Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (ME)   (Sem.–1)
QUALITY ASSURANCE AND RELIABILITY
Subject Code : MME-509
Paper ID : [E0424]

Time : 3 Hrs.   Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :
1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**
3. **Use of Statistical Tables is allowed.**

1. a) Distinguish between 'Cost of Quality' and 'Value of Quality'. How will you optimize both? Show with the curve.   (10)

   b) Explain Quality of conformance and Quality of Design.   (5)

   c) Why is going above the UCL_x undesirable when working to a specification minimum? Is this not a great deal better than can be expected?   (5)

2. a) Define Total Quality control and distinguish between Quality control and inspection in details.   (10)

   b) Distinguish between :   (10)

   i. Type I error and Type II error.

   ii. Natural tolerance limits and Design tolerance limits.

   iii. Manufacturer's risk and Purchaser's risk.

   iv. TQM and ISO standardization.

3. a) Compare the applications and performance between control charts for defectives and control charts for defects.   (10)

   b) A textile mill development group determines that it must have a fiber which, among other properties has a minimum allowable tensile strength of 1.30 grams in 99% of the fiber used. Manufacturer 'X' offers to supply the textile mill with such a fiber and a contract is arranged. Manufacturer 'X' knows that the standard deviation of the process is 0.02.

   i. What is lowest possible target tensile strength to ensure that exactly 99% of the fiber will have atleast 1.30 gram minimum required strength?

   ii. Compute 3σ control limits for $\bar{X}$ and σ charts.   (5+5)

4. a) Explain the control chart patterns in process monitoring.   (10)

    b) Explain Normal and Binomial probability distributions along with their applications.
                                                                                    (10)

5. Daily inspection records are maintained on production of a special design electric device. 100 items have been inspected each day for the past 21 days. A total of 546 items failed during a particularly heat stress test. The four highest and lowest values of p are given below :

Highest	0.46	0.33	0.31	0.31
Lowest	0.18	0.18	0.20	0.21

    a) Compute 3σ trial control limits for a p-chart; if the process is in statistical control.

    b) Recommend an aimed at value p' & 3σ control limits for continued use of p-chart.

    c) The test results as described above are from a special severe heat stress chamber which is designed in such a way that 25% of the product will fail when, in fact, it is satisfactory for its intended use. If the minimum stress specification is 750 units & the process S.D. is known to be 12 units, what should be the lower limit of the test? Assume that this stress characteristic to be normally distributed.   (20)

6. What is Quality Function Deployment and explain its implementation procedure using a case study through QFD relationship matrix?   (20)

7. a) Explain the concept of Six Sigma and write the advantages and limitations of Six Sigma. How is it different from TQM?   (10)

    b) Derive the following relations :

       i. $R(t) = e^{-T|\theta}$

       ii. $R(t) = e^{-\int h(t)dt}$

    where : R(t)= Reliability, θ = Mean life, T = required life of a product and h(t)= Hazard rate   (5+5)

8. Write the short notes on the following :   (5×4)

    a) Series and parallel reliability systems.

    b) ISO 9004 QA standardization.

    c) Chain sampling plan.

    d) Quality Assurance.