**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**B.Sc. STATISTICS – V SEMESTER**

**SEMESTER EXAMINATION: OCTOBER 2021**

**(Examination conducted in March 2022)**

**ST - 5118: Sampling Theory and Designs of Experiment**

**Time: 2½ Hours Max: 70 Marks**

*This question paper contains* ***Two*** *printed pages and* ***Three*** *parts*

**PART A**

**I Answer any FIVE from the following 3 x 5 = 15**

1. Define (i) Population (ii) Sampling frame (iii) Precision
2. Show that sample mean is an unbiased estimator of population if the sampling scheme is systematic sampling.
3. Obtain the confidence interval for population proportion
4. What are the basic ideas behind stratified sampling?
5. Stating the assumptions, give the model for one way ANOVA
6. Write a short note on Tuckey’s test
7. What is confounding in factorial experiment? Identify the confounded effect for the below given block

|  |  |  |  |
| --- | --- | --- | --- |
| abc | ab | c | 1 |
| a | b | ac | bc |

**PART B**

**II Answer any FIVE from the following 7 x 5 = 35**

1. A) What are the Qualities of a Good Questionnaire? Explain

B) Compare sampling errors and nonsampling errors (4+3)

1. A) How do you select simple random sample using random numbers?

B) Show that the element selection probability in sample under simple random sampling is 1/N (3+4)

1. A) What is stratified random sampling? How do you select sample using stratified random sampling scheme?

B) Obtain an unbiased estimator for population mean if we use cluster sampling as our sampling scheme. Assume that all clusters have equal size (4+3)

1. Explain the basic principles of designs of experiment? How these are implemented in randomized block design (7)
2. Outline the analysis of Latin square design (7)
3. A) Define Main effect and interaction effect in 22 factorial experiments

B) Explain the Yates method of finding sum of squares in factorial experiments (2+5)

1. A) Identify the appropriate sampling scheme in following conditions and Justify
	* 1. A situation where a research team is seeking opinions about religion amongst various age groups
		2. The police set up checkpoints at randomly selected road locations, then inspected every driver at those locations.
		3. A school chooses 3 randomly selected athletes from each of its sports teams to participate in a survey about athletics at the school.

B) What is the need for ANOVA (5+2)

**PART C**

**III Answer any TWO from the following 10 x 2 = 20**

1. A) Show that E(s2) = S2 under simple random sampling without replacement

B) Distinguish between simple random sampling with replacement (SRSWR) and simple random sampling without replacement (SRSWOR). Show that SRSWOR is more efficient than SRSWR (5+5)

1. A) Write a short note on different types of allocations in stratified random sampling

B) Show that $Var\left(\overbar{y}\right)\_{srs}\geq Var\left(\overbar{y}\right)\_{Prop}\geq Var\left(\overbar{y}\right)\_{Ney} $ (3+7)

1. A) Derive the least square estimators of parameters of completely randomized test

B) Explain the analysis of two way ANOVA (4+6)