G 6281

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Industrial Engineering

IE 1653 — QUALITY ENGINEERING

(Common to ME–Industrial Safety Engineering)

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the rationale behind placing the control limits at 3 standard deviations from the mean?

2. What are the advantages of multivari charts over scatter diagrams in quality improvement?

3. What is the difference between average sample number and average total inspection?

4. What is the disadvantage of having an acceptance number of zero?

5. What do you mean by randomization?

6. What are the features of 2^k factorial experiments?

7. What is QCDS?

8. How much is the shift in the process mean considered for six-sigma programme? What are the defects per million opportunities expected, if there is no shift in the mean for a six-sigma programme?

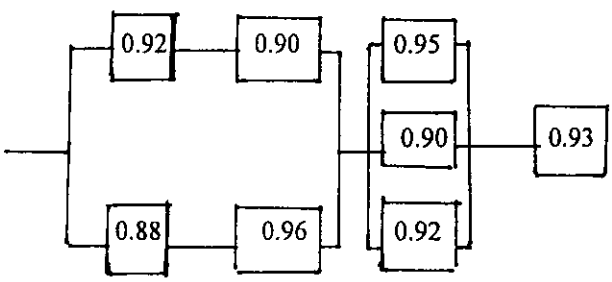
9. What is the role of reliability in quality control?

10. Distinguish between failure – terminated test and sequential tests for reliability and life testing.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A remote control unit has 40 components in series. The reliability of each component is 0.9994. What is the reliability of the remote control unit? If a redesign has 25 components in series, what is the reliability of the unit? (4 + 4 = 8)

(ii) Find the reliability of the eight – component system shown below. The reliability of the components are given in the figure. (8)



Or

(b) (i) Explain the methods of improving product reliability. (8)

(ii) Describe the sequential reliability testing procedure. (8)

12. (a) (i) The bore size on a component to be used in assembly is a critical dimension. Samples of size 4 are collected and the sample average diameter and range calculated. After 25 samples, we have $\overline{X} = 107.5$ and $\overline{R} = 12.5$. The specifications on the bore size are 4.4 ± 0.2 mm. Find the $\overline{X}$ and $\overline{R}$-chart control limits. Assuming the process is in control, estimate its standard deviation. If the process average shifts to 4.5 mm, what is the impact on the rejection? (4 + 2 + 4 = 10)

(ii) Discuss some typical control chart patterns and their likely special causes. (6)

Or

(b) (i) The number of paint blemishes on automobile bodies is observed for 12 sample. Each sample consists of randomly selecting 5 automobiles of a certain make and style. Table below shows the data. Construct a chart for the number of paint blemishes. If there is out of control, revise the control limits. (4 + 4 = 8)

Sample No. :	1	2	3	4	5	7	8	9	10	11	12
Paint blemishes :	4	5	3	8	6	5	7	9	4	5	6

(ii) Is it possible for a process to be in control and still produce non-confirming output? Explain what are some corrective measures under these circumstances? (4 + 4 = 8)

13. (a) (i) What is the importance of the OC curve in the selection of sampling plans? (4)

(ii) Discuss the context in which minimizing the average sample number would be a feasible criterion. Which type of sampling plan would be preferable, and what factors would influence your choice? (3 + 4 + 5 = 12)

Or

(b) Consider a single sampling plan with a lot size of 1500. Sample size of 150, and acceptance number of 3. Construct the OC curve. If the acceptable quality level is 0.05% non conforming and the limiting quality level is 6% non conforming. Describe the protection offered by the plan at these quality levels. (8 + 8 = 16)

14. (a) A construction company intends to test the efficiency of three different insulators. Since the area where the company builds has varying temperature differentials, the following experimental procedure has been planned. The company has divided the area into four geographical regions, based on climatic differences. With in each geographical regions, it randomly used each of the three insulators and records the energy loss as an index. Smaller values of the index correspond to lower losses. Table below shows the energy loss data.

Table : Energy loss data :

Insulator	Geographical Region				
	I	II	III	IV	Total
1	19.2	12.8	16.3	12.5	60.8
2	11.7	6.4	7.3	6.2	31.6
3	6.7	2.9	4.1	2.8	16.5
Total	37.6	22.1	27.7	21.5	108.9

(i) Is there a difference in the mean energy loss for the three insulators? Test at a significance level of 10%. (6)

(ii) Find a 99% confidence interval for the mean energy loss index for insulator 3. (4)

(iii) Find a 90% confidence interval for the difference in the mean energy loss index of insulators 2 and 3. Is there a difference in these two mean? (6)

Or

(b) A city library has established three factors (A, B and C), each at three level, that influence the satisfaction of their patrons. The library governance committee also believe that the interactions BX C is important. Using an orthogonal array, set up an appropriate experimental design. (16)

15. (a) (i) Define TQM. Discuss the critical success factors of TQM relevant to Indian manufacturing industries. (2 + 6 = 8)

(ii) Explain the role of a co-ordinator for a smooth functioning of a quality circle. (8)

Or

(b) What are the objectives of QFD? Explain the QFD process for a Hotel industry. (4 + 12 = 16)