PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2025
(First Semester)

Branch - **STATISTICS**

SAMPLING THEORY

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	To estimate the average work experience of MBA students at a management institute, five students are selected at random from each type of background, say commerce, science and engineering. This type of sampling is called _____ a. Systematic sampling b. Stratified sampling c. Simple random sampling d. Cluster sampling	K1	CO1
	2	What is the goal of optimum allocation in stratified random sampling for proportion? a. To minimize the number of strata b. To maximize the number of samples within each stratum c. To allocate samples to strata to minimize the variance of the estimator d. To ensure each stratum is of equal size	K2	CO1
2	3	In systematic sampling, how are sample elements selected from the population? a. Using a specific interval b. Randomly c. According to their magnitude d. In an ordered sequence	K1	CO2
	4	In systematic sampling in two dimensions, if every 5th element is selected along one dimension and every 3rd element along the other dimension, how many elements are selected in the sample? a. 8 elements b. 15 elements c. 12 elements d. 10 elements	K2	CO2
3	5	What does "varying probability" refer to in varying probability cluster sampling? a. Each cluster is equally likely to be selected. b. Different clusters have different probabilities of being selected c. The probability of selection remains constant throughout the sampling process. d. Probability is not considered in this sampling method.	K1	CO3
	6	In unequal cluster sampling, what can cause a reduction in relative efficiency? a. Increasing the variability of cluster sizes. b. Reducing the number of clusters sampled. c. Selecting larger clusters with high probabilities. d. Using a systematic sampling method.	K2	CO3
4	7	In two-stage PPS sampling, what does "PPS" stand for? a. Population Proportion Sampling b. Proportional Population Sampling c. Probability Proportional to Size d. Primary Probability Selection	K1	CO4
	8	Population has N primary stage units and M secondary stage units, then population variance among 2nd stage units with primary stage units is identified by _____. a. $\frac{\Sigma\Sigma(y_{ij}-\bar{y}_i)^2}{N(M-1)}$ b. $\frac{\Sigma\Sigma(y_{ij}-\bar{Y}_i)^2}{N(M-1)}$ c. $\frac{\Sigma\Sigma(y_{ij}-\bar{Y}_i)^2}{M(N-1)}$ d. $\frac{\Sigma\Sigma(y_{ij}-\bar{y}_i)^2}{M(N-1)}$	K2	CO4

Cont...

5	9	What is the formula for calculating the ratio estimator for the population mean? a. Population Mean = Sample Mean × Ratio b. Population Mean = Sample Mean / Ratio c. Population Mean = Ratio / Sample Mean d. Population Mean = Sample Size × Ratio	K1	CO5
	10	In survey sampling, what is the primary purpose of a regression estimator? a. To estimate the population variance. b. To determine the sample size. c. To predict population parameters based on a linear relationship d. To select a random sample.	K2	CO5

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the relative precision of stratified random and simple random sampling.	K4	CO1
		(OR)		
	11.b.	Discuss in detail about the differences and practical uses of proportional and optimum allocation in sampling techniques.		
2	12.a.	Explain systematic and stratified sampling. Show that there is only a casual resemblance between them.	K3	CO2
		(OR)		
	12.b.	State and prove the sampling variance of systematic sample mean.		
3	13.a.	Explain equal cluster sampling with an example. Show that $V(\bar{Y}_{no}) = \frac{(1-f)}{n} S_b^2$. Where notations have their usual meaning.	K3	CO3
		(OR)		
	13.b.	Define cluster sampling with equal and unequal cluster sizes with suitable real-life examples.		
4	14.a.	Compare two and three-stage sampling and state a real-life example for both.	K2	CO4
		(OR)		
	14.b.	Derive the variance of the estimated mean in two-stage sampling.		
5	15.a.	What is an auxiliary variable? Explain its use in ratio estimator.	K4	CO5
		(OR)		
	15.b.	Define regression estimator. Compare it with that of ratio estimator and simple unbiased estimator.		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Show that $V(\bar{Y}_{st})$ is minimum in stratified random sampling with the given cost function of the form $C = a + \sum_{i=1}^{n} C_i n_i$ if n_i is proportional to $\frac{N_i S_i}{\sqrt{C_i}}$.	K3	CO1
2	17	Explain systematic sampling with an example. Derive the variance of the sample mean in it.	K3	CO2
3	18	Derive the variance of the unbiased estimator for population mean per element in cluster sampling in terms of intra-cluster correlation.	K4	CO3
4	19	Obtain the variance of the estimated mean in two stage PPS sampling.	K4	CO4
5	20	Define the ratio method of estimation. Define the bias of the ratio estimator. State the practical utility of the ratio estimator.	K4	CO5

Z-Z-Z END