Seat No. : _____

ND-106

December-2015

B.Sc., Sem.-V

Core Course-303 : Statistics
(Sampling Techniques)

Time : 3 Hours] **[Max. Marks : 70**

1. (a) What is Simple Random Sampling ? Explain the procedure of drawing a Simple Random Sample. Distinguish between SRSWR and SRSWOR. **7**

OR

For simple random sampling without replacement show that

(i) $\bar{y}$ is an unbiased estimate of $\bar{Y}$.

(ii) $V(\bar{y}) = \frac{N - n}{N} \cdot \frac{S^2}{n}$.

(b) Prove that in Simple Random Sampling without replacement s^2 is an unbiased estimate of population variance S^2. Also show that in SRS without replacement the variance of $\bar{y}$ is less than the variance of $\bar{y}$ in case of sampling with replacement. **7**

OR

Give the notations and terminology for simple random sampling for proportion and also prove that the sample proportion p is an unbiased estimate of the population proportion P.

2. (a) Explain the method of drawing a sample in stratified random sampling. Derive the expression for the unbiased estimator of the population mean in the case of stratified sampling. Also find the variance of this estimator. **7**

OR

If in the stratified random sampling cost C is constant, then in usual notations prove that $V(\bar{y}_{st})$ is minimum when n_h is proportional to $\frac{N_h S_h}{\sqrt{C_h}}$.

(b) If finite population correction is ignored, then with usual notations prove that : **7**

$$V_{opt}(\bar{y}_{st}) \leq V_{prop}(\bar{y}_{st}) \leq V_{ran}(\bar{y})$$

OR

If finite population correction is not ignored, then prove that :

$$V_{ran} = V_{prop} + \frac{N-n}{nN(N-1)} [\Sigma_{h=1}^{L} N_h(\bar{Y}_h - \bar{y})^2 - \frac{1}{N} \Sigma_{h=1}^{L} (N - N_h)S_h^2]$$

3. (a) Describe systematic sampling technique and state its advantages and disadvantages. **7**

OR

"Positive correlation between units in the same sample inflates the variance of the sample mean in systematic sampling." Obtain a formula to justify this statement.

(b) Derive the formula for variance of systematic sample mean and hence find the condition in which systematic sampling is more accurate than simple random sampling. **7**

OR

(i) If N= nk, show that $\bar{y}_{sy}$ is an unbiased estimator of the population mean.

(ii) If N = 1000, n = 12, S^2 = 50 and $\rho = \frac{1}{11}$, then obtain the efficiency of systematic random sampling with respect to simple random sampling.

4. (a) For the Two-stage sampling scheme, in usual notations prove that **7**

(i) $E(t) = E_1 E_2 (t)$

(ii) $V(t) = V_1 (E_2(t)) + E_1 (V_2 (t))$

OR

Discuss Two-stage sampling scheme and also describe a situation where it can be used.

(b) State advantages and disadvantages of Two-stage sampling in detail and in usual notations prove that $E(s_1^2) = S_1^2 - \frac{S_2^2}{M} + \frac{S_2^2}{m}$. **7**

OR

For Two-stage sampling, derive :

$$V(\bar{\bar{y}}) = \left(\frac{1 - f_1}{n}\right) S_1^2 + \left(\frac{1 - f_2}{m}\right) \frac{S_2^2}{n}$$

5. Write answers in brief : **14**

(i) Define a cost function used in Two-stage sampling.

(ii) Define f. p. c. and sampling function.

(iii) Give any two merits and demerits of systematic sampling.

(iv) Why systematic sampling is a particular case of cluster sampling ?

(v) Out of the two methods of SRSWR and SRSWOR which is better ? Why ?

(vi) Define allocation of the sample size and state their types.

(vii) Give any two merits and demerits of Stratified Sampling.