2022

B.A./B.Sc.

Sixth Semester

CORE –13

STATISTICS

Course Code: STC 6.11

(Design of Experiments)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) What do you mean by experimental error? Explain the role of basic principles of design of experiment with regard to the experimental error. 3+4=7

   (b) Represent the yield of a plot in RBD by a fixed effect additive linear model and estimate the parameters involved in it. Also establish the relationship between the sums of squares among various sources of variation. 2+3+2=7

2. (a) Give the layout of Latin Square Design. Mention the advantages and disadvantages of Latin Square Design. 2+4=6

   (b) Suppose in a RBD with 5 treatments and 4 blocks, the observed difference between two treatment means is 10 and EMS is 20. Given that $t_{0.025,12} = 2.18$ then will the observed difference be statistically significant? Justify. 3

   (c) What do you mean by efficiency of design? Obtain the relative efficiency of RBD compared to CRD. 2+3=5

UNIT–II

3. (a) Suppose the yield of a plot in a randomized block design is missing. Estimate the missing yield in usual notation. Also, obtain by what amount the treatment sum of square for the completed data is overestimated. 4+4=8

(b) Give an outline of statistical analysis of a randomized block design when the yield of a plot is missing. 6

4. (a) Explain the different situations with the help of an example of a randomized block design if the yields of two plots are missing. 6

(b) Obtain the standard error of difference between the means of two treatments in a Latin square design when under one of the treatments there is a missing observation and under the other there is no missing observation. 8

UNIT–III

5. Give an outline of statistical analysis of Balanced Incomplete Block Design. 14

6. (a) Define a Balanced Incomplete Block Design stating the meaning of the notations used. 2

(b) Define an incidence matrix of a Balanced Incomplete Block Design. Give an example of an incidence matrix of a Balanced Incomplete Block Design. 2+3=5

(c) Prove that $\lambda(v-1) = r(k-1)$ for a Balanced Incomplete Block Design with usual notation. 7

UNIT–IV

7. (a) Factorial design increases the precision of the design. Justify with an example. 5

(b) Write down all the second order interactions of a 2^5 factorial design with five factors A, B, C, D, E. 2

(c) Prove that the total number of factorial effects in a 2^n factorial design is $2^n - 1$. 7

8. (a) What do you mean by factorial design? Show that the interaction effects AB and ABC in a 2^3 factorial design with factors A, B and C are orthogonal contrast. 3+4=7

(b) Give an outline of the statistical analysis of a 2^3 factorial design. 7

UNIT–V

9. (a) What do you mean by confounding in design of experiment? Describe how confounding helps in reducing the experimental errors in design of experiments. 7

(b) Distinguish between completely confounded and partially confounded design. 4

(c) Suppose three factorial effects have been confounded in a 2^4 factorial design with factors A, B, C and D. Is the subgroup [ABCD, BCD, A, I] a suitable confounding subgroup? If not, why? 3

10. (a) Describe the principle of confounding and how confounding increases the precession of the design. 4

(b) In a 2^4 confounded design, the elements of one of the blocks are $a, b, cd, abcd$. Identify the confounded effects. 5

(c) Distinguish between orthogonality and confounding in design of experiment. 5