AKKINENI NAGESWARA RAO COLLEGE (AUTONOMOUS)GUDIVADA-521301

(Affiliated to Krishna University Machilipatnam-Re-Accredited by NAAC with 'A' Grade)

Department of Statistics

R-20 (Regulation Syllabus)

AKKINENI NAGESWARA RAO COLLEGE:: GUDIVADA
(An Autonomous college under the jurisdiction of Krishna University, Machilipatnam)

SEMESTER-I	IB. Sc(MSCS)	STATISTICS		CODE:20STA1	2022-2023
No. Teaching Hours per week		No. of Credits			Paper – I
Theory : 4	2	4	2		

Semester – I (CBCS With Maths Combination)

Paper - I: Descriptive Statistics

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, Ogive's, 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 it's properties, Regressions lines for bi-variate data and simple problems. Correlation vs regression.

UNIT-V

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.

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of MathematicalStatistics,SultanChand&Sons, NewDelhi.

2 BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy
  - Dr M.JaganmohanRao,DrN.SrinivasaRao, Dr P.TirupathiRao, Smt.D.Vijayalakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I,Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd.,Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
4. M. JaganMohanRao and Papa Rao: A Text book of StatisticsPaper-I.
5. Sanjay Arora and BansiLal: New Mathematical Statistics: SatyaPrakashan , NewDelhi

20STA1(P)-Practicals - Paper – I

1. Graphical presentation of data (Histogram, frequency polygon,Ogive's).
2. Diagrammatic presentation of data (Bar andPie).
3. Computation of non-central, central moments, $\beta 1$ and $\beta 2$ and Sheppard's corrections for groupeddata.
4. Computation of Karl Pearson's and Bowley's coefficients of Skewness.
5. Fitting of parabola by the method of leastsquares
6. Fitting of power curve of the type by the method of leastsquares.
7. Fitting of exponential curve of the type by the method of leastsquares.
8. Computation of correlation coefficient and regression lines for ungroupeddata
9. Computation of Yule's coefficient of association
10. Computation of Pearson's, Tcherprows coefficient ofcontingency

SEMESTER-II		I B.Sc STATISTICS	CODE:20STA2	2022-2023
No. Teaching Hours per week		No. of Credits		Paper – II
Theory : 4	2	Theory: 4	2	

Semester – II (CBCS With Maths Combination)
Paper - II: **Probability Theory and Distributions**

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.

UNIT- III

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-IV

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. Possion approximation to Binomial distribution. Hyper-geometric distribution: Defination, mean and variance.

UNIT - V

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.

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of mathematicalStatistics, Sultan Chand & Sons, NewDelhi.

2 BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu
   Academy- Dr M.JaganmohanRao,DrN.SrinivasaRao, Dr P.TirupathiRao,
Smt.D.Vijayalakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I,Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press
   Pvt.Ltd.,Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
4. M. JaganMohanRao and Papa Rao: A Text book of StatisticsPaper-I.
5. Sanjay Arora and BansiLal: New Mathematical Statistics: SatyaPrakashan , NewDelhi
6. Hogg Tanis Rao: Probability and Statistical Inference.

Practicals Paper – II

1. Fitting of Binomial distribution – Directmethod.
2. Fitting of binomial distribution – Recurrence relationMethod.
3. Fitting of Poisson distribution – Directmethod.
4. Fitting of Poisson distribution - Recurrence relationMethod.
5. Fitting of Negative Binomialdistribution.
6. Fitting of Geometricdistribution.
7. Fitting of Normal distribution – Areasmethod.
8. Fitting of Normal distribution – Ordinatesmethod.
9. Fitting of Exponentialdistribution.

SEMESTER-III	II B. Sc	STATISTICS	CODE:20STA3	2021-2022
No. Teaching Hours per week		**No. of Credits**		**Paper – III**
Theory : 4	2	**Theory: 4**	2	

Semester – III
(CBCS With Maths Combination)
Paper - III:Statistical Inference

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 – stribution, χ^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.

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. χ^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.

TEXT BOOKS

 1. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A.Mohanrao, N.SrinivasaRao, DrR.Sudhakar Reddy, Dr T.C. Ravichandra Kumar.

 2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
 REFERENCE BOOKS:
 1. Fundamentals of Mathematics statistics : VK Kapoor and SC Guptha.
 2. Outlines of statistics, VolII : Goon Guptha, M.K.Guptha, Das Guptha B.
 3. Introduction to Mathematical Statistics :Hoel P.G.
 4. Hogg Tanis Rao: Probability and Statistical Inference. 7th edition. Pearson.

Practicals - Paper –III   Credits: 2

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

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SEMESTER- IV	II B. Sc	STATISTICS	CODE:20STA4-A	2021-2022
No. Teaching Hours per week		**No. of Credits**		**Paper – IV**
Theory : 4	**2**	**Theory: 4**	**2**	

Semester – IV (CBCS With Maths Combination)

Paper - IV:Sampling Techniques and Designs of Experiments
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.

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.

UNIT V

Factorial experiments – Main effects and interaction effects of 22 and 23 factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

Text Books:

1. Telugu AcademyBA/BSc III year paper - III Statistics - applied statistics - Telugu academy by Prof.K.SrinivasaRao, DrD.Giri. DrA.Anand, DrV.PapaiahSastry.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PH

Reference Books:
1. Fundamentals of applied statistics : VK Kapoor and SC Gupta.
2. Indian Official statistics - MR Saluja.
3. AnuvarthitaSankyakaSastram - Telugu Academy

Practical's - Paper –IV

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 withSRSWOR.
3. Systematic sampling with N=nk. Comparison of systematic sampling with Stratified and SRSWOR.
4. ANOVA - one - way classification with equal and unequal number ofobservations
5. ANOVA Two-way classification with equal number ofobservations.
6. Analysis ofCRD.
7. Analysis of RBD Comparison of relative efficiency of CRD withRBD
8. Estimation of single missing observation in RBD and itsanalysis
9. Analysis of LSD and efficiency of LSD over CRD andRBD
10. Estimation of single missing observation in LSD and itsanalysis
11. Analysis of 2^2 with RBDlayout
12. Analysis of 2^3 with RBDlayout

SEMESTER- IV	II B. Sc	Statistics		CODE:20STA4-B	2021-2022
No. Teaching Hours per week		**No. of Credits**			**Paper – V**
Theory : 4	**2**	**Theory: 4**	**2**		

Semester – IV (CBCS With MathsCombination)
Paper - V:Applied Statistics

UNIT I

Time Series: Time Series and its components with illustrations, additive, multiplicative models.
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, Deseasonalization.

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 an d Fisher's index numbers, Criterion of a good index number, Fisher's ideal index numbers. Cost of living index number and wholesale price index number.

UNIT V

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

Text Books:

1. Fundamentals of applied statistics : VK Kapoor and SC Gupta.
2. BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by prof.K.SrinivasaRao, DrD.Giri. DrA.Anand, DrV.PapaiahSastry.

Reference Books:

3. AnuvarthitaSankyakaSastram – Telugu Academy.
4. Mukopadhyay, P (2011). Applied Statistics, 2nd ed. Revised reprint, Books and Allied Pvt. Ltd.
5. Brockwell, P.J. and Devis, R.A. (2003). Introduction to Time Series Analysis.Springer.
6. Chatfield, C. (2001). Time Series Forecasting., Chapman & Hall.
7. Srinivasan, K. (1998). Demographic Techniques and Applications. Sage Publications
8. Srivastava O.S. (1983). A Text Book of Demography.Vikas Publishing House

Practicals Paper –V

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 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
7. Computation of simple index numbers.
8. Computation of all weighted index numbers.
9. Computation of reversal tests.
10. Computation of various Mortality rates
11. Computation of various Fertility rates
12. Computation of various Reproduction rates.   13. Construction of Life Tables

SEMESTER-VI	III B. Sc	STATISTICS	CODE: 20STA6-A	2022-2023
No. Teaching Hours per week		**No. of Credits**		**Paper – 6A**
Theory : 3	3	**Theory: 3**	2	

STATISTICS SYLLABUS
(With Mathematics Combination)
Paper: **OPERATIONS RESEARCH - I**
(Skill Enhancement Course(Elective),
Max. Marks: Theory :100 + Practicals:50

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 LPP - 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.

UNIT-II

General linear programming Problem (GLPP) – 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)

UNIT-III

Artificial variable techniques - 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.

UNIT-IV

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.

UNIT-V

Post Optimal Analysis - Changes in cost Vector $\mathbf{C}$, Changes in the Requirement Vector $\mathbf{b}$ and changes in the Coefficient Matrix $\mathbf{A}$. Structural Changes in a LPP.

Reference Books:

1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut.
2. Kanti Swarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.
3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass S.I : Linear Programming. Mc Graw Hill.
5. Hadly G : Linear programming. Addison-Wesley.
6. Taha H.M: Operations Research: An Introduction : Mac Millan.

Pract icals

1. To solve Linear Programming Problem using Graphical Method with
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 Optimal Analysis.

SEMESTER-VI		III B. Sc	STATISTICS	CODE:20STA7A	2022-2023
No. Teaching Hours per week			No. of Credits:5		Paper – 7A
Theory : 3	3		Theory: 3	2	

STATISTICS SYLLABUS
(With Mathematics Combination)
Paper: **OPERATIONS RESEARCH - II**
(Skill Enhancement Course(Elective),Credits-5
Max.Marks: Theory :100 + Practicals: 50

UNIT -I

Transportation Problem **-** Introduction, Mathematical formulation of Transportation problem. Initial Basic feasible solutions 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. Transshipment Problem.

UNIT-II

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

UNIT-III

Sequencing problem: Introduction, assumptions of sequencing problem, Johnson's algorithm for n jobs and two machines problem- problems with n-jobs 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.

UNIT-IV

Network Scheduling:Introduction, 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.

UNIT –V

Game Theory: Intoduction, basic definitions Two- person zero-sum games. Pure and Mixed strategies. Maxmin and Minimax Principles , Saddle point and its existence. Games without Saddle point-Mixed strategies. Solution of 2 x 2 games. Graphical method of solving 2 x n and m x 2 games. Dominance Property.

Reference Books:

1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut.
2. Kanti Swarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.
3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass: Linear Programming. Mc Graw Hill.
5. Hadly : Linrar programming. Addison-Wesley.
6. Taha : Operations Research: An Introduction : Mac Millan.
7. Dr.NVS Raju; Operations Research, SMS education,

Pract icals

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 MODImethod
3. Solution of Assignment problem using Hungarian method (both maximization andminimization 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 x 2 and 2 x n games.
9. Solution of m x n games by dominance rule.

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