KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
Department Of Mathematics & Statistics

Class:	Semester:	Title of The Paper:	Course Code:	W.E.F
I B.Sc. (M.S.CS)	I	**Descriptive Statistics**	R20STAT101	2020-21

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	2	3 Hours	25	75	4

Objectives

- The objective of this paper is to throw light on the role of statistics in different fields with special reference to business and economics.
- It gives the students to review good practice in presentation and the format most applicable to their own data.
- The measures of central tendency or averages reduce the data to a single value which is highly useful for making comparative studies.
- The measures of dispersion throw light on reliability of average and control of variability
- The concept of Correlation and Linear Regression deals with studying the linear relationship between two or more variables, which is needed to analyze the real life problems.
- The attributes gives an idea that how to deal with qualitative data.

Course Learning Outcomes

Students will acquire

1) knowledge of Statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.
2) knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency and dispersion etc.
3) knowledge of other types of data reflecting quality characteristics including concepts of independence and association between two attributes,
4) insights into preliminary exploration of different types of data.
5) Knowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations.

Syllabus

UNIT - I

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

UNIT-II

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

UNIT-III

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

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

UNIT-IV

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

UNIT-V

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

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution – Telugu Academy
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia 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

Practical's

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

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	1	1	1	3
2	2	1	1	4
3	2	-	2	4
4	1	1	1	3
5	2	1	1	4
TOTAL	8	4	6	18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
Department of Mathematics & Statistics

Class:	Semester:	Title of The Paper:	Course Code:	W.E.F
I B.Sc. (M.S.CS)	II	**Probability Theory and Distributions**	R20STAT201	2020-21

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	2	3 Hours	25	75	4

Obejectives

- This paper deals with the situation where there is uncertainty and how to measure that uncertainty by defining the probability, random variable and mathematical expectation which are essential in all research areas.
- This paper gives an idea of using various standard theoretical distributions, their chief characteristics and applications in analyzing any data.

Course Learning Outcomes

Students will acquire

1) Ability to distinguish between random and non-random experiments,
2) Knowledge to conceptualize the probabilities of events including frequent and axiomatic approach. Simultaneously, they will learn the notion of conditional probability including the concept of Bayes' Theorem,
3) Knowledge related to concept of discrete and continuous random variables and their probability distributions including expectation and moments,
4) Knowledge of important discrete and continuous distributions such as Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric, normal, uniform, exponential, beta and gamma distributions,
5) Acumen to apply standard discrete and continuous probability distributions to different situations.

Syllabus

UNIT-I

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

UNIT-II

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

UNIT- III

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

UNIT-IV

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

UNIT - V

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

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy
3. 3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia 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
6. Hogg Tanis Rao: Probability and Statistical Inference. 7th edition. Pearson.

Practical

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

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	2	2	-	4
2	2	2	-	4
3	1	2	-	3
4	2	2	-	4
5	1	2	-	3
TOTAL	8	10		18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

Department of Mathematics & Statistics

Class:	Semester:	Title of The Paper:	Paper	Paper Code:	W.E.F
II B.Sc.(M.S.Cs.) (DATA SCIENCE)	III	Statistical Inference	III	R20STAT301	2021-22

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max. Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	3		25	75	

Objectives:

- This paper deals with standard sampling distributions like Chi Square, t and F and their characteristics and applications.
- This paper deals with the different techniques of point estimation for estimating the parameter values of population and interval estimation for population parameters.
- In this paper, various topics of Inferential Statistics such as interval estimation, Testing of Hypothesis, large sample tests (Z-test), small sample tests (t-test, F-test, chi-square test) and non-parametric tests are dealt with. These techniques play an important role in many fields like pharmaceutical, agricultural, medical etc.

Course Learning Outcomes

The students will acquire

1. Concept of law large numbers and their uses
2. Concept of central limit theorem and its uses in statistics
3. Concept of random sample from a distribution, sampling distribution of a statistic, standard error of important estimates such as mean and proportions,
4. Knowledge about important inferential aspects such as point estimation, test of hypotheses and associated concepts,
5. Knowledge about inferences from Binomial, Poisson and Normal distributions as

illustrations, concept about non-parametric method and some important non-parametric tests.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT – IV

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

Small Sample tests: t-test for single mean, difference of means and paired t-test. χ^2 - test forgoodness of fit and independence of attributes. F-test for equality of variances.

UNIT – V

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

TEXT BOOKS

1. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A.Mohanrao, N.Srinivasa Rao, Dr R.Sudhakar Reddy, Dr T.C. RavichandraKumar.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

REFERENCE BOOKS:

1. Fundamentals of Mathematics statistics : VK Kapoor and SC Guptha.
2. Outlines of statistics, 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.

PRACTICALS

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 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.

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	1	2	-	3
2	2	2	-	4
3	2	2	-	4
4	1	2	-	3
5	2	2	-	4
TOTAL	8	10		18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

Department of Mathematics & Statistics

Class:	Semester:	Title of The Paper:	Paper	Paper Code:	W.E.F
II B.Sc.(M.S.Cs.) (DATA SCIENCE)	IV	**Sampling Techniques and Design of Experiments**	IV	R20STAT401	2021-22

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	3	2		25	75	

Sampling Techniques and Design of Experiments

- The sampling techniques deals with the ways and methods that should be used to draw samples to obtain the optimum results, i.e., the maximum information about the characteristics of the population with the available sources at our disposal in terms of time, money and manpower to obtain the best possible estimates of the population parameters
- This paper throw light on understanding the variability between group and within group through Analysis of Variance
- This gives an idea of logical construction of Experimental Design and applications of these designs now days in various research areas.
- Factorial designs allow researchers to look at how multiple factors affect a dependent variable, both independently and together.

Course Learning Outcomes

The students shall get

1. Introduced to various statistical sampling schemes such as simple, stratified and systematic sampling.
2. an idea of conducting the sample surveys and selecting appropriate sampling techniques,
3. Knowledge about comparing various sampling techniques.
4. carry out one way and two way Analysis of Variance,

5. understand the basic terms used in design of experiments, use appropriate experimental designs to analyze the experimental data

UNIT I

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) with their layouts and Analysis, Missing plot technique in RBD and LSD. Efficiency RBD over CRD, Efficiency of LSD over RBD and CRD.

UNIT V

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

Text Books:

1. Telugu AcademyBA/BSc III year paper - III Statistics - applied statistics - Telugu academy by Prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.

Reference Books:

1. Fundamentals of applied statistics : VK Kapoor and SC Gupta.
2. Indian Official statistics - MR Saluja.
3. Anuvarthita Sankyaka Sastram - TeluguAcademy.

Practicals:

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

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.

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	1	2	-	3
2	2	2	-	4
3	2	1	1	4
4	1	1	1	3
5	2	2	-	4
TOTAL	8	7	3	18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

Department of Mathematics & Statistics

Class:	Semester:	Title of The Paper:	Paper	Paper Code:	W.E.F
II B.Sc.(M.S.Cs.) (DATA SCIENCE)	IV	**Applied Statistics**	V	R20STAT402	2021-22

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	3	2		25	75	

PAPER-V: Applied Statistics

- This paper deals the time series on simple description methods of data, explains the variation, forecasting the future values, control procedures.
- It gives an idea of using index numbers in a range of practical situations, limitations and uses
- The vital statistics enlighten the students in obtaining different mortality, fertility rates thus obtaining the population growth rates and construction and use of life tables in actuarial science.

Course Learning Outcomes

After completion of this course, the students will know about

1. time series data, its applications to various fields and components of time series,
2. fitting and plotting of various growth curves such as modified exponential, Gompertz and logistic curve,
3. fitting of trend by Moving Average method,
4. measurement of Seasonal Indices by Ratio-to-Trend , Ratio-to-Moving Averageand Link Relative methods,
5. Applications to real data by means of laboratory assignments.
6. Interpret and use a range of index numbers commonly used in the business sector
7. Perform calculations involving simple and weighted index numbers
8. Understand the basic structure of the consumer price index and perform calculations involving its use
9. Various data collection methods enabling to have a better insight in policy

making, planning and systematic implementation,

10. Construction and implementation of life tables,
11. Population growth curves, population estimates and projections,
12. Real data implementation of various demographic concepts as outlined above through practical assignments.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

1. Fundamentals of applied statistics : VK Kapoor and SC Gupta.
2. BA/BSc III year paper - III Statistics - applied statistics - Telugu academy byprof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry.

Reference Books:

1. Anuvarthita Sankyaka Sastram - Telugu Academy.
2. Mukopadhyay, P (2011). Applied Statistics, 2nd ed. Revised reprint, Books and Allied Pvt. Ltd.
3. Brockwell, P.J. and Devis, R.A. (2003). Introduction to Time Series Analysis. Springer.

4. Chatfield, C. (2001). Time Series Forecasting., Chapman & Hall.
5. Srinivasan, K. (1998). Demographic Techniques and Applications. Sage Publications
6. Srivastava O.S. (1983). A Text Book of Demography. Vikas Publishing House

Practicals

1. Measurement of trend by method of moving averages(odd and even period)
2. Measurement of trend by method of Least squares(linear and parabola)
3. Determination of seasonal indices by method simple averages
4. Determination of seasonal indices by method of Ratio to moving averages
5. Determination of seasonal indices by method of Ratio to trend
6. Determination of seasonal indices by method of Link relatives
7. Computation of simple index numbers.
8. Computation of all weighted index numbers.
9. Computation of reversal tests.
10. Computation of various Mortality rates
11. Computation of various Fertility rates
12. Computation of various Reproduction rates.
13. Construction of Life Tables

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.

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	1	1	1	3
2	2	1	1	4
3	2	1	1	4
4	1	1	1	3
5	2	2	-	4
TOTAL	8	6	4	18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
Department of Mathematics & Statistics
Semester – wise Revised Syllabus under CBCS, 2020-21
Course Code:R20STATA501/R20DSSTATA501
Four-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 6A: **OPERATIONS RESEARCH – I(R20STATA501)**
(Skill Enhancement Course(Elective), 05 Credits
Max. Marks: Theory :100 + Practicals: 50

Objective: The Objective of the paper is to introduce the basic concepts of Operational Research and linear programming to the students.

Learning Outcomes:

After learning this course, the student will be able

1. To know the scope of Operations Research
2. To link the OR techniques with business environment and life sciences
3. To convert real life problems into mathematical models
4. To find a solution to the problem in different cases
5. To inculcate logical thinking to find a solution to the problem

UNIT-I

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

UNIT-II

General linear programming Problem(GLP) – Definition and Matrix form of GLP problem, Slack variable, Surplus variable, unrestricted Variable, Standard form of LPP and Canonical form of LPP. Definitions of Solution, Basic Solution, Degenerate Solution, Basic feasible Solution and Optimum Basic Feasible Solution. Introduction to Simplex method and

Computational procedure of simplex algorithm. Solving LPP by Simplex method (Maximization case and Minimization case)

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Reference Books:

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

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

1. To solve Linear Programming Problem using Graphical Method with
   (i) Unbounded solution
   (ii) Infeasible solution
   (iii) Alternative or multiple solutions.
2. Solution of LPP with simplex method.
3. Problem solving using Charne's M - method.
4. Problem solving using Two Phase method.
5. Illustration of following special cases in LPP using Simplex method

(i) Unrestricted variables
(ii) Unbounded solution
(iii) Infeasible solution
(iv) Alternative or multiple solutions.

6. Problems based on Principle of Duality.
7. Problems based on Dual simplex method.
8. Problems based on Post Optimal Analysis.

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	2	1	1	4
2	2	1	1	4
3	1	1	1	3
4	2	1	1	4
5	1	-	2	3
TOTAL	8	10		18

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
Department of Mathematics & Statistics
Semester – wise Revised Syllabus under CBCS, 2020-21
Course Code:R20STATA502/R20DSSTATA502
Four-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 7A: **OPERATIONS RESEARCH – II(R20STATA502)**
(Skill Enhancement Course(Elective), 05 Credits
Max. Marks: Theory :100 + Practicals: 50

Objective: To enrich the knowledge of students with advanced techniques of linear programming problem along with real life applications.

Learning Outcomes:

After learning this course, the student will be able

1. To solve the problems in logistics
2. To find a solution for the problems having space constraints
3. To minimize the total elapsed time in an industry by efficient allocation of jobs to the suitable persons.
4. To find a solution for an adequate usage of human resources
5. To find the most plausible solutions in industries and agriculture when a random environment exists.

UNIT -I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT –V

GameTheory:Two-personzero-sumgames.PureandMixedstrategies.Maxmin and Minimax Principles - Saddle point and its existence. Games without Saddle point-Mixed strategies. Solution of 2 x 2 rectangular games. Graphical method of solving 2 x n and m x 2 games. Dominance Property. Matrix oddment method for n x n games. Only formulation of Linear Programming Problem for m x n games.

Reference Books:

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

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

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

9. Solution of m x n games by dominance rule.
10. Solution of n x n games by using matrix oddment method.
11. Linear programming method for solving m x n games.

Blue Print

It is mandatory to follow the Blue Print

UNIT	SHORT ANSWERS	LONG ANSWERS		TOTAL
		THEORY	PROBLEMS	
1	2	1	1	4
2	1	1	1	3
3	2	1	1	4
4	2	-	2	4
5	1	-	2	3
TOTAL	8	3	7	18