

Total No. of Questions : 8]

SEAT No. :

PD4712

[Total No. of Pages : 3

[6404]-218

B.E. (Mechanical Engineering)

QUALITY AND RELIABILITY ENGINEERING

(2019 Pattern) (Semester - VIII) (402050A) (Elective-V)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Draw suitable neat diagrams, whenever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Assume suitable data if required.*

Q1) a) Differentiate between Quality & Reliability. **[6]**

- b) The failure of ten vehicle brakes are observed to be 43500, 52000, 72000, 84500, 93500, 101000, 111500, 116000 & 123500 miles of operations. Plot the probability density, probability distribution, reliability and the hazard function of the failure time to brakes. **[12]**

OR

Q2) a) Define failure with it's classification and modes of failure in detail. **[9]**

- b) Explain in detail the term Probability Density Function (PDF) & Cumulative Distribution Function (CDF). **[9]**

Q3) a) Explain with illustration reliability analysis of series, parallel & mixed configuration systems. **[8]**

- b) The three main units connected in series together make an assembly of machine which requires reliability of 0.65. The individual reliabilities of units are 0.70, 0.80 & 0.90 respectively. Explain and find how the reliability of machine should be apportioned among these units with minimum effort technique. **[9]**

OR

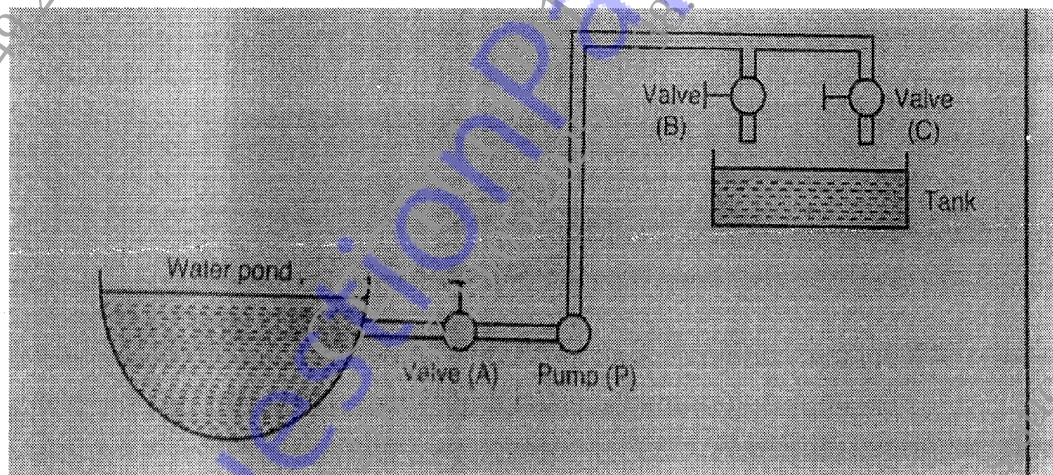
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Q4) a) Explain in detail about Cold, Warm & Hot Standby Redundancy. [8]

- b) A system have three elements 1, 2 and 3 connected in series with their failure rates of $\lambda_1 = 0.006$, $\lambda_2 = 0.004$, $\lambda_3 = 0.001$ per hour respectively Assuming mission time of 20 hours and system reliability of 0.92, find the reliability of each subsystem to achieve the desired reliability goal.[9]

Q5) a) What is fault tree analysis (FTA)? Give four basic symbols used in FTA. Explain four points of differences between FTA and failure mode and effects analysis (FMEA) approach. [9]

- b) Figure shows three valves A, B and C, a pump (P), a pipeline and a tank to collect water pumped from the pond. Construct the fault tree corresponding to the top event no flow of water into the tank. [9]



OR

Q6) a) What is FMECA? Give the procedure of FMECA. State importance of RPN in FMECA with example. [9]

- b) Draw and explain any five symbols used in fault tree construction. [9]

Q7) a) Write a note on : **[9]**

- i) Markov model
 - ii) MTBF
 - iii) Reliability Centered Maintenance (RCM)
- b) Define preventive, predictive and corrective types of maintenance. State the benefits of each type of maintenance with suitable examples. **[8]**

OR

Q8) a) Define maintainability and state the factors which affect maintainability. Also, compare the inherent, achieved and operational availability. **[8]**

- b) A beam is subjected to mean stress 180 N/mm^2 and standard deviation 20 N/mm^2 the mean strength of beam material is 280 N/mm^2 and standard deviation 40 N/mm^2 . **[9]**

Determine:

- i) Reliability of the Beam
- ii) Minimum Factor of Safety
- iii) Average factor of safety

