

Total number of printed pages-7

3 (Sem-6/CBCS) STA HC 1

2022

**STATISTICS**

(Honours)

Paper : STA-HC-6016

**(Design of Experiments)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer **any seven** of the following as directed :  $1 \times 7 = 7$

(a) \_\_\_\_\_ is the simplest design making use of all the three basic principles of design. (Fill in the blank)

(b) The error degrees of freedom in a  $m \times m$  L.S.D. is \_\_\_\_\_. (Fill in the blank)

Contd.

- (c) The error d.f. in an RBD with 4 blocks comparing 6 treatments is \_\_\_\_\_.  
(Fill in the blank)
- (d) The error d.f. for a  $p \times p$  L.S.D. with one missing observation is \_\_\_\_\_.  
(Fill in the blank)
- (e) In a split plot design \_\_\_\_\_ effect is confounded.  
(Fill in the blank)
- (f) In the linear model considered in analysis of variance the error term is distributed as \_\_\_\_\_.  
(Fill in the blank)
- (g) In a  $2^4$  factorial experiment with the four factors  $A, B, C, D$ , each at two levels, the interaction effects  $ABC$  and  $ABD$  is confounded. Name the other factor which is also confounded.
- (h) Define the term 'contract'.
- (i) Write down the main effects and interaction effects for a  $3^2$  design with two factors  $A$  and  $B$  each at three levels 0, 1, 2.
- (j) The concept of confounding is not deliberately introduced in a factorial experiment. (State True or False)

2. Answer **any four** questions from the following : 2×4=8

(a) Give the layout of a  $4 \times 4$  Latin square design.

(b) Explain why there cannot be a  $2 \times 2$  L.S.D.

(c) Write a note on the assumptions made in a linear model in analysis of variance.

(d) Explain the use of local control in Latin square design.

(e) In a  $5 \times 5$  LSD, the following results were obtained :

Row mean square = 11.66

Column mean square = 3.5

Treatment mean square = 49.15

Total sums of square = 285.34

Complete the ANOVA table.

(f) A  $2^3$  experiment was conducted with three factors  $N$ ,  $P$  and  $k$ , each at two levels. The central blocks for the replications are

$np, npk, (1), k$

$(1), npk, nk, p$

$pk, nk, (1), np$

respectively. Find the effect confounded in each replication.

(g) Define balanced incomplete block design.

(h) What do you mean by the term 'efficiency' in a design of experiment?

3. Answer **any three** questions from the following : 5×3=15

(a) Obtain the estimate of the missing plot in a randomised block design.

(b) What is confounding in a factorial experiment? Explain the difference between complete and partial confounding in case of a  $2^4$  factorial experiment.

(c) Write a note on the advantages and disadvantages of confounding.

- (d) Obtain a balanced confounded  $2^4$  design in a number of replications having four blocks in each.
- (e) Write an introductory note on balanced incomplete block design.
- (f) What is factorial experiment? What are the advantages of a factorial experiment over single factor experiment?
- (g) Describe the layout of a  $2^3$  experiment where the 2nd order interaction is confounded in all the four replications. Give the structure of the AOV table in this case.
- (h) What is a split plot design? Why is it said that in a split plot design main effect is unfounded?

4. Answer **any three** questions from the following : 10×3=30

- (a) Give the outline of the analysis of variance of a randomised block design. Obtain the expression for standard error of the difference between two treatment means, when one of them has a missing observation in a randomised block design.

- (b) Discuss the analysis of a Latin square design.
- (c) The elements of control block of each of six replications of a  $2^4$  design are (1),  $ab$ ,  $acd$ ,  $bcd$ . Identify the confounding subgroup and give an outline of the analysis of the data obtained from the experiment.
- (d) In a  $2^3$  factorial experiment conducted with three factors  $A$ ,  $B$ ,  $C$ , each at two levels, all the interactions effects are confounded in one of the four replications. Give an outline of the analysis of the data.
- (e) Describe the layout and give an outline of the analysis of a split plot design.
- (f) Find the standard error of the difference between two treatments mean when one of them has a missing observation in a Latin square design. Also write the expression of standard error when there is no missing observation under any of the treatments.

- (g) (i) Write a note on uniformity trials. 5
- (ii) Give an idea of  $3^2$  factorial experiment. 5
- (h) Discuss briefly **any two** of the following:
- (i) Basic principles of design of experiment.
- (ii) Bio-arrays
- (iii) Relative efficiency of LSD and RBD
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