

**April 2025**  
**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? Discuss the principle of local control and explain its purpose in an LSD design. 3+4=7  
(b) Give the layout of an RBD design and illustrate it using an example. Also, establish the relationship between the sums of squares among various sources of variation. 3+4=7
2. (a) 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+5=7  
(b) Give the analysis of Latin square design and construct the ANOVA table. 7

**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. 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. 4

- (b) What are split plot designs? Give its uses. Discuss the advantages and disadvantages of split plot design.  $2+3+5=10$

### UNIT-III

5. Give an outline of statistical analysis of balanced incomplete block design (BIBD). 14
6. (a) When is BIBD called symmetric? 2  
 (b) Define the following: 6×2=12  
 (i) Resolvable and affine resolvable BIB design  
 (ii) Residual and derived BIB design

### UNIT-IV

7. (a) Define factorial experiment. Illustrate all the terms for factors  $A$  and  $B$  along with example. 1+3=4  
 (b) Give the statistical analysis for  $2^3$  factorial design. 6  
 (c) Find the total number of 1<sup>st</sup> order and 2<sup>nd</sup> order interaction in  $2^5$  factorial experiment. 2  
 (d) Define the following: 1×2=2  
 (i) Contrast (ii) Orthogonal contrast
8. (a) For a  $2^2$  factorial experiment, define main effect and interaction effect. Prove that  $A = \frac{1}{2^2}[A]$ ,  $B = \frac{1}{2^2}[B]$  and  $AB = \frac{1}{2^2}[AB]$  2+3=5  
 (b) Give the Yate's table for  $2^3$  factorial design 3  
 (c) Derive all the number effects in  $2^n$  factorial design. Hence, prove that total number of factorial effects =  $n^2-1$ . 4  
 (d) Define orthogonal contrast along with example. 2

### UNIT-V

9. (a) Define the following terms. 1×2=2  
 (i) Control plot  
 (ii) Control block

- (b) From the given table identify the confounded effect and explain in detail, if it is partially or completely confounded design. 1+4=5

Blocks	
I	II
<i>a</i>	(1)
<i>b</i>	<i>ab</i>
<i>c</i>	<i>ac</i>
<i>abc</i>	<i>bc</i>

- (c) Define principle of confounding and partially confounded design. Give the statistical analysis for the same. 1+1+5=7
10. (a) Define the following terms. 1×2=2
- (i) Confounding subgroup
- (ii) Generalised interaction
- (b) Define completely confounded design and give analysis. Write the conclusion at  $\alpha$  level of significance. 1+6=7
- (c) Give two advantages and disadvantages of using confounding designs. 3
- (d) Identify the confounded effect from the given table and hence explain in detail. 2

Block	I	(1)	<i>ab</i>	<i>c</i>	<i>abc</i>
	II	<i>a</i>	<i>b</i>	<i>ac</i>	<i>bc</i>