# DMC007 Research Methodology (For all branches of Ph.D.)

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**Course Objective:** The aim of this course is to motivate the students an intrinsic interest in statistical thinking and instil the belief that statistics is important for scientific research.

**Introduction:** Nature and objectives of research, Study and formulation of research problem, Scope and formulation of hypothesis, Preparation and presentation of research and project proposals, Selection of thrust research.

**Introduction to Statistical Analysis:** Measures of central tendency and dispersion, Mean, Median, Mode, Range, Mean deviation, Standard deviation.

**Random Variables and Probability Distribution:** Definition, Distributions, Functions, Mathematical Expectation, Binomial, Poisson, Geometric, Negative binomial, Exponential, Normal and log-normal distributions.

**Markov chains:** Basics of markov chains, Finite state space, Markov chains, transition and stationary markov chains, Continuous time markov process: Pure birth, Pure death, Birth and death process.

**Hypothesis Testing:** Tests of significance based on normal, Analysis of variance technique.

**Linear Regression and Correlation:** Linear regression, Least square principle and fitted models, Karl Pearson's correlation coefficient, Rank correlation, Lines of regression.

**Design of Experiments:** Completely randomized design, Random block design, Latin square design, Statistical analysis.

**Time series and forecasting:** Components of time series, Analysis of time series, Measurement of trend, Measurement of seasonal variations.

**Laboratory Work:** Implementation of statistical techniques using statistical packages viz. SPSS R including evaluation of statistical parameters and data interpretation, Regression Analysis, Covariance, Hypothesis testing and analysis of variance.

**Course Learning Outcomes (CLO):** Upon the completion of this course, the student will be able to:

1. learn how to analyze the data using different descriptive measures and present them graphically.
2. compute the probabilities of events along with an understanding of the random variables, expectation and various probability distributions.
3. understand the estimation of Normal distribution parameters and their one-sample and multi-sample hypothesis tests along with applications to real world problems.
4. analyze the bivariate correlated data and fit the regression models along with measurement of different components of the time-series.
5. learn the Markov processes with a study of stochastic process and their applications to real word problems.

**Recommended Books:**

1) Dowdy, S., Wearden, S. and Chilko, D., Statistics for Research, Wiley series (2004). 2nd ed.
2) Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., Probability and Statistics for Engineers and Scientists, Dorling Kindersley (2007). 7th ed.
3) Jhonson, R.A, Gupta C. B., Miller and Freund's Probability and Statistics for Engineers, Dorling Kindersley (2007). 7th ed.
4) Meyer, P.L. Introductory Probability and Statistical Applications, Addison Wesley (1970).
5) Medhi, J., Stochastic Processes, New Age International, 2005.
6) Goon, Gupta, Das, Gupta, Fundamental of Statistics, Vol II, Wold Press, 1999