5. (a) What is meant by confounding in factorial experiments ? Distinguish between partial and total confounding. Construct a system of partial confounding for a 3^2 factorial experiment in blocks of size 3 with 6 blocks so that at least partial information can be obtained about two factor interaction components and full information about the main effects. 9

(b) Describe Yates algorithm for computing the total effects and the sum of squares due to various effects for a 2^3 factorial experiment laid out in r randomized blocks. 6

6. (a) A 2^5 design is to be arranged in 2^2 blocks of size 2^3 each. Suggest a suitable set of 3 degrees of freedom to be confounded such that information on main effects and first order interactions is not at all lost. Also write down the treatment combinations of all the blocks. 6

(b) What are fractional factorial designs ? Construct a 2^{5-2} design with defining relations I = ABD and I = – BCDE. Also, write the alias structure of this design and identify its resolution. 9

[This question paper contains 4 printed pages]

Your Roll No. : ....

Sl. No. of Q. Paper : **2281**　　**IC**

Unique Paper Code : 32371601

Name of the Course : **B.Sc. (Hons.) Statistics**

Name of the Paper : Design of Experiments

Semester : VI

Time : 3 Hours　　　*Maximum Marks : 75*

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in all.

(c) Question **No.1** is compulsory.

(d) Attempt **four** questions from the remaining questions.

1. (a) Suppose an experiment with a single factor at five levels was conducted using a CRD. Each level of the factor is randomly assigned three experimental units. Write down the appropriate linear model. How many degrees of freedom are available for estimating the error variance ? 3

P.T.O.

(b) Suppose we have v treatments to be compared in v^2 plots. Name the design under each of the following situations : 3

(i) There is no fertility difference among the v plots,

(ii) The fertility changes along a particular direction, and

(iii) The fertility changes along two perpendicular directions.

(c) Given a BIBD : 3

1 2 3 4 5 6 7

2 3 4 5 6 7 1

4 5 6 7 1 2 3

with $v = 7$, $b = 7$, $r = 3$, $k = 3$, $\lambda = 1$.

Write down its (i) complementary and (ii) residual designs along with their parameters.

(d) What is a treatment contrast ? When are two contrasts said to be orthogonal ? 3

(e) Following is the principal block of a 2^4 factorial experiment : 3

(0000, 0101, 1010, 1111)

Write down the contents of the other blocks and identify the confounded effects.

2. (a) Explain the principles of replication, randomization and local control in experimental designs. How are these principles used in RBD and LSD ? 9

(b) Derive the expected value of mean sum of squares due to errors and treatments in LSD. Also, show that under the truth of null hypothesis, the mean sum of squares due to treatments gives an unbiased estimate of error variance. 6

3. (a) What is meant by a missing plot ? Give the complete statistical analysis of an RBD with one missing observation. 9

(b) Explain the concept of efficiency of a design and discuss how it can be increased. Derive the expression to measure the efficiency of LSD over CRD. 6

4. (a) Define a BIBD with parameters v, b, r, k and λ. State and prove the **three** basic relationships among its parameters. 8

(b) Derive a necessary condition for the existence of a symmetric BIBD with even number of treatments. 3

(c) For a resolvable BIBD with parameters v, b, r, k and λ, prove that $b \geq v + r - 1$. 4