2-Year Master's Program in Mathematics (NEP-2020)
MATHEMATICAL STATISTICS

Masters Mathematics (1st Semester) Total Credits: 04
Course Code: MMTHDMS126 (15 hours per credit) Total Marks: 100
Continuous Assessment: Marks 30, Theory: Marks 70 Time Duration: 2½ hrs

Course Learning Outcomes(CLO's): Upon successful completion of the course, students will be able to:

CLO1. Analyze and model random experiments using probability theory.
CLO2. Apply various probability distributions to real-world scenarios.
CLO3.Understand and apply concepts of estimation and hypothesis testing.
CLO4.Utilize statistical methods for making sound predictions and decisions.

Unit-I

Probability set function, Random variables: discrete and continuous, Probability density function (pdf), cumulative distribution function (cdf)–properties and applications. Conditional probability and Bayes theorem. Mathematical expectation, variance, and higher moments, Moment generating functions and characteristic functions, Inequalities: Markov, Chebyshev, Jensen, Joint, marginal, and conditional distributions, Covariance, correlation, and stochastic independence.

Unit-II:

Standard Probability Distributions: Discrete distributions: Bernoulli, Binomial, Negative Binomial, Geometric, Trinomial, Poisson, Continuous distributions: Uniform, Exponential, Gamma, Chi-square, Beta, Normal, Bivariate Normal distribution and their properties. Problems and Applications.

Unit-III:

Limit Theorems and Parameter Estimation: Law of large numbers and Central Limit Theorem and its applications. Point estimation: properties of estimators (bias, consistency, efficiency). Methods of estimation: Method of Moments, Maximum Likelihood Estimation (MLE), Interval estimation: confidence intervals for means, variances in normal distributions, Unbiased and minimum variance unbiased estimators (MVUE), Rao-Blackwell theorem. Sufficiency: Factorization Theorem and the Fisher-Neyman.

Unit-IV:

Inference and Hypothesis Testing: Exponential family of distributions and completeness, Complete and sufficient statistics, Rao-Cramer inequality and its implications. Hypothesis testing framework: Null and alternative hypotheses, Type I and Type II errors, power of a test, Most powerful (MP) tests and Neyman-Pearson Lemma.

CLO-PLO Mapping Matrix (Strength version)

CLO ↓ PLO →	PLO1	PLO2	PLO3	PLO4	PLO5	PLO 6	PLO7	PLO8	Average CLO
MMTHDMS126.1	3	3	2	1	2	3	2	3	**2.38**
MMTHDMS126.2	3	3	2	2	3	2	2	2	**2.38**
MMTHDMS126.3	3	3	3	3	1	3	2	3	**2.63**
MMTHDMS126.4	2	2	2	2	2	2	1	1	**1.75**
Average PLO	**2.75**	**2.75**	**2.5**	**2**	**2**	**2.5**	**1.75**	**2.25**	**2.29**

Recommended Books:

1.Sheldon Ross, A First Course in Probability**,** Pearson Education, 10th Edition, 2018

2.Robert V. Hogg, Joseph W. McKean, Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, 8th Edition, 2018.

3.Morris H. DeGroot, Mark J. Schervish, Probability and Statistics, Pearson Education, 4th Edition, 2011.

4. George Casella, Roger L. Berger, Statistical Inference**,** Cengage Learning, 2nd Edition, 2001.