Total No. of Questions : 8]

SEAT No. :

P4009

[Total No. of Pages : 3

[4860] - 105

M.E. (Mechanical) (Design Engineering)

RELIABILITY ENGINEERING

(2008 Pattern) (Elective - III(a))

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

Instructions to the candidates :

1) *Answer any THREE questions from each section.*
2) *Answers to the two sections should be written in separate books.*
3) *Neat diagrams must be drawn whenever necessary.*
4) *Assume suitable data, if necessary.*
5) *Figures to the right indicate full marks.*
6) *Use of non-programmable electronic calculator is allowed.*

SECTION - I

Q1) a) Explain with example : **[8]**

i) MTTF

ii) MTBF

b) The following failure data is collected for a group of 100 LED. Find the failure density, hazard rate and reliability and plot functions to against time. **[8]**

Time Interval(Hrs.)	1	2	3	4	5	6	7	8	9	10
No. of Failures	18	16	9	8	6	7	5	8	10	13

Q2) a) Explain total probability theorem with example. **[8]**

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b) Calculate the reliability for the system shown in Fig. 1. The number in each block shows the reliability of individual component. **[8]**

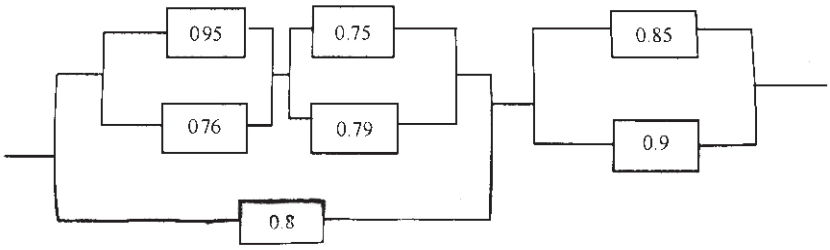

Fig.1

Q3) a) Explain Cut set and Tie set method for reliability. **[8]**

b) Discuss Inherent, Achieved and operational availability with practical example. **[8]**

Q4) Write short note (Any three) : **[18]**

a) Chebyshev inequality

b) Markov analysis

c) Bath tub curve

d) Maintainability

SECTION - II

Q5) a) Explain "Reliability prediction from predicted reliability" with example. **[8]**

b) A system consists of 6 sub-systems connected in series. The reliability goal is 0.98 for period of 20 hours operation. Compute the reliability goal for each sub-system using AGREE method of allocation. **[8]**

Sub-system	Number of modules	Operating Modules	Importance Factor
1	40	20	1.0
2	70	18	0.98
3	40	20	1.0
4	50	16	0.95
5	65	14	0.93
6	75	20	1.0

Q6) a) Derive reliability equation when strength and load follows normal distribution. **[8]**

b) Explain with any one practical example Fault tree analysis method. **[8]**

Q7) a) Explain reliability testing with any one practical example. **[8]**

b) The MTTF and MTTR of four sub-systems in a system are given in the Table no. 1. Estimate the system level mean time to repair, MTTRs. **[8]**

Table no.1

Sub-system	MTTF	MTTR
1	320	24
2	500	36
3	240	12
4	420	08

Q8) Write short note (Any three) : **[18]**

a) Strength based reliability

b) Reliability Testing

c) Monte Carlo evaluation

d) FMEA

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