M.Sc. Examination, 2018
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

1. (a) Define Q, the adjusted treatment totals. Show that where (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. 7

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

   b + Rank (C) = *v* + Rank (D)

   Where C and D have their usual meaning. 3

2. Give two definitions of connectedness of a block design. Prove that these two definitions are equivalent. Also prove that if a block design is connected then Rank (C) = *v*–1, where C has its usual meaning and *v* is the number of treatments. 3+4+3=10

3. Consider a Randomized Block Design with b block and *v* treatments. Suppose because of some reason the observation corresponding to the *i*th block and the *j*th treatments is missing. Analyze the data. Obtain the average variance of all the elementary treatment contrasts. 6+4=10

4. Describe the analysis procedure of a Latin Square Design with one covariate. Derive the average variance of all the elementary treatment contrasts. Describe the test procedure of testing the hypothesis $\tau_1 - 2\tau_2 + \tau_3 = 0$. 5+3+2=10

5. (a) Let N_d be the incidence matrix of a symmetric BIB design d. by obtaining the inverse of $N_d N_d'$, show that any two blocks of d intersect in exactly λ treatments. 6

   (b) Define a Hadamard matrix. The existence of a Hadamard matrix of order 4n is equivalent to the existence of a BIB design. 4

6. With reference to a 2^3 experiment, define the estimates of the factorial effects. Discuss in detail the Yates's algorithm for finding the sum of squares of these factorial effects. Show that for a (2^n, 2^3) factorial experiment, if the factorial effects X, Y and Z are confounded then their generalized interaction effects will automatically gets confounded in the same replicate. 3+3+4=10
