

M.Sc. Examination, 2019
Semester-II
Statistics
Course : MSC-24
(Design of Experiments)

Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer **any four** questions from the following

1. Give the definitions of connectedness of a block design. Prove that these definitions are equivalent. 2+8=10

2. (a) Define Q , the adjusted treatment totals. Show that (i) $Q'1_v = 0$, (ii) $E(Q) = C\tau$, and (iii) $D(Q) = \sigma^2 C$ where 1_v is a vector of ones.

- (b) For any block design with v treatments and b blocks, prove that

$$b + \text{Rank}(C) = v + \text{Rank}(C),$$

where C and D have their usual meanings.

7+3=10

3. (a) For a connected block design d , show that the covariance between the matrices Q and P is zero if and only if $N = kr'/n$ where the notations have their usual meanings.

- (b) For a connected block design d , discuss in brief the testing of the null hypothesis $H_0 : \tau_1 = \tau_2 = \dots = \tau_v = 0$. 5+5=10

4. (a) State the first fundamental theorem of the method of differences. 3

- (b) Construct BIBD with the following parameters, using the method of differences
 (i) $b = 35, v = 15, r = 7, k = 3, \lambda = 1$ (ii) $b = v = 11, r = k = 5, \lambda = 2$.

4+3=7

5. (a) Find the minimal polynomials of $GF(2^2)$ and $GF(3^2)$. 2+2=4

- (b) Define mutually orthogonal Latin squares. Construct three mutually orthogonal Latin squares of order 12. 2+4=6

6. (a) Construct the layout of a $(3^3, 3^2)$ experiment confounding (i) ABC, BC^2 , (ii) AB^2C^2, AC . 3+3=6

- (b) What do you mean by a fractional factorial experiment? Give an example of a $\frac{1}{2}(2^4)$ experiment. 2+2=4
