



Registration Number:

Date & session:

ST. JOSEPH'S UNIVERSITY, BENGALURU -27

M. Sc. (STATISTICS) – I SEMESTER

SEMESTER EXAMINATION: OCTOBER 2022

(Examination conducted in December 2022)

ST 7321 – SAMPLING THEORY AND STATISTICS FOR NATIONAL DEVELOPMENT

Time: 2 Hours

Max Marks: 50

This paper contains TWO printed pages and ONE part

I Answer any FIVE of the following

10 X 5 = 50

1. A) Prove that under simple random sampling without replacement (SRSWOR) sample mean square (s^2) is an unbiased estimator for population mean square (S^2).
 B) Give the procedure of selecting a random sample under systematic sample scheme.
 C) Show that $V(\bar{y})_{prop} \leq V(\bar{y})_{SRS}$ with usual notations. (4+2+4)

2. A) Mention the two procedures of selecting a random sample whenever the units vary in size. Explain any one method.
 B) Show that Lahiri's method ensures the required probability under Probability Proportional to Size (PPS) scheme.
 C) Prove that the sampling variance of Hansen – Hurwitz estimator of population total is given by $V_{PPS}(\hat{Y}_{HH}) = \frac{1}{n} \left[\sum_{i=1}^N \left(\frac{Y_i^2}{p_i} \right) - Y^2 \right]$. (3+3+4)

3. A) Prove that under Horvitz – Thompson estimator $\sum_{i=1}^N \pi_i = n$ and $\sum_{i \neq j=1}^N \pi_{ij} = n\pi_i$
 B) Derive the sampling variance of Horvitz – Thompson estimator.
 C) Show that an unbiased estimator of population total under Sen – Midzuno sampling scheme is $\hat{Y} = \frac{\bar{y}}{\bar{x}} X$ (3+5+2)

4. A) Obtain standard error of unbiased estimator of population mean under cluster sample with equal size and discuss on efficiency of cluster sampling compared with simple random sampling.
 B) Describe two stage sampling. Derive the $V(\bar{y})$ under two stage sampling when units at each stage are selected with SRSWOR. (5+5)

5. A) Explain regression method of estimator. Derive variance under SRSWOR, for regression method.
 B) Derive bias and mean square error under ratio method of estimator. (5+5)



6. A) Describe double sampling in ratio method of estimation. Derive the mean square error of the ratio estimator under double sampling.
- B) Describe cluster sampling. Obtain unbiased estimator of the population mean in cluster sampling (6+4)
7. A) Write a note on Warner's model for randomized response techniques.
- B) Write a note on population growth models.
- C) Mention different approaches of estimation of national income. (4+4+2)
