Course Type	Course Code	Name of Course	L	T	P	Credit
DE	MEC591	Research Methodology and Statistics	3	0	0	9

Course Objective

To illustrate to the students a) the basic concepts of research, b) how a scientific research problem has to be formulated and tackled and c) important statistical tools necessary to analyze the collected data for a meaningful research outcome.

Learning Outcomes

On successful completion of the course, the students will

- Learn various types of research process, methodologies to identify, design and execute a research problem based on scientific and statistical tools;
- Learn various types of sample design techniques and its classification, characteristics of a good sample design and how to select a sampling procedure for data collection;
- Learn various types of measurement scales, sources of error in measurement and technique of developing measurement tools to evaluate the collected data;
- Learn various methods of data collection and the reliability and validity of the collected data;
- Learn various ways to prepare and present report for dissemination of research outcome;
- Learn various statistical tools necessary for designing a sample, analyzing the data and making scientific conclusion(s) out of the collected data to arrive at a research outcome.

Module	Topics	Lecture Hours	Learning Outcome
1	Research Process, Types of Research, Problem identification and Hypothesis formulation	5	Basic ideas on research processes, Definition of various types of research, Knowledge on what constitute a research and how to identify a research problem, Knowledge on the formulation of hypothesis for research
2	Research Design: General Designs of Research, Randomized and Correlated Groups Design.	5	Meaning of research design, Ideas on the need for research design, Knowledge on the features of a good research problem design, Important concepts relating to research design, Ideas on different research design methodologies, Ideas on the basic principles of experimental designs

3	Sampling Design, Measurement and Scaling, Methods of Data Collection, Reliability and Validity	5	Ideas on the Implications of a Sample Design and its classification, Knowledge on the criteria of selecting a sampling procedure and characteristics of a good sample design, Ideas on measurement scales and sources of error in measurement, Knowledge on technique of developing measurement tools, Ideas on the meaning of scaling and important scaling techniques, Ideas on the methods of data
			collection and the reliability and validity of the collected data.
4	Data Presentation and Report Preparation, Introduction to Qualitative and Quantitative Research Methods.	3	Ideas on Data presentation and report preparation techniques, Sensitizing the students on the very important issues of plagiarism, Preliminary ideas on the qualitative and quantitative research methodologies and their mutual difference.
5	Frequency Distribution, Presentation of Data, Measures of Central Tendency, Measures of Dispersion, Skewness	3	Ideas and knowledge on frequency distribution, cumulative frequency distribution, constructing histograms, Knowledge on the measures of central tendency (Mean, Median and Mode), Various measures of dispersion of the data.
6	Probability Distributions, Discrete and continuous random variable, Binomial, Poisson, Normal and Standard Normal distributions.	6	Learn about Experiment, Outcomes, and Sample Space, Calculation of Probability, Ideas on Marginal and Conditional Probabilities, Learn about Mutually Exclusive, Independent and Complementary Events, Learn about Bay's Theorem, Learn about discrete and continuous random variables and how to calculate their mean and standard deviation, Learn about Binomial, Poisson, Normal and Standard Normal distributions.
7	Sampling and Estimation, Sampling Distribution, Estimation of the mean and proportion, Hypothesis tests about the mean and proportion of a population, t-test and ztest, Estimation and hypothesis testing about two different populations.	6	Learn about sampling and estimation methods, hypothesis testing regarding the properties of the population from the sample statistics (sample mean and variance), Learn about Student's t-distribution and z-distribution and t-test and z-tests, Knowledge on estimation and hypothesis testing about two different populations

8	Hypotheses testing: χ^2- test, Analysis of Variance, Correlation and Regression analysis.	6	Learn about the Chi-Square distribution, Goodness-of-Fit test, Learn about making contingency tables, Learn about testing independence or homogeneity of populations, Learn to infer about the population variance, F-Distribution and one-way ANOVA, Learn about simple linear regression models and analysis.

Textbook:

1. 'Research Methodology - Methods and Techniques' C R Kothari and Gaurav Garg New Age International (P)

   Limited Publishers 4rth Edition, 2019 New Delhi
2. 'Applied Statistics and Probability for Engineers' D C. Montgomery and George C. Runger 6 th Edition, 2016 **References:**

1. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, SAGE Publications Ltd; Fifth edition 2018.

Introductory Statistics, Prem S. Mann, 7th Edition, John Wiley and Sons Inc., 2010, Danvers, MA.