Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013

Subject code: 710906N **Date: 17-06-2013**

Subject Name: Robust Design

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** State the expressions for null and alternate hypothesis and interpret them **07**

(b) Explain the procedure for establishing the main and interactive effects of two factors, say A and B, having two levels replicated once **07**

Q.2 **(a)** Explain the following terms citing suitable examples: (i) full factorial design (ii) one-half factorial design **07**

(b) With the help of neat sketches explain (i) blocking (ii) response surface **07**

OR

(b) Explain the procedure that can be adopted to decide whether the fitted model has curvature or not **07**

Q.3 **(a)** Differentiate between first order and second order models **07**

(b) Explain for a 2^3 design, how you create a one-half fraction and bring out the significance of linear combinations **07**

OR

Q.3 **(a)** Giving suitable expressions, state how you fit a regression model **07**

(b) The experimental data for a chemical reaction involves two factors A and B with two levels (factor A: low value = 10, high value = 55;factor B: low value = 2, high value = 4) is given below: **07**

A	B	Replicate	
		I	II
ï	ï	26	28
+	ï	34	32
ï	+	16	19
+	+	30	28

Estimate the factor effects & their interactions and hence fit a model which represents this situation.

Q.4 **(a)** Explain the meaning and significance of each entity of ANOVA table for a 2^3 design **07**

(b) For a given situation with two factors and number of replicates 2, explain how will you estimate the residuals and its use to validate the fitted model **07**

OR

Q.4 **(a)** The experimental data for a chemical reaction involves two factors A and B with two levels (factor A: low value = 15, high value = 25;factor B: low value = 1, high value = 2) is given below: **07**

A	B	Replicate		
		I	II	III
ï	ï	28	25	27
+	ï	36	32	32
ï	+	18	19	23
+	+	31	30	29

The fitted model is $\check{y} = 27.5 + (8.33/2)x_1 + (-5.00/2)x_2$. Convert the model into a model of natural variables.

(b) For a 2^3 design, show graphically, the main effects and two factor interactions. **07**

Q.5 **(a)** Explain the procedure to be adopted, in detail, to identify the optimal region for a response surface model **07**

(b) Explain how a 2^3 design can be confounded in to two blocks **07**

OR

Q.5 **(a)** With the help of suitable example, explain how do you estimate the factor effects, interactions and sum of squares in case of a 2^3 design using contrast **07**

(b) Explain how randomization and replica are useful in design of experiments **07**

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