Syllabus for Statistics

PAPER-I

Unit-I

Linear Algebra: Vector spaces, subspaces, linear independence and dependence, basis and dimension of a vector space, orthogonal and orthonormal bases, examples of vector spaces over real and complex fields, linear equations and their solutions. Elementary matrices, special types of matrices, transpose of a matrix, trace of a matrix and its properties, determinants and their properties, rank and inverse of a matrix and elementary properties.

Real Analysis: Sets, subsets, finite, countable and uncountable sets, unions, intersections and complements, Demorgan's law, supremum and infimum. Interior point and limit point of subsets of R(set of real numbers), open and closed subsets of R, sequences and series, convergence, limsup, liminf and Heine Borel theorem. Continuous functions, continuity and compactness, monotonic functions, derivative of a real function, mean value theorems, L'Hospital's rule and Taylor's theorem. Riemann-Stieltjes integral and its properties.

Interpolation: Nomenclatures and operators related to finite difference table, definition, assumptions, uses, method of parabolic curve fitting, Gregory Newton's forward and backward formulas of interpolation.

Unit-II

Descriptive statistics: Scope and meaning of Statistics, classification and tabulation of data, diagrammatic and graphical representation of data, ungrouped and grouped data. Measures of central tendency, relative and absolute measures of dispersion for ungrouped and grouped data. Meaning and interpretation of coefficient of variation, measures of skewness and kurtosis. Simple linear regression and correlation.

Time series analysis: Definition and scope**,** components of time series, measurement of trend by graphical method, method of semi averages, method of curve fitting and moving average method. Measurement of seasonal fluctuations by method of simple average, ratio to trend method, ratio to moving average method and link relative method. Measurement of cyclic movement, concepts of auto regression and auto correlation.

Index Numbers: Definition, meaning, construction, interpretation, uses and limitations of various index numbers. Classification of index numbers, criteria of a good index number and errors in measurement of index numbers.

Vital statistics: Definition and uses of vital statistics. Different methods of obtaining vital statistics. Measures of mortality, life table, its assumptions, description, construction and uses. Measures of fertility and measurement of population growth.

PAPER – II

Unit I

Probability theory: Sample space, random experiment, events, combanotorics, different approaches to definition and laws of probability, conditional probability and Bayes' theorem. Random variables

(rv), discrete and continuous rvs, distribution and density functions, expectation of random variables and their properties. Probability generating function, moment generating function and characteristic function. Binomial, Poisson, geometric, negative binomial, uniform, exponential, normal, beta of I and II kinds, gamma distributions and their properties. Order statistics and their distributions. Sampling distributions (t, chi square and F) and their properties. Central limit theorem.

Sampling theory: Basic terminologies, census and sample surveys, need for sampling, probability and non-probability sampling procedures. Simple random sampling, stratified sampling, systematic sampling and cluster sampling. Determination of sample size(n), bias in sampling, sampling and non-sampling errors.

Statistical inference: Conceps of consistency, sufficiency, unbiasedness and efficiency. Group families, exponential family of distributions, concepts of minimal sufficiency and completeness. Construction of UMVUE and Cramer-Rao lower bound. Moment estimators, maximum likelihood estimators and their properties. Interval estimation and calculation of confidence intervals. Meaning and interpretation of basic terms of testing of hypotheses, simple and composite hypothesis. Randomized tests, Neyman Pearson lemma, MP, UMP and LR tests. Applications of Z, t, chi-square and F-tests for various situations. SPRT and its simple applications. Non-parametric tests: run test, sign test, Wilcoxon signed rank test, Wilcoxon rank sum test, Kolmogorov one sample and two sample tests.

Elementary stochastic processes: Definition and classification of stochastic processes. Statement of Kolmogorov consistency condition, transition probability, n-step transition probabilities and classification of states. Markov chains and their applications. Poisson process, pure birth process, pure death process, birth and death process.

Unit II

Operations Research: Definition and formulation of linear programming problem (LPP). Graphical, simplex and artificial variable techniques of solving LPP. Transportation and assignment problems. Poisson queues, steady state probabilities and properties of M/M/1 and M/M/C queues. Two-person and n-person zero sum game, saddle point, mixed strategies and graphical method of solving games.

Statistical Quality Control: Basic concepts of quality control, process control and process capability. Probability limits and control limits. Shewart's control charts for variables and attributes. OC, ARL functions of these charts. Acceptance sampling plans, single and double sampling plans for attributes OC, AOQ, ASN and ATI functions of these plans.

Linear models and Applications: Guass-Markov model, estimability of linear parametric functions, least squares method, BLUE, Guass-Markov theorem, applications of Guass-Markov theory to one-way, two-way and three-way classifications. Principles of designs of experiments, CRD, RBD, LSD and missing plot techniques. Analysis of factorial experiments and BIBD.