DEPARTMENT OF MATHEMATICS & STATISTICS

VEERANARI CHAKALI ILAMMA WOMEN'S UNIVERSITY

Koti, Hyderabad – 500095

(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - V)

Paper – V(A) : Applied Statistics - I

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Objectives: To know the importance of Sampling and to learn various design of sample surveys and comparison of their efficiencies.

To Learn the Analysis and uses of Time series, Index numbers, with their applications.

Outcomes: On successful completion of the course students will know the importance of various sampling techniques and learn to use time series data for future trend, importance of index numbers in economy.

UNIT-I

Sample Surveys: Concepts of population, sample, sampling unit, parameter, statistic, sample frame and standard error. Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

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

UNIT-II

Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

(i) Stratified Random Sampling with Proportional and Neyman allocation, and

(ii) Systematic Sampling when N= nk.

Comparison of relative efficiencies. Advantages and disadvantages of SRS, Stratified and Systematic sampling methods.

UNIT-III

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

UNIT-IV

Statistical Quality Control: Importance of SQC in industry. Dimensions of quality, Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np with fixed and varying sample sizes) and their Interpretation. Control charts for attributes (c and u charts with fixed and varying sample sizes) and their Interpretation.

Acceptance sampling plans: Single and Double sampling plans for attributes and their OC and ASN functions

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(Examination at the end of Semester - V)

Practical – 5(A) : Applied Statistics - I

[with 3 HPW, Credits 1 and 50 Marks]

Practical using R – Software and MS – Excel

R – Software : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Running R, Packages in R, Variable names and assignment, Operators, Integers, Factors, Logical operations. Operations of Scalars, Vectors, Lists, Arrays, Matrices, Data Frames. Control structures, Functions.

1. Data Visualization using R - Frequency polygons and curves, Ogives, Histogram using R.
2. Data Visualization using R - Bar diagrams (simple, compound, percentage and multiple) and Pie diagram (single and multiple) using R.
3. Computation of Descriptive Statistics using R (Measures of Central tendencies and Dispersion, Moments, Skewness and Kurtosis) using R.
4. Computation of expected frequencies for Binomial, Poisson, Normal and Exponential distributions using R.
5. Computation of Karl Pearson's coefficient of correlation and rank correlation using R.
6. Computation of partial and multiple correlations using R.
7. Time series Analysis : Computation of Secular trend by least squares and moving averages methods using R and MS-Excel.
8. Computation of Seasonal variations by Ratio to moving averages, Ratio to trend and Link Relatives methods using R and MS-Excel.
9. Construction of control charts for variables ($\bar{x}$, **R** and σ - charts) using R and MS – Excel.
10. Construction of control charts for attributes (p, np with fixed and varying sample size, C and u charts) using R and MS – Excel.

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(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - V)

Paper - V(B) : Analytical Statistics - I

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Objectives: To know the importance of Sampling and to learn various design of sample surveys and comparison of their efficiencies. To Learn the Analysis and uses of Time series. Index numbers, with their applications. To learn analysis of variance and Design of Experiments with the applications and comparison of relative efficiencies.

Outcomes: On successful completion of the course students will know the importance of various sampling techniques and learn to use time series data for future trend, importance of index numbers in economy.

UNIT-I

Sample Surveys : Principal steps in sample surveys, census versus sample surveys, sampling and non- sampling errors, advantages and limitations of sampling.

Sampling Methods: Types of sampling : Subjective, Quota, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean and total, their variances and the estimates of variances in Simple Random Sampling With and Without Replacement, Stratified Random Sampling with Proportional and Neyman optimum allocation and Systematic Sampling when N= nk.

UNIT-II

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

UNIT-III

Statistical Quality Control : Importance of SQC in industry. Dimensions of quality, Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np, c and u- charts with fixed and varying sample sizes). Interpretation of control charts.

UNIT-IV

Analysis of Variance and Design of Experiments : Concept of Gauss-Markov linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell, Statistical analysis, Importance and applications of design of experiments**.** Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square design (LSD) including one missing observation**.**

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(Examination at the end of Semester - V)

Practical – 5(B) : Analytical Statistics – I

[with 3 HPW, Credits 1 and 50 Marks]

Practical using R – Software

R – Software : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Running R, Packages in R, Variable names and assignment, Operators, Integers, Factors, Logical operations. Operations of Scalars, Vectors, Lists, Arrays, Matrices, Data Frames. Control structures, Functions.

1. Data Visualization using R - Frequency polygons and curves, Ogives, Histogram.
2. Data Visualization using R - Bar diagrams (simple, compound, percentage and multiple) and Pie diagram (single and multiple).
3. Computation of Descriptive Statistics using R (Measures of Central tendencies and Dispersion, Moments, Skewness and Kurtosis).
4. Computation of expected frequencies for Binomial, Poisson using R.
5. Computation of expected frequencies of Normal and Exponential distributions using R.
6. Computation of Karl Pearson's coefficient of correlation and rank correlation using R.
7. Computation of partial and multiple correlations using R.
8. Analysis of Variance for one way and two way classified data using R.
9. Analysis of Variance for CRD and RBD two way classified data using R.
10. Time series Analysis : Computation of Secular trend by least squares and moving averages methods using R.
11. Computation of Seasonal variations by Ratio to moving averages, Ratio to trend and Link Relatives methods using R.
12. Construction of control charts for variables ($\bar{x}$, **R** and σ - charts) using R.
13. Construction of control charts for attributes (p, np with fixed and varying sample size, C and u charts) using R.

Reference Books :

1. V.K. Kapoor and S.C. Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. A. M. Goon, M. K. Gupta, B. Das Gupta : Fundamentals of Statistics Vol - II World Press Private Ltd.,Calcutta
3. A. M. Goon, M. K. Gupta, B. Das Gupta : An outline of Statistical Theory Vol – II, World Press Private Ltd.,Calcutta17.
4. Anuvartita Sankhyaka Sastram – Telugu Academy.

Additional References :

5. Arora, Sumeet Arora, S.Arora : Comprehensive Statistical Methods, S. Chand.
6. B. L. Agarwal : Basic Statistics, New Age publications.
7. S. P. Gupta : Statistical Methods. Sultan Chand and Sons.
8. Parimal Mukhopadhyay : Applied Statistics, New Central Book agency.
9. Daroga Singh and Chowdhary : Theory and Analysis of Sample survey designs. Wiley Eastern.
10. M. R. Saluja : Indian Official Statistics. ISI publications.

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(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - V)

Paper – VI - GE : Basic Statistics

[4 HPW :: 4 Credits :: 100 Marks]

Objectives: To learn Basic Statistics that are widely used in any field

Outcomes: Students get the knowledge on various basic Statistical tools and techniques.

UNIT I

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives.

UNIT II

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

UNIT III

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

UNIT IV

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

Reference Books :

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd. PRACTICAL/ LAB WORK

DEPARTMENT OF MATHEMATICS & STATISTICS

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(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - Vi)

Paper - VII(A) : Applied Statistics - II

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Objectives: To learn analysis of variance and Design of Experiments with the applications and comparison of relative efficiencies.

To get the knowledge about Index numbers, Various Vital rates and ratios and their importance.

Outcomes: Will acquire the knowledge on various designs in agronomical data, measuring vital events and importance of Official Statistics.

Unit –I

Analysis of Variance and Design of Experiments : Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell Expectation of various sums of squares, Statistical analysis, Importance and applications of design of experiments.

Unit –II

Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

Unit – III

Vital statistics : Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Unit –IV

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

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

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(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - VI)

Practical – 7(A) : Applied Statistics - II

[with 3 HPW, Credits 1 and Marks 50]

Practical using R – Software and MS – Excel

1. Generation Random Samples from the Uniform, Binomial, Poisson, Normal and Exponential distributions using R.

2. Fitting of straight line, parabola and power curves of the type $y= a\, x^b$, $y=a\, b^x$ and $y=a\ e^{bx}$ using R.

3. Large sample tests : Testing population means, proportions, variances based on single and two samples using R.

4. Parametric Tests : Testing means, variances based on single and two samples using R.

5. Tests based on χ^2 distribution using R.

6. Nonparametric Tests : one sample run test, Sign test and Wilcoxon sign rank test for one and two samples using R.

7. Nonparametric Tests : Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs Test using R.

8. Analysis of Variance for CRD and RBD data using R and MS - Excel.

9. Analysis of Variance for RBD without and with one missing observation using R and MS - Excel.

10. Analysis of Variance for LSD without and with one missing observation using R and MS - Excel.

11. Computation of Morality rates, Fertility rates and Reproduction rates using MS-Excel.

12. Construction of life tables using MS-Excel.

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(w.e.f.2022-23) (With Mathematics Combination)

(Examination at the end of Semester - VI)

Paper - VII(B) : Analytical Statistics - II

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Objectives: To expose into the basic concepts of multivariate data analysis.

To get the knowledge about Various Vital rates and ratios and their importance.

Outcomes: Will acquire the knowledge on Multi variate data techniques, measuring vital events and importance of Official Statistics.

Unit-I

Multivariate Distributions : Introduction, concept of Multivariate, Definitions and Statements of properties of Multinomial and Multivariate Normal Distributions with Real life applications.

Regression Analysis : Definition, procedure of Least square estimation, methods of analysis and interpretation, Simple Linear Regression and Multiple Linear Regression for 'n' variables : estimation of parameters, Lack of fit, Mean Square Error, R^2 and adjusted R^2 values, Testing Regression coefficients.

Logistic Regression : Definition and model assumptions, estimation of parameters, statements of properties for simple and Multiple Logistic regression. Interpretation of the same.

Unit-II

Multivariate Data Analysis Techniques : Definitions, Statements of properties of Principal Component Analysis, Factor Analysis, Cluster analysis and Linear Discriminant Analysis (Bayesian and Fishers approaches), Multidimensional Scaling, Applications and interpretation of above techniques to Image processing / pattern recognition.

Unit-III

Vital Statistics : Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Unit –IV

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

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

Note : In first two Units emphasis will be on concepts and applications of techniques only.

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(w.e.f.2022-23)

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Practical - 7(B) : Analytical Statistics - II

[with 3 HPW, Credits 1 and Marks 50]

Practical using R – Software

1. Generation Random Samples from the Uniform, Binomial, Poisson, Normal and Exponential distributions using R
2. Fitting of straight line, parabola and power curves of the type $y= a x^b$, $y=a b^x$ and $y=a e^{bx}$ using R.
3. Large sample tests : Testing population means, proportions, variances based on single and two samples and tests based on χ^2 distribution using R.
4. Parametric Tests : Testing means, variances based on single and two samples using R.
5. Nonparametric Tests : one sample run test, Sign test and Wilcoxon sign rank test for one and two samples, Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test using R.
6. Principal Component Analysis using R.
7. Factor Analysis using R.
8. Cluster analysis and Linear Discriminant analysis using R.
9. Model fitting by Simple and Multiple Linear Regression methods using R.
10. Model fitting by simple Logistic regression using R.
11. Computation of Morality rates, Fertility rates and Reproduction rates using R.
12. Construction of life tables using R.

Reference Books:

E-Book : https://onlinelibrary.wiley.com/doi/book/10.1002/9781118391686

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. **Multivariate Analysis by Johnson and Wrichon**
3. Pratirupa Sidhanthamulu – Telugu Academy,
4. Prayoga Rachana and Visleshana – Telugu Academy.

Additional References:

5. ParimalMukhopadhyay : Applied Statistics . New Central Book agency.
6. M.R.Saluja : Indian Official Statistics. ISI publications.
7. B.L.Agarwal: Basic Statistics.New Age publications.
8. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

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(w.e.f.2022-23)

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Paper - VIII : Operations Research / Project

[4 HPW :: 4 Credits :: 100 Marks]

Objectives: To know the importance of Operations Research.To frame and solve Linear Programming problem, Transportation problem and Assignment problems, Sequencing problems with their applications.

Outcomes: Students acquire the knowledge to get the optimum results using minimum resources.

Unit –I

Operations Research: Meaning and scope of OR. Convex sets and their properties. Definition of general LPP. Formulation of LPP. Solution of LPP by graphical method. Fundamental theorem of LPP. Simplex algorithm.

Unit –II

Concept of artificial variables. Big –M /Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it. Concept of duality, duality as LPP. Dual Primal relationship.

Unit –III

Definition of transportation problem, TPP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum method and VAM. Optimal solution through MODI tableau and stepping stone method for balanced and unbalanced transportation problem.
Degeneracy in TP and resolving it. Concept of Transshipment problem.

Unit –IV

Formulation and description of Assignment problem and its variations. Assignment problem as special case of TP and LPP. Unbalanced assignment problem, traveling salesman problem. Optimal solution using Hungarian method.
Problem of Sequencing. Optimal sequence of N jobs on two and three machines without passing.

Reference Books:

1. Kanti Swaroop, P. K. Gupta and Man Mohan : Operations Research, Sultan Chand.
2. S. D. Sarma : Operations Research
3. Parikriya Parishodhana - Telugu Academy.

Additional References :

4. Gass : Linear Programming. Mc Graw Hill.
5. Hadly : Linrar programming. Addison-Wesley.
6. Wayne L. Winston : Operations Research. Thomson, India edition. 4^{th} edition.
7. Anuvartita Sankhyaka sastram – Telugu Academy.
8. Taha : Operations Research: An Introduction : Mac Millan.

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PROJECT ASSESSMENT

w.e.f: Academic Year: 2022-23

Time: 3 hours

Distribution of the marks for project evaluation of sixth semester.
The evaluation of the project shall be according to the scheme given below.

Component	Marks
Originality approach/Field work/ Literature survey	25
Report/ Thesis	30
Presentation & Viva	25
Internal Assessment	20

The evaluation of the project shall be done by external examiner according to the scheme given below. There shall be maximum of 12 candidates per batch.

The project/ dissertation duly attested by the supervising teacher and certified by the head of the department, has to be submitted on the day of examination of project. The project/ dissertation shall be prepared in 50- 75 pages as per the format given below.

1. Title page/ Font page (certified by HOD)
2. Declaration by the candidate
3. Certificate attested by the Supervising teacher
4. Acknowledgement, if any
5. Table of content
6. Abbreviation, if any
7. Abstract, Induction & Review of literature
8. Material and methods
9. Results and discussions
10. Conclusions
11. References.