FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2023
(Regular/Improvement/Supplementary)

STATISTICS
FMST1C04- SAMPLING THEORY

Time: 3 Hours   **Maximum Weightage: 30**

Part A: Answer any *four* questions. Each carries *two* weightage.

1. Explain the probability sampling and non-probability sampling with the help of examples.
2. What is Multi-Phase Sampling? Why it is differed from Multistage Sampling?
3. Explain Murthy's unordered estimator.
4. Explain circular systematic sampling with the help of an example.
5. What are the different types of regression estimators in stratified random sampling?
6. If the regression on Y on X is perfectly linear, the variance of the regression estimator becomes zero. Is it true? Prove.
7. Obtain the mean and its variance in equal cluster sampling.

$$(4 \times 2 = 8 \text{ weightage})$$

Part B: Answer any *four* questions. Each carries *three* weightage.

8. a) Write a note on ratio estimator.
   b) Prove that in ratio estimation $B(\hat{R}) = -Cov(\hat{R}, \bar{x})/\bar{X}$
9. Give an unbiased estimator of population proportion in SRSWOR.
10. What are the principal steps in sampling?
11. Give any three estimators of population mean in cluster sampling where clusters are of unequal size and discuss their properties.
12. Carry out a comparison between the mean per unit and ratio estimator with regression estimator.
13. Differentiate between Cumulative Total Method and Lahiri's method. Explain them with the help of an example.
14. Show that $\text{Var}(\overline{y_{sys}}) = \frac{N-1}{Nn}(1 + (n-1)\rho)S^2$, where ρ is the interclass correlation between the units of the same systematic sample.

$$(4 \times 3 = 12 \text{ weightage})$$

Part C: Answer any *two* questions. Each carries *five* weightage.

15. Explain the methods of allocation in stratified sampling and find efficiency of variances.
16. Differentiate between linear and circular systematic sampling. Explain them with the help of examples. Also explain linear and periodic trends in systematic sampling.
17. a) In two stage sampling with equal first stage units, derive the mean and variance.
    b) Obtain an unbiased estimate of population mean in simple random sampling without replacement. Find the variance of the estimate.
18. a) Prove that in PPS sampling without replacement, Desraj ordered estimator is unbiased for population total. Derive its sampling variance.
    b) Explain the general selection procedure in PPS sampling.

$$(2 \times 5 = 10 \text{ weightage})$$