

**M. SC. (APPLIED STATISTICS)
(MSCAST)**

Term-End Examination

December, 2024

**MST-013 : SURVEY SAMPLING AND DESIGN OF
EXPERIMENTS—I**

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining question nos. 2 to 6.*

(iii) *Use of scientific calculator(non-programmable) is allowed.*

(iv) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers :

$$5 \times 2 = 10$$

- (a) The total number of all possible samples of size 2 without replacement from a population of size 7 is 21.

- (b) The selection of cricket team for the World Cup is an example of Simple Random Sampling.
 - (c) In one-way ANOVA, the amount of total variation that is unexplained is measured by the treatment sum of squares.
 - (d) If there are two missing values in a randomised block design with 3 blocks and 4 treatments, the error degrees of freedom will be 4.
 - (e) When population size N is multiple of sample size n , circular systematic sampling is appropriate to use.
2. In a population of size $N = 5$, the values of the population units are 1, 3, 5, 7 and 9. Draw all possible samples of size 2 with SRSWOR. Verify that the sample mean is an unbiased estimate of the population mean. Also calculate the variance of the sample mean. 10
3. The data given below pertain to the total geographical area in 20 villages of a block. Treating this as population of 20 units, stratify this population into three strata taking stratum sizes to be villages with geographical area (i) 50 hectares (ha) or less, (ii) between 60 and 100 ha. and (iii) more than 100 ha. A random sample of 6 villages is to be selected by taking 2 villages from each stratum.

Geographical Area (in ha.) of 20 villages are :

20, 80, 50, 100, 150, 70, 20, 250, 220, 10, 50, 140, 80, 20, 50, 30, 70, 90, 100, 220.

Compute the variances of sample mean for stratified random sampling and compare with that of simple random sampling without replacement. 10

4. A researcher wants to test four diets A, B, C, D on growth rate in mice. These animals are divided into 3 groups according to their weights. Heaviest 4, next 4 and lightest 4 are put in Block I, Block II and Block III, respectively. Within each block, one of the diets is given at random to the animals. After 15 days, increase in weight is noted, which is given in the following table :

Blocks	Treatments/Diets			
	A	B	C	D
I	12	08	06	05
II	15	12	09	06
III	14	10	08	05

Perform a two-way ANOVA to test whether the data indicate any significant difference between the four diets as well as between the blocks. 10

[You may use $F_{(2, 6)} = 7.26$ and $F_{(3, 6)} = 6.60$]

5. Identify the design given in the following table and carry out the analysis :

Column Row	I	II	III	IV
I	A 8	C 18	B 11	D 8
II	C 16	B 10	D 7	A 4
III	B 12	D 10	A 6	C 20
IV	D 10	A 9	C 28	B 16

[You may use value of $F_{(3, 6)} = 6.60$ at 5% level of significance.]

10

6. (a) Differentiate between probability and non-probability sampling schemes. Also define any *two* probability sampling schemes and any *two* non-probability sampling schemes.

5

- (b) Describe the layout of the Completely Randomised Design and explain analysis of CRD using *one* example.

5

× × × × × × ×