

**2022**  
**B.A./B.Sc.**  
**Third Semester**  
CORE – 6  
**STATISTICS**  
*Course Code: STC 3.21*  
(Survey Sampling & Indian Official Statistics)

Total Mark: 70

Pass Mark: 28

Time: 3 hours

Answer five questions, taking one from each unit.

**UNIT-I**

1. (a) Write the correct answers: 1×2=2
- (i) Precision of an estimate can be increased
- (A) by increasing the population size  
(B) by increasing the sample size  
(C) by decreasing the population size  
(D) by decreasing the sample size
- (ii) The ratio of the sample size to the population size is known as
- (A) sampling frame                      (B) sampling error  
(C) sampling fraction                      (D) sampling unit
- (b) Distinguish between census survey and sample survey. Discuss the advantages of sample survey over census survey. 2+4=6
- (c) Show that in SRSWOR, the sample mean square is an unbiased estimate of the population mean square. 6
2. (a) Write the correct answers: 1×2=2
- (i) Sampling error can be decreased by
- (A) increasing the sample size  
(B) increasing the population size  
(C) reducing the population size  
(D) reducing the sample size

(ii) The finite population correction factor (fpc) is given by

(A)  $\frac{n}{N}$

(B)  $\left(1 - \frac{n}{N}\right)$

(C)  $\left(\frac{n}{N} - 1\right)$

(D)  $\left(\frac{N-n}{n}\right)$

(b) Discuss about the basic principles of sample survey. 6

(c) Define simple random sampling. Show that in case of SRSWOR, the variance of the estimate of the population mean i.e  $V(\bar{x}_n)$  is given by

$$V(\bar{x}_n) = (1 - f) \frac{S^2}{n} \quad 2+4=6$$

### UNIT-II

3. (a) Write the correct answers: 1×2=2

(i) Stratified sampling is used when

(A) population is uniform

(B) population is homogenous

(C) population is heterogenous

(D) population is unique

(ii) In stratified sampling, population is divided into

(A) a number of strata

(B) a number of subpopulation

(C) a number of blocks

(D) Both (A) and (B)

(b) Define stratified random sampling. Write down the advantages of stratified sampling. 2+5=7

(c) Show that in case of systematic sampling

$$V(\bar{x}_{sys}) = \frac{nk-1}{nk} \cdot \frac{S^2}{n} \{1 + (n-1)\rho\}$$

where  $\rho$  is the intraclass correlation coefficient between units of the same systematic sample. 5

4. (a) Write the correct answers: 1×2=2

(i) The relation  $n_i = \frac{n}{N} N_i$  comes under

(A) Neyman allocation

(B) optimum allocation

(C) proportional allocation

(D) equal allocation

- (ii) Systematic sampling is also known as  
 (A) mixed sampling (B) convenience sampling  
 (C) purposive sampling (D) judgement sampling
- (b) With the usual notations and symbols, ignoring fpc, prove that  

$$V(\bar{x}_{st})_{opt} \leq V(\bar{x}_{st})_{prop} \leq V(\bar{x}_{st})_{Ran}$$
 7
- (c) Show that in case of systematic sampling  $S^2_{wsy} > S^2$ . 5

### UNIT-III

5. (a) Write the correct answers: 1×2=2
- (i) Under ratio method of estimation, estimates obtained are  
 (A) biased (B) unbiased  
 (C) complete (D) incomplete
- (ii) In ratio and regression method of estimation, observation are taken on  
 (A) one variable only  
 (B) two variables only  
 (C) variable under study and auxiliary variable  
 (D) three variables only
- (b) Show that in SRS the large sample variance of the regression estimator  $V(\bar{y}_d) = V(\bar{y}) + \beta^2 V(\bar{x}) - 2\beta Cov(\bar{y}, \bar{x})$  6
- (c) What do you mean by cluster sampling? Explain its advantages. 2+4=6
6. (a) Write the correct answers: 1×2=2
- (i) Ratio and regression method can be used in  
 (A) SRSWR (B) SWSWOR  
 (C) Stratified random sampling  
 (D) any sampling scheme
- (ii) The limit distribution of ratio estimate is \_\_\_ as  $m$  becomes very large.  
 (A) binomial (B) Poisson  
 (C) normal (D) uniform
- (b) Define ratio estimate. Show that in SRSWOR, of size  $n$  (large  $n$ )  

$$V(\hat{\bar{y}}_R) = \frac{(1-f)}{n} \{ S^2_y - 2R\rho S_x S_y + R^2 S^2_x \}$$
 2+5=7

(c) Show that in cluster sampling

$$V(\bar{y}_{n0}) = \left(1 - \frac{1}{NM}\right) \left(\frac{N-n}{N-1}\right) \frac{S^2}{nM} \{1 + (M-1)\rho\}$$

where  $\rho$  is the intracluster correlation coefficient.

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#### UNIT-IV

7. (a) What do you mean by probability proportional to size (PPS) sampling? Show that in PPS sampling with replacement (WR) an unbiased estimator of the population mean is given by:

$$\hat{Y}_{PPS} = \frac{1}{nN} \sum_{i=1}^n \frac{y_i}{p_i} \text{ with its sampling variance given by}$$

$$V\left(\hat{Y}_{PPS}\right) = \frac{1}{n} \sum_{i=1}^n p_i \left(\frac{y_i}{Np_i} - \bar{Y}\right)^2 \quad 2+6=8$$

(b) Write a note on two stage sampling. 6

8. (a) What is the basic difference between PPS sampling and simple random sampling? 3
- (b) Describe cumulative total method and Lahiri's method of PPS sampling. 6
- (c) Write a note on multistage sampling. 5

#### UNIT-V

9. (a) Write short notes on the following: 4×2=8
- (i) Central Statistical Office (CSO)
- (ii) Industrial statistics
- (b) Explain in brief about gross domestic product (GDP) and NNP. 3+3=6
10. (a) What are the methods of collecting Indian official statistics? Explain briefly each of them mentioning their reliability and limitations. 2+6=8
- (b) Write short notes on the following: 3×2=6
- (i) Role of Ministry of Statistics and Program Implementation (MOSPI)
- (ii) National Sample Survey Office (NSSO)