Reg. No. : | | | | | | | | | | | |

# K 4403

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Eighth Semester

Mechatronics Engineering

MH 1006 — STATISTICAL QUALITY CONTROL

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is meant by process control in industrial statistics?

2. Mention the properties of Normal distribution.

3. What are the control limits for $\sigma$-chart?

4. Define chance and assignable causes of quality variation.

5. Give some examples of defects for which the c-chart is applicable.

6. How is the choice between p and np charts made?

7. Define AOQL.

8. Define producer's risk with example.

9. Define Reliability and Maintainability.

10. Mention the uses of Pareto analysis.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the Poisson distribution as a limiting form of Binomial distribution.

(ii) Fit a Poisson distribution to the following data and calculate the theoretical frequencies.

| Deaths : | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Frequency : | 122 | 60 | 15 | 2 | 1 |

Or

(b) Explain briefly the different categories of quality cost. Give suitable examples.

12. (a) (i) Explain the construction and $\overline{X}$ and $R$ charts under different environments.

(ii) Discuss the advantages of control charts for variables.

Or

(b) Define process capability when the process shows a state of control. Discuss in detail the various courses of action often employed under the following situations.

(i) The process capability is greater than the specified tolerance

(ii) The process capability is approximately equal to the specified tolerance

(iii) The process capability is less than the specified tolerance.

13. (a) (i) Describe the construction of p-chart and list out the interpretations of p-chart.

(ii) Construct a suitable control chart for the data given below :

| Sample size : | 15 | 20 | 18 | 25 | 10 | 24 | 15 | 26 |
|---|---|---|---|---|---|---|---|---|
| No. of defects : | 8 | 4 | 6 | 10 | 0 | 8 | 3 | 8 |

Or

(b) A control chart is used to control the fraction non conforming for a plastic part manufactured in an injection molding process. Ten subgroups yield the following data :

| Sample Number : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample size : | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Number Non conforming : | 10 | 15 | 31 | 18 | 24 | 12 | 23 | 15 | 8 | 8 |

(i) Setup a control chart for the number Non conforming in samples of $n = 100$.

(ii) What is the probability of detecting a shift in the process fraction non conforming to 0.30 on the first sample after the shift has occurred?

14. (a) (i) State and derive the expressions for OC AOQ curves.

(ii) Describe the Double sampling plan and derive its OC curve.

Or

(b) Write a brief note on the following :

(i) IS 2500 standards

(ii) MIL-STD-1050 tables.

15. (a) Mention different forms of Hazard Models. Obtain reliability rate and MTTF for any two forms of Hazard Models.

Or

(b) A system has n independent components each having a constant failure rate. Derive the mean time to failure of the system when the components are connected.

(i) in series

(ii) in parallel

Assume that the components fail independently.

---