KAKATIYA UNIVERSITY

WARANGAL

REVISED SYLLABUS FOR B.A. / B.Sc. (STATISTICS), WITH EFFECT FROM THE ACADEMIC YEAR: 2008 – 2009

(With Mathematics Combination)

THEORY

Year	PAPER	SUBJECT	Instruction Hrs/Week	Duration of Exam	Maximum Marks
I	**PAPER -I**	Descriptive Statistics and Probability Distributions	4	3	100
II	**PAPER -1I**	Statistical Methods and Inference	4	3	100
III	**PAPER -III**	Applied Statistics	3	3	100
	PAPER -1V	(Elective) 1. Quality, Reliability and Operations Research	3	3	100
TOTAL (Theory)			14		400

PRACTICALS

Year	PAPER	SUBJECT	Instruction Hrs/Week	Duration of Exam	Maximum Marks
I	**PRACTICAL -I**	Descriptive Statistics and Probability Distributions	3	3	50
II	**PRACTICAL -II**	Statistical Methods and Inference	3	3	50
III	**PRACTICAL -III**	Applied Statistics	3	3	50
	PRACTICAL -IV	(Elective) 1. Quality, Reliability and Operations Research	3	3	50
TOTAL (Practical)			12	…...	200
GRAND TOTAL (Theory + Practical)			**14+12 = 26**		**600**

B.Sc. (STATISTICS)

FIRST YEAR

Paper -I: DESCRIPTIVE STATISTICS AND PROBABILITY DISTRIBUTIONS

UNIT -I

Descriptive Statistics: Concept of primary and secondary data. Methods of collection and editing of primary data. Designing a questionnaire and a schedule. Sources and editing of secondary data. Classification and tabulation of data. Measures of central tendency (mean, median, mode, geometric mean and harmonic mean) with simple applications. Absolute and relative measures of dispersion (range, quartile deviation, mean deviation and standard deviation) with simple applications. Importance of moments, central and non-central moments, and their interrelationships, Sheppard's corrections for moments for grouped data. Measures of skewness based on quartiles and moments and kurtosis based on moments with real life examples**.** **(15L)**

Probability: Basic concepts in probability—deterministic and random experiments, trail, outcome, sample space, event, and operations of events, mutually exclusive and exhaustive events, and equally likely and favorable outcomes with examples. Mathematical, statistical and axiomatic definitions of probability with merits and demerits. Properties of probability based on axiomatic definition. Conditional probability and independence of events. Addition and multiplication theorems for n events. Boole's inequality and Bayes' theorem. Problems on probability using counting methods and theorems.

(15L)

UNIT-II

Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function with illustrations. Distribution function and its properties. Transformation of one-dimensional random variable (simple 1-1 functions only). Notion of bivariate random variable, bivariate distribution and statement of its properties. Joint, marginal and conditional distributions. Independence of random variables.

(15L)

Mathematical Expectation: Mathematical expectation of a function of a random variable. Raw and central moments and covariance using mathematical expectation with examples. Addition and multiplication theorems of expectation. Definition of moment generating function (m.g.f), cumulant generating function (c.g.f), probability generating function (p.g.f) and characteristic function (c.f) and statements of their properties with applications. Chebyshev's, and Cauchy-Schwartz's inequalities and their applications. Statement and applications of weak law of large numbers and central limit theorem for identically and independently distributed (i.i.d) random variables with finite variance.

(15L)

UNIT-III

Discrete distributions: Uniform, Bernoulli, Binomial, Poisson, Negative binomial, Geometric and Hyper-geometric(mean and variance only) distributions. Properties of these distributions such as m.g.f, c.g.f, p.g.f., c.f., and moments up to fourth order and their real life applications. Reproductive property wherever exists. Binomial approximation to Hyper-geometric, Poisson approximation to Binomial and Negative binomial distributions.

(30L)

UNIT-IV

Continuous distributions: Rectangular and Normal distributions. Normal distribution as a limiting case of Binomial and Poisson distributions. Exponential, Gamma, Beta of two kinds (mean and variance only) and Cauchy (definition and c.f. only) distributions. Properties of these distributions such as m.g.f, c.g.f., c.f, and moments up to fourth order, their real life applications and reproductive productive property wherever exists.

(30L)

List of Reference Books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume -I, Wiley.
2. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand&Sons, New Delhi.
3. GoonAM,Gupta MK,Das Gupta B : Fundamentals of Statistics, Vol-I, the World Press Pvt.Ltd., Kolakota.
4. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.
5. M.JaganMohan Rao and Papa Rao: A Text book of Statistics Paper-I.
6. Sanjay Arora and Bansi Lal.New Mathematical Statistics : Satya Prakashan, New Delhi
7. Hogg.Tanis.Rao: Probability and Statistical Inference. 7th edition. Pearson
8. Sambhavyata Avadhi Siddantalu—Telugu Academy
9. Sahasambandham-Vibhajana Siddantamulu - Telugu Academy
10. K.V.S. Sarma: Statistics Made Simple: do it yourself on PC. PHI
11. Gerald Keller: Applied Statistics with Microsoft excel . Duxbury,Thomson Learning.
12. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel 4th edition. Pearson Publication.

PRACTICAL PAPER – I

1. Basics of Excel- data entry, editing and saving, establishing and copying a formulae, built in functions in excel, copy and paste and exporting to MS word document.
2. Graphical presentation of data (Histogram, frequency polygon, Ogives).
3. **Graphical presentation of data (Histogram, frequency polygon, Ogives) using MS Excel**
4. Diagrammatic presentation of data (Bar and Pie).
5. **Diagrammatic presentation of data (Bar and Pie) using MS Excel**
6. Computation of non-central and central moments - Sheppard's corrections for grouped data.
7. Computation of coefficients of Skewness and Kurtosis – Karl Pearson's and Bowley's β_1 and β_2.
8. **Computation of measures of central tendency, dispersion and coefficients of Skew -ness, Kurtosis using MS Excel**.
9. Fitting of Binomial distribution - Direct method.
10. **Fitting of Binomial distribution - Direct method using MS Excel.**
11. Fitting of binomial distribution - Recurrence relation Method.
12. Fitting of Poisson distribution - Direct method.
13. **Fitting of Poisson Distribution - Direct method using MS Excel.**
14. Fitting of Poisson distribution - Recurrence relation Method.
15. Fitting of Negative Binomial distribution.
16. Fitting of Geometric distribution.
17. Fitting of Normal distribution - Areas method.
18. Fitting of Normal distribution - Ordinates method.
19. Fitting of Exponential distribution.
20. **Fitting of Exponential distribution using MS Excel.**
21. Fitting of a Cauchy distribution.
22. **Fitting of a Cauchy distribution using MS Excel.**

Note: Training shall be on establishing formulae in Excel cells and derive the results.

The excel output shall be exported to MS word for writing inference.

B.Sc. (STATISTICS)

SECOND YEAR

PAPER - II: STATISTICAL METHODS AND INFERENCE

UNIT – I

Population correlation coefficient and its properties. Bivariate date, scattered diagram, sample correlation coefficient, computation of correlation coefficient for grouped data. Correlation ratio, Spearman's rank correlation coefficient and its properties. Principle of lease squares, simple linear regression correlation verses regression, properties of regression coefficients. Fitting of quadratic and power curves. Concepts of partial and multiple correlation coefficients (Only for three variables). Analysis of categorical data, independence and association and partial association of attributes, various measures of association (Yule's) for two way data and coefficient of contingency (Pearson and Tcherprow), coefficient of colligation. **(30 L)**

UNIT – II

Concepts of population, parameter, random sample, statistic, sampling distribution and standard error. Standard error of sample means(s) and sample proportion(s). Exact sampling distributions-Statement and properties of χ^2, t and F distributions and their interrelationships. Independence of sample means and variance in random sampling from normal distributions.

Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of good estimator - consistency, unbiasedness, efficiency and sufficiency with examples. Statement of Neyman's Factorization theorem, derivations of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Estimation by method of moments, Maximum likelihood (ML), statements of asymptotic properties of MLE. Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method.

(30 L)

UNIT – III

Concepts of statistical hypotheses, null and alternative hypothesis, critical regional two types of errors, level of significance and power of a test. One and two tailed tests, test function (non-randomized and randomized). Neyman-Pearson's fundamental lemma for Randomized tests. Examples in case of Binomial, Poisson, Exponential and Normal distributions and their powers. Use of central limit theorem in tests. Large sample tests and confidence intervals for means(s), proportion(s), standard deviation(s) and correlation coefficient(s).

(30 L)

UNIT – IV

Tests of significance based on χ^2, t and F. χ^2-tests goodness of fit and test for independence of attributes. Definition of order statistics and statement of their distributions.

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.

(30 L)

List of Reference Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Cahnd & Sons, New Delhi
2. Goon.A.M, Gupta.M.K, Das Gupta B: Outlines of Statistics, Vol-II, the World Press Pvt.Ltd.,Kolakota
3. Hoel P.G.: Introduction to matechematical statistics, Asia Publishing house.
4. Sanjay Arora and Bansi Lai: New mathematical Statistisc Satya Prakashan, New Delhi
5. Hogg and Craig: Introduction to Mathematical statistics. Prints Hall
6. Siegal,S.,and Sidney:Non-param etric statistics for Behavioral Science. McGraw Hill.
7. Gibbons J.D. and Subhabrata Chakraborti: Nonparametric Statistical Inference. Marcel Dekker
8. Parimal Mukhopadhyay: Mathematical Statistics. New Central Book agency
9. Conove Practical Nonparametric Statistics. Wiley series
10. V.K.Rohatgi and A.K.Md.Ehsanes Saleh: An introduction to probability and statistics Wiley series,
11. Mood AM,Graybill FA, Boe's DC.Introduction to theory of statistics. TMH
12. Paramiteya mariyu aparameteya parikshalu. Telugu Academy
13. K.V.S.Sarma: Statistics Made simple do it yourself on PC. PHI
14. Gerald Keller: Applied Statistics with Microsoft excel. Duxbury. Thomson Learning
15. Levin, Stephan, Krehbiel, Berension: Statistics for Managers using Microsoft Excel.4th edition. Pearson Publication
16. Hogg, Tanis, Rao.Probability and Statistical Inference. 7$^{!h}$ edition. Pearson Publication.

PRACTICAL PAPER – II

1. Generation of random samples from Uniform (0,1), Uniform (a, b) and exponential distributions,
2. Generation of random samples from Normal and Poisson distributions
3. **Simulation of random samples from Uniform (0, 1), Uniform (a, b), Exponential, Normal and Poisson distributions using MS Excel.**
4. Fitting of straight line and parabola by the method of least squares
5. **Fitting of straight line and parabola by the method of least squares using MS Excel.**
6. Fitting of power curves of the type $y=a\,x^b$, $y=a\,b^x$ and $y=a\,e^{bx}$ by the method of least squares.
7. **Fitting of power curves of the type $y=a\,x^b$, $y=a\,b^x$ and $y=a\,e^{bx}$ by the method of least squares using MS Excel**
8. Computation of Yule's coefficient of association
9. Computation of Pearson's, Tcherprows coefficient of contingency
10. Computation of correlation coefficient and regression lines for ungrouped data %
11. Computation of correlation coefficient, forming regression lines for ungrouped data
12. Computation of correlation coefficient, forming regression lines for grouped data
13. **Computation of correlation coefficient, forming regression lines using MS Excel**
14. Computation of multiple and partial correlation coefficients
15. **Computation of multiple and partial correlation coefficients using MS Excel**
16. Computation of correlation ratio
17. Large sample tests for mean(s), proportion(s), Standard deviation(s) and correlation coefficient.
18. Small sample tests for single mean and difference of means and correlation coefficient
19. Paired t-test
20. **Small sample tests for means(s), paired t-test and correlation coefficient using MS Excel**
21. Small sample test for single and difference of variances
22. **Small sample test for single and difference of variances using MS Excel**
23. χ^2- test for goodness of fit and independence of attributes
24. **χ^2- test for goodness of fit and independence of attributes using MS Excel.**
25. Nonparametric tests for single and related samples (sign test and Wilcoxon signed rank test) and one sample rims test.
26. Nonparametric tests for two independent samples (Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz' s runs test)

Note: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MS Word for writing inferences.

B.Sc. (STATISTICS)

THIRD YEAR

PAPER – III: APPLIED STATISTICS

UNIT – I

Design of Sample Surveys: Concepts of population, sample, sampling unit, parameter, statistic, sampling errors, sampling distribution, sample frame and standard error.

Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non-sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

Types of sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

(i) SRSWR and SRSWOR

(ii) Stratified random sampling with proportional and Neyman - allocation, and

(iii) Systematic sampling when N= nk.

Comparison of relative efficiencies. Advantages and disadvantages of above methods of sampling.

(23L)

UNIT – II

Analysis of Variance and Design of Experiments: ANOVA - one-way, two-way classifications with one observation per cell -concept of Gauss-Markoff linear model, statement of Cochran's theorem, concept of fixed effect model and random effect model. Expectation of various sums of squares, Mathematical analysis, importance and applications of design of experiments. Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

(23L)

UNIT – III

Time series:- Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting- Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods. **(12L)**

Index Numbers: -Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers. **(6L)**

Official Statistics: - Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics, National Income and its computation, utility and difficulties in estimation of national income.

(4L)

UNIT – IV

Vital statistics: Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and 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. Measurement of population growth, crude rate if natural increase- Pearl's vital index. Gross reproductive rates and Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

(12L)

Demand Analysis: Introduction. Demand and supply, price elastics of supply and demand. Methods of determining demand and supply curves, Leontief's ,Pigous's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration. **(10L)**

List of Reference Books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency,
3. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs., Wiley Eastern.
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. B.L.Agarwal: Basic Statistics.New Age publications.
6. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
7. Pratirupa Sidhanthamulu - Telugu Academy.
8. Prayoga Rachana and Visleshana - Telugu Academy.
9. K.V.S. Sarma: Statistics made simple : do it yourself on PC. PHI
10. Gerald Keller; Applied Statistics with Microsoft excel. Duxbury. Thomson Learning.
11. Levine, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel. Pearson Publication.
12. Anuvartita Sankhyaka sastram - Telugu Academy.
13. Arora, Sumeet Arora, S. Arora: Comprehensive statistical Methods. S.Chand.

PRACTICAL PAPER – III

Sampling Techniques:

Estimation of population mean, population total and variance of these estimates 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 number of observations
5. **ANOVA - one-way classification with equal number of observations using MS Excel.**
6. ANOVA Two-way classification with equal number of observations.
7. **ANOVA Two-way classification with equal number of observations using MS Excel**
8. Analysis of CRD. Analysis of RBD with and without missing observation
9. **Analysis of CRD. Analysis of RBD with and without missing observation using MS Excel**
10. Analysis of LSD with and without missing observation
11. **Analysis of LSD with and without missing observation using MS Excel.**
12. Comparison of relative efficiency of CRD with RBD and comparison of relative efficiencies of LSD with RBD and CRD.

Time Series Analysis:

13. Measurement of trend by methods of Least squares and moving averages
14. **Measurement of trend by method s of Least squares and moving averages using MS Excel.**
15. Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives.
16. **Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives using MS Excel.**

Index Numbers:

17. Computation of simple and all weighted index numbers.
18. Computation of reversal tests.
19. Construction of cost of living index number and whole sale index number.
20. Construction of fixed base and chain base index numbers.
21. **Base shifting, Splicing** and **Deflation.**
    (a). Computation of all weighted indices, cost of living index number, Base shifting, splicing and deflation using MS Excel.

Vital Statistics:

22. Computation of various Mortality rates, Fertility rates and Reproduction rates.
23. Construction of Life Tables and Abridged life tables.
24. **Construction of various rates, life tables and abridged life tables using MS Excel**

Demand Analysis:

25. Construction of Lorenz curve.
26. Fitting of Pareto law to an income data.
27. **Construction of Lorenz curve using MS Excel.**

Note : Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.

B.Sc. (STATISTICS)

THIRD YEAR

Paper-IV: QUALITY, RELIABILITY AND OPERATIONS RESEARCH

UNIT -I

Statistical Process Control: Importance of SQC in industry. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np, and c- charts with fixed and varying sample sizes). Interpretation of control charts. Natural tolerance limits and specification limits, process capability index. Concept of Six sigma and its importance. **(20L)**

UNIT -II

Acceptance sampling plans: Producers risk and consumer's risk. Concept of AQL and LTPD. Single and Double sampling plans for attributes and derivation of their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial.

Reliability: Introduction. Hazard function, Exponential distribution as life model, its memory- less property. Reliability function and its estimation. Concepts of censoring and truncation. System reliability - series, parallel and k out of N systems and their reliabilities. **(20L)**

UNIT -III

Linear Programming: Meaning and scope of OR. Convex sets and their properties. Definition of general LPP. Formulation of LPP. Solution of LPP by graphical method. Fundamental theorem of LPP. Simplex algorithm. Concept of artificial variables. Big-M /Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it, Concept of duality, duality as LPP. Dual Primal relationship. Statement of Fundamental theorem of duality. Dual simplex method. **(25L)**

UNIT -1V

Transportation, Assignment and Sequencing Problems: Definition of transportation problem, TPP as a special case of LPP, feasible solutions by North-West and Matrix minimum methods and VAM. Optimal solution through MODI tableau and stepping stone method for balanced and unbalanced transportation problem. Degeneracy in TP and resolving it. Transshipment problem.

Formulation and description of Assignment problem and its variations. Assignment problem as special case of TP and LPP. Unbalanced assignment problem, traveling salesman problem. Optimal solution using Hungarian method.

Problem of Sequencing. Optimal sequence of N jobs on two and three machines without passing. **(25L)**

List of Reference Books

1. Kanti Swaroop,P.K.Gupta and ManMohan: Operations Research. Sultan Chand.
2. D.C.Montgomary: Introduction to Statistical Quality Control. Wiley.
3. V.K.Kapoor and S.C.Gupta L Fundamentals of Applied Statistics. Sultan Chand
4. S.K.Sinha: Reliability and life testing. Wiley Eastern
5. L.S.Srinath: Reliability Engineering. Affiliated East-West Press.
6. Gass: Linear Programming. Me Graw Hill.
7. Hadly : Linrar programming. Addison-Wesley.
8. Wayne L. Winston : Operations Research. Thomson, India edition. 4th edition.
9. S.M.Ross: Probability Models. Harcourt India PVT. Ltd.,
10. Parimal Mukhopadhyay : Applied Statistics. New Central Book agency
11. Anuvartita Sankhyaka sastram - Telugu Academy.
12. R.C.Gupta: Statistical Quality Control.
13. Talia : Operations Research: An Introduction : Mac Millan.
14. Parikriya Parishodhana - Telugu Academy.

PRACTICAL PAPER –IV

Statistical Quality Control:

1. Construction of mean, range and standard deviation charts.
2. **Construction of mean, range and standard deviation charts using MS Excel**
3. Construction of p, np and c- charts with fixed and varying sample sizes.
4. **Construction of p, np and c- charts with fixed and varying sample sizes using MS Excel.**
5. Designing of Single sampling plan and Double sampling plan for attributes and construction of their OC and ASN curves
6. **Designing of Single sampling plan and Double sampling plan for attributes and construction of their OC and ASN curves using MS Excel.**

Reliability:

7. Computation of reliability for series, parallel and k out of n systems.
8. **Computation of reliability for series, parallel and k out of n systems using MS Excel.**

Operations Research:

9. Formulation and graphical solutions of LPP (using different inequality type constraints)
10. Solution of LPP by simplex method.
11. **Solution of LPP by simplex method using TORA**
12. Solution of an LPP using Big-M and two phase simplex methods
13. **Solution of an LPP using Big-M method and two phase simplex method using TORA**
14. Solution of an LPP using principal of duality and dual simplex methods.
15. **Solution of an LPP using principal of duality and dual simplex methods using TORA.**
16. Formulation and solution of transportation problem using North- West corner rule, Matrix minimum methods and VAM and to test their optimality.
17. **Formulation and solution of transportation problem using North- West corner rule, Matrix minimum methods and VAM and to test their optimality using TORA**
18. Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases)
19. Formulation and solution of Assignment problem using Hungarian method (both maximization and minimization cases),
20. **Formulation and solution of Assignment problem using Hungarian method (both maximization and minimization cases using TORA**
21. Solution of unbalanced Assignment problem.
22. Solution of traveling salesman problem.
23. Solution of sequencing problem—processing of n jobs through two machines and processing of n jobs through three machines.