Syllabus for M.A./M.Sc. Statistics Entrance Test-2023

 Note: The syllabus prescribed for the entrance test has been divided into fifteen units. Each unit carries a weightage of four marks. Paper setters are required to set four multiple choice type questions with only one correct or most appropriate answer separately for each unit, giving uniformity to the whole syllabus contained therein.

 UNIT- I Measures of central tendency or location (Arithmetic mean, median, mode, geometric mean and harmonic mean). Requisite conditions for a good average. Relationship between various measures of location and their applications. Merits and demerits of these measures. Dispersion and its relative and absolute measures. Coefficient of variation. Skewness, Kurtosis and their measures including those based on quartiles. Moments, relation between central moments in terms of raw moments and vice-versa. Bivariate Data: Concept of correlation and its types. Scatter diagram method and product moment method of studying correlation.

UNIT- II Properties of a correlation coefficient (limits of the correlation coefficient, effect of change of origin and scale). Concept of rank correlation, derivation of Spearman's rank correlation coefficient and its limits. Principal of least squares and fitting of first-degree polynomial and parabola. Meaning of regression, derivation of two regression lines. Regression coefficients and their properties.

UNIT- III Important concepts in probability: Definition of probability – classical, relative frequency approach to probability and axiomatic approach of probability. Merits and demerits of these approaches (only general ideas to be given). Random Experiment: Trial, sample space, definition of an event, operation of event, mutually exclusive events. Discrete sample space, properties of probability based on axiomatic approach. Conditional probability, independence of events, Bayes' theorem and its application.

UNIT- IV Random Variables: Definition of discrete random variables, probability mass function, idea of continuous random variable, probability density function, illustrations of random variables and its properties. Expectation of random variable and its properties. Moment generating functions (mgf), properties and uses. Standard univariate discrete distributions, their applications and properties (mean variance and mgf): Uniform, Binomial, Poisson, Geometric, and Hyper geometric distribution.

UNIT-V Continuous univariate distributions, their applications and properties (mean, variance, moments and mgf: Uniform, Normal, Exponential, Gamma and Beta Distributions (first-kind).

UNIT- VI Concept of population, sample, Statistic, parameter and sampling distribution. Standard error of sample mean and sample proportion. Statistical hypothesis and its types. One tail and two tail tests. Types of errors, level of significance and critical region. Procedure for testing of hypothesis. Large sample tests: Tests of significance for testing of a single mean, single proportion, difference of two means and two proportions.

UNIT- VII Tests of significance based on Chi- square. Test for goodness of fit. Contingency table and tests of independence of attributes in a contingency table. Exact sampling distributions: t- Statistic. Test for single mean and difference between two means. Paired t-test. Testing for the significance of sample correlation in sampling from normal population. F-Statistic. Testing of equality of two variances of two-univariate normal distribution.

UNIT- VIII Sampling Theory: Need for sampling, Census and sample survey, basic concept in sampling, Principles of sample survey, advantages of sample survey over census. Sampling and non-Sampling errors. Simple random sampling (SRS) with and without replacement. Merits and demerits of Simple random sampling (SRS). Methods of selecting SRS. Estimation of mean, its Variance and estimate of its variance. Unbiased estimate of population mean square.

UNIT- IX Stratified random sampling: Estimation of mean, its variance. Need for stratification. Advantage of stratified sampling over simple random sampling. Allocation of sample size under proportional and optimum allocation. Comparison of stratified sampling over SRS Systematic sampling and its uses. Advantages of systematic sampling over SRS. Estimation of mean and its variance.

UNIT- X Analysis of Variance, assumptions and applications, ANOVA for one way and two way (using Principle of LSE). ANOVA table & its interpretation. Principles of Experimental Design. Completely randomized design (CRD): layout, analysis, advantages and disadvantages. Randomized block design (RBD): layout, analysis, advantages and disadvantages of RBD over CRD. Single missing observation analysis for RBD. Latin Square Design (LSD) layout, analysis and advantages.

UNIT- XI Linear programming: Definition of convex set. Basic definitions (Solution to LPP, Feasible solution, Basic solution, Basic feasible solution, Optimum basic feasible solution, unbounded solution) in linear programming problems (LPP). Mathematical formulation of LPP, Standard form of LPP, graphical and simplex method of solving LPP (Without artificial technique). Transportation problem and its mathematical formulation and tabular representation. Basic definitions with reference to transportation problem (Feasible solution, Basic feasible solution and optimal solution). Methods for initial basic feasible solution (North-West corner rule, Lowest Cost Entry Method and Vogel's Approximation method). Optimal solution to T.P.

UNIT- XII Index number: Definition and applications of index number. Price relatives and quantity or volume relatives, link and chain relatives, Problems involved in computation of index number, use of averages, simple aggregative and Weighted average methods, Lasperey's, Passche's and Fisher's index numbers, time and factor reversal tests of index number. Time series Analysis: Time series – Notation of time series – components of time series – methods of determination of trend by graphical, semi-averages, least squares and moving average methods- Determination of seasonal indices by simple average –ratio to trend methods –ratio to moving average.

UNIT- XIII Vital Statistics – Introduction – definition, uses, source of vital statistics – registration method, census method – rates and ratios, crude death rates – age specific death rate, standardized death rates – crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Gross reproductive rate and net reproductive rate.

UNIT -XIV Statistical quality control and its uses. Chance and assignment causes of variation. Process and product control, 3σ. Control chars for variables ($\bar{X}$, R and S Charts). Control chart for attributes (np, p and c charts). Introduction to computers. Basic set of an electronic computer (CPU, input & output devices) Need of computers in statistics.

UNIT- XV Statistical Inference, parameter, Parameter space, Statistic and its sampling distribution. Types of Estimation (Point Estimation and Interval estimation). Estimate and estimator. Requirements of a good estimator. Unbiasedness, consistency, efficiency and sufficiency. Neyman-Factorization theorem without proof and related examples. Methods of Estimation: Maximum likelihood method of estimation and methods of moment.

Head of the Department