Total No. of Questions : 8]

SEAT No. :

PE2297

[Total No. of Pages : 4

[6584]-205
B.E. (Mechanical)
QUALITY AND RELIABILITY ENGINEERING
(2019 Pattern) (Semester - VIII) (Elective - V) (402050A)

Time : 2½Hours] *[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 diagrms, whenever necessary.*
3) *The figures to the right indicates full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Explain failure density and failure rate. Describe the main features of the 'bathtub' failure rate curve, explaining why each of the three regions has its characteristic shape. **[8]**

b) Explain the following Terms (Any 3): **[9]**

i) Safety and Reliability

ii) Importance and Reliability

iii) Areas of Reliability

iv) Uncertainty Analysis in Reliability

OR

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

i) Poisson's distribution

ii) Exponential distribution

iii) Log-normal distribution

b) In an engine manufacturing plant, 70% of the crankshaft is ground by machinist 'R' and 30% by machinist 'S'. It is known from past experience that the crankshaft ground by machinists 'R' and 'S' contain 2 and 3 defective units respectively. If a randomly selected crankshaft is found to be defective, find the probability that it was ground by the machinist 'R'. **[5]**

c) A system has a constant failure rate of 10^{-3}/hr. What is the probability that the system will fail before t = 1000 hrs? Determine the probability that it works at least 1000 hr. **[4]**

P.T.O.

Q3) a) Write a short note on (Any 2): **[10]**

i) Tie Set and Cut Set Methods of Reliability Evaluation

ii) Cold, Hot, and Standby Redundancy Techniques

iii) Reliability Evaluation by Conditional Probability Method

b) A system having four subsystems has a reliability level of 0.95 for 10 hrs. Mission time of continuous operation. Subsystems 1 & 3 must be there for the successful operation of the system. Subsystem 2 has to function for only 9 hrs. for the operation of the system and its importance factor is 0.95. Subsystem 4 has to function for 8 hrs. for the operation of the system and its importance factor is 0.9. Number of modules in each subsystem is given below. What are allocated subsystem reliabilities and system reliability? Use the AGREE Allocation Method. **[8]**

Subsystem No. (i)	1	2	3	4
No. of Modules (N_i)	15	25	100	70

OR

Q4) a) Calculate the reliability for the system shown in the following Fig. 1. The number in each block shows the reliability of the individual component. **[10]**

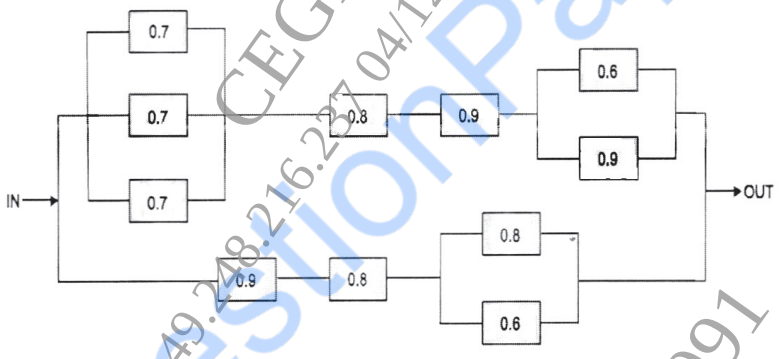

Fig. (1)

b) The following data refer to the predicted reliability of six components in a series. In case the desired reliability of the system does not fall below 0.85. Find the reliability goal for individual components. **[8]**

Components	1	2	3	4	5	6
Predicted Reliability	0.994	0.998	0.990	0.996	0.990	0.980

Q5) a) What is FMECA? Give the procedure of FMECA. State the importance of RPN in FMECA, with example. **[9]**

b) A room with two light bulbs is operated by a single switch. By assuming the 'No light in the room' as the top undesirable event. Construct the fault tree for the system shown in Fig 2. **[8]**

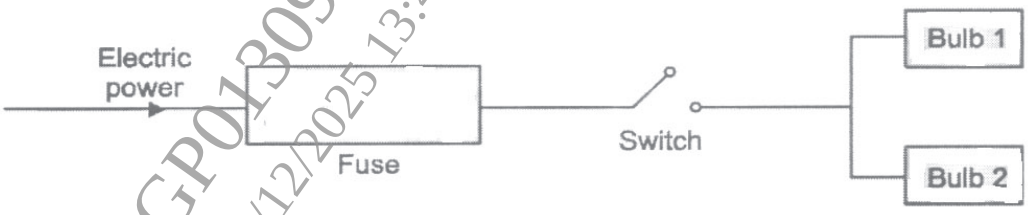

Fig. (2)

OR

Q6) a) Write Short notes on: **[9]**

i) Fault Tree Analysis

ii) Ishikawa for failure representation (Cause Effect Diagram)

iii) Symbols used in FTA

b) A SPM (Special purpose machine) requires a continuous DC supply during operation. A required DC supply is made available through AC to DC converters. Two converters are used in order to ensure uninterrupted DC supply. Converters receive power supply from sub-station which is directly connected to the main supply line. Construct the fault tree for the system shown in Fig 3. **[8]**

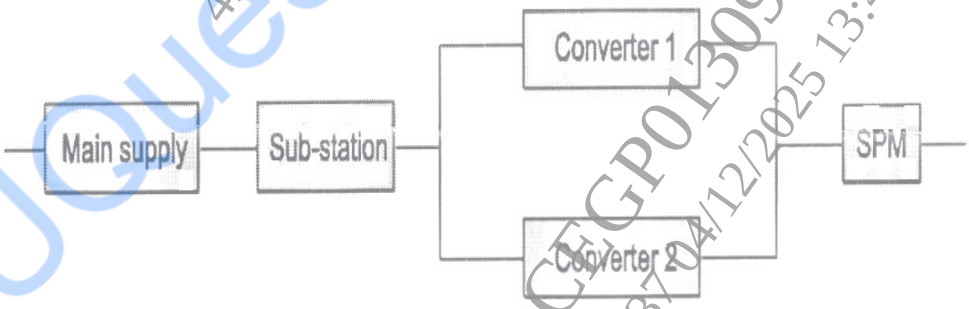

Fig. (3)

Q7) a) i) Explain factors affecting on Maintainability. **[10]**

ii) From the following data collected at a plant:

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) Explain Availability and Maintainability. Show that mean time to repair (MTTR) is the reciprocal of repair rate, from the basic maintainability equation. **[8]**

OR

Q8) a) In a short sample 'accelerated life testing" of a system based on weibull distribution the following data are recorded. **[10]**

Failure No.	1	2	3	4	5	6	7
MTTF (hrs.)	28.0	12.0	21.5	26.0	35.0	38.0	30.0

Plot the variation of reliability against time using:

i) Mean ranking and

ii) Median ranking method.

b) Classify the different tests carried out for Reliability testing and explain in brief (Any 2): **[8]**

i) Accelerated Life Testing (ALT)

ii) Highly Accelerated Life Testing (HALT)

iii) Highly Accelerated Stress Screening (HASS)