

# SYLLABUS IN STATISTICS

## Unit - I

**Descriptive Statistics:** Scope and limitation of Statistics, Tabular and graphical presentation of Data, Consistency, Association and independence of data with special reference to attributes. Measures of Central Tendency: Measures of Dispersion, Moments, Skewness & Kurtosis.

**Bivariate Data:** Scatter diagram, simple, partial and multiple correlation (3 variables only), Rank correlation, simple linear regression, Principle of least squares and fitting of polynomials and exponential curves.

**Index Numbers:** Index number, Types of Index Numbers, weighted and unweighted index nos. including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's Index Number, Chain base index number, Conversion of fixed base to chain base index nos. & vice-versa, Consumer price index number.

**Probability & Probability Distributions:** Conditional prob., laws of addn. & multiplication, independent events, Bayes' theorem & its applications. p.m.f, p.d.f & c.d.f with illustrations, univariate transformations with illustrations. Two dimensional r.v: Joint, Marginal & conditional p.m.f, p.d.f & c.d.f, independence of random variables. Standard prob distns: Uniform, Binomial, Poisson, Normal, Geometric, and Exponential distns., Beta & Gamma distributions.

**Sampling Distribution:** Sampling distn. of sample mean, sample variance & sample proportion, Null & Alternative hypothesis, Level of significance, Type I & Type II errors, Critical region, large sample tests for testing single proportion, difference of two proportions, single mean, diff. of two means, standard deviation. Exact sampling distn: Chi-square, Student's t and F distns. Tests of significance and conf. intervals based on these distns.

## Unit - II

### Survey Sampling:

Types of sampling, Probability and non-probability Sampling. Basic principles of sample survey. Simple random sampling with & without replacement, estimates of Popln mean, total & prop, Variances of these estimates, Sample size determination. Stratified Random Sampling: Estimates of Popln mean & total, Variances of these estimates, prop & optimum allocations & their comparison with SRS, estimation of gain in precision, efficiency. Systematic Sampling: Estimates of popln mean & total, Variances of these estimates, comparison of syst. sampling with SRS & stratified sampling. Cluster Sampling: estimation of popln mean & variance, efficiency as compared to SRS. Ratio & Regression methods of estimation: Estimation of popln mean and total upto first approximation, variance of these estimates, comparison of the efficiency of ratio & reg estimators relative to SRS.

### Statistical Inference:

Criterion of a good estimators; Relative efficiency of estimators, Maxm. likelihood estimation. MVUE, Rao-Blackwell theorem and applications, Cramer-Rao Inequality, most powerful critical region, Neyman Pearson Lemma, uniformly most powerful critical region, OC function & OC curve, ASN function & ASN curve, Examples based on Binomial and Normal distribution. Size & power of a test, Likelihood ratio test, Non-parametric Tests.

**Linear Model:** Multiple regression, Estimation & hypothesis testing in regression models, ANOVA of a one-way classified data, ANOVA of a two-way classified data with one obsvs per cell, Model Matrix and its use in estimation.

**SQC (Statistical Quality Control):**

Construction & interpretation of statistical control charts,  $\bar{X}$  & R chart, s-chart, np-chart, p-chart, c-chart & u-chart. Single sample inspection plan: Construction & interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves, Use of Dodge-Romig & other tables, ISO quality standards, SPC.

**Stochastic Process & Queuing Theory:**

Markov chains, Identification of types of classes of reducible and irreducible chains, Poisson process. Pure birth process, pure death process (M/M/1) model, Yule-Furry process, (M/M/c) model with finite and infinite system capacity.

**Unit - III**

**Operations Research:** Math. formulation of LPP, & solving the problems using graphical method, and two-phase method and Simplex technique, Charnes' Big M method. Identifying special cases by Graphical & Simplex method & interpretation (Unbounded, Infeasible and alternate soln), Transportation Problem, Assignment Problem, Game theory and Inventory Management problems.

**Time Series:** Components of a Time Series, Estimation of Trend and seasonal components, stationarity in time series, fitting of various math curves & growth curves (modified exp. curve, Gompertz curve, logistic curve, Parabola, st. line). Elimination of Trend, Estimation of Seasonal components, Forecasting by exponential smoothing, variate component method.

**Demography & Vital Statistics:** Concept of vital statistics, Measurement of mortality and fertility (CDR, Crude death rate, age specific death rate, complete & indirect method). Abridged life table, their applications, Measurement of population growth (CBR, GFR, SFR, TFR), Vital index, GRR & NRR, Concept of stable and stationary population.

**Mathematical Analysis:** Finding roots of algebraic eqns, soln of linear eqns by matrix method, Rank & inverse of a matrix, characteristic roots & vectors of a matrix, Applications of matrices. Determination of Maxima & Minima, Use of definite integral to find the area under curve, differential equations, and partial differential equations, and their applications.

**Numerical Analysis:** Operators E,  $\Delta$ ,  $\nabla$ , Interpolation with equal & unequal intervals, Numerical Integration (Trapezoidal, Simpson's & Weddle's method), Stirling's approximation.