LMDQ/M-24   **7512**

LINEAR ESTIMATION AND DESIGN OF EXPERIMENTS
ST-402

Time : Three Hours]   [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Develop the procedure to test the general linear hypothesis based on a linear model, stating clearly the assumptions.

  (b) Explain,what do you mean by Gauss-Markov Theorem ?

  (c) Explain the following :

    (i) Experimental error

    (ii) Precision

    (iii) Efficiency of a design.

  (d) What are the advantages and disadvantages of confounding ?

  (e) Prove the relation $vr = bk$ for a BIBD (v, b, r, k, λ).

                                   3×5=15

Unit I

2. Consider three independent random variables with y_1, y_2 and y_3 having common variance σ^2 and $E(y_1) = 2\mu_1 + 3\mu_2$, $E(y_2) = 3\mu_1 + 4\mu_2$, $E(y_3) = 4\mu_1 + 5\mu_2$. Show that μ_1 and μ_2 are estimable. Also, find their best linear unbiased estimate. **15**

3. Define the general linear model with all the standard assumptions. For the model, define an estimable parametric function. In the usual notations prove that a linear parametric function $\lambda'\beta$ is estimable if and only if Rank$(X') =$ Rank (X'/λ'). **15**

Unit II

4. Define a latin square design (LSD). Discuss its applications and give its complete analysis. How would one evaluate efficiency of LSD over CRD ? **15**

5. Define with suitable examples, the following terms used in block designs : **4+4+4+3=15**

   (i) C-matrix of a design

   (ii) Criteria of orthogonality of block designs

   (iii) Balancing in block design

   (iv) General block designs.

Unit III

6. In 2^3 factorial experiment suppose there are three replicates each divided into 2 blocks of 4 units each. How will you confound ABC in first replication, AC in second replication and BC in third replication, and how the results of confounded factorial design can be analysed ? **15**

7. Explain the layout of a split plot design. Write down the model for a split plot design with 5 main treatments and 2 sub-treatments conducted in 4 replicates. Give the sketch of ANOVA table and discuss how various hypotheses of interest may be tested ? **15**

Unit IV

8. Prove that for a BIB design complementary to the design with parameters v, b, r, k, λ, we have $\lambda' = b - 2r + \lambda$. Here λ' is the number of blocks of the complementary design in which any *two* treatments occur together. **15**

9. What do you understand by orthogonal latin squares ? Also discuss the construction of orthogonal latin squares of order 4. **15**