

**B.Sc. (Honours) Examination, 2018**  
**Semester-V**  
**Statistics**  
**Course : BSC-53**  
**(Sample Survey)**

**Time : 3 Hours**

**Full Marks : 40**

Questions are of value as indicated in the margin

Answer **any four** questions

1. a) Compare the advantages and disadvantages of cluster sampling, two-stage sampling and stratified sampling.  
b) Find the optimal size of first stage and second stage units selected for minimizing the variance of the estimator of population total in two – stage sampling. 4+6=10
2. a) ‘Systematic sampling is a mixed sampling scheme’ - explain.  
b) Discuss the problem of estimation of the variance of the unbiased estimator of population total in systematic sampling. How can you solve the problem? 3+(2+5)=10
3. a) The units in a population are allocated to two strata with  $\frac{N_1}{N_2} = d$  and  $\frac{\sigma_1}{\sigma_2} = \lambda$ . In WOR sampling from within strata for estimating the population total, let  $V_e$  be the variance when the administratively convenient equal allocation ( $n_1 = n_2 = \frac{n}{2}$ ) is used and  $V_0$  be the variance when the optimal allocation is used. Show that  
$$\frac{V_e - V_0}{V_0} = \left( \frac{1 - \lambda d}{1 + \lambda d} \right)^2$$
  
b) Discuss about the use of auxiliary information in estimating the population total and its advantages. 5+5=10
4. a) Define ratio estimator of population total. Find approximate expressions for the bias and MSE of the estimator.  
b) In this context, suggest a ratio-type estimator which is unbiased for the population total. 6+4=10
5. a) What do you mean by double sampling?  
b) Define regression estimator for double sampling and its approximate MSE.  
c) Compare its performance with the regression estimator for single – phase sampling. 2+5+3=10
6. a) A Simple random sample of size  $n = n_1 + n_2$  with mean  $\bar{y}$  is drawn from a finite population and a simple random subsample of size  $n_1$  is drawn from it with mean  $\bar{y}_1$ . Show that

P.T.O.

(2)

$$\text{i) } \text{Var}(\bar{y}_1 - \bar{y}_2) = S_y^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)$$

$$\text{ii) } \text{Var}(\bar{y}_1 - \bar{y}) = S_y^2 \left( \frac{1}{n_1} - \frac{1}{n} \right)$$

$$\text{iii) } \text{Cov}(\bar{y}, \bar{y}_1 - \bar{y}) = 0,$$

where  $S_y^2$  is the population variance and  $\bar{y}_2$  is the mean of the remaining  $n_2$  units in the sample.

- b) Mention some advantages of using random number tables. 6+4=10
7. a) Discuss about the basic principles of sample survey.
- b) What are the different sources of non-sampling error? 5+5=10
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