DEPARTMENT OF MATHEMATICS
GOVERNMENT DEGREE COLLEGE BARAMULLA (AUTONOMOUS)

SYLLABUS FOR B.A./B.Sc. MATHEMATICS (HONORS) 7TH & 8TH SEMESTERS
Year 2025 AND ONWARDS

MATHEMATICAL STATISTICS

Course Code: MMTC3822M
Semester: 8th
Total Credits: 4+2
Continuous Assessment: Marks 50
Theory: Marks 100
Total Marks: 150
Course hrs: 64+32

Course Learning Outcomes (CLO's): Upon 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.

Credit-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.

Credit-II Discrete Distributions: Bernoulli Distribution, Binomial distribution, Poisson Distribution (pmf, mean, variance, mode, mgf, moments and applications). Poisson distribution (as a limiting case of binomial distribution), Additive properties. Negative Binomial Distribution, Geometric (pdf, important properties, mean, variance, mgf, moments and applications). Continuous Distributions: Normal distribution, its p.d.f, properties (mean, median, mode, variance and mgf median mode), Characteristics, Standard Normal Distribution, its p.d.f, illustration. Exponential Distrbution, Beta and Gamma 1st type Distribution (Important properties mean, variance and mgf).

Members:
1. Prof. Tariq Ahmad Chishti
2. Prof Tariq Ahmad Chalkoo
3. Dr. Tariq Ahmad Naikoo
4. Dr. Nisar Ahmad Lone
5. Dr. Farooq Ahmad Sheikh
6. Dr. Shahnawaz Ahmad Rather

Dr. Mahnaz Shafi Chishti
(Chairperson/Member)

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Credit-III Limit Theorems and Parameter Estimation: Law of large numbers and Central limit theorem and its applications. Point estimation: properties of estimators (unbiased, 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.

Credit-IV Inference and Hypothesis Testing: Exponential family of distributions, 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.

Tutorials:
Credit-I Distributions of functions of one or more random variables, Distribution function method, change of variables method and moment generating method, Applications of distribution functions. Illustrations on discrete and continuous distributions.

Credit-II Applications of central limit theorem, examples on maximum likelihood estimation, unbiased and minimum variance unbiased estimators. Examples on sufficient statistics, testing of hypotheses.

Recommended Books:

1. Hogg and Craig, An Introduction to Mathematical Statistics, Pearson 7th Edition, 2012.
2. Mood and Grayball, An introduction to Mathematical Statistics, McGraw Hill 3rd edition, 2017.
3. C.R.Rao, Linear Statistical Inference and its applications, Wiley 2nd Edition, 2009.
4. George Casella, Roger L. Berger, Statistical Inference, Cengage Learning, 2nd Edition, 2001.
5. Morris H. DeGroot, Mark J. Schervish, Probability and Statistics, Pearson Education, 4th edition, 2011.

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Dr. Malinaz Shafi Chishti
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