Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 710906

Subject Name: Robust Design

Date:12/07/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 60

Instructions:

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

Q.1 **(a)** Explain the "Randomized Complete Block Design" citing one suitable example. **06**

(b) Explain the terms (i) inner array (ii) outer array (iii) crossed array design (iv) signal-to-noise ratio. With the help of graphs explain the role of control X noise interaction in robust design. **06**

Q.2 **(a)** Explain the importance of quality in Engineering practice and what efforts can be made for improving the quality? **06**

(b) Explain the concept of Design of Experiments giving one suitable example. **06**

OR

(b) What are the three stages of design developed by Taguchi for product development and explain any one of them giving a suitable example. **06**

Q.3 **(a)** With the help of a appropriate example explain the term "Taguchi Loss function" Also explain the importance of this concept in the situation of ensuring quality of the product. **06**

(b) Explain the concept of Robust Response Surface Design and Analysis. **06**

OR

Q.3 **(a)** Explain the Orthogonal Array - L_8 (2^7) with one example. **06**

(b) Explain the concept of Design for Six Sigma. **06**

Q.4 **(a)** What do you understand by confounding? Explain its importance in design of experiments with the help of a appropriate example. **06**

(b) Explain split-plot design and nested design giving one appropriate example. **06**

OR

Q.4 **(a)** A soft drink bottler is interested in obtaining more uniform fill heights in the bottles produced by his manufacturing process. The filling machine theoretically fills each bottle to the correct target height, but in practice, there is variation around this target, and the bottler would like to understand the sources of this variability and eventually reduce it. The process engineer can control three variables during the filling process as given below, and the two levels of experimental interest for each factor. **06**

A: The percentage of carbonation (A_0 = 10%, A_1 = 12%)

B: The operating pressure in the filler (B_0 = 25 N/mm^2, B_1 = 30 N/mm^2)

C: The line speed (C_0 = 200 bpm, C_1 = 250 bpm)

Develop the ANOVA Table and identify the most significant factor.

Run	A	B	C	Treatment Combinations	A	B	C	Response Data
	(+/- notation)				(1/0 notation)			
1	-	-	-	(1)	0	0	0	-2.5
2	-	-	+	c	0	0	1	-1.0
3	-	+	-	b	0	1	0	3.5
4	-	+	+	bc	0	1	1	1.0
5	+	-	-	a	1	0	0	-2.6
6	+	-	+	ac	1	0		-1.4
7	+	+	-	ab	1	1	0	4.0
8	+	+	+	abc	1	1	1	2.0

(b) Explain how factorial design can provide more information compared to conventional experiments. Explain why experiments are replicated. **06**

Q.5 **(a)** Explain Training Scheme and Measurement System. **06**

(b) Discuss the issues for the Implementation of Six Sigma. **06**

OR

Q.5 **(a)** Explain the term six sigma quality with the help of frequency chart. **06**

(b) Distinguish between first order and second order models. When will you go for a central composite design? **06**

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