



**WEST BENGAL STATE UNIVERSITY**

B.Sc. Honours 6th Semester Examination, 2021

**STSACOR13T-STATISTICS (CC13)**

**DESIGN OF EXPERIMENTS**

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.*

**Answer any four questions from question numbers 1-6 and any two questions from question numbers 7-10**

1. What is a uniformity trial? Discuss its use in field experiments. 5
2. Discuss the role of local control in designing an experiment. 5
3. If there are  $n$  observations  $y_1, y_2, \dots, y_n$ , show that S.S. due to full set of observational contrasts is 5
$$\sum_{i=1}^n (y_i - \bar{y})^2, \quad \bar{y} = \frac{1}{n} \sum_{i=1}^n y_i$$
4. With reference to an RBD, show that the estimate of any treatment contrasts is orthogonal to the estimate of any block contrast. 5
5. Show that for a  $2^n$ -experiment with  $r$  replicates 5
$$\text{S.S. due to any effect} = [\text{Effect total}]^2 / (2^n \cdot r)$$
6. Prove that in a  $(2^n, 2^2)$  design if any two effects are confounded then their generalized interaction is also confounded. 5
7. What is a Latin Square Design (LSD)? Discuss its analysis. Discuss the efficiency of LSD relative to a comparable randomised block design. Write down an application of LSD with a practical real life example. 10
8. Describe missing plot technique with single missing value. In an RBD one observation is missing. Find an estimate of the missing value and give the analysis of the design. 10

9. (a) In a  $2^2$  factorial experiment with the factors  $A_1$  and  $A_2$  show that 5
- the three factorial effects can be denoted by  $A_1^{\alpha_1} A_2^{\alpha_2}$ , where  $\alpha_i = 0$  and 1, but  $(\alpha_1, \alpha_2) \neq (0, 0)$ , and if  $\alpha_i = 0$ ,  $A_i$  is dropped from the effect,  $i = 1, 2$ .
  - the coefficient ( $C_{x_1 x_2}$ ) of the treatment effect  $\alpha_1^{x_1} \alpha_2^{x_2}$ ;  $x_i = 0, 1$ ;  $i = 1, 2$  in the expression of  $A_1^{\alpha_1} A_2^{\alpha_2}$  is given by
- $$C_{x_1 x_2} = (-1)^{\alpha_1(1-x_1) + \alpha_2(1-x_2)}$$
- (b) Indicate the method of analysis of a partially confounded  $(2^4, 2^2)$  experiment. 5
10. Discuss total and partial confounding in connection with factorial experiments. What do you mean by balancing in a confounded design with more than one replicate? Construct a  $(2^5, 2^2)$  design with minimum number of replicates achieving balance over 3-factor and 4-factor interactions without confounding any main-effect and 2-factor interactions. 10

**N.B. :** *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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