

M.Sc. Examination, 2019
Semester-II
Statistics
Course : MSC-23
(Sample Survey)

Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer **any four** questions

1. Given an unbiased estimator t of the population total y , based on a sample s drawn according to a design p , describe the procedure for constructing an estimator having smaller variance than that of t . 10
2. 'Instead of applying PPSWR directly to draw samples from a population, if we classify the observations through SRSWOR and then select one unit from each group by PPSWR; there will be gain in the efficiency' – justify. 10
3. Show that the variance (v) of the unbiased estimator of the population mean under double sampling for stratification, satisfies the relationship

$$n' \left(v + \frac{S^2}{N} \right) = \left(S^2 - \sum_{h=1}^k W_h S_h^2 \right) + \sum_{k=1}^k \frac{W_h S_h^2}{v_n},$$

where the symbols have their usual meanings. In this context, describe the optimal sizes of the first and the second phase samples, for a specified cost. 10

4. a) What is the utility of using randomized response technique? 4
- b) Explain how will you estimate the proportion of people in West Bengal belonging to different political parties by unrelated questionnaire method, where the unrelated question has multiple answers. 6
5. a) Find the expectation and variance of the effective size of a PPSWR sample s of size n . you need to prove the necessary results. 5
- b) Explain Lahiri's method for collecting a PPS sample. Prove that the sample obtained by this method is actually a PPS sample. 2+3=5
6. a) Define HLUE. Prove that among the class of HLUES, no one exists with uniformly minimum variance for any usual design. 2+6=8
- b) Distinguish between an informative and a non-informative design. 2
7. a) Define Horvitz-Thompson's estimator for the population total. Find its variance and express it in Sen, Yates and Grundy's form. 2+2+4=8
- b) Define Murthy's estimator for population total. 2