BBF-003-1016051   Seat No. _____

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2016) Examination

July - 2021

Statistics : Paper - 601

(Design of Experiment & Sampling Technique)

Faculty Code : 003

Subject Code : 1016051

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions : (1)   All question carry equal marks.

(2)   Attempt any five question from 10.

(3)   Scientific calculator is allowed.

(4)   Stastical table and graph paper will be provided by Institution.

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

(1)   The plan of an experiment which controls all factors as far as possible expect the treatment in known as _____.

(2)   A subject receiving a treatment in an experiment is called _____.

(3)   Replication provide a valid estimate of _____.

(4)   _____ was the founder of Design of Experiment.

(b)   Explain Replication.   2

(c)   Explain analysis of One way classification.   3

(d)   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.   5

x_1	25	30	36	38	31
x_2	31	39	38	42	35
x_3	24	30	28	25	28

2 (a) Give the answer of following question :   **4**

        (1) The average performance of a treatment is better reflected through _____.

        (2) Greater homogeneity within the block in an experiment is better maintained through _____.

        (3) _____ variation is not controlled by us.

        (4) _____ was the founder of this control chart methods.

    (b) Explain Replication.   **2**

    (c) Explain analysis of Two way classification.   **3**

    (d) Analysis the following information b two way classification.   **5**

Variety of Wheat	Plot Number			
	1	2	3	4
A	10	15	7	12
B	12	20	10	16
C	14	7	9	10
D	8	16	20	8

3 (a) Give the answer of following question :   **4**

        (1) A completely randomized design is used when all experimental units are _____.

        (2) Each treatment occurs _____ in a block of randomized complete block design.

        (3) In completely randomized design _____ principle is not used.

        (4) A Latin Square Design control _____ heterogeneity.

    (b) State Advantage and Disadvantage of CRD.   **2**

    (c) Explain one missing plot of RBD.   **3**

    (d) Explain analysis of CRD.   **5**

4 (a) Give the answer of following question : **4**

    (1) If there are t treatments and m blocks in a randomized block design, the error degrees of freedom in ANOVA table be $(t-1)$ $(m-1)$.

    (2) A Latin square design is a balanced two way classification scheme.

    (3) Each row and each column is a _____ in a Latin Square Design.

    (4) If total no. of treatments is 7 then total plots in LSD is _____.

  (b) Write notes on ANOVA of LSD. **2**

  (c) Write analysis of RBD. **3**

  (d) Explain one missing in CRD. **5**

5 (a) Give the answer of following question : **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) A factorial experiment, with equal number of levels of all factors, is called a _____ factorial experiment.

    (4) In a 2n factorial, the contrast for main effects and interactions are _____ to each other.

  (b) Define complete Confounding. **2**

  (c) Write notes on factorial experiments. **3**

  (d) Write the Yate's method for a 2^2 – experiment. **5**

6 (a) Give the answer of following question :   4

    (1) An experiment involving 5 levels of nitrogen, 4 levels of phosphorous and 3 level of potash is _____ factorial experiment.

    (2) If A and B are two factors each at 2 levels, the simple effect of A at the first level of B is _____.

    (3) In factorial experiments, one estimates _____ and _____ effects.

    (4) If the same effect is not confounded in all the replications, it is known as _____.

  (b) Define main effect in effect in factorial experiment.   2

  (c) Explain Interaction effect.   3

  (d) Write the set of orthogonal contrasts for main effects and interaction effect in 2^2 factorial experiments.   5

7 (a) Give the answer of following question :   4

    (1) The list of all the items of a population is known as _____.

    (2) The errors other than sampling errors are termed as _____.

    (3) If the numbers of units in a population are limited, it is known as _____ population.

    (4) The process of obtain sample from population is known as _____.

  (b) Write notes on Non Sampling error.   2

  (c) Explain Simple Random Sampling Method.   3

  (d) The observation of population are 10, 12, 20, 22, 26. Taking all possible samples of size 2 without replacement verify the result (i) $E(\bar{y}) = \bar{Y}$ (ii) $V(\bar{y}) = \left(\dfrac{N-n}{N}\right)\dfrac{S^2}{n}$ (iii) $E(s^2) = S^2$.   5

8 (a) Give the answer of following question :   4

        (1) The probability of selection of any one sample out of $\binom{N}{n}$ sample is _____.

        (2) Simple random sampling is useful when population is _____.

        (3) For taking sample, _____ methods used in simple random sampling.

        (4) When population is heterogeneous, _____ method used for taking sample.

    (b) Write merits of Stratified random sampling method.   2

    (c) For simple random sample without replacement   3

      prove that $V(\bar{y}) = \left(\dfrac{N-n}{N}\right)\dfrac{S^2}{n}$.

    (d) Prove that $V(\bar{y}_{st}) = \dfrac{1}{N}\left[\sum_{h=1}^{L} N_h (N_h - n_h)\dfrac{S_h^2}{n_h}\right]$.   5

9 (a) Give the answer of following question :   4

        (1) If $N = 100$, $n = 10$, $N_1 = 30$ then according proportional allocation $n_1 = $ _____.

        (2) In stratified random sampling, the variance of $\bar{x}_{st}$ for fixed total size of sample is minimum if n_j is proportional to _____.

        (3) Variance of stratified sample mean under _____ allocation is least as compared to proportional allocation.

        (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) Prove that stratified sample mean is an unbiased **2**
estimator of Population Mean.

(c) A population is divided into three strata, following **3**
information is obtained.

Stratum	No. of Units in the Stratum	Stratum Mean	Stratum Variance
1	60	8	12
2	30	6	10
3	10	9	4.5

If a stratified random sample is obtained by taking
respectively 10,6,3 units from the strata. Find the
variance of the stratified mean. Find the population
mean.

(d) In Stratified random sampling with given cost **5**

function of the form $C = a + \sum_{i=1}^{k} C_i n_j$, $V\left(\bar{y}_{st}\right)$

is minimum if $n_i \alpha \dfrac{N_i S_i}{\sqrt{C_i}}$.

10 (a) Give the answer of following question : **4**

(1) In Systematic sampling ratio of N to n is _____ .

(2) When the population consists of units arranged in
a sequence and deck, one would prefer _____ .

(3) When the population size N is a multiple of
sample size n, _____ Systematic sampling
appropriate.

(4) When the population size N is not divisible by the
sample size n, _____ Systematic sampling
appropriate.

(b) Write notes on Systematic random sampling. **2**

(c) From the following data find $V\left(\overline{y}_{st}\right)$ under optimum   **3**

allocation 10% stratified sample is to be taken.

Stratum	N_h	S_h
I	200	10
II	100	8
III	200	6

(d) If the population consists of a linear trend then   **5**

prove that $V\left(\overline{y}_{st}\right) \leq V\left(\overline{y}_{sys}\right) \leq V\left(\overline{y}_n\right)_{ran}$.