

Total No. of Questions : 8]

SEAT No. :

P1428

[6004]-618

[Total No. of Pages : 4

B.E. (Mechanical)

QUALITY AND RELIABILITY ENGINEERING
(2019 Pattern) (Semester - VIII) (Elective - V) (402050 A)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Draw suitable neat diagrams, whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

Q1) a) Explain following basic concepts of Reliability (Any 4): **[8]**

- i) Failure Rate ($\lambda(t)$)
- ii) Hazard Rate ($h(t)$)
- iii) MTTF
- iv) MTBF
- v) Probability Density Function (PDF)
- vi) Cumulative Distribution Function (CDF)

b) What is Reliability? Distribution between Quality and Reliability of a product. Explain the causes of Unreliability in mechanical system. **[9]**

OR

Q2) a) What are the different modes of Failure? Draw & explain a specimen 'Bath Tub Curve' showing various life characteristic phases/regions. **[8]**

b) The failures of brakes of Ten Automobiles 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. **[9]**

P.T.O.

- Q3) a)** Calculate the reliability of the system shown in following Fig. (1). The value shows the reliability of individual components in the system. [10]

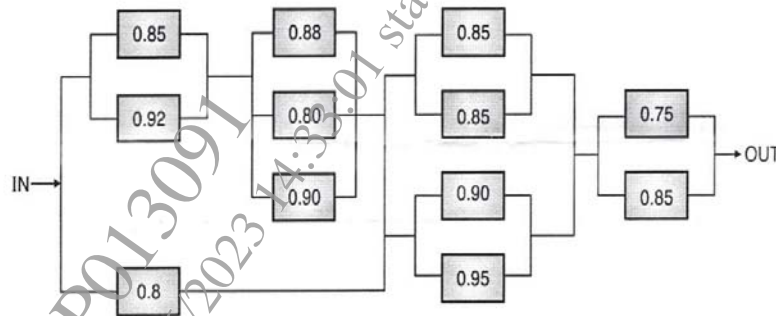


Fig.(1)

- b) A system consists of three components 1, 2 and 3 having failure rates $\lambda_1 = 0.006$, $\lambda_2 = 0.004$ and $\lambda_3 = 0.001$ per hour respectively. Assuming mission time of 20 hrs. and system reliability of 0.92, find failure rates as well as reliability of each subsystem for entire mission period by 'ARINC' method of Reliability Allocation. [8]

OR

- Q4) a)** Evaluate the Reliability of System shown in following Fig. (2) By Conditional Probability Approach. [10]

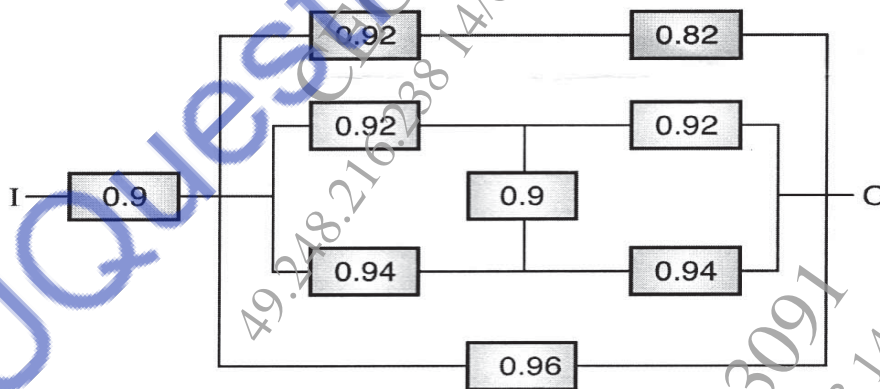


Fig.(2)

- b) A system consists of three units connected in series, with reliabilities $R_1 = 0.70$, $R_2 = 0.80$ and $R_3 = 0.9$. It is desired that the reliability of the system to be 0.65. How should this be apportioned among three units by Minimum Effort Method? [8]

Q5) a) What is FMECA? Give the procedure of FMECA. State importance of RPN in FMECA, with example. [8]

b) Fig. (3) 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]

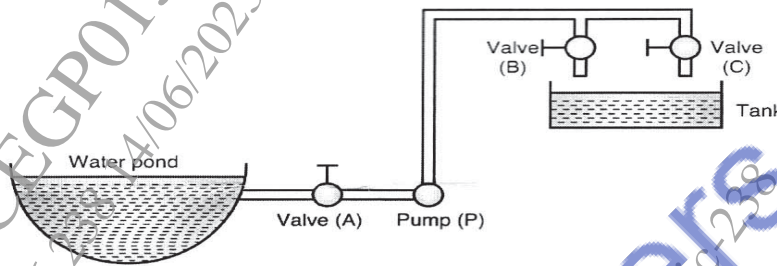


Fig.(3)

OR

Q6) a) Write Short notes on(Any 2): [8]

- i) Fault Tree Analysis.
- ii) Ishikawa for failure representation (Cause Effect Diagram)
- iii) Symbols used in FTA

b) For an emergency operation theatre in a hospital, the power is obtained from the main city supply through a transformer connected in series. To ensure an uninterrupted supply, an auxiliary generator is also used with a suitable switch over. Refer Fig. (4). The probability of failure of the main city supply is 0.01 and transformer reliability is 0.996. The auxiliary power generator has a reliability factor of 0.99. Draw a block diagram for the system. Construct the fault tree and calculate reliability of the system.[9]

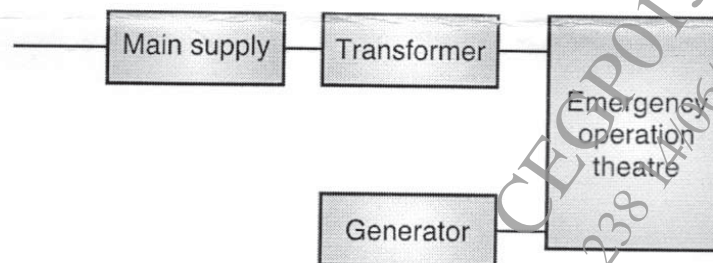


Fig.(4)

Q7) a) Define Maintainability and Availability for the system from the following data collected at a plant. [8]

Mean time before failure: 35 Hrs.

Mean time to repair: 10 Hrs.

Administrative and logistic time: 50% of MTTR

Calculate operational availability and inherent availability of the plant.

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 . (Given: for $Z = -2.24$, Area = 0.4875) [10]

Determine:

i) Reliability of the beam.

ii) Minimum factor of safety.

iii) Average factor of safety.

OR

Q8) a) What is meant by Accelerated test in evaluating Reliability? Give at least six point differences between Highly Accelerated Life Testing (HALT) and Accelerated Life Testing (ALT) [8]

b) The following data is obtained while Accelerated life testing of a rubber Gasket: [10]

Failure No.	1	2	3	4	5	6	7	8	9
MTTF(hrs.)	24	22	12	28	35	38	30	19	25

Find out the reliability and plot the variation of reliability against time using:

i) Mean ranking method and

ii) Median ranking method

