Syllabus for Statistics Paper

Calculus: Finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property; Sequences and series, convergence; Limits, continuity, uniform continuity, differentiability, mean value theorems; Riemann integration, Improper integrals; Functions of two or three variables, continuity, directional derivatives, partial derivatives, total derivative, maxima and minima, saddle point, method of Lagrange's multipliers; Double and Triple integrals and their applications; Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem.

Linear Algebra: Finite dimensional vector spaces over real or complex fields; Linear transformations and their matrix representations, rank; systems of linear equations, eigenvalues and eigenvectors, minimal polynomial, Cayley-Hamilton Theorem, diagonalization, Jordan canonical form, symmetric, skew-symmetric, Hermitian, skewHermitian, orthogonal and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, definite forms.

Probability: Classical, relative frequency and axiomatic definitions of probability, conditional probability, Bayes' theorem, independent events; Random variables and probability distributions, moments and moment generating functions, quantiles; Standard discrete and continuous univariate distributions; Probability inequalities (Chebyshev, Markov, Jensen); Function of a random variable; Jointly distributed random variables, marginal and conditional distributions, product moments, joint moment generating functions, independence of random variables; Transformations of random variables, sampling distributions, distribution of order statistics and range; Characteristic functions; Modes of convergence; Weak and strong laws of large numbers; Central limit theorem for i.i.d. random variables with existence of higher order moments.

Stochastic Processes: Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Inference: Unbiasedness, consistency, sufficiency, completeness, uniformly minimum variance unbiased estimation, method of moments and maximum likelihood estimations; Confidence intervals; Tests of hypotheses, most powerful and uniformly most powerful tests, likelihood ratio tests, large sample test, Sign test, Wilcoxon signed rank test, MannWhitney U test, test for independence and Chi-square test for goodness of fit.

Regression Analysis: Simple and multiple linear regression, polynomial regression, estimation, confidence intervals and testing for regression coefficients; Partial and multiple correlation coefficients.

Multivariate Analysis: Basic properties of multivariate normal distribution; Multinomial distribution; Wishart distribution; Hotelling's T2 and related tests; Principal component analysis; Discriminant analysis; Clustering

Design of Experiments: One and two-way ANOVA, CRD, RBD, LSD, 22 and 23 Factorial experiments.

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