Exam.Code:1014
Sub. Code: 7432

2023

M.E. (Mechanical Engineering)

First Semester

MME-102: Design of Experiments

Time allowed: 3 Hours

Max. Marks: 50

***NOTE**: Attempt <u>five</u> questions in all, selecting atleast two questions from each Unit.*

x-x-x

UNIT - I

I. a) What do you mean by asymmetrical factorial experiments and E-optimality?

b) Distinguish between 'COMPLETE' and 'PARTIAL' Confounding in Partial factorial design. (2x5)

II. "In the completely randomized design, treatments are assigned at random." In the light of the statement, explain randomized complete block design with the help of an example. (10)

III. Explain briefly about 2^3 factorial experiments and also derive the analysis of it. (10)

IV. A test panel of 15 individuals participating in testing two brands of beer (A and B) was asked to give their judgments on a scale from 1 to 10. 8 individuals were given brand A and 7 were given B. The distribution was not known to the test panel. The results were:

Brand A: 2, 4, 2, 1, 9, 9, 2, 2 and

Brand B: 8, 3, 5, 3, 7, 7, 4

Test the null hypothesis $\mu A = \mu B$ against the alternative μA 6=/ μB, an remember to give the necessary assumptions underlying your test method. Could you suggest a better design for this experiment? Write out precisely how you would then conduct your improved experiment. (10)

UNIT - II

V. What is response surface methodology? Describe the concept of steepest Ascent to determine optimize point in the response. (10)

VI. The data given in Table 8.12 has been collected from a central composite design with two factors. Fit a second order model.

X_1	X_2	y
-1	-1	34
1	-1	26
-1	1	13
1	1	26
-1.414	0	30
1.414	0	31
0	-1.414	18
0	1.414	30
0	0	20
0	0	18
0	0	23
0	0	22
0	0	20

Table 8.12

(10)

P.T.O.

VII. An experiment was conducted with seven main factors (A, B, C, D, E, F, and G) using L_8 OA and the following data was collected (tabled 13.24) Assuming larger - the better type quality characteristic. Compute S/N rations and identify the optimal levels for the factors.

Trail No	Factors/Columns							Response		
	A	B	C	D	E	F	G	R_1	R_2	R_3
	1	2	3	4	5	6	7			
1	1	1	1	1	1	1	1	11	4	11
2	1	1	1	2	2	2	2	4	4	4
3	1	2	2	1	1	2	2	4	1	14
4	1	2	2	2	2	1	1	4	0	8
5	2	1	2	1	2	1	2	9	8	4
6	2	1	2	2	1	2	1	4	1	1
7	2	2	1	1	2	2	1	1	4	4
8	2	2	1	2	1	1	2	14	4	8

Table 13.24

(10)

VIII. An engineer is interested in the effects of cutting speed (A), tool geometry and cutting angle (C) on the life (in hours) of a machine tool. Two level each factor is chosen, and two replicates of a 2^3 factorial design is run. The results are given below.

Treatment	(1)	a	b	ab	c	ac	bc	abc
Response								
R_1	21	33	24	37	35	27	40	31
R_2	17	29	40	36	28	26	44	37

a) Analyze the data using ANOVA and conclude. Use alpha = 0.05.

b) Write down the regression model to predict the response and find out R^2 and R^2adj.

(10)