PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION MAY 2024
(Fourth Semester)
Branch – **STATISTICS**

BASIC SAMPLING THEORY

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 Which of the following is a sampling error?
(i) Faulty selection of sample (ii) Response error
(iii) Prestige bias (iv) Interviewer bias

2 When Simple random sampling is very effective if
(i) The population is not very large
(ii) The population is not heterogenous
(iii) The population is parttioned in to several sections
(iv) Both (i) and (ii)

3 When strata is a ---
(i) Non homogenous subgroup of a population (ii) Sample of the population
(iii) Homogenous sub group of population (iv) None of the above

4 What is the formula for the sampling interval k?
(i) N/n (ii) n/N
(iii) 1/N (iv) 1/n

5 Ratio method of estimation is not applicable when regression line is passing
(i) Not through the origin (ii) through the origin
(iii) through Y-axis (iv) through X-axis

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Explain the terms (i) Sampling distribution and (ii) Standard error. Also explain the uses of standard error.

OR

b Explain the limitations of sampling.

7 a Prove that the probability of selecting a specified unit of population at any given draw is equal to the probability of its being selected at the first draw in simple random sampling.

OR

b State the drawbacks of simple random sampling.

8 a Show that $Var(\bar{y}_{st}) = \frac{1}{N^2}\sum_{i=1}^{k} N_i(N_i - n_i)\frac{{S_i}^2}{n_i}$

OR

b State the principal advantages of stratified random sampling.

9 a Compare the sample variance of simple random sample and systematic sampling.

OR

b Show that systematic sampling would be more efficient as compared with srswor if $\rho < \frac{1}{nk-1}$

10 a Define ratio estimator and explain its properties.

OR

b Prove that $V\left(\hat{\bar{Y}}_R\right) = \frac{(1-f)}{n}\sum_{i=1}^{n}\frac{(y_i - Rx_i)^2}{N-1}$

Cont...

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a Highlight the principal steps in a sampling survey.

OR

b Examine non sampling errors with examples.

12 a In SRSWOR, prove that $Var(\bar{y}_n) = \left(\frac{1}{n} - \frac{1}{N}\right) S^2$.

OR

b Explain the different methods of selecting a simple random sample.

13 a. Show that greater the difference in the stratum, greater is the gain in precision of stratified random sampling with proportional allocation over simple random sampling.

OR

b Show that $var(\bar{y}_{st})_{Ney} = \frac{1}{n}(\sum_{i=1}^{k} p_i S_i)^2 - \frac{1}{N}\sum_{i=1}^{k} p_i {S_i}^2$

14 a If the population has a linear trend prove that
$Var(\bar{y}_{st}) \leq Var(\bar{y}_{sys}) \leq Var(\overline{y_n})_R$

OR

b Show that $Var(\bar{y}_{sys}) = \frac{N-1}{N} S^2 - \frac{k(n-1)}{N} {S^2}_{wsy}$.

15 a Show that $V(\bar{y}_{lr}) = \frac{1-f}{n} {S_y}^2 (1 - \rho^2)$

OR

b. Show that $V(\bar{y}_{lr}) = \frac{1-f}{n}[S_y^2 - 2b_0 S_{yx} + {b_0}^2 {S_x}^2]$

Z-Z-Z END