

[Time: $2\frac{1}{2}$]

[Marks:75]

- N.B.:** 1. All questions are compulsory.
 2. Attempt any two sub questions out of four from question no.1 to question no. 3.
 3. From question no.4, attempt any one out of (a) and (b) and any one out of (c) and (d).
 4. Use of Non- Programmable Scientific Calculator is allowed.

- Q.1 a) i) State Cochran's theorem. (04)
 ii) Briefly explain the following terms with example. (06)
 1. Treatment 2. Experimental error 3. Experimental material
- b) State mathematical model, assumption made and hypothesis tested for one way classified data with unequal number of observation. Obtain the least square estimators of the parameter of the model. (10)
- c) Give the layout of the two way ANOVA. Describe the various steps in carrying out the ANOVA of a two way classified data with one observation per cell by stating the assumptions used and the hypothesis to be tested. (10)
- d) Write the short note on the following (10)
 1. Fixed and Random Effect in ANOVA.
 2. Choice of size of the plots and shape of blocks and plot.
- Q.2 a) i) With the help of suitable example, explain the terms 'Experimental unit' and 'Replicate' used in the design of experiment. (04)
 ii) Discuss the three fundamental Principles of experimental design. (06)
- b) Define the term Precision and Efficiency of the design D_1 with respect to another design D_2 . Also derive the expression for efficiency of RBD over CRD (10)
- c) Explain completely randomized design (C.R.D.) and State its model. Show that error mean sum of squares is an unbiased estimate of population variance. State if the same holds for treatment mean sum of square. (10)
- d) State the model of Randomized Block Design (R.B.D.). State the assumption for the design. Obtain least square estimators of the parameters involved and find variance of these estimators. (10)
- Q.3 a) For Latin Square Design (L.S.D.), give the breakup of the 'Total sum of squares' and state the degrees of freedom for each sum of squares. Give the computational form of all sums of squares. Construct the blank ANOVA table. (10)
- b) Explain the concept of Missing plot technique. Obtain the estimate of one missing observation for LSD. (10)
- c) Describe the factorial method of experimentation. Explain the situation where it could be used. State the advantages of factorial experiment over simple experiment. (10)
- d) Explain the main and interaction effects in a 2^3 factorial experiments conducted as an R.B.D. in r blocks. State the hypothesis to be tested and write the blank ANOVA. (10)

PTO

- Q.4 a) Explain the uses of ANOVA tests in different field. State its merits over the two sample tests. **(07)**
- b) Define Variability. What is the difference between 'variability within classes' and 'variability between classes'? Explain with suitable example. **(07)**
- c) Define the terms Blocks and Yield with suitable example. Also write the advantages and disadvantages of Randomized Block Design over Completely Randomized Design. **(08)**
- d) Describe Yates method of computing 2^2 factorial experiment laid out in a LSD and Give its blank ANOVA table and state the hypothesis to be tested. **(08)**
