M. Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2021
[2021 Admissions Regular and 2020 Admissions Improvement & Supplementary]
SEMESTER I - CORE COURSE (APPLIED STATISTICS AND DATA ANALYTICS)
ST1C04TM - SAMPLING THEORY

Time : 3 Hours   **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight   **(8x1=8)**

1.   Define random number table method of selection of simple random sample.

2.   Briefly explain the principles of sample survey.

3.   Explain lottery method of selection of simple random sample.

4.   Explain the advantages of stratification.

5.   What is meant by circular systematic sampling?

6.   Define Harley – Ross ratio type estimator. Give its significance.

7.   Explain Double sampling and area sampling.

8.   Define Desraj estimator.

9.   Explain Lahiri's method under PPS.

10. What is inclusion probability?

Part B

II. Answer any Six questions. Each question carries 2 weight   **(6x2=12)**

11. Explain the terms random sampling and non-random sampling, what are their advantages and
     disadvantages?

12. Distinguish between census and sampling. Discuss their merits and demerits.

13. Explain relative precision. Find the expression for relative precision of optimum allocation over SRS.

14. Compare Stratified random sampling with SRSWOR.

15.
     What is difference estimator? Show that $V(\bar{y_D}) = \dfrac{N-n}{Nn}\left(S_y^2 + k^2 S_x^2 - 2k\rho S_y S_x\right)$.

16. Carry out a comparison between cluster sampling and SRS.

17. The following table give the number of houses and the area under paddy in 12 villages in West Bengal. Draw
     a PPS with replacement sample of 4 villages using the number of houses as sizes.

Village No.	1	2	3	4	5	6	7	8	9	10	11	12
No. of houses	15	21	109	51	42	7	11	23	12	21	28	32

18. Estimate the total production in the 8 orchards and the SE using the H-T estimator for the following data.

Orchard	1	2	3	4	5	6	7	8
No. of trees	35	20	44	26	40	25	30	50
Yield	40	22	50	30	44	30	35	60

Part C

III. Answer any Two questions. Each question carries 5 weight   **(2x5=10)**

19. (a) Explain the method of estimation of the population proportion or percentage. (b) Show that p is an
     unbiased estimate of P when the sample is selected with SRSWR and SRSWOR. (c) Find an estimate for the

variance of the population proportion if the sample is selected using SRSWR scheme.

20. Explain Neyman allocation.

21. Define cluster sampling, obtain the expression for the variance of the estimator for the population mean. Discuss the relative efficiency of cluster sampling over SRS.

22. (a) Explain Harwitz- Thompson estimator, when it is used and its drawbacks.

(b) Show that in PPSWOR, $\hat{Y}_{H-T}$ is an unbiased estimate of the population total Y and its sampling variance is given by,

$$V\left(\hat{Y}_{H-T}\right) = \sum_{i=1}^{N}\left(\frac{1-\pi_i}{\pi_i}\right)y_i^2 + \sum_{i=1}^{N}\sum_{j=1i\neq j}^{N}\left(\frac{\pi_{ij}-\pi_i\pi_j}{\pi_i\pi_j}\right)y_iy_j.$$