

F-3/2050

DESIGN AND ANALYSIS OF EXPERIMENTS–365
(Semester–VI)

Time : Two Hours]

[Maximum Marks : 30

Note : Attempt any *four* questions. All questions carry equal marks.

- I. Develop the procedure to test the general linear hypothesis based on a linear model, stating clearly the assumptions.
- II. Complete the following two-way classified data with one observation per cell.

Source of variations	d.f.	Sum of Squares (SS)	Mean sum of squares (MSS)	F-ratio
Blocks	4	26.8	–	–
Treatments	3	–	–	–
Error	–	–	2.5	–
Total	–	85.3		

- III. Outline the various steps in carrying out the analysis of variance of a two-way classified data with one observation per cell.

- IV. A farmer applies three types of fertilizers on 4 separate plots. The figures on yield per acre are tabulated in table. Find out if plots are materially different in fertility, as also, if the three fertilizers make any material difference in yields. Use level of significance is 0.05. Given that $F_{0.05}(2,6) = 5.14$ and $F_{0.05}(3,6) = 4.76$.

Fertilizers\Plots	Yield			
	A	B	C	D
Nitrogen	6	4	8	6
Potash	7	6	6	9
Phosphates	8	5	10	9

- V. Derive the expression to measure the efficiency of (i) a latin square design and (ii) a randomized block design over a completely randomized design. Also compare the efficiency in each case.
- VI. Derive the contrasts due to main effects and interaction effects in 22 factorial experiment.
- VII. When is a randomized block design used? Write the model for the analysis of it and prepare the ANOVA table.
- VIII. An industrial engineer is investigating the effect of four assembly methods (A, B, C, D) on the assembly time for a color television component. Four operators are selected for the study. Furthermore, the engineer knows that each assembly method produces such fatigue that the time required for the last assembly may be greater than the time

required for the first, regardless of the method. That is, a trend develops in the required assembly time. To account for this source of variability, the engineer uses the Latin square design shown below. Analyze the data from this experiment ($\alpha = 0.05$) and draw appropriate conclusions.

Order of Assembly	Operator			
	1	2	3	4
1	C = 10	D = 14	A = 7	B = 8
2	B = 7	C = 18	D = 11	A = 8
3	A = 5	B = 10	C = 11	D = 9
4	D = 10	A = 10	B = 12	C = 14

IX. Attempt all the questions :

- (a) Explain the concept of linear model.
- (b) When do we use ANOVA?
- (c) Write a short note on the fixed effect model.
- (d) What are the basic assumptions made in analysis of variance.
- (e) State the mathematical model used in analysis of variance for a two-way classification.
- (f) Give two advantages of completely randomized design.
- (g) What do you mean by Factorial experiment?