Exam.Code:1014
Sub. Code: 7750

1129

M.E. (Mechanical Engineering)
First Semester
MME-102: Design of Experiments

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, selecting atleast two questions from each Section.

x-x-x

Q. No.	Section A
1 (a)	What is experimental design? Enumerate some typical applications of experimental design?
(b)	Explain null hypothesis and alternative hypothesis by taking a suitable example?
2 (a)	What are blocking and confounding in DOE? Explain the steps in partial confounding?
(b)	**It is believed that the precision of an instrument is no more than 0.16. Write down the null and alternative hypotheses for testing this belief. Carry out the test at 1% level of significance, given 11 measurements of the same subject on the instrument.** **2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5.** (8)
3 (a)	What is fractional factorial design? Explain by taking a suitable example.
(b)	With a suitable illustration show the 2^k design and fit a First order model using suitable designs?
4	An Industrial Engineer has studied the effect of speed (B) feed (C) and Depth of Cut (A) on the surface finish of a machined component using a three-factor factorial design. All the three factors were studied at two-levels each. The surface roughness measurements (microns) from two replications are given in Table 2. Analyze the data and draw conclusions

Depth of cut (A)	Speed (B)			
	100		120	
	Feed (C)		Feed (C)	
	0.20	0.25	0.20	0.25
0.15	54	41	59	43
	52	58	61	55
0.20	86	62	82	65
	82	64	75	77

	Section B
5 (a)	What is Response Surface Methodology? Describe the concept of Steepest Ascent to determine Optimize point in the response?
(b)	What is Signal to Noise ratio? How it is useful in Taguchi Method of experimentation? Discuss.
6 (a)	A psychologist wishes to test the effects of noise level, light level and temperature on the behaviour of monkeys. He plans to use each factor at five levels and assumes that there will be no interactions among these factors. He has 25 monkeys available and intends to use each animal just

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	once. (a) Construct a design for this experiment in such a way that all main effects can be estimated. (b) Write down the skeleton analysis of variance table, showing strata, sources and degrees of freedom. (c) What problems will there be in interpreting the results of this experiment?
(b)	What are parametric tests? Describe the student's "t" test with suitable illustration.
7	The output voltage measured from two brands of compressors A and B is as follows. The samples were selected randomly. Brand A: 230, 225, 220, 250, 225, 220, 220, 230, 240, 245 Brand B: 220, 215, 222, 230, 240, 245, 230, 225, 250, 240 Assume that the output voltage follows normal distribution has equal Variance. i) Test the hypothesis that the output voltage from both the brands is same. Use alpha= 0.05. ii) Construct a 95% confidence interval on the difference in the mean output voltage.
8	An engineer is interested in the effects of cutting speed (A), tool geometry *(B)*, and cutting angle (C) on the life (in hours) of a machine tool. Two levels of 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 i) Analyze the data using ANOVA and conclude. Use alpha = 0.05. ii) Write down the regression model to predict the response and find out $R^2$and R^2adj

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