

Reg. No. : .....

Name : .....

**VI Semester B.Sc. Degree (CBCSS – OBE – Regular) Examination, April 2022  
(2019 Admission)  
CORE COURSE IN STATISTICS  
6B12STA-Sampling Techniques and Design of Experiments**

Time : 3 Hours

Max. Marks : 48

**PART – A  
(Short Answer)**

Answer **all** questions. **Each** question carries **1** mark.

1. Define population and sample with an example.
2. In SRSWOR, find the probability that  $i^{\text{th}}$  unit in the population of size  $N$  is included in the sample of size  $n$ .
3. What is sampling error ?
4. Write the mathematical model used in the analysis of variance in a two way classification.
5. Write any two conditions under which stratified sampling is more suitable than simple random sampling.
6. Name any two method of allocating sample size in different strata in stratified random sampling.

**PART – B  
(Short Essay)**

Answer **any seven** questions. **Each** question carries **2** marks.

7. Define the terms :  
i) Replication  
ii) Precision.
8. Show that sample mean  $\bar{y}$  is an unbiased estimator  $\bar{Y}$  in a SRSWR.
9. What are the advantages of sampling over complete enumeration ?
10. Find  $V(\bar{y}_{\text{sys}})$  under systematic sampling.

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11. Explain the procedure of selecting stratified random sample.
12. Write any two advantages of systematic sampling.
13. Find the gain in precision under stratified sampling over simple random sampling.
14. Explain the systematic sampling and state the circumstances when it is optimum.
15. State the basic assumptions in an ANOVA.

**PART – C  
(Essay)**

Answer **any four** questions. **Each** question carries **4** marks.

16. Show that the sample mean  $\bar{y}$  is more efficient estimator in SRSWOR than SRSWR.
17. Prove that  $E(s^2) = S^2$ .
18. Explain the statistical analysis of CRD.
19. What is the relative efficiency of systematic sampling over stratified sampling ?
20. What are the advantages of stratified random sampling ?
21. What is meant by Randomized block design ?

**PART – D  
(Long Essay)**

Answer **any two** questions. **Each** question carries **6** marks.

22. Suggest an unbiased estimate of population mean  $\bar{Y}$  under stratified sampling and obtain the expression for its variance under :  
1) Proportional allocation.  
2) Optimum allocation.
23. Show that under simple random sampling  $\text{Cov}(\hat{X}, \hat{Y}) = \frac{N^2(N-n)}{Nn} S_{xy}$ ,  
where  $\hat{X} = \frac{N}{n} \sum_{i=1}^n x_i$ ,  $\hat{Y} = \frac{N}{n} \sum_{i=1}^n y_i$  and  $S_{xy} = \frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X})(Y_i - \bar{Y})$ .
24. Explain in detail, the principles of experimental design.
25. How is the efficiency of a design is measured ? By stating the assumptions, Derive the expression to measure the efficiency of Latin square design over a randomized block design.