

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**III B.Sc. – Statistics / Semester- V (2020-21)**

**Paper-V**

**Course: sampling & design of experiments**

**Total Hrs. of Teaching: 45 @ 3 h / Week**

**Total Credits: 03**

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**Objective:** In the design of experiments, the experimenter is often interested in the effect of some process or intervention (the "treatment") on some objects (the "experimental units"), which may be people, parts of people, groups of people, plants, animals, etc. Design of experiments is thus a discipline that has very broad application across all the natural and social sciences and engineering.

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**Module -1**

**Sampling**

**(12h)**

- a. Concepts of sampling
- b. Principal steps(main steps) in a sample survey
- c. Sampling errors and Non-sampling errors
- d. Principles of sampling
- e. Types of sampling ,Simple random sampling with replacement(SRSWR)
- f. Simple random sampling without replacement(SRSWOR), expected value for population mean, sample variance, variance of sample mean in SRSWR and SRSWOR

**Module - 2**

**Stratified and Systematic Sampling**

**(11h)**

- a. Stratified random sampling, Proportional and Optimum Allocation, variance of sample mean in both allocations
- b. Systematic random sampling
- c. Advantages & disadvantages of systematic & stratified random sampling

**Module - 3**

**Analysis of Variance**

**(11h)**

- a. One way classification. (mathematical model, statistical model & ANOVA table)
- b. Two way classification (mathematical model, statistical model & ANOVA table)
- c. Principles of design of experiments- randomization, replication and local control

**Module - 4**

**Design of Experiments:**

**(11h)**

- a. Completely randomized design(mathematical model, statistical model & ANOVA table)
- b. Randomized block design(mathematical model, statistical model & ANOVA table)
- c. Latin square design(mathematical model, statistical model & ANOVA table)
- d. Advantages &disadvantages of CRD,RBD &LSD

**Additional Input:** Missing plot Technique in RBD and LSD with one missing value  
(not included in examination)

**List of text books:**

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

**List of reference books**

- 1.Parimal Mukhopadhyay : Applied Statistics .New Central Book agency.
2. B.L.Agarwal: Basic Statistics.New Age publications.
- 3.S.C.Gupta : Statistical Methods. Sultan Chand and Sons.
- 4.Pratirupa Sidhanthamulu – Telugu Academy.
5. PrayogaRachana and Visleshana – TeluguAcademy.

**List of Practicals: (3 hrs/week credits:2)****Conduct any SIX (MS-Excel mandatory)**

Estimation of population mean, population total and variance of these estimates by

1. Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.
3. Systematic sampling with  $N=nk$ . Comparison of systematic sampling with Stratified and SRSWOR.
4. ANOVA – one – way classification with equal number of observations
5. ANOVA Two-way classification with equal number of observations.
6. Analysis of CRD.
7. Analysis of RBD and Comparison of relative efficiency of RBD with CRD
8. Analysis of LSD and comparison of relative efficiencies of LSD with RBD and CRD.
9. Practicals 4, 5, 6, 7 using MS-Excel

**Model blue print for the Question Paper setter****V Semester Paper-V Sampling & Design of Experiments****Max. Marks: 60****Time : 2 1/2 Hrs.**

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
<b>Unit - 1</b>			
Sampling	2	2	30
<b>Unit - 2</b>			
Stratified and Systematic sampling	1	2	25
<b>Unit - 3</b>			
Analysis of Variance	2	2	30
<b>Unit - 4</b>			
Design of Experiments	1	2	25
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Total No. of Questions including choice (14)	6	8	--
<b>Total marks allotted to all questions including choice =</b>			<b>110</b>

**Statistics Paper V: Sampling & Design of Experiments**  
**Question Bank**

**SHORT QUESTIONS:**

1. Explain the principles of sampling.
2. Write the difference between sampling versus census.
3. Explain the types in sampling.
4. Explain stratified random sampling.
5. Explain systematic sampling.
6. Write a short note on cost function.
7. Explain ANOVA and its basic assumptions.
8. Write a short note on local control.
9. Write a short note on randomization and replication.
10. Write advantages and disadvantages of CRD.
11. Write advantages and disadvantages of RBD.

**ESSAY QUESTIONS:**

12. Explain the principal steps involved in conducting of sample survey.
13. Explain sampling errors and non sampling errors.
14. Explain SRSWR and SRSWOR.
15. Explain stratified random sampling with proportional and optimum allocation.
16. Show that  $E(s^2) = S^2$
17. Explain one way classification.
18. Explain two way classification.
19. Explain principles of design of experiments.
20. Define CRD and explain the analysis of CRD.
21. Define RBD and explain the layout and analysis of RBD.
22. Define LSD and explain the layout and analysis of LSD.
23. Discuss the efficiency of RBD over CRD and that of LSD over RBD and CRD.
24. Show that  $V(\bar{y}_{opt}) \leq V(\bar{y}_{prop}) \leq V(\bar{y}_{srswor})$

**P.R. Government College (Autonomous), Kakinada**  
**III year B.Sc., Degree Examinations- V Semester**  
**Statistics Paper V: Sampling & Design of Experiments**  
**(Model paper)**

Time: 2 1/2 Hrs.

Max. Marks: 60

**Section – A**

**4x5 = 20 M**

Answer any four of the following questions. Each question carries five marks.

1. What are the errors involved in sample surveys.
2. State briefly the advantages of sampling over complete enumeration.
3. Explain the method of stratified random sampling.
4. List out the basic assumptions involved in ANOVA technique.
5. Write a note on principle of “Randomization”.
6. Write the advantages of C.R.D.

**Section – B**

Answer any two questions.

**2X10=20M**

7. What are the main steps involved in a sample survey. Discuss them briefly.
8. Explain SRSWR and SRSWOR.
9. In simple random sampling without replacement prove that sample mean square is an unbiased estimation of population mean square i.e.  $E(S^2) = \sigma^2$
10. Explain the method of systematic sampling. Discuss the merits and demerits of systematic sampling.

**Section – C**

Answer any two questions.

**2X10=20M**

11. What is meant by two way classification? Give layout and analysis for a two way classification.
12. Explain about ANOVA Technique. Give layout and analysis for a one way classification.
13. What is meant by Randomized Block Design? Give the layout and analysis of a Randomized Block Design. Discuss the advantages and disadvantages of Randomized Block Design.
14. What is Latin Square Design? Give the layout and analysis of a Latin Square Design. Discuss the advantages and disadvantages of Latin Square Design.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**III B.Sc. – statistics / Semester- V ( 2020-21)**

**PAPER-VI**

**Course: Applied Statistics**

**Total Hrs. of Teaching: 45 @ 3 h / Week**

**Total Credits: 03**

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**Objectives:** Statistics is an inductive science in which information is extracted from sample data in order to draw inferences. This most often involves planning experiments to ensure that valid answers to questions are obtained from the sample. Statistics is a subject that deals with the collection and analysis of data and affects most aspects of modern life.

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**Module-1 (12h)**

**Time Series**

- a. Components of Time Series
- b. Importance of Time Series
- c. Measures of Trend
- d. Measures of seasonal trend
- e. Uses of Time Series
- f. Models of Time Series

**Module -2 (11h)**

**Index Numbers**

- a. Steps involved in the construction of index numbers.
- b. Quantity index number
- c. Weighted & Un Weighted index numbers
- d. Criteria of good index number
- e. Cost of living index number
- f. Base Shifting, Splicing, Deflating of index numbers
- g. Uses, importance of index numbers

**Module - 3 (11h)**

**Vital Statistics**

- a. Collection of Vital Statistics
- b. Measures of Mortality
- c. Measures of Fertility.
- d. Measures of Population Growth.
- e. Construction & Uses of life Table.

**Module – 4 (11h)**

**Demand Analysis**

- a. Demand & Supply-Laws of demand & supply-Price Elasticity's of Demand & Supply.
- b. Time Series data
- c. Family budget data
- d. Leonitef's Method for demand & Supply
- e. Pareto's law of income distribution

**Additional Input:** Official Statistics – NSSO & CSO ( not included in examination)

**List of Text Books:**

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

**List of reference books:**

1. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
2. M.R.Saluja : Indian Official Statistics. ISI publications.
3. B.L.Agarwal: Basic Statistics.New Age publications.
4. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

**List of Practicals: (3 hrs/week credits:2)****Conduct any EIGHT (MS-Excel mandatory)**

1. Measurement of trend by methods of Least squares and moving averages
2. Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives
3. Computation of simple and all weighted index numbers.
4. Computation of reversal tests.
5. Construction of cost of living index number and wholesale index number.
6. Construction of fixed base and chain base index numbers.
7. Base shifting, Splicing and Deflation.
8. Computation of various Mortality rates, Fertility rates and Reproduction rates.
9. Construction of Life Tables and Abridged life tables.
10. Construction of Lorenz curve.
11. Fitting of Pareto law to an income data.
12. Practicals 1, 2, 3, 5, 7, 9, 10 using MS Excel.

## V Semester Paper –VI-: Applied Statistics

### Model blue print for the Question Paper setter

Max. marks: 60

Time : 2 1/2 Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
<b>Unit - 1</b>			
Time Series	2	2	30
<b>Unit - 2</b>			
Index Numbers	1	2	25
<b>Unit - 3</b>			
Vital Statistics	2	2	30
<b>Unit - 4</b>			
Demand Analysis	1	2	25
Total No. of Questions including choice (14)	6	8	-
<b>Total marks allotted to all questions including choice =</b>			<b>110</b>

## **Statistics Paper VI: Applied Statistics Question Bank**

### **SHORT QUESTIONS:**

1. Define Time series. Write its uses.
2. Explain the models in time series.
3. Explain irregular variations in Time series.
4. Explain base shifting.
5. Explain splicing & deflating.
6. Write the uses of index numbers.
7. Explain NRR.
8. Explain GRR.
9. Write the uses of life table.
10. Explain the terms-registration method & survey method.
11. Explain laws of demand & supply.
12. Explain price elasticity's of demand & supply.

### **ESSAY QUESTIONS:**

13. Explain components of time series.
14. Explain trend in time series and explain different methods to measure trend..
15. Explain link relative method to measure seasonal variations..
16. Explain the method of ratio to moving averages to measure seasonal variations.
17. Explain the steps involved in construction of index numbers.
18. Explain weighted price index numbers.
19. Explain criteria of good index number.
20. Explain various components of life table.
21. Explain measures of mortality rate.
22. Explain measures of fertility rate.
23. Explain Leinoteif's method.
24. Explain family budget data in demand analysis.
25. Explain Pareto's law of income distribution.



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**III year B.Sc., Degree Examinations V Semester**  
**Statistics Paper VI: Applied Statistics**  
**(Model paper)**

Time: 2 1/2 Hrs.

Max. Marks: 60

**Section – A**

**4x5 = 20 M**

Answer any **four** of the following questions. Each question carries **five** marks.

1. Explain the method of moving averages in time series data.
2. Explain cyclical component of a time series.
3. What is meant by base shifting.
4. Write the uses of life table.
5. Explain about Net Reproduction Rate.
6. Write about price elasticity of demand.

**Section – B**

**2x10 = 20 M**

Answer **any two** questions

7. What are the measurement of seasonal variation. Discuss briefly about the difference types of measurement of seasonal variation.
8. Describe the methods of Trend. Discuss briefly about the measures different types of Trend.
9. What are the Problems or steps involved in the construction of Index Numbers?
10. Explain about the Criteria for Good Index Number?

**Section – C**

**2x10 = 20 M**

Answer **any two** questions

11. Explain (i) General Fertility Rate. (ii) Specific Fertility Rate. (iii) Total Fertility Rate.
12. State the meanings of various columns of a life table and mention the construction of a life table. Explain the relationship between different columns.
13. Describe demand and supply curves and the uses of these curves.
14. Explain Pareto's law of income distribution.