References

[1] R. Courant and D. Hilbert, *Methods of Mathematical Physics*, Vol I, Interscience Press, 1953.

[2] L. E. Elsgolc, *Calculus of Variations*, Pergamon Press Ltd., 1962.

[3] R. Weinstock, *Calculus of Variations with Applications to Physics and Engineering*, Dover, 1974.

[4] D. Porter and D. S. G. Stirling, Integral Equations, *A practical treatment from spectral theory and applications*, Cambridge University Press, 1990.

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MTS 559	Mathematical Statistics	4 Credits (48 hours)

Course Objectives

1. **Understand Probability Concepts**: Define probability, conditional probability, and independence; apply Bayes' theorem, and understand random variables, distributions, expectations, and moment generating functions.
2. **Study Distributions**: Analyze standard discrete and continuous distributions, including Bernoulli, Binomial, Uniform, Exponential, Normal, and their properties, and apply transformation techniques and sampling distributions.
3. **Explore Random Sequences and Statistical Inference**: Study random sequences, convergence, and laws of large numbers. Apply the central limit theorem and methods of point estimation, including sufficiency, unbiasedness, and maximum likelihood estimation.
4. **Master Hypothesis Testing**: Understand hypothesis testing fundamentals, apply Neyman-Pearson lemma, and use various tests such as the likelihood ratio test, t-test, Chi-square test, and nonparametric tests in applications.

Course Outcomes

1. Ability to define and apply probability concepts, conditional probability, and distributions, including their functions and inequalities.
2. Competence in analyzing and applying properties of standard discrete and continuous distributions and using transformation and sampling distributions effectively.
3. Skill in handling random sequences, applying laws of large numbers, and performing point estimation using methods like maximum likelihood estimation.
4. Ability to perform hypothesis testing using various tests, including Neyman-Pearson, likelihood ratio, t-test, Chi-square test, and nonparametric tests.
5. Proficiency in applying probability theory, statistical inference, and hypothesis testing techniques to real-world problems and data analysis.

Unit I - Probability, Conditional Probability and Moments (12 Hours)

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.

Unit II – Distributions (12 Hours)

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 their properties.

Unit III - Random Sequences, Statistical Inference (12 Hours)

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.

Unit IV - Testing Hypothesis (12 Hours)

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.

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MTS 560	Computational Geometry	4 Credits (48 hours)

Course Objectives:

1. To understand the fundamental concepts and computational techniques related to shape operators and surface geometry.
2. To study the intrinsic and extrinsic geometry of surfaces in Euclidean space and their global properties.
3. To explore the principles of Riemannian geometry and its applications in surface analysis.
4. To gain proficiency in computer-aided geometric design, including Bezier curves, spline curves, and interpolation methods.

Course Outcomes:

1. Comprehend and apply the concepts of shape operators and normal curvature in various computational scenarios.
2. Analyze the intrinsic and extrinsic properties of surfaces in E3E^3E3 and understand their fundamental equations and theorems.
3. Utilize the principles of Riemannian geometry, including covariant derivatives and geodesics, in surface construction and analysis.