentation**, Descriptive measures of statistics: central tendency, dispersion ,moments ,cumulants, coefficients of variation .	2	
3.2 Probability and random Variables: Probability, pmf, pdf, expectation and their properties.	5	
3.3 Probability Distributions: Discrete & Continuous distributions such as Binomial, Poisson, Normal, Uniform. Selection of random samples from a given distribution.	5	
Unit-4 **Topic: Testing of Hypothesis-Parametric & Nonparametric Tests**		**12**
4.1 Construction of hypotheses, Power curve, Most powerful test, BCR, Large Sample Tests.	2	
4.2 Introduction of sampling distributions: t, chi-square. Small Sample Tests: t ,chi-square F and nonparametric tests.	5	

Commented [1]:

4.3 Construction of confidence intervals, **Tests for Qualitative data:Association of attributes ,Consistency of data, Yule's coefficient, Colligation,**	5	
5.Topic: Bivariate Frequency distributions and ANOVA		**10**
5.1 Correlation: Karl Pearson's correlation coefficient for grouped and ungrouped data, rank correlation, intra-class correlation.	2	
5.2 Regression Analysis: Simple and multiple, Stochastic model	5	
5.3 ANOVA one-way and two way classifications Introduction to discriminant analysis, **Factor analysis and data mining**. **Notion of simulation & methods.**	5	
6. Research Reporting		**6**
➢ 6.1 IMRD structure, structure of thesis, research paper, research report, Oral & Poster presentation, Review & peer review, Referencing, Reference managed software. **Citation (in-text and end-text); MLA and APA style.**	3	
6.2 Case Studies from **various subjects**	3	
Total Hours		**60**
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Reference Books: 1. Research Methods for Engineers by David V.Theil.Cambridge University Press, 2014

2. Research Methodology-An Introduction by Wayne Goddard & Stuart Melville,JUTA & Co.,2004

3. Research Methodology and Scientific Writing by C.G.Thomas.Ane Books Pvt.Ltd. 2016.

4. Basic Statistics by B.L.Agarwal. New Age Int.pub., 2015

5. An introduction to probability and statistics by Vijay K.Rohatgi and SalehA.K.Md.Wiley ,2001

6. Research Methodology by S.Panse,Oxford university press,2016

7. Research Methods & Statistics by Bernard A.Mc Carthy,Cambridge University Press,2017.

Evaluation Scheme:

Item	Weightage (%)
Quiz1	5
Quiz2	5
Assignments/Case studies	10
Midterm	30
Final Examination	50