Total number of printed pages–7

3 (Sem–6/CBCS) STA HC 1

2025

STATISTICS

(Honours Core)

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 the following as directed : 1×7=7

(a) Replications provide a valid estimate of _____. *(Fill in the blank)*

(b) If σ_1^2 is the error variance of design-1 and σ_2^2 of design-2 utilizing the same experiment material, the efficiency of design 1 over 2 is—

(i) $\frac{1}{\sigma_1^2} / \frac{1}{\sigma_2^2}$

(ii) $\frac{1}{\sigma_2^2} / \frac{1}{\sigma_1^2}$

(iii) σ_1^2 / σ_2^2

(iv) None of the above

(Choose the correct option)

(c) Give the name of the design in which the main effect is confounded.

(d) _____ is the design where principle of local control is not used.

(Fill in the blank)

(e) What will be error d.f. in a RBD to compare 5 treatments in 4 blocks, having one missing observation ?

(f) The maximum possible number of orthogonal contrasts among four treatments is—

(i) four

(ii) three

(iii) two

(iv) one

(Choose the correct option)

(g) What will be the total number of factorial effects in 2^n factorial experiment ?

2. Answer the following questions : 2×4=8

(a) Write a note on the assumptions made in a linear model in Analysis of Variance.

(b) In a 4×4 LSD, the following results were obtained :

RMS = 87, CMS = 52, TMS = 457

Total SS = 1943

Complete the ANOVA table

(c) In a partially confounded 2^3-factorial experiment, the control blocks of two replications are given below :

(i)

(1)	*a*	*bc*	*abc*

(ii)

(1)	*b*	*ac*	*abc*

Identify the confounded effects and write down the other blocks of the replications.

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

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

(a) Discuss the types of model and their underlying assumptions that are associated with the Analysis of Variance (AOV) technique.

(b) What is factorial experiment ? What is its advantage over single factor experiment ?

(c) What is a split-plot design ? State main advantages and disadvantages of splitplot design.

(d) Six treatments were tested in an R.B.D with 4 blocks and the following sum of squares were detained. Analyse the design and interpret the results. Given $F_{0.05}(3,15) = 5.42$ and $F_{0.05}(5, 15) = 4.5$

Treatment SS = 901.19

Block SS = 219.43

Total SS = 1350.26

(e) Describe the layout of a 2^3-experiment where all the interactions are partially confounded. Give the structure of the AOV table in this case.

4. Answer the following questions: 10×3=30

(a) Starting with a linear mathematical model, give the complete analysis of a two-way classified data.

Or

(b) Obtain the formula for estimating a single missing value of a $p \times p$ Latin square design and give the AOV table.

(c) Suppose in a 2^4-design, the effects ABC and ABD are confounded. Write down the contents of the control block. Taking four such replications, discuss the analysis of such a design.

Or

(d) What is balanced incomplete block design (BIBD) with parameters v, b, r, k, λ ?

(i) When is a BIBD called symmetric ?

(ii) For a resolvable BIBD, show that $b \geq v + r - 1$.

(e) Derive the expression to measure the efficiency of LSD over a RBD when—

(i) rows are used as blocks.

(ii) columns are used as blocks.

Or

(f) Discuss the necessity of confounding in a factorial design. How does partial confounding differ from complete confounding ? Give your answer with suitable illustrations.

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