# KAKATIYA UNIVERSITY

## WARANGAL


(With Mathematics Combination)

## THEORY

<table>
<thead>
<tr>
<th>Year</th>
<th>PAPER</th>
<th>SUBJECT</th>
<th>Instruction Hrs/Week</th>
<th>Duration of Exam</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PAPER -I</td>
<td>Descriptive Statistics and Probability Distributions</td>
<td>4</td>
<td>3</td>
<td>100</td>
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<tr>
<td>II</td>
<td>PAPER -II</td>
<td>Statistical Methods and Inference</td>
<td>4</td>
<td>3</td>
<td>100</td>
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<tr>
<td>III</td>
<td>PAPER -III</td>
<td>Applied Statistics</td>
<td>3</td>
<td>3</td>
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<tr>
<td></td>
<td>PAPER -IV</td>
<td>(Elective) 1. Quality, Reliability and Operations Research</td>
<td>3</td>
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<td>100</td>
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<td></td>
<td></td>
<td>TOTAL (Theory)</td>
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## PRACTICALS

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

8. Sambhavyata Avadhi Siddantalu—Telugu Academy
9. Sahasambandham-Vibhajana Siddantamulu - Telugu Academy
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**


7. Computation of coefficients of Skewness and Kurtosis – Karl Pearson's and Bowley's $\beta_1$ and $\beta_2$.

8. **Computation of measures of central tendency, dispersion and coefficients of Skew -ness, Kurtosis using MS Excel.**


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.**


15. Fitting of Negative Binomial 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.**


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


(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 $\chi^2$, t and F distributions and their interrelationships. Independence of sample means and variance in random sampling from normal distributions.


(30 L)

UNIT – III

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, 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 $\chi^2$, t and F. $\chi^2$-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:

7. Gibbons J.D. and Subhabrata Chakraborti: Nonparametric Statistical Inference, Marcel Dekker
11. Mood AM,Graybill FA, Boe's DC.Introduction to theory of statistics. TMH
12. Paramiteya mariyu aparameteya parikshalu. Telugu Academy
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. \( \chi^2 \) test for goodness of fit and independence of attributes
24. **\( \chi^2 \) 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.
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


(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)


(4L)
UNIT – IV


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:

7. Pratirupa Sidhanthamulu - Telugu Academy.
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
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.
   (a). Computation of all weighted indices, cost of living index number, Base shifting, splicing and deflation using MS Excel.
Vital Statistics:

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.


UNIT -III


UNIT -IV

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.


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

11. Anuvartita Sankhyakastra - 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**
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)**
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.