MANGALORE UNIVERSITY

DEPARTMENT OF MATHEMATICS

MSC MATHEMATICS

MTS 559	Mathematical Statistics	4 Credits (48 hours)

Prerequisite: Knowledge of Mathematics at Under-Graduate level.

Course Outcome: Students will have the knowledge and skills to develop the concept of Probability, Conditional Probability and Momentsto study the different statistical models,describe the use of probability distributions and functions of random variables in the study of sampling distributions and their properties, andillustrate testing of hypotheses statistical inference to summarize the main features of a data set and study the behaviors of the collected data.

Course Specific Outcome: At the end of the course Students will have the knowledge and skills to understand, explain in depth and apply in various situations the concepts -

- A probability generating function, a moment generating function, and a cumulant generating function and cumulants.
- Apply central limit theorem, and explain the concepts of random sampling, statistical inference and sampling distribution, and use basic sampling distributions.
- Describe the main methods of estimation and the main properties of estimators, and apply them.
- Use different testing hypothesis like MP test, Likelihood ratio tests, t- test, Chi-square test, Wilcoxon sign rank test, and Run test etc.

Unit I - Probability, Conditional Probability and Moments:

Sample space, class of events; Classical and Axiomatic definitions of Probability, their consequences. Conditional Probability, Independence, Bayes' theorem and applications. Random Variables, Distributions Functions, Probability Mass functions, Probability Density functions. Expectations, Moment generating function, Probability generating function,Chebyshev's and Jensen's inequalities and applications.

(12 Hours)

Unit II - Distributions:

Standard discrete distribution and their properties - Bernoulli, Binomial, Geometric, Negative Binomial, Poisson distributions. Standard continuous distribution and their properties - Uniform, Exponential, Normal, Beta, Gamma distributions. Functions of random variables - transformation technique and applications, Sampling distributions - t, Chi-square, F and theirproperties.

(14 Hours)

Unit III - Random Sequences, Statistical Inference and Testing Hypothesis:

Sequences of random variables - Convergence in distribution and in probability, Chebyshev's, Weak law of large numbers. Central limit theorem and applications. Point estimation-sufficiency, unbiasedness, method of moments, maximum likelihood estimation. Testing of hypotheses - Basic concepts, Neyman-Person lemma, MP test. Likelihood ratio tests, t- test, Chi-square test and their applications. Nonparametric tests and their applications - Sign, Wilcoxon sign ranktest, Run test.

(22 Hours)

References

[1] Rohatgi V. K., *An introduction to probability theory and mathematical statistics*, Wiley Eastern ltd, 1985.

[2] Bhat B. R., *Modern Probability Theory*, an introductory text, Wiley eastern Ltd, 1981.

[3] Robert B Ash, *Probability and Mathematical Statistics*, Academic Press, Inc. NY, 1972.

[4] Hogg R.V. and Craig A. T., *Introduction to Mathematical Statistics*, 6th Ed., McMillan and Co., 2004.

[5] E. L. Lehmann and J. P. Romano, *Testing Statistical Hypothesis*, 3rd Ed., Springer, 2005.

[6] Freund, J.F., *Mathematical Statistics*, 8th Ed., Prentice Hall India, 2012.