Total No. of Questions : 12]

SEAT No. :

P2679

[Total No. of Pages : 5

[5154]-49
B.E. (Mechanical)
RELIABILITY ENGINEERING
(2008 Course) (Semester - II) (Elective - IV) (402050C)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer 3 questions from Section I and 3 questions from Section II.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is Reliability? Explain different reliability measures. How to select particular reliability measure? **[8]**

b) Following table shows the results of life test carried out on 200 components simultaneously for 100 Hrs. **[10]**

Operating time [Hrs.]	0	10	20	30	40	50	60	70	80	90	100
No. of surviving components	200	180	160	145	130	110	98	80	76	68	50

Evaluate Hazard rate, failure density & Reliability. Plot these functions against time.

OR

Q2) a) Explain maintainability with practical applications. **[8]**

b) The random variation with respect to time in the O/P voltage of systems are exponentially distributed with mean value of 150V. What is the probability that the O/P voltage will be found at any time to lie in the range of 140-160V. **[10]**

P.T.O.

Q3) a) Explain total probability theorem with suitable example. Explain any one distribution used in probability theory. **[8]**

b) Fig. No. 1 shows a reliability block dig. for the system. R(1) = 0.90, R(2) = 0.94, R(3) = 0.88, R(4) = 0.80, R(5) = 0.90. Find the system reliability using conditional probability method. **[8]**

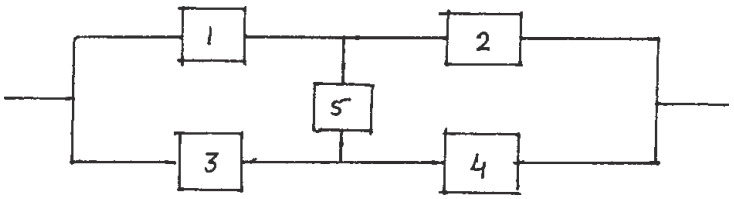


Fig. No. 1

OR

Q4) a) Explain system Redundancy. **[8]**

b) Evaluate the reliability of the system as shown in Fig. No. 2 using Tie-set & cut set method.

Reliability of each component R(A) = R(B) = R(C) = R(D) = 0.98. **[8]**

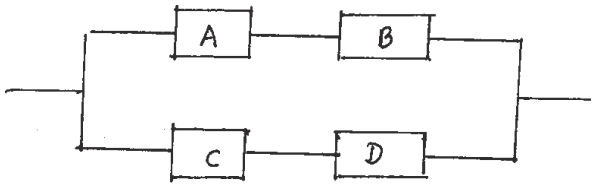


Fig. No. 2

Q5) a) Describe some methods of enhancing the reliability of a multicomponent system. **[8]**

b) A system is composed of Five subsystem with details as indicated in the following table: **[8]**

Sub system	No. of Components	Operating period [Hrs.]	Probability of system failure due to failure of subsystem
1	5	10	0.15
2	2	25	0.10
3	8	05	0.20
4	6	20	0.05
5	4	18	0.25

Determine the mean lives of the component of various subsystems so as to have a system reliability of 0.99 using AGREE method.

OR

Q6) a) Explain in detail Reliability Apportionment technique. **[8]**

b) Explain with practical example reliability predictions from predicted unreliability. **[8]**

SECTION - II

Q7) a) Define the terms reliability, availability and maintainability. What is the difference between Inherent availability and operational availability? **[8]**

b) The following data relates to a plant on predictive preventive maintenance.

Mean time between failure = 28 hours.

Mean time to repair = 12 hours

Calculate :

i) Operational availability and

ii) Inherent availability of the plant

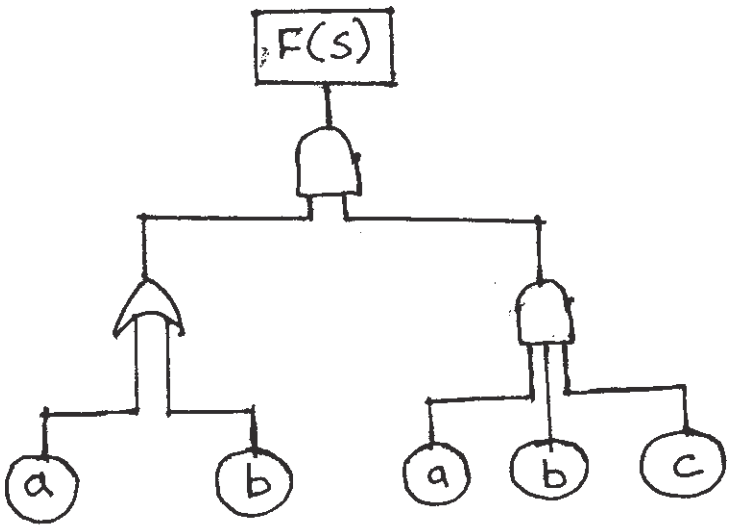
Assuming administrative logistics times add upto 60% of the mean time to repair. **[8]**

OR

Q8) a) What is meant by reliability centred maintenance? **[8]**

b) A component has to be so designed, that it has to have a reliability value of 0.95 for an operation of 800 hrs. The availability value over the same period of time is required to be 0.98. Assuming constant hazard for failure and repairs estimate the time to failure and mean repairs time. **[8]**

Q9) a) Figure shows a fault tree diagram. The failure rate of each basic element is given as λ (a) = 0.025, λ (b) = 0.01 and λ (c) = 0.005. Find out the failure rate of the system. **[8]**

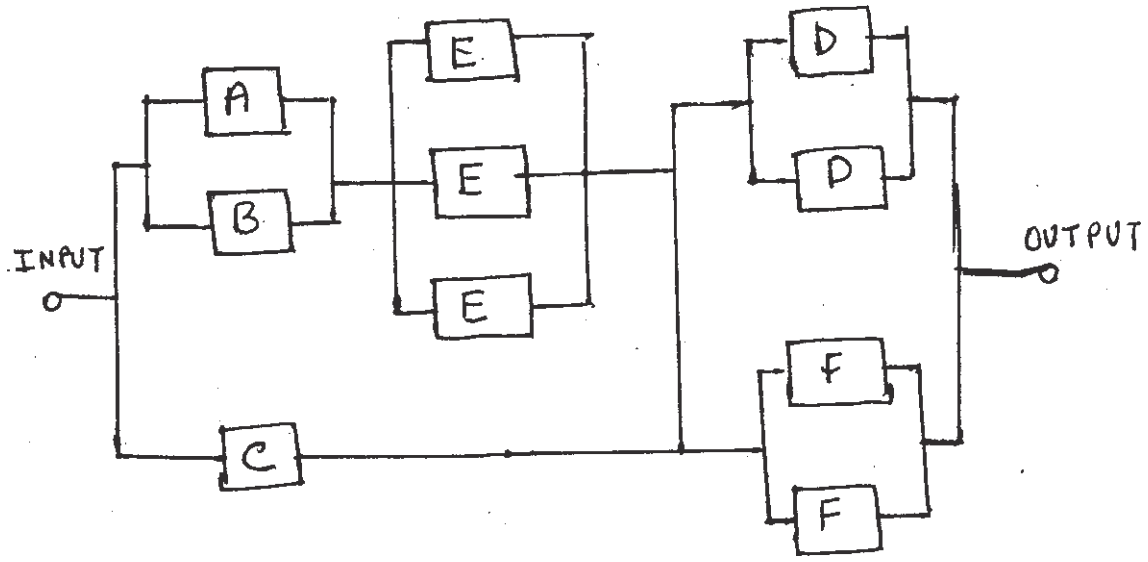


b) Explain the methodology of constructing fault tree diagram as a part of F.M.E.A. and F.M.E.C.A. Write down the specific advantages and field of applicability of F.M.E.A. and F.M.E.C.A. **[8]**

OR

Q10)a) What is 'Risk Priority Number' and how it can be determined? **[6]**

b) Construct a fault tree for the system shown in Figure. If all the elements are having failure probability of 0.1, Calculate system failure using fault tree analysis. **[10]**



Q11)a) Define safety margin, a rising out of load-strength interaction and discuss its significance on the assessment of design reliability. **[8]**

b) The mean strength and standard deviation of a bolted joint are 3000 kgf/cm^2 and 300 Kgf/cm^2 respectively. The joint is loaded such that stress induced has a mean value of 2500 kgf/cm^2 with standard deviation of 50 kgf/cm^2. Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of bolted joint. Statistical data given below: **[10]**

Z	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Q(Z)	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.9640

OR

Q12)a) Explain how markov models are applied in reliability analysis of a system having constant hazard rate? **[8]**

b) From the following data, find the reliability based on: **[10]**

i) Mean ranking

ii) Median ranking methods.

Plot the two curves and comment on deviation if any

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