STATISTICS

Unit 1 - Analysis (Real & Complex) and Linear Algebra

Real number system; Sequences and series of real numbers and their convergence; Algebra of continuous functions; Types of discontinuities; Differentiability of a function; Reimann integration; Euclidean space R^n; Metric on R^n, Open and closed sets, Limit points of a set in a metric space, Complete metric spaces, Compact sets. Complex numbers and their properties; Analytic functions, Cauchy-Reimann equations; Line integrals; Cauchy's theorem; Power series; Singularities; Cauchy's residue theorem; Contour integration.

Vector spaces, subspaces, linear independence, basis and dimension; Algebra of linear transformations; Matrices and algebra of matrices, rank and determinant of matrices; Simultaneous linear equations; Characteristic roots and vectors, Cayley-Hamilton theorem; Classification of quadratic forms.

Unit 2 - Measure and Probability

Sequence of sets- limit superior and limit inferior, convergence; Field and σ-field of sets; Measure, Lebesgue and Lebesgue-Stieltjes measures; Measurable functions and integration, Basic integration theorems; Radon-Nikodym theorem-applications only; Measures in product spaces.

Definitions of probability, addition theorem, independent events; Conditional probability, multiplication theorem, Bayes' theorem; Monotone and continuity properties of the probability measure; Borel-Cantelli lemma, Borel zero-one law; Random variables, distribution functions and their properties (univariate & bivariate), discrete and continuous random variables, joint, marginal and conditional distributions, independent random variables; Moments, Chebychev's and Liapunov inequalities; Moment generating and characteristic functions; Stochastic convergence of sequence of random variables; Law of large numbers and central limit theorem.

Unit 3 - Ditribution Theory

Standard discrete and continuous distributions - binomial, Poisson, geometric, negative binomial, hypergeometric; uniform, exponential, normal, Cauchy, Laplace, gamma, beta and lognormal. Functions of random variables and their distributions, distributions of sum, product and ratio of independent random variables; Sampling distributions of the mean and variance of a random sample from the normal distribution; χ^2, t, and F distributions; Order statistics- basic distribution theory, order statistics arising from uniform and exponential distributions and their properties; Multivariate normal distribution; Correlation and regression, partial and multiple correlation coefficients.

Unit 4 - Statistical Inference

Estimation- Point estimation, properties of estimators; Cramer-Rao inequality, MVB estimator, UMVU estimator, Rao-Blackwell and Lehmann-Scheffe theorems; Methods of estimation; Basic concepts in interval estimation; Fundamental notions of hypothesis testing, Neymann-Pearson lemma, most powerful and uniformly most powerful tests; Tests for the mean and variance of normal distribution, tests for proportions, tests for simple, partial and multiple correlation coefficients; Sequential probability ratio test; Non-parametric tests.

Unit 5 - Sampling Theory and Design of Experiments

Sampling techniques- simple random sampling, stratified sampling, systematic sampling, ratio and regression methods, cluster sampling; estimation problems in these sampling methods; Sampling and non-sampling errors.

Linear models and estimation; Analysis of variance; Basic principles of experimental design; Analysis of CRD, RBD, LSD and BIBD; Factorial experiments - 2^n and 3^n experiments; Confounding in 2^n and 3^n experiments.