2023
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) Explain the terms 'uniformity trials' and 'size of the plot' and discuss their role in designing an experiment. 3+3=6
   (b) Give an outline of statistical analysis of a completely randomised design and discuss its merits and demerits. 5+3=8

2. (a) What is meant by a randomised block design? Obtain the efficiency of this design compared to completely randomised design. 2+3=5
   (b) Define precision of a design. Explain the idea of efficiency of an experimental design. Compare the relative efficiency of a $p \times p$ Latin square design with respect to a randomised block design. 2+4+3=9

UNIT–II

3. (a) Explain the method of missing plot technique. Show how this technique can be used to estimate the missing yield of one plot in the case of a randomised block design. 2+6=8
   (b) Provide an estimate of the missing observation when the yield of one plot is missing in an LSD. Construct the ANOVA table for completed data in LSD with one missing observation and give the conclusion for its test of significance. 3+3=6

4. (a) Distinguish between standard deviation and standard error. 3

(b) Find the value of x for column correct treatment sum of squares for an RBD with one missing observation equal to the treatment sum of squares of completed data. Also find which one of this is greater than the other. Also show that treatment sum of squares for completed data is overestimated by

$$\frac{\{Q-(p-1)x\}^2}{p(p-1)}.$$ 6

(c) What are split plot designs? Discuss the advantages and disadvantages of split plot design. 5

UNIT–III

5. Define balanced incomplete block design (BIBD). Derive the equality and inequality relation among its parameters. 2+12=14

6. (a) Define the following terms: 2×2=4

(i) Resolvable design

(ii) Affine resolvable design

(b) When is BIBD called symmetric? 3

(c) Prove that for a resolvable BIBD with parameters v, b, r, k, λ $b \geq v + r - 1$. 7

UNIT–IV

7. (a) Define factorial experiment. For a 2^2 factorial design, give all the treatment combinations by defining main effect and interaction effect with its relations. 2+5=7

(b) Give the statistical analysis for a 2^3 factorial experiment along with ANOVA table. 5+2=7

8. (a) Describe the advantages of a factorial experiment over simple experiment along with example. 7

(b) Find the total number of interaction effect (main effect, first order, second order, third order and fourth order) in a 2^5 factorial experiment. 7

UNIT–V

9. (a) Define confounding in factorial experiment. Also explain the principle of confounding and how it increases the precision of a design. 3+4=7

   (b) Define complete (or totally) confounded design. Also give the analysis of complete confounding for 2^3 design. 2+5=7

10. (a) Define the following terms for a 2^3 design: 1×2=2
    (i) Control plot
    (ii) Control block

    (b) Explain the advantages and disadvantages of confounding. 3

    (c) Differentiate between orthogonality and confounding. 2

    (d) Define partial confounding design. Also give the analysis of confounding for 2^3 design. 2+5=7