



Seat No. _____

H-003-2016051

B. Sc. (Sem. VI) (W.E.F. 2019) Examination

April - 2023

Statistics : Paper - 601

(Design of Experiments & Sampling Techniques)

Faculty Code : 003

Subject Code : 2016051

Time : $2\frac{1}{2}$ Hours / Total Marks : 70

- Instructions :**
- (1) All the five questions are compulsory.
 - (2) Each question carries 14 marks.
 - (3) Students can carry their own scientific calculator.
 - (4) Graphs and Log table should be provided to students on demand.

1 (a) Give the answer of following questions : 4

- (1) An experimental design is _____.
- (2) The factors like spacing, date of sowing and breeds are often used as : _____.
- (3) Randomization in an experiment helps to eliminate _____.
- (4) Local control is a device to maintain _____ within blocks.

(b) Write any **one** : 2

- (1) Define ANOVA.
- (2) Statement of Cochran's theorem.

(c) Write any **one** : 3

- (1) The three samples below have been obtained from the normal population with equal variance. Test the hypothesis at 5% level that population means are equal.

x_1	20	21	23	16	20
x_2	18	20	17	25	15
x_3	25	28	22	28	32

- (2) Explain Analysis of one way classification.

- (d) Write any **one** : 5
- (1) Explain the Analysis of two way classification.
 - (2) Analyse the following information by two way classification.

		Workers		
		W ₁	W ₂	W ₃
	M ₁	8	28	6
Machine	M ₂	32	36	38
	M ₃	20	38	14

- 2 (a) Give the answer of following questions : 4
- (1) Each contrast has _____ degree of freedom (d.f.).
 - (2) A Latin square design is a _____ two way classification scheme.
 - (3) If there are t treatments and m blocks in a randomized block design, the error degrees of freedom in ANOVA table be _____.
 - (4) A completely randomized design is used when all experimental units are _____.
- (b) Write any **one** : 2
- (1) Define RBD.
 - (2) Write ANOVA table of LSD.
- (c) Write any **one** : 3
- (1) Write advantages of C.R.D.
 - (2) Explain estimation of one missing plot in R.B.D.
- (d) Write any **one** : 5
- (1) Define LSD and analyse it.
 - (2) Analyse two missing treatments in RBD with same block or different block.
- 3 (a) Give the answer of following questions : 4
- (1) An experiment involving two or more factors at various levels is called a _____ experiment.
 - (2) The linear combination $-3T_1 - T_2 + T_3 + 3T_4$ of four treatments is a _____.
 - (3) An experiment involving 5 levels of nitrogen, 4 levels of phosphorous and 3 levels of potash is _____ factorial experiment.
 - (4) If A and B are two factors each at 2 levels, the simple effect of A at the first level of B is _____.
- (b) Write any **one** : 2
- (1) Define Factorial experiment.
 - (2) Define main effect in factorial experiment.

- (c) Write any **one** : 3
- (1) Define efficiency and compare efficiency of RBD over CRD.
 - (2) Write the set of orthogonal contrasts for main effects and interaction effect in 2^2 factorial experiment.
- (d) Write any **one** : 5
- (1) Yate's Method for 2^3 -experiment.
 - (2) Write the Yate's method for a 2^2 -experiment.
- 4 (a) Give the answer of following questions : 4
- (1) A population consisting of an unlimited number of units is called an _____ population.
 - (2) The errors other than sampling errors are termed as _____.
 - (3) Formula for standard error of sample mean \bar{x} based on a sample of size n and with stand deviation s is _____.
 - (4) The probability of selection of any one sample out of $\binom{N}{n}$ sample is _____.
- (b) Write any **one** : 2
- (1) Prove that $E(\bar{y}) = \bar{Y}$.
 - (2) A random sample of 100 units is taken without replacement from a population of 1000 units. The population variance 480 Find the variance of sample mean.
- (c) Write any **one** : 3
- (1) Explain meaning of Non-sampling error.
 - (2) For simple random sample without replacement prove that $V(\bar{y}) = \left(\frac{N-n}{N}\right) \frac{S^2}{n}$.
- (d) Write any **one** : 5
- (1) For studying the characteristics the observation of a population are 3, 9, 12, 36. How many random samples of size 3, without replacement can be taken from it? Make a list of all the samples and verify the following results?
 - (i) $E(\bar{y}) = \bar{Y}$ (ii) $V(\bar{y}) = \frac{N-n}{N} \frac{S^2}{n}$
 - (iii) $E(s^2) = S^2$

- (2) Explain in brief Non-probability sampling method. Also show that Cluster sampling is an area sampling.

5 (a) Give the answer of following questions : 4

- (1) Stratified sampling is not preferred when the population is _____.
- (2) When the population consists of units arranged in a sequence and deck, one would prefer _____.
- (3) In stratified random sampling, the variance of \bar{x}_{st} for fixed total size of sample is minimum if n_j is proportional to _____.
- (4) With varying cost C_j per unit in stratified random sampling, the variance of \bar{x}_{st} attains the smallest value if n_j is proportional to _____.

(b) Write any **one** : 2

- (1) Find the population mean and variance of stratified sample mean from the given data :

$$N_1 = 600, N_2 = 800, n_1 = 60, n_2 = 80, \bar{Y}_1 = 52, \bar{Y}_2 = 60,$$

$$S_1^2 = 200, S_2^2 = 400$$

- (2) From the following data find $V(\bar{y}_{st})$ under optimum allocation 10% stratified sample is to be taken

Stratum	N_h	S_h
I	400	10
II	200	8
III	400	6

(c) Write any **one** : 3

- (1) Write the difference between Simple Random Sampling technique and Stratified Random Sampling Technique.

- (2) Prove that $V(\bar{y}_{sys}) = \frac{N-1}{N} \frac{S^2}{n} [1 + (n-1)\rho]$.

(d) Write any **one** : 5

- (1) Explain Concept of complete enumeration and sample survey.

- (2) If the population consists of a linear trend then prove that $V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y}_n)_{ran}$