

# **S.K. S. D. Mahila Kalasala (U.G&P.G.) (A), Tanuku-534211**

(Affiliated to Adikavi Nannaya University, Rajamahendravaram)

## **B.Sc I YEAR: STATISTICS SYLLABUS**

### **I SEMISTER**

#### **PAPER – I Descriptive Statistics**

**w.e.f. 2020-2021**

#### **UNIT-I**

**Introduction to Statistics:** Importance of Statistics. Scope of Statistics in different fields. Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Ogives, Pie. Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean. Median and Mode through graph.

#### **UNIT-II**

**Measures of Dispersion:** Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance. Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

#### **UNIT-III**

**Curve fitting:** Bi- variate data, Principle of least squares, fitting of degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, Fitting of power curve and exponential curves.

**Correlation:** Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Bi-variate frequency distribution, correlation coefficient for bi-variate data and simple problems. Concept of multiple and partial correlation coefficients (three variables only ) and properties

#### **UNIT-IV**

**Regression :** Concept of Regression, Linear Regression: Regression lines, Regression coefficients and its properties, Regressions lines for bi-variate data and simple problems. Correlation vs regression.

**Attributes:** Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency, Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

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**B.Sc I YEAR: STATISTICS**

**PRACTICAL SYLLABUS**

**I SEMISTER**

**PAPER – I Descriptive Statistics**

**w.e.f. 2020-2021**

1. Graphical presentation of data (Histogram, frequency polygon, Ogives).
2. Diagrammatic presentation of data (Bar and Pie).
3. Computation of measures of central tendency (Mean, Median and Mode)
4. Computation of measures of dispersion (Q.D, M.D and S.D)
5. Computation of non-central, central moments,  $\mu_1$  and  $\mu_2$  for ungrouped data.
6. Computation of non-central, central moments,  $\mu_1$  and  $\mu_2$  and Sheppard's corrections for grouped data.
7. Computation of Karl Pearson's coefficients of Skewness and Bowley's coefficient of Skewness.
8. Fitting of straight line by the method of least squares
9. Fitting of parabola by the method of least squares
10. Fitting of power curve of the type by the method of least squares.
11. Fitting of exponential curve of the type and by the method of least squares.
12. Computation of correlation coefficient and regression lines for ungrouped data
13. Computation of correlation coefficient, forming regression lines for grouped data
14. Computation of Yule's coefficient of association
15. Computation of Pearson's, Tchebyshev's coefficient of contingency

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**B.Sc I YEAR: STATISTICS SYLLABUS**

## II SEMISTER

### PAPER – I PROBABILITY AND PROBABILITY DISTRIBUTIONS

w.e.f. 2020-2021

#### UNIT I:

**Introduction to Probability:** Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events, Addition and multiplication theorems of probability for 2 and for n events. Boole's inequality and Baye's theorem and its applications in real life problems.

#### UNIT II:

**Random variable:** Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function. Probability density function, Distribution function and its properties. For given pmf, pdf calculation of moments, coefficient of skewness and kurtosis. Bivariate random variable - meaning, joint, marginal and conditional Distributions, independence of random variables and simple problems.

**Mathematical expectation :** Mathematical expectation of a random variable and function of a random variable. Moments and covariance using mathematical expectation with examples. Addition and Multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F and their properties. Chebyshev and Cauchy - Schwartz inequalities.

#### UNIT III:

**Discrete Distributions:** Binomial, Poisson, Negative Binomial, Geometric distributions: Definitions, means, variances, M.G.F, C.F, C.G.F, P.G.F, additive property if exists. Poisson approximation to Binomial distribution. Hyper-geometric distribution: Definition, mean and variance.

#### UNIT IV:

**Continuous Distributions:** Rectangular, Exponential, Gamma, Beta Distributions: mean, variance, M.G.F, C.G.F, C.F. Normal Distribution: Definition, Importance, Properties, M.G.F, CF, additive property.

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**B.Sc I YEAR: STATISTICS SYLLABUS**

**II SEMESTER**

**PAPER – I PROBABILITY AND PROBABILITY DISTRIBUTIONS**

**w.e.f. 2020-2021**

**Practicals**

**List of Experiments:**

1. Fitting of Binomial distribution –Directmethod.
2. Fitting of binomial distribution – Recurrence relation Method.
3. Fitting of Poisson distribution –Directmethod.
4. Fitting of Poisson distribution - Recurrence relation Method.
5. Fitting of Negative Binomial distribution.
6. Fitting of Geometric distribution.
7. Fitting of Normal distribution –Area method.
8. Fitting of Normal distribution –Ordinate method.
9. Fitting of Exponential distribution.

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**II B.Sc. STATISTICS SYLLABUS**

**SEMESTER – III,**

**Subject : STATISTICS**

**Paper III: STATISTICAL INFERENCE**

(w.e.f.2020-2021)

**UNIT I:**

**Concepts:** Population, Sample, Parameter, statistic, Sampling distribution, Standard error, convergence in probability and convergence in distribution, law of large numbers, central limit theorem (statements only). Student's t- distribution, F – Distribution,  $\chi^2$ -Distribution: Definitions, properties and their applications.

**UNIT II:**

**Theory of estimation:** Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, & sufficiency and. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's. Binomial, Poisson & Normal Population parameters estimate by MLE method. Confidence Intervals.

**Additional Input:** Crammer's Rao inequality.

**UNIT III:**

**Testing of Hypothesis:** Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Neyman- Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

**UNIT IV:**

**Large sample Tests:** large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. standard deviation(s) and correlation coefficient(s).

**Small Sample tests:** t-test for single mean, difference of means and paired t-test.  $\chi^2$ -test for goodness of fit and independence of attributes. F-test for equality of variances.

**UNIT V:**

**Non-parametric tests-** their advantages and disadvantages, comparison with parametric tests. Measurement scale- nominal, ordinal, interval and ratio. One sample runs test, sign test and Wilcoxon- signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon – Mann-Whitney U test, Wald Wolfowitz's runs test.

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**II B.Sc. STATISTICS PRACTICAL SYLLABUS**  
**SEMESTER – III,**  
**Subject : STATISTICS**  
**Paper III: STATISTICAL INFERENCE**  
(w.e.f.2020-2021)

List of Experiments:

1. Large sample test for difference of means
2. Large sample test for single proportion
3. Large sample test for difference of proportions
4. Large sample test for difference of standard deviations
5. Large sample test for correlation coefficient
6. Small sample test for single mean
7. Small sample test for difference of means
8. Small sample test for correlation coefficient
9. Paired t-test (paired samples).
10. Small sample test for single variance ( $\chi^2$  - test)
11. Small sample test for difference of variances (F-test)
12.  $\chi^2$  - test for goodness of fit and independence of attributes
13. Nonparametric tests for single sample (run test, sign test and Wilcoxon signed rank test)
14. Nonparametric tests for related samples (sign test and Wilcoxon signed rank test)
15. Nonparametric tests for two independent samples (Median test, Wilcoxon - Mann-Whitney - U test, Wald - Wolfowitz' s run test)

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**II B.Sc. STATISTICS SYLLABUS**

**SEMESTER – IV,**

**Subject : STATISTICS**

**Paper IV: SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS**

**(w.e.f.2020-2021)**

**UNIT I:**

**Simple Random Sampling** (with and without replacement): Notations and terminology, various probabilities of selection. Random numbers tables and its uses. Methods of selecting simple random sample, lottery method, method based on random numbers. Estimates of population total, mean and their variances and standard errors, determination of sample size, simple random sampling of attributes.

**Additional Input:** Sampling Theory, Principles of Sample survey, Sampling and non sampling errors, types of sampling.

**UNIT II:**

**Stratified random sampling:** Stratified random sampling, Advantages and Disadvantages of Stratified Random sampling, Estimation of population mean, and its variance. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.

**Systematic sampling:** Systematic sampling definition when  $N = nk$  and merits and demerits of systematic sampling - estimate of mean and its variance. Comparison of systematic sampling with Stratified and SRSWOR.

**UNIT III:**

**Analysis of variance :** Analysis of variance (ANOVA) – Definition and assumptions. One-way with equal and unequal classification, Two way classification.

**Design of Experiments:** Definition, Principles of design of experiments, CRD: Layout, advantages and disadvantage and Statistical analysis of Completely Randomized Design (C.R.D).

**UNIT IV:**

Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) with their layouts and Analysis,

Missing plot technique in RBD and LSD. Efficiency RBD over CRD, Efficiency of LSD over RBD and CRD.

**Factorial experiments** – Main effects and interaction effects of  $2^2$  and  $2^3$  factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

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II B.Sc.

**SEMESTER – IV,**

**Subject : STATISTICS**

**Paper IV: SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS**  
**PRACTICAL SYLLABUS**  
(w.e.f.2020-2021)

**List of Experiments:**

**Sampling Techniques:**

Estimation of population mean and its variance by

1. Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.
3. Systematic sampling with  $N=nk$ . Comparison of systematic sampling with Stratified and SRSWOR.

**Design of Experiments:**

4. ANOVA - one - way classification with equal and unequal number of observations
5. ANOVA Two-way classification with equal number of observations.
6. Analysis of CRD.
7. Analysis of RBD Comparison of relative efficiency of CRD with RBD
8. Estimation of single missing observation in RBD and its analysis
9. Analysis of LSD and efficiency of LSD over CRD and RBD
10. Estimation of single missing observation in LSD and its analysis
11. Analysis of  $2^2$  with RBD layout
12. Analysis of  $2^3$  with RBD layout

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**II B.Sc. STATISTICS SYLLABUS**

**SEMESTER – IV,**

**Subject : STATISTICS**

**Paper V: APPLIED STATISTICS**

**(w.e.f.2020-2021)**

**UNIT I:**

**Time Series:** Time Series and its components with illustrations, additive, multiplicativemodels. Trend: Estimation of trend by free hand curve method, method of semi averages.Determination of trend by least squares (Linear trend, parabolic trend only), moving averages method.

**UNIT II:**

**Seasonal Component:** Determination of seasonal indices by simple averages method, ratio to moving average, Ratio to trend and Link relative methods, Depersonalization.

**UNIT III:**

**Growth curves:** Modified exponential curve, Logistic curve and Grompertz curve, fitting of growth curves by the method of three selected points and partial sums.Detrending. Effect of elimination of trend on other components of the time series

**UNIT IV:**

**Index numbers:** Concept, construction, problems involved in the construction of index numbers, uses and limitations. Simple and weighted index numbers. Laspayer's, Paasche's and Fisher's index numbers, Criterion of a good index number, Fisher's ideal index numbers. Cost of living index number and wholesale price indexnumber.

**UNIT V:**

**Vital Statistics:** Introduction, definition and uses of vital statistics, sources of vital statistics. easures of different Mortality and Fertility rates, Measurement of population growth. Life tables: construction and uses of lifetables.

**Additional Input:** Official Statistics – Functions and organization of CSO & NSSO.

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**SEMESTER – IV,**  
**Subject : STATISTICS**  
**Paper V: APPLIED STATISTICS**  
(w.e.f.2020-2021)

**List of Experiments:**

**Time Series:**

1. Measurement of trend by method of moving averages(odd and even period)
2. Measurement of trend by method of Least squares(linear and parabola)
3. Determination of seasonal indices by method of simple averages
4. Determination of seasonal indices by method of Ratio to moving averages
5. Determination of seasonal indices by method of Ratio to trend
6. Determination of seasonal indices by method of Link relatives

**Index Numbers:**

7. Computation of simple index numbers.
8. Computation of all weighted index numbers.
9. Computation of reversal tests.

**Vital Statistics:**

10. Computation of various Mortality rates
11. Computation of various Fertility rates
12. Computation of various Reproduction rates.
13. Construction of Life Tables

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**III B.Sc., (MSCs)**

**V - SEMESTER**

**Subject- STATISTICS**

**SYLLABUS**

**Paper –VI : Operations Research-I**

**UNIT-I:**

Introduction of OR – Origin and development of OR – Nature and features of OR – Scientific Method in OR – Modeling in OR – Advantages and limitations of Models- General Solution methods of OR models – Applications of Operation Research. Linear programming problem (LPP) - Mathematical formulation of the problem - illustrations on Mathematical formulation of Linear programming of problem. Graphical solution of linear programming problems. Some exceptional cases - Alternative solutions, Unbounded solutions, non-existing feasible solutions by Graphical method.

**UNITII:**

General linear programming Problem (GLP) – Definition and Matrix form of GLP problem, Slack variable, Surplus variable, unrestricted Variable, Standard form of LPP and Canonical form of LPP. Definitions of Solution, Basic Solution, Degenerate Solution, Basic feasible Solution and Optimum Basic Feasible Solution. Introduction to Simplex method and Computational procedure of simplex algorithm. Solving LPP by Simplex method (Maximization case and Minimization case)

**UNITIII:**

Artificial variable technique - Big-M method and Two-phase simplex method, Degeneracy in LPP and method to resolve degeneracy. Alternative solution, Unbounded solution, Non existing feasible solution and Solution of simultaneous equations by Simplex method.

**UNITIV:**

Duality in Linear Programming –Concept of duality - Definition of Primal and Dual Problems, General rules for converting any primal into its Dual, Economic interpretation of duality, Relation between the solution of Primal and Dual problem (statements only). Using duality to solve primal problem. Dual Simplex Method.

**PostOptimalAnalysis**-Changes in cost Vector **C**, Changes in the Requirement Vector **b** and changes in the Coefficient Matrix **A**. Structural Changes in a LPP.)

**Additional topics:** Integer programming problem – concept – applications of integer programming Concept of Non linear programming problem.

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**III B.Sc., (MSCs)**

**V - SEMESTER**

**Subject- STATISTICS**

**PRACTICAL SYLLABUS**

**Paper –VI : OperationsResearch-I**

**Practical/Lab to be performed on a computer using OR/Statistical packages**

1. To solve Linear Programming Problem using Graphical Method with
  - (i) Unbounded solution
  - (ii) Infeasible solution
  - (iii) Alternative or multiple solutions.
2. Solution of LPP with simplex method.
3. Problem solving using Charnes-M method.
4. Problem solving using Two Phase method.
5. Illustration of following special cases in LPP using Simplex method
  - (i) Unrestricted variables
  - (ii) Unbounded solution
  - (iii) Infeasible solution
  - (iv) Alternative or multiple solutions.
6. Problems based on Principle of Duality.
7. Problems based on Dual Simplex method.
8. Problems based on post optimality analysis

**Practical's Skills Outcomes:**

On successful completion of this practical course, students shall be able to:

1. Solve LPP using Graphical method
2. Solve the LPP using Simplex method, Big M method and Two Phase method
3. Solve the problems using principle of duality
4. Solve the problems using Dual Simplex method
5. Solve the problems for Post Optimal Analysis

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**III B.Sc., (MSCs)**

**V - SEMESTER**

**Subject- STATISTICS**

**SYLLABUS**

**Paper –VII : OperationsResearch-II**

***Objective:Toenrichtheknowledgeofstudentswithadvancedtechniquesoflinear programming problem along with real life applications.***

**UNITI:**

Transportation Problem - Introduction, Mathematical formulation of Transportation problem. Initial Basic feasible solution of Transportation problem -North-West corner rule, Lowest cost entry method, Vogel's approximation method. Method of finding optimal solution- MODI method (U-V method). Degeneracy in transportation problem, Resolution of degeneracy, Unbalanced transportation problem. Maximization TP. Transshipment Problem.

**Additional Input** : stepping stone method.

**UNITII:**

Assignment Problem - Introduction, Mathematical formulation of Assignment problem, Reduction theorem (statement only), Hungarian Method for solving Assignment problem, Unbalanced Assignment problem. The Traveling salesman problem, Formulation of Traveling salesman problem as an Assignment problem and Solution procedure.

**UNITIII:**

Sequencing problem: Introduction and assumptions of sequencing problem, Sequencing of n jobs and one machine problem. Johnson's algorithm for n jobs and two machines problem- problems with n- job on two machines, algorithm for n jobs on three machines problem- problems with n- jobs on three machines, algorithm for n jobs on m machines problem, problems with n-jobs on m-machines.

**UNITIV:**

Network Scheduling: Basic Components of a network, nodes and arcs, events and activities- Rules of Network construction- Time calculations in networks- Critical Path Method (CPM) and PERT.

**Additional Input** : Time cost optimization method.

**UNITV:**

**Game Theory:** Two- person zero-sum games. Pure and Mixed strategies. Maximin and Minimax Principles - Saddle point and its existence. Games without Saddle point- Mixed strategies. Solution of  $2 \times 2$  rectangular games. Graphical method of solving  $2 \times n$  and  $m \times 2$  games. Dominance Property.

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**III B.Sc., (MSCs)**

**V - SEMESTER**

**Subject- STATISTICS**

**PRACTICAL SYLLABUS**

**Paper –VII : Operations Research-II**

***Practical/Lab to be performed on a computer using OR/Statistical packages***

1. IBFS of transportation problem by using North-West corner rule, Matrix minimum method and VAM
2. Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases)
3. Solution of Assignment problem using Hungarian method (both maximization and minimization cases),
4. Solution of sequencing problem—processing of  $n$  jobs through two machines
5. Solution of sequencing problem -processing of  $n$  jobs through three machines
6. To perform Project scheduling of a given project (Deterministic case-CPM).
7. To perform Project scheduling of a given project (Probabilistic case-PERT).
8. Graphical method of solving for  $m \times 2$  and  $2 \times n$  games.
9. Solution of  $m \times n$  games by dominance rule.
10. Linear programming method for solving  $m \times n$  games.