

GUJARAT TECHNOLOGICAL UNIVERSITY
ME Semester –III Examination Dec. - 2011

Subject code: 732901

Date: 05/12/2011

Subject Name: Reliability and Maintainability Engineering

Time: 10.30 am – 01.00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Notations used have usual meaning.

Q.1 (a) Explain reliability and hazard rate. Derive relationship between reliability and hazard rate. **07**

(b) A component has reliability function as $R(t) = e^{-at^2}, t \geq 0$ **07**
 Obtain (i) hazard rate (ii) failure law (iii) MTTF.

Q.2 (a) Explain Hypo-exponential failure law. **07**

(b) A random variable X has the following probability function: **07**

x :	-2	-1	0	1	2	3
f(x):	0.1	k	0.2	2k	0.3	3k

Find (i) k (ii) Evaluate $P(X < 2)$, $P(X \geq 2)$, $P(-2 < X < 2)$
 (iii) the minimum value of k such that $P(X \leq 1) > 0.36$ (iv) expected mean value.

OR

(b) Explain followings in brief, **07**
 (i) Reliability prediction and allocation
 (ii) MTTF and MTBF

Q.3 (a) Write brief note on load sharing system. **07**

(b) Explain sneak circuit analysis for electronic system reliability. **07**

OR

Q.3 (a) Differentiate Binomial and Poisson distribution. Derive Poisson distribution from Binomial distribution. **07**

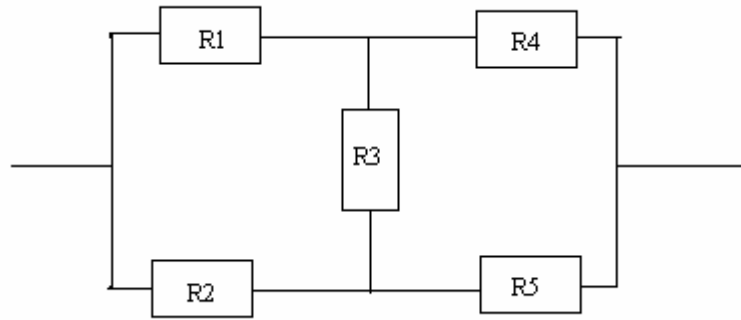
(b) Explain Tie-set method for reliability evaluation with illustrative example. **07**

Q.4 (a) Discuss the effect of perfect preventive maintenance on reliability of a component. **07**

(b) An active generator has a failure rate (failures per day) of 0.01. An older standby generator has a failure rate of 0.001 while in standby and a failure rate of 0.1 when online. Determine the system reliability for a planned 30 day use and compute the system MTTF. **07**

OR

Q.4 (a) Using decomposition method find the reliability of following system **07**
 where $R_1 = R_2 = R_3 = R_4 = R_5 = r$.



- (b) A random variable X is uniformly distributed between $[-1, 1]$. **07**
Find $f(x)$, $R(x)$ and expected mean value Also Obtain probability distribution function of $y = x^2$.

- Q.5** (a) Discuss star delta method for reliability evaluation with illustration. **07**
(b) A random variable X is exponentially distributed with parameter λ . **07**
Find $f(x)$, $R(x)$ and expected mean value. Also Obtain probability density function of $y = e^{-x}$

OR

- Q.5** (a) A product is made of three parts A, B and C. the manufacturing process are such that the probability of A being defective is 0.07, of B is defective is 0.05 and of C being defective is 0.08. what is the probability that the assembled product will contain,
(i) No defectives
(ii) at least 2 defectives
(iii) at least one defectives. **07**
(b) Explain part count method for electronic system reliability. **07**
