Code No: **RT42034D** **R13** Set No. 1

IV B.Tech II Semester Regular Examinations, April/May - 2017
QUALITY AND RELIABILITY ENGINEERING
(Mechanical Engineering)

Time: 3 hours   **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) What is the chain reaction of quality?   [4]
    b) What are the benefits of an $\overline{X}$ chart?   [4]
    c) Find a single-sampling plan for which $p_1=0.01$, $\alpha=0.05$, $p_2=0.10$, and $\beta=0.10$ [3]
    d) Write a short note on ISO-9000 series.   [4]
    e) Derive the relation between Reliability and MTTF.   [4]
    f) Define Reliability, Availability and Maintainability.   [3]

PART–B *(3x16 = 48 Marks)*

2. a) What is the meaning of the quality? Discuss the factors affecting the quality of a   [8]
        product?
    b) What are the objectives of the quality control?   [8]

3. a) $\overline{X}$ and R charts are used to control a process by drawing subgroups of five units
        every 2h. Specifications on one critical characteristic are 2,119119. Product over
        space may be reworked: if undersized it must be scrapped. After 50 sub-groups,
        $\sum \overline{X} = 106,200$ and $\sum R = 581.5$
        i)   Determine 3-sigma control charts for $\overline{X}$ and R charts
        ii) Assuming the process is in control and normally distributed, estimate σ
             and determine the percent of product that must be reworked and that must
             be scrapped.   [8]
    b) Explain the three categories of statistical quality control (SQC). How are they
        different, what different information do they provide, and how can they be used   [8]
        together?

4. a) Design a single sampling plan for a consumer's risk of 0.05, producer's risk of
        0.10, RQL of 0.1 and AQL of 0.05   [8]
    b) Draw a neat sketch of O.C curve showing its different regions   [8]

5.   a)   Explain about Dodge-Roming system   [8]
    b)   How quality circles will improve the industry?   [8]

6.   a)   When newly designed short-range missile from a company are test-fired, they seem to hit the target at unpredictable distances from the Centre of the target. The distance r from the centre where the hit occurs is found to follow the Rayleigh distribution function $f_R(r) = (Ar)\exp\ (-h^2 r^2)$.

       i).   Determine the factor A
       ii).   Determine the distance r from the centre where most of the hits occur.
       iii).   Calculate the mean of the distribution.   [8]

    b)   Explain Hazard models   [8]

7.   a)   What are standby systems? Explain its need?   [5]
    b)   How many components having reliability of 0.9 are required to have overall reliability of system of 0.99?   [5]
    c)   Three components having reliabilities 0.8, 0.85 and 0.9 are connected in parallel
       (i) What is the overall reliability of the system?
       (ii) If another component of reliability 0.7 is connected in series to this system, What is the reliability of the resultant system?   [6]