Total number of printed pages–7

3 (Sem–6) STS M2

2021

STATISTICS

(Major)

Paper : 6·2

(Design of Experiments)

Full Marks : 60

Time : Three hours

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

1. Answer the following : 1×5=5

   (a) What are the assumptions made about the error component in the analysis of variance techniques ?

   (b) Name the Simplest design making use of all the three basic principles of design of experiments.

Contd.

(c) What will be the error degrees of freedom (d.f.) in an RBD with 4 blocks comparing 5 treatments, having one missing observation ?

(d) What is contrast ?

(e) Name *one* technique which is used to reduce the error in design of experiment.

2. Answer the following : 2×5=10

(a) Explain the situation in which a randomized block design is considered as an improvement over a completely randomized design.

(b) In a RBD, the yield of the plot for first treatment and first block is 50 *kg*. Mean of the first treatment is 25 *kg*, mean of the first block is 12 *kg* and grand mean is 10 *kg*. Find the estimate of error component for the corresponding plot.

(c) Show that in a 2^3 factorial design with the factors A, B and C each at two levels *viz.*, 0 and 1, the main effect A and the interaction effect AB are orthogonal contrast.

(d) State why a particular block in each replication of confounded factorial design, whether completely or partially is known as the 'Key block' or the 'Control block' .

(e) When will you call a confounded factorial design to be balanced ? Explain with 2^3 factorial experiment for three replications.

3. Answer the following : 5×3=15

(a) What do you mean by control of error in Design of experiments ? Describe *two* methods for control of error.

(b) In a LSD, five treatments are used. The treatments are tabulated as below :

Treatment	*A*	*B*	*C*	*D*	*E*
Mean	48.48	46.94	41.04	43.00	51.40

The treatment SS and error SS are respectively 348.24 and 304.08.

Examine at 5% level whether there exists real difference between means of treatment *B* and *E* .

Given,

F □.□ □ ; □, □ □ = 3.26

t □.□ □ □, □ □ = 2.18

(c) Describe the layout of a 2^3 experiment where all the interactions are partially confounded. In such a case, indicate degrees of freedoms (d.f.s) and sum of squares (SS) for all the components of treatment SS.

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

(a) Suppose you have k treatments to be compared in k^2 plots. How will you carry out the experiment under each of the following situations ?

(i) There is no fertility difference among k^2 plots

(ii) The fertility changes along one direction only

(iii) The fertility changes along two perpendicular directions

Give the appropriate analysis of variance table for each case.

(b) Show that when missing plot technique is applied in a randomized block design (RBD).
[adjusted treatment SS] ≥ [SS_t]
where SS_t = treatment SS obtained from original data.

(c) Suppose you wish to set up an experiment to test the effectiveness of 2 levels of Nitrogen, 2 of phosphate and 2 of potash on the yield of potatoes and have enough land to plant 40 plots. Show how you will set up this experiment and how you will analyse the results obtained.

(d) What are the main considerations in the use of confounded factorial design ? Suppose three factors A, B and C (all parametric) are to be studied, each at two levels. In carrying out the experiment it is necessary to run it in 2 blocks of 4 plots. Two replicates are planned. Set up the formulas for the sum of squares and degrees of freedom for each effect, if the first replicate has blocks confounded with ABC and second replicate has blocks confounded with BC.

(e) If Y_{ij} is the observation from plot in the i^{th} block to which j^{th} treatment is applied and $E(Y_{ij}) = \mu + a_i + t_j$; where μ is the average effect, a_i and t_j are fixed effects of i^{th} block and j^{th} treatment respectively ($i = 1, 2, \ldots\ldots b$; $j = 1, 2, \ldots\ldots r$). Obtain estimate of a_i and t_j.

Analyse the above design and compare it with completely randomized design.