

SRI VENKATESWARA UNIVERSITY
B.A/B.Sc. DEGREE COURSE IN STATISTICS(WM)
SEMESTER SYSTEM WITH CBCS

SEMESTER IV

W.E.F. 2021-2022

Semester – IV (CBCS With Maths Combination Common to B.A./B.Sc)

Paper IV: Sampling Techniques and Designs of Experiments

UNIT-I

Theory Of Sample Survey - Concepts of population, sample, parameters, statistic, sampling distribution standard error. census and sample survey – Differences – sampling and non sampling errors – controlling – steps involved in Large scale sample survey – Limitations of sampling – pilot survey.

UNIT II

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, important theorems and problems.

UNIT III

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. Important theorems and problems.

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. Important theorems and problems.

UNIT IV

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

UNIT V

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

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.

Text Books:

1. Telugu Academy BA/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 Sankhyaka Sastram - Telugu Academy.

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Paper – IV Sampling Techniques and Design of Experiments

Section-A

Answer any **FIVE** questions. Each question carry **FIVE** marks **5X5=25M**

1. Define Simple random sampling with and without replacement
2. Explain about proportional and optimum allocations
3. Mention the properties of systematic sampling
4. Describe the terms treatments , experimental error with examples
5. Give the layout of RBD
6. Distinguish between parameters and statistics.
7. Prove that $V(\text{systematic}) \leq V(\text{Simple})$ iff $S^2(\text{WSY}) \geq S^2$
8. Distinguish among CRD , RBD and LSD

Section - B

Answer all questions and each question carries 10 marks **5X10=50M**

Unit-I

9. a) Describe non sampling and sampling errors? How do you control them.
(OR)
b) Deduce various steps involved in Large scale sample survey?

Unit-II

10. a) Find Variance of Sample mean in SRSWOR
(OR)
b) i) Describe about Random number Tables to draw simple random samples.
ii) A population contains the values 10, -2, 16, -5, 24. Draw a Simple random sample of size 3 without replacement method and show that
(1) Sample mean is an unbiased estimate of population mean and
(2) Sample mean square is an unbiased estimate of population mean square

Unit-III

11. (a) With usual notations prove that $V(\text{opt}) \leq V(\text{prop}) \leq V(\text{ran})$

(OR)

b) With usual notations prove that $V(\text{strat}) \leq V(\text{systematic}) \leq V(\text{simple})$

Unit-IV

12. (a) Define analysis of variance . Give an example mention the assumptions and uses of analysis of variance

(OR)

(b) Describe about analysis of variance of two way classification.

Unit-V

13. a) Deduce the efficiency of RBD over CRD

(OR)

b) How do you estimate single missing observation in LSD

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Credits: 2

Practical's - Paper -IV

Sampling Techniques:

1. Simple random sampling without replacement
2. To show that $E[\bar{y}] = \bar{y}$ and $E(s^2) = S^2$ in SRSWOR method.
3. Simple random sampling with replacement.
4. Variance of sample mean in stratified random sampling.
5. Proportional and optimum allocations.
6. To show that $V(opt) \leq V[prop] \leq V[ran]$

Design of Experiments:

7. ANOVA - one - way classification with equal and unequal number of observations
8. One way classification with unequal repetitions.
9. ANOVA Two-way classification with equal number of observations.
10. Estimation of single missing observation in RBD
11. Estimation of single missing observation in LSD

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.

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,
- 6) use appropriate experimental designs to analyze the experimental data.

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Paper V: Applied Statistics

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

UNIT III

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 IV

Vital Statistics: Introduction, definition and uses of vital statistics, sources of vital statistics, Fertility rates and growth rates.

UNIT V

Mortality Rates- Measures of different Mortality Rates, Life table, Components and relationships, abridged life table, differences between abridged and complete life tables, theorems and problems. Life tables: construction and uses of life tables.

Text Books:

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2. BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.PapaiahSastry.

Reference Books:

1. AnuvarthitaSankyakaSastram - TeluguAcademy.
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

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Paper – V Applied Statistics

Section-A

Answer any **FIVE** questions. Each question carry **FIVE** marks **5X5 = 25**

1. Define Time Series. Also write its Uses.
2. Explain the method of simple averages to determine seasonal variations.
3. Describe about fertility and fecundity?
4. Explain various simple index numbers
5. Explain the Procedure to construct the cost of living index number.
6. Explain Crude Growth Rate and Vital Index.
7. Define Vital Statistics and write its Uses.
8. Define central mortality rate and age specific Mortality Rate.

PART-B

Answer **ALL** questions. Each question carries 8 Marks.

5X10=50M

UNIT-I

9. (a) Explain the method of fitting parabolic trend in time series analysis.
OR

(b) Describe the measurement of seasonal variations by ratio-to-moving average method.

UNIT-II

10. (a) Explain about various components of time series with examples?
OR

(b) Describe about link relatives method to determine seasonal indices.

UNIT-III

11. (a) Explain the Problems involved in the construction of Index numbers
OR

b) Define Index Numbers. Explain various Weighted index numbers.

UNIT-IV

12. (a) Explain various rates of fertility.

OR

(b) Explain different sources of vital statistics.

UNIT-V

13. (a) Describe about various mortality rates?
OR

(b) Define Life table? Mention the uses of Life table? Also explain components and their inter relationships in Life table?

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Credits: 2

Practical Paper –V

Time Series:

1. Trend by odd period Moving Averages Method
2. Trend by even period Moving Averages Method
3. Fitting of Linear Trend
4. Fitting of Parabolic Trend
5. Determination of seasonal indices by method simple averages
6. Determination of seasonal indices by method of Ratio to moving averages
7. Determination of seasonal indices by method of Ratio to trend
8. Determination of seasonal indices by method of Link relatives

Index Numbers:

9. Computation of simple index numbers.
10. Computation of all weighted index numbers.
11. Computation of reversal tests.
12. Cost of Living Index Numbers.

Vital Statistics:

13. Computation of various Mortality rates
14. Computation of various Fertility rates
15. Computation of various Reproduction rates.
16. 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.

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 Average and 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.