

Total No. of Questions : 8]

SEAT No. :

P-6678

[Total No. of Pages : 4

[6181]-246

B.E. (Mechanical)

QUALITY AND RELIABILITY ENGINEERING

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Draw suitable neat diagrams, wherever necessary.*
- 2) *Figure to the right indicate full marks.*
- 3) *Assume suitable data if required.*

Q1) a) Explain the following (Any 3) : [9]

- i) Reliability
- ii) Hazard Rate
- iii) Mean Time to failure (MTTF)
- iv) Probability density functions of failure

b) State the importance and role of the reliability function in an organization. Distinguish between Quality and Reliability of a product. [8]

OR

Q2) a) Explain following probability distributions (Any 2) : [8]

- i) Binomial distribution
- ii) Normal distribution
- iii) Weibull distribution

b) A cinema house gets electric power from a generator run by a diesel engine. On a given day, the probability that the generator is down (Event A) is 0.025 and the probability that the diesel engine is down (Event B) is 0.04, what the probability that the cinema house will have power on any given day? Assume that the occurrence of event A & B are independent of each other. [4]

c) Draw & explain a specimen 'Bath Tub Curve'. [5]

P.T.O.

Q3) a) 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]

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

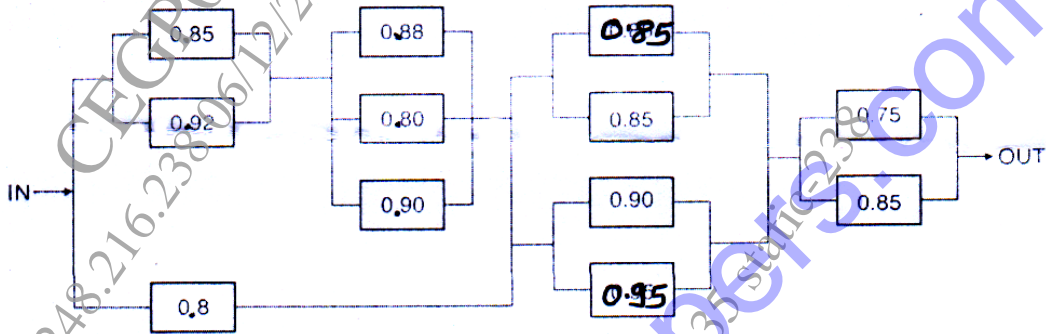


Fig. (1)

OR

Q4) a) A system consists of three units connected in series, with reliabilities $R_1 = 0.70$, $R_2 = 0.80$ and $R_3 = 0.90$. 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]

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

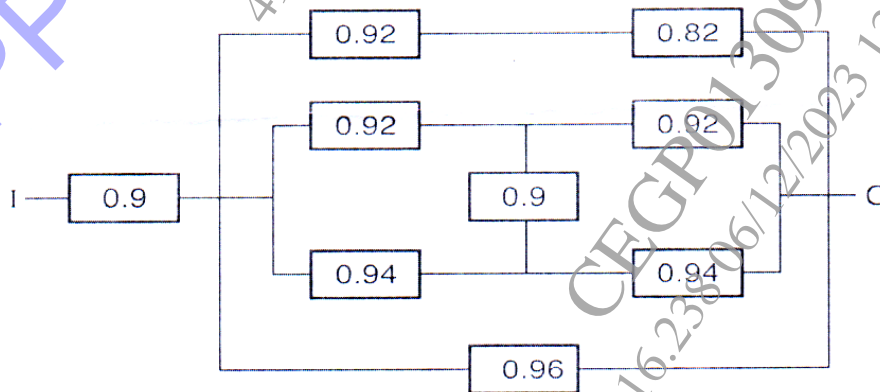


Fig. (2)

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]

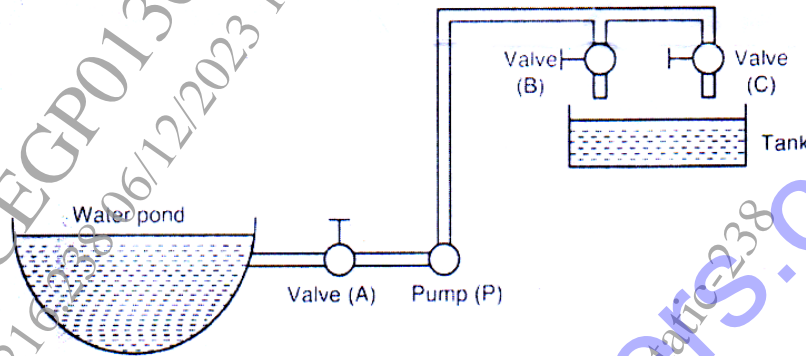


Fig. (3)

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 ETA

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]

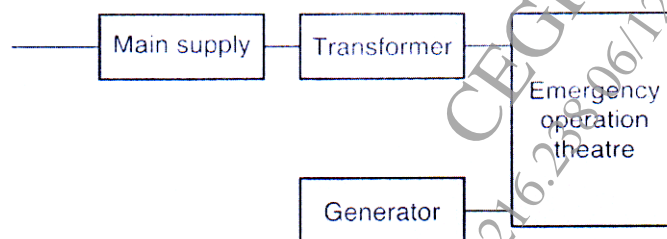


Fig. (4)

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

