



Registration Number:
Date & session:

ST. JOSEPH'S UNIVERSITY, BENGALURU -27
M. Sc (STATISTICS) – I SEMESTER
SEMESTER EXAMINATION: OCTOBER 2023
 (Examination conducted in December 2022)

ST 7321 – SAMPLING THEORY AND STATISTICS FOR NATIONAL DEVELOPMENT

Time: 2 Hours

Max Marks: 50

This paper contains ONE printed page and ONE part.

I Answer any FIVE of the following

10 X 5 = 50

1. A) Give the procedure of drawing a systematic sample of size n from a population of size N.

Show that $V(\bar{y})_{sys} = \frac{N-1}{N} S^2 - \frac{n-1}{n} S_{sy}^2$.

B) Show that $E(s^2) = \begin{cases} \sigma^2 & \text{under SRSWR} \\ S^2 & \text{under SRSWOR} \end{cases}$ (5+5)

2. A) Derive an expression for sample size under cost optimum allocation, if the cost function is $C = C_0 + \sum_{i=1}^n C_i n_i$ where C_0 is overhead cost and C_i is cost per unit in the i^{th} stratum.

B) Describe the procedure of drawing a probability proportional to size (PPS) sampling scheme.

C) Prove that $\sum_{i=1}^N \pi_i = n$, $\sum_{i=1}^N \sum_{j \neq i=1}^N \pi_{ij} = n(n-1)$ with usual notations under Horvitz – Thompson estimator. (4+3+3)

3. A) Show that $\hat{Y} = \frac{\bar{y}}{\bar{x}} X$ is an unbiased estimator for population total under Sen – Midzuno sampling scheme. Derive an unbiased estimator for $V(\hat{Y})$ under the same sampling scheme.

B) Show that $\widehat{Y}_{TS} = \frac{N}{n} \sum_{i=1}^n M_i \bar{y}_i$ is an unbiased estimator for population total under two-stage sampling. Also derive its sampling variance. (5+5)

4. A) Explain cluster sampling with unequal size with example. Derive the Bias and Mean Square Error for mean of cluster mean. Give an unbiased estimator for population mean. Justify.

B) Show that regression estimator is more efficient than ratio estimator. (7+3)

5. A) Show that cluster sampling is effective if clusters are arranged so that variation within a cluster is as large as possible while variation between clusters is as small as possible.

B) Describe double sampling in ratio method of estimation. Derive the mean square error of the ratio estimator under double sampling. (3+7)

6. A) Derive bias and mean square error under regression method of estimator.

B) Distinguish between Cluster sampling and Stratified sampling. (6+4)

7. A) Outline the various methods used to measure inequality in income.

B) Describe Warner's model for randomized response techniques. (5+5)
