[This question paper contains 3 printed pages.]

1430 Your Roll No. ....

B.Sc. (Hons.)/III A

STATISTICS – Paper XXII

(Design of Experiments)

(Admissions of 1999 and onwards)

Time : 2 Hours *Maximum Marks : 38*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **Four** *questions in all, selecting* **two** *from each Section.*

SECTION I

1. (a) Explain the importance of Uniformity trials and Fertility Contour maps in design of experiments.

   (b) Prove that, in a latin square design, the mean sum of squares due to error is always an unbiased estimate of the error variance, but mean sums of squares due to treatments, rows and columns are biased. (3,6½)

2. Carry out the analysis of a randomised block design with one missing observation, using the ANOCOVA technique. (9½)

P.T.O.

3. (a) Derive the expressions to measure the efficiency of (i) a latin square design and (ii) a randomised block design over a completely randomised design. Also compare the efficiency in each case.

(b) What is a split-plot design? Compare it to a factorial design, giving appropriate examples.

(5,4½)

SECTION II

4. (a) In a symmetric BIBD with parameters b, k, v, r and λ, show that

$$(NN')^{-1} = \frac{1}{r-\lambda}\left(I_v - \frac{\lambda}{r^2} E_{vv}\right)$$

where N is the incidence matrix, I_v is an identity matrix of order $v \times v$ and E_{vv} is a square matrix of order $v \times v$ with all elements equal to unity.

(b) "If we delete, from a symmetric BIBD with parameters b, k, v, r and λ, one block and from the remaining blocks we delete all those treatments which belong to the deleted block, then remainder is a BIBD." Find its parameters. (4½,5)

5. (a) Describe the Yates' algorithm for computing the total effects, mean effects and their sums of squares for a 2^3 factorial experiment run in r randomised blocks.

(b) An experiment for 5 treatment factors each having two levels is designed, such that only 32 observations are taken in all. Suggest a suitable method for analysing such a design. Give its ANOVA table. (5,4½)

6. (a) Explain the terms 'complete confounding' and 'partial confounding'.

(b) Construct a system of partial confounding for a 3^2 factorial experiment in blocks of size 3 with 6 blocks, so that at least partial information can be obtained about 2-factor interaction components and full information about the main effects.

(c) Construct a 2^{5-2} fractional factorial design with I = ABD = –BCDE. Also, write the complete alias structure for this design and identify its resolution. (3,3,3½)