DEPARTMENT OF STATISTICS
SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10
(An Autonomous College in the jurisdiction of Krishna University)

STATISTICS	STA T11B	2021 – 22 Onwards	B.Sc. (MSCS, MSDS & MSCA)

SEMESTER- I **PAPER - I** **No. of Credits: 4**

DESCRIPTIVE STATISTICS AND THEORY OF PROBABILITY
No. of Hours/week: 04

Unit – I **12H**

Moments: Central and non-central moments and their inter-relationships, Sheppard's corrections for moments for grouped data. **Skewness:** Definition, measures of skewness by Karl Pearson's, Bowley's formulae and based on moments. **Kurtosis:** Definition, measures of kurtosis based on moments, Simple problems.

Unit –II **12H**

Probability-I: Definitions of various terms - Random experiments, trial, sample space, mutually exclusive, exhaustive, equally likely, favourable and independent events. Definitions- Mathematical, Statistical and Axiomatic definitions of probabilities. Law of addition of probabilities for two events and extension of general law of addition of probabilities. Boole's inequality for n events and real life problems.

Unit –III **12H**

Probability-II: Conditional Probability-Definition - dependent and independence events,
Multiplication law of probability for two events, extension of multiplication law of probability. Pairwise independent events and conditions for mutual independence of n events and Baye's theorem and its applications and problems.

Unit – IV **12H**

Random Variables: Univariate Random variables- Definition, Discrete and Continuous random variables - Probability mass function and probability density function with illustrations. Distribution function and its properties. Bivariate random variables- Definition, Discrete and Continuous bi-variate random variables- joint, marginal and conditional distributions- its properties. Distribution functions of the bivariate random variables and its properties. Independence of random variables, and simple problems.

Unit V: **12H**

Mathematical Expectations: Definition, Mathematical expectation of function of a random variable, Properties of Expectations - Addition and Multiplication theorems of expectation. Properties of Variance and Covariance. Cauchy-Schwartz Inequality. Generating Functions 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 inequality and its applications. Statement of Weak Law of Large Numbers for identically and independently distributed (i.i.d) random variables with finite variance.

Text Book: Fundamentals of Mathematical Statistics, 12th Edition, 10th September 2020,
S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi.

Recommended References books:

1. B.A/B.Sc. First Year Statistics (2010), Telugu Academy, Hyderabad.

2. Mathematical Statistics with Applications, 2009, K. M. Ramachandran and Chris P. Tsokos Academic Press (Elsevier), Haryana.
3. Probability and Statistics, Volume I, D. Biswas, New central book Agency (P) Ltd, New Delhi.
4. An outline of Statistical theory, Volume Two, 3rd Edition,2010 (with corrections) A. M. Goon, M. K. Gupta, B. Dasgupta ,The World Press Pvt. Ltd., Kolakota.
5. Sanjay Arora and BansiLal:. New Mathematical Statistics, Satya Prakashan, New Delhi.

Websites of Interest: **http://onlinestatbook.com/rvls/index.html**

Co-Curricular Activities in the class:

1. Pictionary
2. Case Studies on topics in field of statistics
3. Snap test and Open Book test
4. Architectural – To be build the procedures
5. Extempore – Random concept to students
6. Interactive Sessions
7. Teaching through real world examples

Model Paper Structure

Section A: Answer FIVE questions out of EIGHT questions (5 x 5M= 25 M)

Section B: Answer FIVE questions out of FIVE questions with internal choice.

(5 x 10M = 50M)

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA, VIJAYAWADA-520 010

An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

STATISTICS	STA P11B	2021 – 22 Onwards	B.Sc. (MSCS, MSDS & MSCA)

SEMESTER-I **Practical – I** **No of Credits: 1**

Descriptive Statistics Lab

(Practical at end of First Semester) 30hrs (2h / w)

List of Practicals

1. Diagrams & Graphs- Bar, Pie , Histogram, frequency polygon, and O-give curves
2. Computation of measures of central tendency- Arithmetic Mean, Geometric mean and Harmonic Mean – Grouped Data.
3. Computation of measures of central tendency- Median, Mode and Partition Values - Grouped Data.
4. Computation of measures of Dispersion – Quartile Deviation, Mean Deviation, Standard Deviation, Variance and Coefficient of Variation – Grouped Data.
5. Computation of non-central, central moments, β_1 and β_2 and Sheppard's corrections for grouped data.
6. Computation of central moments, β_1 and β_2 and Sheppard's corrections when non –central moments are given.
7. Computation of Karl Pearson's coefficients, Bowley's coefficients of Skewness and coefficients of skewness based on moments – Grouped Data

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.

Reference Books

1. Practical Manual -Prepared by the Department Faculty Members
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Websites of Interest: http://www.statsci.org/datasets.html

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An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

Statistics	**Course Code:**	**Course Type:** Core (Theory)	**Offered to whom:** B.Sc. (MSCS (A) & (B), MSCA,MSDS)
SEMESTER -II	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of. Credits: 4**	**Time**: 4 Hours/ week

Probability Distributions and Statistical Methods
Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	**Theoretical Probability Discrete Distributions** Rectangular, Binomial, Poisson, Negative Binomial, Geometric, Hyper Geometric distributions: Definitions, Means, Variances, M.G.F, C.G.F, P.G.F, additive property, limiting cases, memory less property if exists . Simple problems.	**12**
II	**Theoretical Probability Continuous Distributions** Rectangular, Normal, Exponential, Gamma, Beta Distributions: Definitions, Means, Variances, M.G.F, C.G.F, P.G.F, additive property, limiting cases, memory less property if exists . Simple problems.	**12**
III	**Theory of Attributes**: Notations, Dichotomy classification, class and class frequencies, order of classes and class frequencies. Ultimate class frequencies, relation between class frequencies. Consistency of data - Conditions for consistency of data for 2 and 3 attributes only. Independence of attributes- criterion of independence of two attributes. Association of attributes-Yule's coefficient of association and coefficient of colligation. Relationship between coefficient of association and colligation and simple problems.	**12**
IV	**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.	**12**
V	**Multiple and Partial Correlation**- Coefficients of multiple and partial correlations, properties of multiple and multiple correlation coefficients, coefficient of multiple determination. simple problems **Curve fitting** Principle of least squares, fitting of straight line, fitting of second degree polynomial or parabola. Fitting of power curve and exponential curves. **Regression Analysis**: Introduction, Linear Regression- Regression coefficients, properties of regression coefficients, angle between two lines of regression. Standard error of estimate (residual variance), Explained and unexplained variation, coefficient of determination and simple problems	**12**

Text Book:

Fundamentals of Mathematical Statistics, 12th Edition, Sep 2020, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi

Reference Books:

1. B.A/B.Sc. Second Year Statistics (2010) , Telugu Akademi, Hyderabad.
2. Mathematical Statistics with Applications, 2009, K.M. Ramachandran and Chris P. Tsokos Academic Press(Elsevier), Haryana .
3. Probability and Statistics, Volume I & II, D. Biswas, New central book Agency (P) Ltd, New Delhi.
4. An outline of Statistical theory, Volume II,3rd Edition,2010(with corrections) A.M. Goon, M.K. Gupta, B. Dasgupta ,The World Press Pvt. Ltd., Kolakota.
5. Sanjay Arora and Bansi Lal: New Mathematical Statistics, Satya Prakashan, New Delhi.

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An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

Statistics	**Course Code:**	**Course Type:** Core (Practical)	**Offered to whom:** B.Sc. (MSCS (A) & (B), MSCA,MSDS)
SEMESTER -II	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 30 hrs. Per Sem	**No. of. Credits: 1**	**Time**: 2 Hours/ week

Probability Distributions and Statistical Methods Lab

(Practical at end of First Semester) 30hrs (2h / w)

1. (a) Fitting of Binomial distribution (Direct Method)
   (b) Fitting of Binomial distribution (Recurrence Method)
2. (a) Fitting of Poisson distribution (Direct Method)
   (b) Fitting of Poisson distribution (Recurrence Method)
3. (a) Fitting of Normal distribution (Areas Method)
   (b) Fitting of Normal distribution (Ordinates Method)
4. Computation of Yule's coefficient of association
5. Computation of Pearson's and Tcherprows coefficient of contingency
6. (a) Computation of correlation coefficient for ungrouped data
   (b) Computation of correlation coefficient for grouped data
7. (a) Fitting of a straight line by the method of least squares
   (b) Fitting of a parabola by the method of least squares
   (c) Fitting of power curve $y = ax^b$ by the method of least squares
   (d) Fitting of exponential curves $y = ae^{bx}$ and $y = ab^x$ by the method of least squares
8. (a) Construction of regression lines for the ungrouped data.
   (b) Construction of regression lines for the grouped data

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STATISTICS	STA T37	2021-2022 Onwards	B.Sc. (MSCS, MSDS & MSCA)

SEMESTER –III **PAPER-III** **No. of credits: 4**

STATISTICAL INFERENCE

No. of Hours/week: 04

UNIT-I: **(12H)**

Sampling Distributions: 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, χ^2-Distribution: Definitions, properties and their applications.

UNIT-II: **(12H)**

Theory of Estimation: Estimation of a parameter, criteria of a good estimator – Unbiasedness, Consistency, Efficiency, & Sufficiency and. Statement of Neyman's factorization theorem. Properties of MLE's. Estimation of parameters by the Method of Moments and Maximum likelihood (M.L), Binomial, Poisson & Normal Population parameters estimate by MLE method. Confidence Intervals.

UNIT-III: **(12H)**

Testing of Hypothesis: Statistical hypotheses-Null and Alternative hypothesis, and 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: **(12H)**

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 co-efficient(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: **(12H)**

Non-parametric tests- their advantages and disadvantages, comparison with parametric tests. Measurement scale-nominal, ordinal, interval and ratio. One sample Run 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. B.A./B.Sc. II year statistics - statistical methods and inference - Telugu Academy by A. Mohanrao, N. Srinivasa Rao, Dr. R. 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: V.K. Kapoor and S. C. Guptha.
2. Outlines of statistics, Vol II: 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.

Co-curricular activities and Assessment Methods:

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

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STATISTICS	STA P	2021 – 2022 onwards	B.Sc. (MSCS & MSCA)

SEMESTER - III **No. of credits: 1** **PRACTICAL - III**

STATISTICAL INFERENCE LAB

(Practical at end of Third Semester) 30hrs (2h / w)

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(χ^2 - test)
12. Small sample test for difference of variances (F-test)
13. χ^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 related samples (sign test and Wilcoxon signed rank test)
16. Nonparametric tests for two independent samples (Median test, Wilcoxon –Mann- Whitney - U test, Wald - Wolfowitz' s run 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.

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STATISTICS	STAT33 A	2021-2022 Onwards	B.Sc. Honors

SEMESTER –III **PAPER-I** **No. of credits: 4**

STATISTICAL METHODS & THEORY OF PROBABILITY

No. of Hours/week: 04

Unit-I: **(12H)**

Introduction: Statistics, Frequency distribution and Graphical Representation of data.

Measures of Central Tendency: Mathematical averages (Arithmetic Mean, Geometric Mean and Harmonic Mean) and Positional averages (Median and Mode)-Definition, Merits, Demerits and Applications

Unit-II: **(12H)**

Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of Variation-Definition, Properties and simple problems. Moments-Definitions, and formulae. Sheppard's corrections, Skewness-Definition, Measures. Kurtosis and Applications.

Unit-III: **(12H)**

Correlation: Meaning, Types of Correlation, and Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation and its properties (statements only), Spearman's Rank Correlation Coefficient (with and

without ties)-Definition and Applications. Bi-variate frequency distribution, correlation coefficient for bi-variate data-Definition and simple problems. Definitions of Multiple and Partial correlation coefficients (three variables only).

Unit-IV: **(12H)**

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

Unit-V: Probability **(12H)**

Introduction, Basic Terminology. Definitions of Probability – Classical, Statistical, and Axiomatic. Conditional Probability, Independent events, Theorems on Probability-Addition and Multiplication, and results on probability (statements only). Bayes' theorem (statement only) and its applications and Applications.

Text Books:

1. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - Descriptive statistics, probability distribution – Telugu Akademi- Dr M. Jaganmohan Rao, Dr. N .Srinivasa Rao, Dr P. Tirupathi Rao, Smt. D. Vijaya Lakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. William 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., Kolkata.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.
4. M. Jaganmohan Rao and Papa Rao: A Text book of Statistics Paper-I.
5. Sanjay Arora and Bansi Lal: New Mathematical Statistics: Satya Prakashan, New Delhi

Co-curricular activities and Assessment Methods:

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

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STATISTICS	STAP33A	2021-2022 Onwards	B.Sc. (Honors)

SEMESTER -III **No. of credits: 1** **PRACTICAL - I**

STATISTICAL METHODS LAB

(Practical at end of Third Semester) 30hrs (2 h / w)

1. Graphical Representation-Histogram, Bar Chart, Pie-Diagram, O-give curves, Frequency Polygon using MS-Excel
2. Computation of Measures of central tendency-Mean, Median and Mode for ungrouped and grouped data.
3. Computation of Measures of central tendency-Mean, Median and Mode for ungrouped and grouped data using MS-Excel.
4. Computation of Measures of Dispersion-Quartile Deviation, Mean Deviation and Standard Deviation for both ungrouped and grouped data.
5. Computation of Correlation coefficient and Regression coefficient and fitting of regression lines and fitting of regression lines for ungrouped data.
6. Computation of Correlation coefficient and Regression coefficient and fitting of regression lines for ungrouped data using MS-Excel.
7. Computation of Correlation coefficient and Regression coefficient for grouped data.

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STATISTICS	STA T02	2021-2022 Onwards	B.Sc. Honors

SEMESTER –III **PAPER-II** **No. of credits: 4**

RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS

No. of Hours/week: 04

Unit-I: Random Variables (12H)

Random variables: Discrete and Continuous random variables, P.M.F, P.D.F, and C.D.F., illustrations and properties of random variables. Two dimensional random variables: discrete and continuous type, joint, marginal, and conditional P.M.F, P.D.F, independence of variables and problems.

Unit-II: Mathematical Expectation and Generating Functions: (12H)

Expectation: Expectation of Univariate and bivariate random variables and its properties, Addition and Multiplication Theorems of Expectation-Applications. Cauchy-Schwartz and Chebyshev's inequalities (statements only)

Generating Functions: Moment Generating Function, Characteristic Function and their properties.

Unit-III: Univariate Discrete Distributions (12H)

Uniform, Bernoulli, Binomial, Poisson, Negative Binomial, Geometric distributions: Definitions, Mean, Variance and properties and Applications. Memory less property of Geometric distribution.

Unit-IV: Univariate Continuous Distribution-I **(12H)**

Rectangular distribution- Definition, Properties. Central Limit theorem (Statement only)

Normal distribution-Definition, Chief characteristics, Properties and its importance, Limiting Cases (Statements only), and Applications.

Exponential distribution–Definition, Properties and Applications.

Unit-V: Univariate Continuous Distributions-II **(12H)**

Gamma Distribution-Definition, properties, and Applications.

Weibul Distribution-Definition, properties, and Applications.

Beta distribution of First kind – Definition, Properties and Applications.

Beta distribution of Second kind – Definition, Properties and Applications.

Text Book:

1. Fundamentals of Mathematical Statistics, 11th Edition, 2007, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi.
2. B.A/B.Sc. First & Second Year Statistics (2010), Telugu Akademi, Hyderabad.

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5. Mathematical Statistics, 3rd Edition, 2009, Parimal Mukhopadhyay, Books & Allied (p) Ltd, Kolkata.

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STATISTICS	STA P02	2021-2022 Onwards	B.Sc. (Honors)

SEMESTER -III **No. of credits: 1** **PRACTICAL - II**

PROBABILITY DISTRIBUTIONS LAB

(Practical at end of Third Semester) 30hrs (2 h / w)

1. Fitting of Binomial distribution – Direct method & Recurrence relation Method.
2. Fitting of Binomial distribution using MS-Excel.
3. Fitting of Poisson distribution – Direct method & Recurrence relation Method.
4. Fitting of Poisson distribution using MS-Excel.
5. Fitting of Negative Binomial distribution.
6. Fitting of Geometric distribution.
7. Fitting of Normal distribution – Area method.
8. Fitting of Normal distribution – Ordinates method.
9. Fitting of Exponential distribution.
10. Fitting of Exponential distribution using MS-Excel.

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STATISTICS	STA T01	2021-2022 Onwards	B.Sc. (MSDS)

SEMESTER-III **PAPER - IV** **No of Credits: 4**

APPLIED STATISTICS

No. of Hours/week: 04

Unit I: Index Numbers **12H**

Basic problems involved in the construction of index numbers. Construction of index numbers - Simple aggregate, Weighted aggregate, Simple price relative and Weighted price relative methods. The criteria of good index number. Cost of living index number. Uses and Limitations of index numbers.

Unit II: Statistical Quality Control – I **12H**

Introduction. Basis of SQC Uses of SQC Types of controls - Process & Product. Construction of 3-σ limits. Construction of Mean $(\bar{x})$ and Range (R) charts Interpretation of $\bar{x}$ and R charts

Unit III: Statistical Quality Control – II **12H**

Construction of p and c charts - Fixed control limits. Interpretation of p and c-charts. Natural and Specification limits. Acceptance sampling inspection plans-AQL, LTPD. AOQL and ASN. OC curves.

Unit IV: Vital Statistics **12H**

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.

Unit V: Statistics in Psychology & Education **12H**

Introduction. Scaling procedures - Scaling of scores - Z or σ scores, Standard and Normalised scores, T and

Percentile scores. Reliability of test scores - Def. index and parallel tests. Methods of determining test reliability. Validity of test scores.

Text Book:

1. S.C. Gupta, (2016), Seventh Edition, Fundamentals of Statistics, Mumbai: Himalaya Publishing House.
2. Fundamentals of Applied Statistics, 2014, S.C. Gupta and V.K. Kapoor ; Sultan Chand &Sons , New Delhi.

Reference Books:

1. Levine, D.M., Berenson, M. L. & Stephan, D. (2012*), Statistics for managers using Microsoft Excel*, New Delhi: Prentice Hall India Pvt.
2. Aczel, A. D. & Sounderpandian, J. (2011), *Complete Business Statistics*, New Delhi: Tata McGraw Hill.
3. Sharma, J. K. (2013), *Business statistics*, New Delhi: Pearson Education
4. Anderson, D., Sweeney, D., Williams, T., Camm, J., & Cochran, J. (2013), *Statistics for Business and Economics*, New Delhi: Cengage Learning.
5. Agarwal, B.L. Basic Statistics, New Age International Publishers, New Delhi, 6th edition 2013

Websites of Interest: http://onlinestatbook.com/rvls/index.html

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STATISTICS	STA P	2021-2022 Onwards	B.Sc. MSDS

SEMESTER –III **PRACTICAL-IV** **No. of credits: 1**

(Practical at end of Third Semester) 30hrs (2h / w)

APPLIED STATISTICS

ractical No	Theme	Key Topics
Applied Statistics		
1	ol Charts	uction of Mean & Range charts
2	ol Charts	uction of p & c charts
3	Numbers	uction of Weighted index numbers
4	Numbers	g of good index number
5	Numbers	uction of Whole sale price index number
6	tatistics	nining of Mortality rates
7	tatistics	nining of Fertility & reproduction rates
8	tatistics	uction of life tables

9	ology & Education	g of ratings using Normal distribution

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An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

Statistics	**Course Code:**	**Course Type:** Core (Theory)	**Offered to whom:** B.Sc. (MSCS (A) & (B), MSCA,MSDS)
SEMESTER -IV	**Course No - I**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of. Credits: 4**	**Time**: 4 Hours/ week

Sampling Techniques and Design of Experiments

UNIT I:

Introductory Concepts of Sampling:

Concepts of Population and Sample, Basic principles of sample survey, The principles steps in a sample survey, Complete enumeration Vs Sampling, Sampling and non-sampling errors, Limitations of sampling, Types of sampling, Non Probability sampling methods, Probability sampling methods

Simple Random Sampling:

SRSWR definition and procedure of selecting a sample, SRSWOR definition and procedure of selecting a sample , expectation of sample mean and variance of sample mean in srswor and srswr, advantages and disadvantages

UNIT II:

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

Systematic sampling: procedure of construction, types, merits and demerits of systematic sampling. Comparison of systematic sampling with Stratified and SRSWOR.

UNIT III:

Analysis of variance : Analysis of variance(ANOVA) –Definition and assumptions. One-way classification, Two way classification.(one observation per cell)

Design of Experiments: Terminology, 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 2^2 and 2^3 factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

Text Books:

1. *Fundamentals of applied statistics : VK Kapoor and SC Gupta*
2. Telugu AcademyBA/BSc III year paper - III Statistics - applied statistics

Reference Books:

1. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
2. Indian Official statistics - MR Saluja
3. Anuvarthita Sankyaka Sastram - Telugu Academy.

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An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

Statistics	**Course Code:**	**Course Type:** Core (Practical)	**Offered to whom:** B.Sc. (MSCS (A) & (B), MSCA,MSDS)
SEMESTER -IV	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision: --**
Percentage of Revision: 100%	**No. of Hours:** 30 hrs. Per Sem	**No. of. Credits: 2**	**Time**: 2 Hours/ week

Sampling Techniques and Designs of Experiments Lab

(Practical at end of First Semester) 30hrs (2h / w)

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
5. ANOVA Two-way classification
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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STATISTICS	STA T51	2015 – `16	B.Sc. (MSCS, MSCA & MSDS)

SEMESTER-V **PAPER - V** **No of Credits: 4**

Designs of Sample Survey

No. of Hours/week: 04

Unit: I **(12H)**

1.1 Concepts of Population and Sample
1.2 Basic principles of sample survey
1.3 The principles steps in a sample survey
1.4 Complete enumeration Vs Sampling
1.5 Sampling and non-sampling errors
1.6 Limitations of sampling
1.7 Types of sampling
  1.7.1 Non Probability sampling methods
  1.7.2 Probability sampling methods

Unit: II **(12H)**

2.1 Non Random Sampling Methods
2.2 Purposive sampling
2.3 Quota sampling
2.4 Sequential sampling
2.5 Cluster sampling

Unit: III **(12H)**

3.1 Simple Random sampling
  3.1.1 SRSWR definition and procedure of selecting a sample
  3.1.2 SRSWOR definition and procedure of selecting a sample
3.2 Estimates of population
  3.2.1 Mean
  3.2.2 Variance
3.3 Variance of
  3.3.1 Mean
  3.3.2 Variance
3.4 Advantages and disadvantages

Unit: IV **(12H)**

4.1 Stratified Random Sampling
  4.1.1 Construction procedure
  4.1.2 Estimates of mean and variance
  4.1.3 Advantages
4.2 Allocation of sample size and estimates of mean and variance
  4.2.1 Proportional
  4.2.2 Optimum (Neymann)
4.3 Comparison of STRS with SRS
4.4 Efficiency of STRS over SRS
4.5 Determination of number of strata

Unit: V **(12H)**

5.1 Systematic sampling
  5.1.1 Construction procedure
  5.1.2 Estimates of mean and variance
  5.1.3 Advantages and disadvantages
5.2 Types
  5.2.1 Linear (N = n x k)
  5.2.2 Circular
5.3 In the presence of linear trend, Systematic sampling vs
  5.3.1 Simple Random sampling
  5.3.2 Stratified Random Sampling

Text Book

1. Fundamentals of Applied Statistics – S.C. Gupta & V.K. Kapoor

Unit: I 7.3 to 7.7
Unit: II 7.8.1, 7.14
Unit: III 7.9.2, 7.9.4, 7.9.5
Unit: IV 7.10.1 to 7.10.4, 7.10.7, 7.10.9
Unit: V 7.11.1 to 7.11.5

Reference Text Books

1. B.A/B.Sc. Third Year by Telugu Akademi
2. Sampling Techniques – W.G. Cochran. 3rd edition, John wiley & Sons Pvt. Ltd.
3. Applied Statistics – P. Mukhopadhyay. Books & Allied pvt. Ltd.
4. Theory and Analysis of Sample Survey Designs – D. Singh & Chowdhary John wiley & Sons Pvt. Ltd

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STATISTICS	STA P51	2015 – '16	B.Sc. (MSCS, MSCA & MSDS)

SEMESTER –IV **PRACTICAL-V** **No. of credits: 2**

DESIGNS OF SAMPLE SURVEY LAB
(Practical at end of Fifth Semester) 30hrs (2h / w)

1. Construction of random sample using Normal Distribution
2. Construction of SRS when population units are specified under WR & WOR Verification of sample mean is an unbiased estimate of the population mean
3. Comparison of efficiency of SRSWR & SRSWOR
4. Determination of sample sizes from strata using
   (i) Proportional allocation (ii) Optimum allocation
5. Computation of variance of estimate of the population mean in STRS
6. Comparison of efficiencies of proportional and optimum allocations with SRSWOR
7. Construction of systematic sample
8. Comparison of precision of systematic sampling, simple random sampling and stratified sampling

Structure of Practical Paper-V

External Examination for 50 Marks

(i) For Continuous Evaluation – 10 marks

(ii) For semester end practical Examination _ 40 marks

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STATISTICS	STA T56	2021-2022 onwards	B.Sc. (MSDS)

SEMESTER-V **PAPER - VI** **No of Credits: 4**

MULTIVARIATE ANALYSIS

No. of Hours/week: 04

Unit I **(12H)**

Introduction to Multiple Linear Regression Model, Partial Regression Coefficients, Testing for Individual Regression Coefficients, Testing Significance of Overall fit of the model, Estimating R^2, mean absolute error and mean absolute percentage error.

Unit II **(12H)**

Introduction to Multivariate Analysis - Meaning of Multivariate Analysis, classification of multivariate techniques (Dependence Techniques and Inter-dependence Techniques), Applications of Multivariate Techniques in different disciplines. Multivariate normal distribution: Estimation of Mean and Var-Cov matrix.

Unit III **(12H)**

The Generalized T^2 Statistic (HOTTELING T^2)– Distribution & Applications. Mahalanobi's D^2 Statistic. Wilk's -criterion and statement of its their properties with simple applications.

Unit IV **(12H)**

Discriminant Analysis: Classification and discriminant procedures for discrimination between two multivariate normal populations, Fisher's discrimination function – separation of two populations. Classification with several multivariate normal populations.

Unit V **(12H)**

Cluster Analysis: Hierarchical Clustering Methods – Single linkage, complete linkage and average linkage, and Ward's method. Non-Hierarchical Methods – K Means. Multidimensional scaling.

Books for Study

1. S.C. Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics, 11/e (2010), Sultan Chand & Sons
2. Johnson, Richard A and Wichern D.W (2007): Applied Multivariate Statistical Analysis, 6 /e, Pearson edition

Books for Reference

1. Anderson T. W : An Introduction to Multivariate Statistical Analysis, 3/e, , Wiley Inter science
2. Alvin C. Rencher (2003): Methods of Multivariate Analysis, 2/e, Wiley Inter science
3. Affifi, Abdelmonem, May, Susanne. and A. Clark., Virginia. (2012) Practical Multivariate Analysis 5 / e, CRC Press, Taylor & Francis Group.

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STATISTICS	STA P57	2021-2022 onwards	B.Sc. (MSDS)

SEMESTER –IV **PRACTICAL-VI** **No. of credits: 2**

MULTIVARIATE DATA ANALYSIS USING 'R'
(Practical at end of Fifth Semester) 30hrs (2h / w)

1. Hotelling's T^2 Test (One sample problem)
2. Hotelling's T^2 Test (Two sample problem)
3. D^2 test for two samples

List of Practical's using 'R'

1. Building Simple Linear Regression Model to the given data.
2. Building Multiple Linear Regression Model with Categorical Explanatory Variable.
3. Testing for Overall Model fit and Individual Regression Coefficients.
4. Determining R-Square, Adjusted R-Square, MAE and MAPE.
5. Study of Interaction Effects among Explanatory variable
6. Cluster Analysis – Hierarchical method with different linkages
7. Cluster Analysis – K-Means method.

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5.2.1 Linear (N = n x k)
5.2.2 Circular

5.3	In the presence of linear trend, Systematic sampling vs	
5.3.1	Simple Random sampling	
5.3.2	Stratified Random Sampling	
Text Book	1. Fundamentals of Applied Statistics – S.C. Gupta & V.K. KapoorUnit: I	7.3 to 7.7
	Unit: II	7.8.1, 7.14
	Unit: III	7.9.2, 7.9.4, 7.9.5
	Unit: IV	7.10.1 to 7.10.4, 7.10.7, 7.10.9
	Unit: V	7.11.1 to 7.11.5

Reference Text Books

1 B.A/B.Sc. Third Year by Telugu Akademi

2 Sampling Techniques – W.G. Cochran. 3rd edition, John Wiley & Sons Pvt. Ltd.

3 Applied Statistics – P. Mukhopadhyay. Books & Allied Pvt.Ltd.

4 Theory and Analysis of Sample Survey Designs – D. Singh & Chowdhary John Wiley & Sons Pvt. Ltd

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STATISTICS	**STAT52**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA**

SEMESTER-V **PAPER - VI** **No of Credits: 4**

Linear Programming Techniques--

Unit I: Operations Research - An overview **12 Hrs**

1.1 Origin and development of O.R.,
1.2 Nature and features of O.R.,
1.3 Scientific method and Modelling in O.R.,
1.4 Advantages and limitations of models,
1.5 General solution methods for O.R. models,
1.6 Methodology of O.R.,
1.7 Operations Research and Decision Making,
1.8 Applications, Opportunities and Shortcomings of O.R.

Unit II: Linear Programming Problem **12 Hrs**

2.1 Definition, components, basic assumptions
2.2 Mathematical formulation of the problem,
2.3 Illustrations on mathematical formulation of L.P.P. (two and three variables)
2.4 L.P.P - graphical solution method (search approach method)
2.5. Some exceptional cases in graphical method-Alternative optima, unboundedsolution and infeasible solution

Unit III: Linear Programming Problem-Simplex Method-I **12 Hrs**

3.1 General LPP-Objective function, constraints, non-negative restrictions,Solution of LPP, feasible solution and optimum solution
3.2 Canonical and
3.3 Standard forms of LPP.
3.4 Basic solution-definition, degenerate solution, basic feasible solution
3.5 Associated cost vector, improved basic feasible solution, optimum basic feasible solutionand net evaluation
3.6 The computational procedure- Simplex Algorithm
3.7 Simple linear programming problems on 2 and 3 variables using SimplesMethod

Unit IV: Linear Programming Problem-Simplex Method-II **12 Hrs**

4.1 Artificial Variable Technique (2 and 3 variables only)
4.1.1 The Big M Method or Method of Penalties.
4.1.2 The Two-phase Simplex Method
4.2 Special cases in simplex method (2 and 3 variables only)
4.2.1 Degeneracy
4.2.2 Alternative optima
4.2.3 Unbounded solutions
4.2.4 Non existing or infeasible solutions

Unit V: Duality in Linear programming **12 Hrs**

5.1 General primal – Dual pair
5.2 Formulating a dual problem
5.3 Primal- Dual pair in Matrix form

5.4. Duality and simplex method (2 and 3 variables only)

5.5. Dual Simplex method (2 and 3 variables only)

Text Book: KantiSwarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

Unit I: Chapter 1: Section 1.2 -1.11,

Unit II: Chapter 2: Section 2.2, 2.3
Chapter 3: Section 3.2, 3.3.

Unit III: Chapter 3: Section 3.4, 3.5,
Chapter 4: Section 4.1, 4.3,

Unit IV: Chapter 4: Section 4.4

Unit V: Chapter 5: Section 5.2, 5.3, 5.4, 5.7, 5.9

List of Reference Books:

1. Quality, Reliability & Operations Research, First Edition (2010), Published by Telugu Akademi,Hyderabad.

2. Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improved and enlarged edition, KedarNath Ram Nath & Co., Meerut.

3. Krishna's Operations Research, Dr. R. K. Gupta, 27th Edition, 2010, Krishna PrakashanMedia (P) Ltd., Meerut.

4. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013,Macmillan.

5. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

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STATISTICS	**STATEL61**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA**

SEMESTER-V **PAPER - VII** **No of Credits: 4**

Elective I

Operations Research

Unit I: **Linear programming problem - Advanced Techniques** **12 Hrs**

1.1 Revised Simplex Method- Algorithm

1.1 simple problems (2 and 3 variables)

1.2 Simplex method versus revised simplex method

1.3 Bounded Variables- computational procedure

1.4 Simple problems (2 and 3 variables)

1.5

Unit II: **Transportation Problem** **12 Hrs**

2.1 L.P. formulation of the Transportation Problem,

2.2 Tabular Representation,

2.3 Initial Basic Feasible Solution (I.B.F.S.) to Transportation Problem-

2.3.1 North West Corner,

2.3.2 Least Cost and

2.3.3 Vogles approximation Methods.

2.4 The Optimality Test- Transportation Algorithm – MODI (Modified Distribution Method

2.5 Degeneracy in Transportation Problem,

2.6 Some Exceptional Cases-

2.6.1 Unbalanced,
2.6.2 Prohibited,
2.6.3 Maximization Transportation Problems.
2.6.4 Time minimization transportation problem.

2.7 Simple problems.

Unit III: Assignment Problem **12Hrs**

3.1 Mathematical formulation of the problem,

3.2 Hungarian method for Assignment problem.

3.3 Special cases in Assignment problems-

3.3.1 Unbalanced,
3.3.2 Prohibited,
3.3.3 Maximization,

3.4 Travelling salesman problem,

3.5. A typical Assignment Problem.

3.6 Simple problems.

Unit IV Sequencing Problem **12Hrs**

4.1 Problem of Sequencing,

4.2 Principal Assumptions,

4.3 Solution of Sequencing Problem-

4.3.1 Processing n jobs through 2-Machines and

4.3.2 Processing n jobs through 3-Machines- Johnson's Optimal sequenceAlgorithm.

4.3.3 Processing n jobs through k-Machines- Johnson's Optimal sequenceAlgorithm.

4.4 Simple problems

Unit V: Replacement Problem **12Hrs**

5.1 Introduction,

5.2 Replacement of items that deteriorate gradually replacement policy for items whose maintenance cost increases with time and money value is constant

5.2.1 When time is continuous variable

5.2.2 When time is discrete variable

5.3 Simple problems

5.3 Replacement policy for items whose maintenance cost increases with time and money valuechanges with constant rate.

5.4 Simple problems

5.5 Replacement of items that fail completely:

5.4.1 Individual Replacement policy

5.4.2 Group replacement of items that fail completely.

5.6 Simple problems

Text Book: KantiSwarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

Unit I: Chapter 9: Section 9.2, 9.3, 9.4,

Unit II: Chapter 10: Section 10.1, 10.2, 10.4-10.6, 10.8 - 10.13, 10.15, 10.16.

Unit III: Chapter 11: Section 11.1-11.5, 11.7.

Unit IV: Chapter 12: Section 12.1 - 12.5.

Unit V: Chapter 18: Section 18.1 - 18.3.

List of Reference Books:

1. Quality, Reliability& Operations Research, First Edition (2010), Published by Telugu Akademi, Hyderabad.

2. Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improved and enlarged edition, KedarNathRamNath & Co., Meerut.

3. Krishna's Operations Research, Dr. R. K. Gupta, 27 th Edition , 2010, Krishna Prakashan Media
(P) Ltd., Meerut.

4. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013,Macmillan.

5. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

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STATISTICS	**STATELS62**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA**

SEMESTER-V **PAPER - VII** **No of Credits: 4**

Elective II
Applied Statistics

Unit: I **Index Numbers** **12Hrs**

1.1 Basic problems involved in the construction of index numbers
1.2 Construction of index numbers
1.2.1 Simple aggregate method
1.2.2 Weighted aggregate method
1.2.3 Simple price relative method
1.2.4 Weighted price relative method
1.3 The criteria of good index number
1.4 Cost of living index number
1.5 Base shifting of index numbers
1.6 Splicing of index numbers
1.7 Deflating of index numbers
1.8 Uses and Limitations of index numbers

Unit: II **Vital Statistics** **12Hrs**

2.1 Introduction
2.2 Uses of vital statistics
2.3 Methods of obtaining vital statistics data
2.4 Rates and Ratios
2.5 Mortality rates
2.5.1 Crude death rate
2.5.2 Specific death rate
2.5.3 Standardized death rate
2.6 Mortality table
2.6.1 Assumptions
2.6.2 Complete life table
2.6.3 Uses
2.7 Fertility rates
2.7.1 Crude birth rate
2.7.2 General fertility rate
2.7.3 Specific fertility rate
2.7.4 Total fertility rate
2.8 Measurement of population growth
2.8.1 Gross reproduction rate
2.8.2 Net reproduction rate

Unit: III **Demand Analysis** **12Hrs**

3.1 Introduction
3.2 Laws of demand and supply
3.3 Price elasticity of demand
3.4 Demand function with constant price elasticity
3.5 Price elasticity of supply & Family budget method

3.5.1 Time series data
3.6 Estimating methods for elasticities
3.6.1 Leontief's method (from time series data)
3.6.2 Pigou's method (from time series data)
3.7 Utility function

Unit: IV **Statistics in Psychology & Education** **12Hrs**

4.1 Introduction
4.2 Scaling procedures
4.3 Reliability test scores
4.4 Validity of test scores
4.5 I.Q tests

Unit: V **Indian Official Statistics** **12Hrs**

5.1 Central Statistical Organization
5.2 National Sample Survey Organization
5.3 Agricultural Statistics in India
5.4 National Income
5.4.1 Gross National Product
5.4.2 Gross Domestic Product
5.4.3 per-capital Income
5.4.4 Uses
5.5 Methods of Estimating National Income
5.5.1 Output method
5.5.2 Income method
5.5.3 Expenditure method

Text Book

1. Fundamentals of Applied Statistics – S.C. Gupta & V.K. Kapoor
2. B.A/B.Sc. Statistics Paper – III - DVLN Jogi Raju, C SriKala & P Sudarsan

Unit: I 3.1, 3.2, 3.3.1 to 3.4.4, 3.5.2, 3.6, 3.9, 3.10
Unit: II 9.1, 9.3, 9.4.1, 9.4.2, 9.4.4, 9.5only, 9.7 to 9.7.4, 9.8.2, 9.8.3
Unit: III 4.1 to 4.3, 4.5, 4.5.1, 4.5.2, 4.8only
Unit: IV 8.1 to 8.5
Unit: V 18.4 to 18.6, 18.9, 18.10.1, 18.10.2, 18.10.6, 18.11, 18.12

Reference Text Books

1. B.A/B.Sc. Third Year by Telugu Akademi
2. Applied Statistics – P. Mukhopadhyay. Books & Allied pvt. Ltd
3. Fundamentals of Statistics, Vol. II –A.M.Goon, M.K.Gupta, B.Dasgupta. 8th edition.World Press, Kolkata
4. Basic Statistics – B.L. Agarwal. 4th edition. New Age International Pvt. Ltd.

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STATISTICS	**STATCL 61**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA)**

SEMESTER-VI **PAPER - VIII** **No of Credits: 4**

Hybrid Operations Research Models

Unit I: Inventory Control -I 12Hrs

1.1 Basic concepts of inventory problems,
1.2 Types of inventories and
1.3 Cost associated with inventories.
1.4 Factors affecting inventory control.
1.5 The concept of EOQ (Economic Order Quantity).
1.6 Deterministic inventory problems (Static Demand Model)
1.7 The EOQ model without shortage -
1.7.1 The economic lot size system with uniform demand,
1.7.2 Different rates of demand in different cycles,
1.7.3 Finite rate of replenishment (EOQ production Model).
1.8 Simple problems

Unit II: Inventory Control-II 12Hrs

2.1 Price Breaks (Quantity Discounts): Problems of EOQ with
2.1.1 One price break and
2.1.2 More than one price break.
2.2 Simple problems.
2.3 Probabilistic inventory models-
2.4 Instantaneous demand,
2.5 No setup cost model -
2.5.1 Discrete case and
2.5.2 Continuous case.
2.6 Newspaper Boy Problem.
2.7 Simple problems

Unit III: Network Scheduling -I 12Hrs

3.1 Basic steps in PERT/CPM techniques
3.2 Basic components,
3.3 Logical sequencing (errors in drawing networks)
3.4 Rules for network construction,
3.5 Critical path analysis,
3.5.1 Forward pass Method
3.5.2 Backward pass Method
3.6 Determination of floats and slack times.
3.7 Simple problems

Unit IV: Network Scheduling -II 12Hrs

4.1 Probability considerations in PERT (Project Evaluation and Review Technique).
4.2 Distinction between PERT and CPM,
4.3 Applications of network techniques.
4.4 Limitations and difficulties in using Network

4.5 Project Cost
4.6 Time cost optimization Algorithm
4.7 Simple problems.

Unit V: Learning Curve theory **12Hrs**

5.1 Graphical and Tabular presentation of Learning curve
5.2 Learning curve equation
5.3 Specific learning curves
5.4. Regression and learning curve
5.5. Learning curve table when production is not exactly doubled
5.6 Uses of learning curve
5.7 Costs affected by learning curve
5.8 Learning curve theory in manufacturing organization
5.9 Advantages of learning curve theory
5.10 Limitations of Learning curve theory

Text Book: KantiSwarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

Unit I: Chapter 19: Section 19.2, 19.6, 19.7, 19.9, 19.10

Unit II: Chapter 19: Section 19.12,

Unit II: **Chapter 26 Model VI(a), VI(b)** Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improved and enlarged edition(16 th revised), 2009 KedarNathRamNath& Co., Meerut.

Unit III:	Chapter 25:	Section 25.2-25.4, 25.6.
Unit IV:	Chapter 25:	Section25.7, 25.8-25.11,
	Chapter 26:	Section 26.2, 26.3,
Unit V:	Chapter 32:	Section 32.2-32.11

List of Reference Books:

1. Quality, Reliability& Operations Research, First Edition (2010), Published by Telugu Akademi, Hyderabad.

2. Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improved and enlarged edition, KedarNathRamNath& Co., Meerut.

3. Kirshna's Operations Research, Dr. R. K. Gupta, 27th Edition, 2010, Krishna PrakashanMedia (P) Ltd., Meerut.

4. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013,Macmillan.

5. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

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STATISTICS	**STA TCL 62**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA)**

SEMESTER-VI **PAPER - IX** **No of Credits: 4**

STOCHASTIC OPERATIONS RESEARCH MODELS

Unit I: Theory of Games -I **12Hrs**

1.1 Basic definitions of game theory,
1.1.1 Competitive game
1.1.2 Zero-sum and Non-zero sum games
1.1.3 Strategy - pure strategy, mixed strategy
1.1.4 Two- person, zero- sum games
1.1.5 Pay-off matrix
1.2 characteristics of game theory,
1.3 Rectangular games,
1.4 Minimax-Maximin principle,
1.4.1 Saddle point,
1.4.2 Optimal strategies and
1.4.3 Value of game.
1.5 Solution of games with saddle points,
1.6 Games without saddle points - mixed strategies.
1.7 Minimax-Maximin principle for mixed strategy games.
1.8 Graphical method for (2 X n) and (m X 2) games.
1.9 Dominance property and simple problems.

Unit II: Theory of Games –II **12Hrs**

2.1 Two- By – Two games without saddle point
2.2 Linear programming method (2X3, 3X2, 3X3 games only)
2.3 Algebraic method for the solution of a general game (3 x3 games only)
2.4 Fundamental theorem of game theory (Minimax theorem- statement only)
2.5 Summary of methods for Rectangular games
2.6 Limitations of game theory
2.7 Simple problems.

Unit III Queuing Theory-I **12Hrs**

3.1 Queuing system,
3.2 Elements of a queuing system,
3.3 Operating characteristics of a queuing system,
3.4 Transient and steady states.
3.5 Traffic intensity or utilization factor

3.6 Probability distributions in queuing systems -
3.6.1 Distribution of arrivals the Poisson process (Pure birth Process),
3.6.2 Inter-arrival times (Exponential Process),
3.6.3 Markovian property of inter arrival times

3.6.4 Departures (Pure Death Process) and service time.

3.6.5 Derivation of service time distribution

Unit IV Queuing Theory-II 12Hrs

4.1 Classification of queuing models- Probabilistic Queuing Models

4.2 Solution of Queuing models

4.3 Limitation for application of Queuing models

4.4 Poisson queuing systems-Model I: (M/M/1): (∞ / FIFO) - Birth and Death Model.

4.5 Characteristics of (M/M/1): (∞ / FIFO)

4.5.1: $E(L_q), E(L_s),$

4.5.2 $E(L \mid L > 0), V(\text{Queue Length})$.

4.6 PDF of Waiting time distribution for (M/M/1): (∞ / FIFO),

4.7 Characteristic of waiting time distribution (M/M/1): (∞ / FIFO)

4.7.1: $E(W_q), E(W_s)$

4.7.2: $E(W \mid W > 0)$

4.8. Inter- Relationship between $E(L_q), E(L_s)\, E(W_q), E(W_s)$

4.9 Simple problems.

Unit V Queuing Theory-III 12Hrs

5.1 Poisson queuing systems-Model II: (M/M/1): (∞ /SIRO),

5.1.1 Probability distribution of queue length: (M/M/1): (∞ /SIRO)

5.2 Characteristics of (M/M/1): (∞ / SIRO)

5.2.1: $E(L_q), E(L_s),$

5.2.2: $E(L \mid L > 0), V(\text{Queue Length})$.

5.3 PDF of Waiting time distribution for (M/M/1): (∞ / SIRO),

5.4 Characteristic of waiting time distribution (M/M/1): (∞ / SIRO)

5.4.1 : $E(W_q), E(W_s)$

5.4.2: $E(W \mid W > 0)$

5.5 Poisson queuing systems-Model III: (M/M/1): (N/FIFO),

5.5.1 : Probability distribution of queue length of (M/M/1): (N/FIFO),

5.6 Characteristics of (M/M/1): (N/ FIFO)5.6.1: $E(L_q), E(L_s),$

5.7 Characteristic of waiting time distribution (M/M/1): (N/ FIFO)5.7.1: $E(W_q), E(W_s)$

5.8 Simple problems based on (M/M/1): (N/ FIFO)

Text Book:

1. Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improvedand enlarged edition (16th revised), 2009 KedarNathRamNath& Co., Meerut.

2. Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

Unit I:	Text book 1:	Chapter 24
Unit II:	Text book 1:	Chapter 24
Unit III:	Text book 1:	Chapter 28,

	Textbook 2:	Chapter 21: sections 21.2-21.8(page no 591-596)
Unit IV:	Textbook 1:	Chapter 28,
	Textbook 2:	Chapter 21: sections 21.9 (page no 597-607)

Unit V: Text book 1: Chapter 28,
Text book 2: Chapter 21: sections 21.9 (page no 608-611)

List of Reference Books:

1. Quality, Reliability & Operations Research, First Edition (2010), Published by Telugu Akademi, Hyderabad.

2. Kirshna's Operations Research, Dr. R. K. Gupta, 27th Edition, 2010, Krishna Prakashan Media
(P) Ltd., Meerut.

3. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013,Macmillan.

4. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

5. Operations research Algorithms and applications, RathindraP.Sen, 2010 PHI learning privatelimited, New Delhi,

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STATISTICS	**STAT CLS63**	**2017 – 18** **2018 -19**	**B.Sc. (MSCS &MSCA)**

SEMESTER-VI **PAPER - VIII** **No of Credits: 4**

Time Series--

Unit: I **12Hrs**

1.1 Introduction

1.2 Components of time series

1.3 Analysis of time series by

1.3.1 Additive model

1.3.2 Multiplicative model

1.4 Measurement of trend by

1.4.1 Semi averages method

1.4.2 Moving averages method

1.4.3 Least squares method (Straight line and Exponential curves)

1.5 Uses of time series

Unit: II **12Hrs**

2.1 Measurement of Trend by growth curves

2.2 Modified Exponential curve

2.2.1 Method of three selected points

2.2.2 Method of partial sums

2.3 Gompertz curve

2.3.1 Method of three selected points

2.3.2 Method of partial sums

2.4 Logistic curve

2.4.1 Method of three selected points

2.4.2 Yule's method

Unit: III **12Hrs**

3.1 Measurement of Seasonal variations

3.2 Ratio to moving averages method

3.3 Ratio to trend method

3.4 Link relative's method

3.5 De-Seasonliastion of data

Unit: IV **12Hrs**

4.1 Measurement of cyclical variations

4.2 Harmonic analysis

4.3 Auto regression series

4.3.1 Order one
4.3.2 Order two

4.4 Correlogram
4.4.1 Moving averages
4.4.2 Harmonic series

4.5 Auto regressive series (first order only)

Unit : V **12Hrs**

5.1 Measurement of Random variations

5.2 Variate difference method

5.3 Smoothing methods in Time Series

5.4 Exponential Smoothing
5.4.1 Method
5.4.2 Merits

5.4.3		Limitations
5.5	Forecasting Methods	
5.5.1		Types
5.5.2		using in Time series

Text Book

1 Fundamentals of Applied Statistics – S.C. Gupta & V.K. Kapoor

2 Comprehensive Statistical Methods – PN Arora., Sumeet Arora &S. Arora

Unit: I	2.1 to 2.4.3, 2.4.5
Unit: II	2.4.4
Unit: III	2.5, 2.5.2 to 2.5.5
Unit: IV	2.6, 2.7, 2 8.1 to 2.8.3
Unit: V	2.9, 2.9.1, 9.33 to 9.37

Reference Text Books

1 B.A/B.Sc. Third Year by Telugu Akademi

2 Applied Statistics – P. Mukhopadhyay. Books & Allied pvt. Ltd

3 Fundamentals of Statistics, Vol. II – A.M.Goon, M.K.Gupta, B.Dasgupta. 8thedition.World Press, Kolkata

4 Basic Statistics – B.L. Agarwal. 4th edition. New Age International Pvt. Ltd.

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COMPUTER SCIENCE	**STA TCLS64**	**2017-18** **2018-19**	**B.Sc. (MPCS, MECS, MSCA, MSCS)**

SEMESTER – VI **Credits: 3**

Total Hrs: 60

Paper-VIII: Elective – II (CLUSTER A – 3(a)
COMPUTING FOR DATA ANALYTICS

Course Objective

The objective of this course is to teach fundamental concepts and tools needed to understand the emerging role of business analytics in Organizations.

Course Outcomes

1. Learn the Big Data in Technology Perspective.
2. Understanding of the statistical procedures most often used by practicing engineers
3. Understand Forecasting methods and apply for business applications.

UNIT – I 12 Hours

DATA ANALYTICS LIFE CYCLE: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project -Main phases of life cycle - Developing core deliverables for stakeholders.

UNIT – II 12 Hours

STATISTICS: Sampling Techniques : Data classification, Tabulation, Frequency and Graphic representation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

UNIT – III 14 Hours

PROBABILITY AND HYPOTHESIS TESTING: Random variable, distributions, two-dimensional R.V, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang. Multivariate normal distribution - Sampling distribution – Estimation - point, confidence – Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, χ2distribution.

UNIT – IV 10 Hours

PREDICTIVE ANALYTICS: Predictive modelling and Analysis - Regression Analysis, Multicollinearity, Correlationanalysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

UNIT – V 12 Hours

TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS: Forecasting Models for Time series: MA, SES, TS with trend, season - Design of Experiments, one wayclassification, two-way classification, ANOVA, Latin square, Factorial Design.

Reference Books:

1. Chris Eaton, Dirk Deroos, Tom Deutsch etal., "Understanding Big Data", McGrawHIll, 2012.
2. Alberto Cordoba , "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.
3. Eric Siegel, Thomas H. Davenport , "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die",Wiley, 2013.
4. James R Evans, "Business Analytics – Methods, Models and Decisions", Pearson 2013.
5. R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2015.
6. S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists",Academic Foundation, 2011.
7. David Hand, Heiki Mannila, Padhria Smyth, "Principles of Data Mining", PHI 2013.
8. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).

Student Activity:

1. Collect temperatures of previous months and prepare a logic to estimatethe temperature of next one week
2. Collect real time data and apply statistical techniques to classify it.

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COMPUTER SCIENCE	**STA TCLS65**	**2017-18** **2018-19**	**B.Sc. (MPCS, MECS)**

SEMESTER – VI **Credits: 3**

Paper-VIII: Elective – II (CLUSTER A – 3(b)) DESIGN OF EXPERIMENTS

Unit: I ANOVA **10 Hrs**

1.1 Introduction
1.1.1 Assumptions
1.2 One way classification for fixed effect model
1.3 Two way classification for fixed effect modelWith one observation per cell

Unit: II Completely Randomised Design **14 Hrs**

2.1Introduction & terminology of design of experiments2.2Principles of Design of Experiments
2.3Introduction to Completely Randomized Design2.4Advantages & disadvantages of CRD 2.5Applications of CRD
2.6Analysis of CRD

Unit: III Randomised Block Design **12 Hrs**

3.1 Introduction to Randomized Block Design
3.2 Layout of RBD
3.3 Advantages & disadvantages of RBD
3.4 Applications of RBD
3.5 Analysis of RBD (One observation per cell)

Unit: IV Latin Square Design **10 Hrs**

4.1 Introduction to Latin Square Design
4.2 Layout of LSD
4.3 Advantages & disadvantages of LSD
4.4 Applications of LSD
4.5 Analysis of LSD (One observation per cell)

Unit: V Efficiency & Missing Plot Technique **12 Hrs**

5.1 Efficiency of RBD relative to CRD
5.2 Efficiency of LSD relative to
5.2.1 Completely Randomised Design
5.2.2 Randomised Block Design
5.3 Estimation of missing of one observation in RBD
5.4 Estimation of missing of one observation in LSD

Text Book

1Fundamentals of Applied Statistics – S.C. Gupta & V.K. KapoorUnit: I 5.1, 5.2, 5.2.1, 5.3, 5.3.1
Unit: II 6.1 to 6.4, 6.4.1
Unit: III 6.5, 6.5.1,
Unit: IV 6.6, 6.6.1,
Unit: V 6.5.6, 6.5.7, 6.6.6, 6.6.7, 6.6.8, 6.7, 6.7.1

Reference Text Books

1 B.A/B.Sc. Third Year by Telugu Akademi
2 Fundamentals of Statistics, Vol. II –A.M. Goon, M.K. Gupta, B. Dasgupta. 8th edition. World Press, Kolkata
3 Design and Analysis of Experiments – D.C. Montgomery. 5th edition Wiley India Pvt.Ltd.
4 Basic Statistics – B.L. Agarwal. 4th edition. New Age International Pvt. Ltd

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STATISTICS	**STA PCLS65**	**2017-18** **2018-19**	**B.Sc. (MSCA & MSCS)**

SEMESTER-VI **PRACTICAL - IX** **No of Credits: 2**

DESIGN OF EXPERIMENTS **45Hrs**

1. ANOVA I-Way Classification
2. ANOVA II-way classification
3. Completely Randomized Design
4. Randomized Block Design
5. Latin Square Design
6. Missing plot - RBD
7. Missing plot - LSD
8. Comparison of efficiencies

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STATISTICS	**STA P52**	**20 17 – 18**	**B.Sc. (MSCS &MSCA**

SEMESTER –IV No. of credits: 2 PRACTICAL-VI

Statistical-Data Analysis using SPSS and Operations Research-I 45Hrs

Chapter No	**Theme**	**Key Topics**
SPSS TECHNIQUES		
1	**Descriptive Statistics**	Data Entry, Frequencies, Descriptives, Cross Tabs,Exploratory, Custom Tables
2	**Visual Statistics**	Chart Builder, Histograms, Box Plots, Bar Charts, Cluster Bar, Stacked Bar, Error bar, Line charts, Piecharts, Editing graphs and Axes
3	**Statistical Testing**	Parametric vs. Non parametric, Logic, Confidence Intervals, Power of the test, Normal Curve, NormalityTest, Homogeneity of variance, Bootstrapping
4	**Linear Correlation and Regression**	Pearson Correlation, Spearman Correlation, Scatter Plots, Partial correlation, Linear Regression, LogisticRegression
OPERATIONS RESEARCH TECHNIQUES		
5	**Linear programming Problem -I**	Simplex Method - Mimization and Maximizationwith all constraints are less than or equal to type
6	**Linear programming Problem -II**	Simplex Method - Mimization and Maximization with all constraints are less than or equal to type orgreater than or equal to type or equations
7	**Linear programming Problem -III**	Special cases in Simplex Method - Degeneracy andAlternative optima,Unbounded solutions
8	**Linear programming Problem -IV**	Dual Simplex Method - Mimization and Maximization

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STATISTICS	**STAPELS62**	**2017 – 18** **2018 -19**	**B.Sc. (MSCS &MSCA**

SEMESTER –VI No. of credits: 2 PRACTICAL-VII

Applied Statistics **45Hrs**

1. Construction of different weighted index numbers
2. Verification of Fisher's index number is an ideal index number
3. Construction of cost of living index number
4. Determination of Mortality rates
5. Construction of life tables
6. Determination of fertility rates
7. Determination of reproduction rates
8. Computation of Sigma and standard scores

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STATISTICS	**STAPCL61**	**2017 – 18** **2018-19**	**B.Sc. (MSCS &MSCA)**

SEMESTER –VIII No. of credits: 2 PRACTICAL-VII

Hybrid Operations Research Models **45Hrs**

I. Project Management:

1) To Construction the PERT network, calculation of expected completion time for the project using Critical path method
2) To determine the probability that project is completed within specified time.
3) Time – cost optimization techniques

II. Deterministic Inventory Models

4) The fundamental problem of EOQ
5) Problem of EOQ with Finite replenishment (production)
6) Problems of EOQ with Price breaksIII Stochastic Inventory Models
7) Instantaneous Demand, No set-up cost model- discrete case
8) Instantaneous Demand, No set-up cost model- continuous caseIV Learning Curve theory
9) Specific learning curves
10) Regression and Learning curve

Text Book: **1.** KantiSwarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

2. Operations Research Theory, Methods and Applications, S.D. Sharma,Himanshu Sharma, improved and enlarged edition(16th revised), 2009 KedarNathRamNath& Co., Meerut

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STATISTICS	**STA PCL 62**	**2017-18** **2018-19**	**B.Sc. (MSCS & MSCA)**

SEMESTER – VI **Practical -IX** **No. of credits: 2 Stochastic**

Operations Research Models
45 Hrs

I To solve game problem by using LPP method - 2 experiments IITo solve game problem by using Algebraic Method 2 experiments III

To solve the game problems using graphical method 2 experiments IV To solve the queuing problems based on the Model (M/M/1): (∞/FIFO) 2 experiments VTo solve the queuing problems based on the Model (M/M/1): (N/FIFO) 2 experiments

Text Book: 1. Operations Research Theory, Methods and Applications, S.D. Sharma,Himanshu Sharma, improved and enlarged edition (16^{th} revised), 2009 KedarNathRamNath& Co., Meerut

2. Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research,15^{th} Edition, 2010, Sultan Chand & Sons, New Delhi.

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STATISTICS	**STAPELS63**	**2017-18** **2018-19**	**B.Sc. (MSCS & MSCA)**

SEMESTER-VI **PRACTICAL - VIII** **No of Credits: 2**

TIME SERIES

45Hrs

1. Trend – Moving Averages Method
2. Trend – Least Squares Method
3. Trend - Logistic Curve (by three selected points)
4. Seasonal variations – Simple averages method
5. Seasonal variations – Ratio to moving averages
6. Seasonal variations – Ratio to trend method
7. Seasonal variations – Link relatives method
8. Forecasting of values by the method of exponential smoothing

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STATISTICS	**STAT53**	**2018-19**	**B.Sc. (HONORS)**

SEMESTER – V **PAPER – III** **No. of credits:**

Statistical Inference

Unit I: Theory of Estimation **12Hrs**

1.1 Point estimation of a parameter,
1.2 Criteria of good estimator-
1.2.1 Consistency,
1.2.2 Unbiasedness,
1.2.3 Efficiency and
1.2.4 Sufficiency with examples.
1.3 Statement of Neyman's Factorization theorem–Simple Applications.
1.4 Methods of Estimation-
1.4.1 Estimation by method of moments,
1.4.2 Maximum likelihood (ML),
1.4.3 Problems on MLE
1.5 Distinction between point estimation and interval estimation -
1.6 Confidence interval and confidence limits –
1.6.1 Construction of confidence intervals for parameters of Poisson and Normal.

Unit II: Testing of hypothesis **12Hrs**

2.1 Concepts of statistical hypotheses,
2.1.1 Simple,
2.1.2 Composite,
2.1.3 Null and
2.1.4 Alternative hypothesis,
2.2 Critical region,
2.3 Two types of errors,
2.4 Level of significance,
2.5 power of a test and
2.6 p-value,
2.7 One and two tailed tests,
2.8 NP lemma Statement and proof

Unit III: Large Sample Tests **12Hrs**

3.1 Sampling of Attributes-
3.1.1 Test of significance for Single Proportion,
3.1.2 Difference of proportions,
3.1.3 Confidence intervals for proportion(s) and
3.1.4 Problems.
3.2 Sampling of Variables-
3.2.1 Test of significance for Single Mean,
3.2.2 Difference of Means,
3.2.3 Confidence intervals for mean(s) and

3.2.4 Problems.

3.3. Test of significance for Single Standard deviation,

3.1 Difference of Standard deviations

3.1 Problems.

Unit IV: 3.2 Small Sample Tests **12Hrs**

4.1 t-test-

4.1.1 t -Test for single mean,

4.1.2 Difference of means,

4.1.3 Paired t- test for difference of means and

4.1.4 Test for single correlation coefficient.

4.2 F-test-

4.2.1 F-test for Equality of two population variances.

4.3 Fisher's Z- transformation-

4.3.1 Test of significance for Difference of correlation coefficient(s),

Unit V: Chi-Square test & Non-Parametric Methods **12Hrs**

5.1 Chi Square test

5.1.1 Test for single population variance,

5.1.2 Goodness of fit

5.1.3 Independence of Attributes

5.2 Non-parametric tests-

5.2.1 Advantages and disadvantages,

5.2.2 Comparison with parametric tests.

5.3 Measurement scale-

5.3.1 Nominal,

5.3.2 Ordinal,

5.3.3 Interval and

5.3.4 Ratio.

5.4 One sample tests-

5.4.1 Sign test

5.4.2 Run test

Text Book:

1. B.A/B.Sc. (Second Year) Statistics-II (2010), Statistical Methods and Inference Telugu Akademi,Hyderabad.

Unit I: Chapter 7: Section 7.1, 7.2, 7.3, 7.3.1-7.3.4, 7. 4.

Chapter 8: Section 8.1, 8.2, 8.3, 8.4,

Unit II: Chapter 9: Section 9.1 - 9.9.

Chapter10: Section 10.5

Unit III: Chapter 11: Section 11.4 - 11.5

Unit IV: Chapter 12: Section 12.1-12.7;

Chapter 11: Section 11.6

Unit V: Chapter 13: Section 13.1-13.4.

Chapter14: Section 14.1-14.3

Chapter15: Section 15.1 & 15.3

2. Fundamentals of Mathematical Statistics, 11th Edition, 2010, S. C. Gupta and V. K. Kapoor,Sultan Chand & Sons, New Delhi.

List of Reference Books:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2005): Fundamentals of Statistics, Vol. II,8th Edn.World Press, Kolkata.
2. Kandethody M. Ramachandran and Chris P.Tsokos (2009): Mathematical Statistics with Applications, First Edn, Elsevier, Haryana, India.
3. Parimal Mukhopadhyay (2009), Mathematical Statistics, 3rd Edition, Books & Allied (p)Ltd, Kolkata
4. Hogg, R.V., Craig, A.T. and Mckean, J.W. (2009): Introduction to Mathematical Statistics, 6th Edn,(6th Impression). Pearson Education.
5. GibbonsJ.D and Subhabrata Chakraborti: Nonparametric Statistical Inference. Marcel Dekker.

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STATISTICS	**STAT61**	**2018-19**	**B.Sc. (HONORS)**

SEMESTER – VI **PAPER – IV** **No. of credits: 4**

Operations Research

Unit I: Operations Research- An overview and L.P.P **12Hrs**

1.1 Origin and development of O.R.,
1.2 Nature and features of O.R.,
1.3 Scientific method and Modelling in O.R.,
1.4 Advantages and limitations of models,
1.5 Applications and Opportunities of O.R.
1.6 Linear Programming Problem (L.P.P)
1.6.1 Definition, components, basic assumptions
1.6.2 Mathematical formulation of the problem,
1.6.3 Illustrations on mathematical formulation of L.P.P. (two and three variables)
1.7 L.P.P - graphical solution method (search approach method)
1.8 General LPP-Objective function, constraints, non-negative restrictions,
Solution of LPP, feasible solution and optimum solution, Canonical and Standard forms ofLPP.

Unit II: Linear Programming Problem-Simplex Method **12Hrs**

2.1 The computational procedure- Simplex Algorithm
2.2 Simple linear programming problems on 2 and 3 variables using SimplexMethod.
2.3 Artificial Variable Technique (2 and 3 variables only)
2.4 The Big *M* Method or Method of Penalties.
2.5 The Two-phase Simplex Method.
2.6 Simple linear programming problems on 2 and 3 variables using Big *M and* Two-phaseSimplex Method.

Unit III Transportation Problem **12Hrs**

3.1 L.P. formulation of the Transportation Problem, Tabular Representation,
3.2 Initial Basic Feasible Solution (I.B.F.S.) to Transportation Problem-
3.2.1 North West Corner,
3.2.2 Least Cost and
3.2.3 Vogel's approximation Methods,
3.3 The Optimality Test - Transportation Algorithm – MODI (Modified Distribution Method),
3.4 Special cases in Assignment problems-
3.4.1 Unbalanced,
3.4.2 Prohibited,
3.4.3 Maximization
3.5 Simple problems.

Unit IV Assignment Problem: **12Hrs**

4.1 Mathematical formulation of the problem

4.2 Hungarian method for Assignment problem.
4.3 Special cases in Assignment problems-
4.3.1 Unbalanced,
4.3.2 Prohibited,
4.3.3 Maximization,
4.4 Travelling salesman problem,
4.5 A typical Assignment Problem.
4.6 Simple problems.

Unit V: Network Scheduling by PERT/CPM **12Hrs**

5.1 Basic steps in PERT/CPM techniques, Basic components
5.2 Logical sequencing (errors in drawing networks)
5.3 Rules for network construction,
5.4 Critical path analysis,
5.4.1 Forward pass Method
5.4.2 Backward pass Method
5.4.3 Determination of floats and slack times.
5.5 Probability considerations in PERT (Project Evaluation and Review Technique).
5.6 Distinction between PERT and CPM,
5.7 Applications of network techniques, Limitations and difficulties in using Network
5.8 Simple problems.

Text Book: Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research,15th Edition, 2010, Sultan Chand & Sons, New Delhi.

List of Reference Books:

1. Quality, Reliability & Operations Research, First Edition (2010), Published by Telugu Akademi,Hyderabad.
2. Operations Research Theory, Methods and Applications, S.D. Sharma, Himan Sharma, improved and enlarged edition, KedarNathRamNath & Co., Meerut.
3. Krishna's Operations Research, Dr. R. K. Gupta, 27th Edition, 2010, Krishna PrakashanMedia (P) Ltd., Meerut.
4. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013,Macmillan.
5. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

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STATISTICS	**STA P53**	**2018-19**	**B.Sc. (HONORS)**

SEMESTER -V **No. of credits: 2** **PRACTICAL – III**

Statistical Inference

45Hrs

1. Large sample tests for mean(s), proportion(s), Standard deviation(s) and correlation coefficient.
2. Small sample tests for single mean and difference of means and correlation coefficient, Paired t-test.
3. Small sample tests for mean(s), paired t-test and correlation coefficient using MS Excel.
4. Small sample test for single and difference of variances.
5. Small sample test for single and difference of variances using MS Excel.
6. χ^2 – test for goodness of fit and independence of attributes.
7. χ^2 – test for goodness of fit and independence of attributes using MS Excel.
8. Nonparametric tests sign test and run test of one sample

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STATISTICS	**STA P61**	**2019-20**	**B.Sc. (HONORS)**

SEMESTER -VI **No. of credits: 2** **PRACTICAL - IV**

Statistical-Data Analysis using SPSS and Operations Research

45Hrs

1. Descriptive Statistics- frequency Tables, Central Tendency,Dispersion, Skewness and Kurtosis
2. Visual Statistics: Bar diagrams, Histogram and Pie- diagram
3. Correlations & Regressions
4. Testing of Hypothesis: Normal test, t-test, Chi-square test and F- test

Operations Research

1. Optimum Solution of LPP by using Simplex Method

2. Optimum solution of Transportation problems (Minimization & Maximization)

3. Optimum solution of Assignment Models (Minimization & Maximization)

4. Project Management: To Construction the PERT network, calculation ofexpected completion time for the project using Critical path method and
to determine the probability that project is completed within specified time.

1. Reference books for SPSS:

(i) SPSS Base 11.0 User's Guide, Bangalore, India
(ii) STATISTICS: CONCEPTS AND APPLICATIONS, PAL, NABENDU, SARKAR, SAHADEB Edition: Second Edition, Publication: PHI Learning, New Delhi - 110 001, India.

2. Reference books for Operations Research:

(i) Operations Research: Kanti Swaroop, P.K. Gupta and Man Mohan, SultanChand & Sons
(ii) Operations Research: S.D. Sharma, Kedar nath Romnath & Co. Meerut.

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA, VIJAYAWADA-520 010
An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P

STATISTICS	**STAT22**	**2017-18** **2018-19**	**I BBA**

SEMESTER – II **PAPER – I** **No. of credits: 4**

Quantitative Methods for Managers

Expected Learning Outcomes: The student is expected to be equipped with the tools of processing and description of statistical data. In addition, the student would develop competence to use statistical techniques in business management and research methodology etc.

Unit I: Statistical Description of data and Measures of Central tendency 12Hrs

1.1 Classification of data, tabulation & diagrammatic representation of data.Frequency distribution.

1.2 Graphical representation of frequency distribution histogram, FrequencyPolygon, Ogive curves.

1.3 Mathematical averages – Arithmetic mean geometric mean & HarmonicMean. Properties & applications.

1.4 Positional averages- mode, median & Partition values Quartiles, Deciles &Percentiles – properties and Problems.

Unit II: Measures of Dispersion 12Hrs

2.1 Absolute & relative measure of dispersion – range, Quartile Deviation, meanDeviation.

2.2 Standard deviation and co- efficient of variation properties & applications.

2.3 Moments – importance of moments, central & non- central moments & their Interrelationships (Excluding derivations, Sheppard's corrections for central Moments for grouped data)

2.4 Measures of skewness & kurtosis with simple problems.

Unit III: Simple correlation & Regression Analysis 12Hrs

3.1 Correlation Analysis: meaning of correlation, Scatter diagram, simple linear Correlation, Pearson coefficient of correlation, Properties & simple Problems.

3.2 Probable & Standard errors of simple linear correlation Rank correlation,Concurrent deviation and coefficient of determination.

3.3 Regression Analysis, Principle of least squares & Regression Lines.Regression Equations.

3.4 Properties of regression co- efficient (Proofs are not required) & Problems.

Unit IV Probability and it's Distributions: 12Hrs

4.1 Theory of Probability. Approaches to the calculation of probability.

4.2 Calculation of Event Probability. Addition & Multiplication laws of probability (proofs not required). Conditional Probability & Bayes' theorem.(proofs not required) & Problems.

4.3 Normal distribution, Probability Density function, mean, variance, properties and applications (proofs not required)

4.4 Exact Sampling Distributions: t, F, χ^2 distributions & properties & its applications.

Unit V SPSS Package: 12Hrs

5.1 Basic principles of sampling theory, comparison between sampling survey &Complete enumeration, errors in sample survey

5.2 Types of sampling

5.2.1 Non-Probabilistic-Purposive, Quota & sequential methods

5.2.2 Probabilistic-Simple Random, Stratified Random & Systematic sampling methods(only concepts)

5.3 Determination of sample size based on sample mean & sample proportion

5.4 Confidence intervals for single mean & single proportion

Text Book: 1. Gupta, S.C. Fundamentals of Statistics, sixth Revised & Enlarged Edition Himalaya Publishing House

List of Reference Books:

1. Gupta, S.P., and Archana Gupta, Statistical Methods. Sultan Chand and sons, New Delhi.
2. Levin, Richard and David S.Rubin. Statistics for Management. 7th Edition. Prentice Hall of India.
3. Siegel, Andrew F. Practical Business Statistics. International Edition. (4th Ed.). Irwin Mc GrawHill.
4. Berenson and Levine. Basic Business Statistics: Concepts and Applications. Prentice Hall.
5. Spiegel M.D. Theory and Problems of Statistics. Schaums Outlines Series. McGraw Hill Publishing Co.

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Statistics	**Course Code: STA T65**	**Course Type:** Core (Theory)	**Offered to whom:** B.Sc. (MSDS)
SEMESTER -VI	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of. Credits: 4**	**Time**: 4 Hours/ week

Operations Research for Data Science
Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	**Operations Research -** Origin and development of O.R., Nature and features of O.R., Scientific method and Modelling in O.R., Advantages and limitations of models, Applications, Opportunities and Shortcomings of O.R. **Linear Programming Problem** - Definition, components, basic assumptions Mathematical formulation of the problem, Illustrations on mathematical formulation. Graphical solution method. Simplex, Big *M* or Method of Penalties and Two-phase Simplex Methods.	**12**
II	**Transportation Problem –L.P**P. formulation of the Transportation Problem, Initial Basic Feasible Solution(I.B.F.S.) to Transportation Problem- North West Corner , Least Cost and Vogel's approximation Methods. The Optimality Test - Transportation Algorithm - MODI (Modified Distribution Method), Simple problems. **Assignment Problem -**Mathematical formulation of the problem, Hungarian method for solving balanced assignment problem. Solving of Unbalanced, Maximization, Simple problems	**12**
III	**Network Scheduling by PERT/CPM**: Basic components, Logical sequencing (errors in drawing networks). Rules for network construction, Basic steps in PERT/CPM techniques. Critical path analysis. Method. Probability considerations in PERT (Project Evaluation and Review Technique). Distinction between PERT and CPM, Crashing. Applications of network techniques.	**12**
IV	**Queuing Theory**: Queuing system, Elements of a queuing system, Operating characteristics of a queuing system. Probability distributions in queuing systems - Distribution of arrivals the Poisson process, distribution of departures Exponential Process. Classification of queuing models- Model I: (M/M/1): (∞ / FIFO). Simple problems.	**12**
V	**Simulation** : Introduction, definition, uses, advantages & limitations, phases of simulation, generation of random numbers, Monte - Carlo technique, applications of simulation – event type, queuing, inventory, hospital, capital budgeting models. Simple	**12**

	problems	

Text Book:

1. KantiSwarup, S.C.Gupta, Man Mohan,Operations Research, 15th Edition, 2010, Sultan Chand & Sons, New Delhi.
2. Operations Research Theory, Methods and Applications, S.D. Sharma, HimanshuSharma, improved and enlarged edition (16th revised), 2009 Kedar Nath Ram Nath& Co., Meerut.

Books for Reference:

1. Kirshna's Operations Research, Dr. R. K. Gupta, 27 thEdition , 2010, Krishna Prakashan Media (P) Ltd., Meerut.
2. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013, Macmillan.
3. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition, 2010, Prentice Hall.

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An Autonomous College in the jurisdiction of Krishna University, Machilipatnam, A.P., India

Statistics	**Course Code: STA P65**	**Course Type:** Core (Practical)	**Offered to whom:** *B.Sc. (MSDS)*
SEMESTER -VI	**Course No - I**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of Credits: 2**	**Time**: 2 Hours/ week

Operations Research for Data Science using R – Package

(Practical at end of First Semester) 30hrs (2h / w)

ractical No	Theme	Key Topics
	Manual	
1	**r Programming Problem – I**	ex Method
2	**r Programming Problem – II**	M method
3	**portation Problem**	ıization and Maximization – Balanced and Unbalanced

4	**ıment Problem**	ıization and Maximization – Balanced and Unbalanced
using R – Package		
5	**r Programming Problem**	ex, Big M
6	**portation Problem**	ıization and Maximization – Balanced and Unbalanced
7	**ıment Problem**	ıization and Maximization – Balanced and Unbalanced
8	**ng Model**	1) : (∞/FIFO)

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Statistics	**Course Code: STA T64**	**Course Type:** Core (Theory)	**Offered to whom:** B.Sc. (MSDS)
SEMESTER -VI	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of. Credits: 4**	**Time**: 4 Hours/ week

Time Series Analysis

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	**Introduction to analysis of Time Series** Introduction time series data, applications of time series data from various fields, Components of a time series data, Models of time series data, Decomposition of time series data.	**12**
II	**Analysis of Trend** Estimation of trend by Method of curve fitting by principle of least squares, growth curves and moving averages. Detrending of a time series data	**12**
III	**Analysis of Seasonal Component** Estimation of seasonal component by the methods of – simple averages, Ratio to trend, Ratio to moving average, and Link Relative method. Deseasonalistion of the data.	**12**
IV	**Analysis of Cyclic Component** Harmonic analysis, Auto- Regression series: Second order Auto-Regressive series (Yule's series) Auto Correlation and	**12**

	Correlogram, Correlogram of Moving average, Correlogram of Harmonic series, Correlogram of Auto Regressive Series.	
V	**Analysis of Random Component and Forecasting** Variate difference method, Introduction to methods of forecasting a time series analysis, forecasting by the method of Exponential smoothing. Introduction of ARMA and ARIMA models	**12**

TEXT BOOK:

1. S.C. Gupta and V.K.Kapoor (2019), Seventh Edition, Fundamentals of Applied Statistics, Sultan Chand and Sons Publications
2. Probability and Statistics Dr. D. Biswas, New central publications

REFERENCE BOOKS

1. Sharma, J. K. (2013), *Business statistics*, New Delhi: Pearson Education
2. Levine, D.M., Berenson, M. L. & Stephan, D. (2012*)*, *Statistics for managers using Microsoft Excel*, New Delhi: Prentice Hall India Pvt.
3. Aczel, A. D. & Sounderpandian, J. (2011), *Complete Business Statistics*, New Delhi: Tata McGraw Hill.
4. Anderson, D., Sweeney, D., Williams, T., Camm, J., & Cochran, J. (2013), *Statistics for Business and Economics*, New Delhi: Cengage Learning.
5. Davis, G., &Pecar, B. (2014), *Business Statistics using Excel*, New Delhi: Oxford University Press.

Websites of Interest: http://onlinestatbook.com/rvls/index.html

Co-Curricular Activities in the class:

1. Pictionary
2. Case Studies on topics in field of statistics
3. Snap test and Open Book test
4. Architectural – To be build the procedures
5. Extempore – Random concept to students
6. Interactive Sessions
7. Teaching through real world examples

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Statistics	**Course Code: STA P64**	**Course Type:** Core (Practical)	**Offered to whom:** B.Sc. (MSDS)
SEMESTER -VI	**Course No -**	**Year of introduction:** 2021-2022	**Year of revision:** --
Percentage of Revision: 100%	**No. of Hours:** 60 hrs. Per Sem	**No. of. Credits: 2**	**Time**: 2 Hours/ week

Statistical Data Analysis using SPSS

(Practical at end of First Semester) 30hrs (2h / w)

actical No	**Theme**	**Key Topics**
SPSS TECHNIQUES		
1	iptive Statistics	Entry, Frequencies, Descriptive, Cross Tabs, Exploratory, Custom Tables (CO – 1)
2	l Statistics	Builder, Histogram, Box Plots, Bar charts, Cluster Bar, Stacked Bar, Error bar, Pie chart, Editing graphs and axes (CO – 2)

3	lation	on Correlation, Spearman Correlation, Scatter Plots. (CO – 3)
4	ssion Modeling	Simple and Multiple Linear Regression, Prediction, error, Model Accuracy in the Model and Overall Significance of Model to the fitted data. (CO – 3)
5	netric Test	Mean, Difference of Means and Paired Test (CO – 4)
6	quare Test	ness of Fit and Independence of attributes (CO – 4)
7	st	Way and Two Way Analysis of Variance (CO – 4)

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