

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2299

L

Unique Paper Code : 2372573601

Name of the Paper : DSC: Survey Sampling

Name of the Course : **B.A./B.Sc. (P)**

Semester : VI (NEP)

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any **Five** questions from the remaining.
4. Use of a non-programmable scientific calculator is allowed.

1. (a) Attempt any three (2 marks each) :

- (i) Distinguish between sampling error and non-sampling error.
- (ii) Differentiate between random and non-random sampling, giving one practical example of each.
- (iii) Define stratified sampling and state one condition under which it is more efficient than SRS.
- (iv) Define sampling interval (k) in systematic sampling and explain how it is used in sample selection.

P.T.O.

(b) Attempt any **three** (3 marks each) :

- (i) Describe the main steps of a sample survey and explain the importance of the sampling frame in this process.
- (ii) Distinguish between SRSWR and SRSWOR, and comment on which is more efficient and why.
- (iii) A sample of 40 students is to be drawn from a population consisting of 450 students, as given below :

	Total number of students	Mean	Standard Deviation
College A	200	30	10
College B	250	60	40

Draw a sample from each college using proportional and Neyman allocations.

- (iv) Discuss the advantages of systematic sampling and explain one situation where it may give biased results.
2. (a) Define Simple Random Sampling Without Replacement (SRSWOR). Consider a population consisting of the values 2, 4, 6, and 8. Draw all possible samples of size 2 without replacement (SRSWOR). Hence, show that the sample mean is an unbiased estimator of the population mean.
- (b) Show that in SRSWOR,

$$Var(\bar{y}_n) = \left(\frac{N-n}{nN} \right) S^2$$

Where the symbols have their usual meanings.

- (c) In simple random sampling without replacement, find the probability that (i) i^{th} unit of the population is included in the sample, (ii) i^{th} and j^{th} ($i \neq j$) units of the population are included in the sample. (5,7,3)
3. (a) Comment on the statement: "Stratified random sampling is more efficient than simple random sampling without replacement (SRSWOR)."
- (b) A population of size 500 is divided into four strata with sizes 100, 150, 200, and 50. The corresponding stratum means are 20, 25, 30, and 35, and the stratum variances are 20, 15, 10, and 30.
- (i) Obtain the overall population mean.
- (ii) Obtain the population mean square and obtain the variance of the sample mean under proportional allocation. (7,8)
4. (a) Show that :

$$\text{Var}(\bar{y}_{\text{sys}}) = \frac{N-1}{N} S^2 - \frac{(n-1)k}{N} S_{\text{wsy}}^2$$

Where $S_{\text{wsy}}^2 = \frac{1}{k(n-1)} \sum_{i=1}^k \sum_{j=1}^n (y_{ij} - \bar{y}_i)^2$ is the mean square among units that lie within the same systematic sample.

- (b) Consider a population consisting of the first 30 natural numbers arranged in order. A systematic sample of size 10 is drawn using a random start. Show that the sample mean is an unbiased estimator of the population mean.
- (c) Discuss the advantages and limitations of systematic sampling. (5,5,5)
5. (a) For a population with a linear trend, show that $V(\bar{y}_{\text{sys}}) \leq V(\bar{y}_n)_{\text{SRS}}$. (Notations have their usual meaning).
- (b) Show that in a stratified random sampling, the Neyman allocation is more efficient than the proportional allocation. (7,8)

6. (a) Determine the sample size in SRSWOR when the coefficient of variation is given.
- (b) What are the practical difficulties in the application of stratified random sampling?
- (c) Establish the result which justifies the statement "The larger the variability within the stratum, the larger should be the size of the sample from that stratum". (7,3,5)
7. (a) What are the advantages of a sample survey over a census survey?
- (b) Discuss the structure and functions of MOSPI, NSSO, and CSO in India. (7,8)