

[Total No. of Questions - 8] [Total No. of Printed Pages - 3]
(2064)

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M. Tech 2nd Semester Examination
Reliability of Electronic Communication Systems
EC-205

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions.

1. (a) Define Reliability and explain what are the important aspects of the definition of reliability that needs careful consideration.

(b) Explain conditional probability with example. A given lot of small devices is 98 percent good and 2 percent defective. To be certain of using a good device, each device is tested before installation. The tester itself is not totally reliable since it has the following conditional probabilities:

 $P(\text{says good/actually good}) = 0.95$

 $P(\text{says bad/actually bad}) = 0.95$

A device is tested with the tester indicating the device is bad. What is the probability the device is actually bad?
(10+10=20)
2. (a) Explain Exponential distribution with graphs. Discuss its importance in the field of reliability engineering.

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- (b) In a certain manufacturing process, one percent of the products are known to be defective. If 50 items are purchased by a customer, what is the probability of getting two or less number of defectives? Use Poisson distribution to solve the problem. What are the factors that contribute to the delay time of transistor switch? (10+10=20)
3. (a) Derive expression for the reliability and MTBF for series system and parallel systems.
- (b) Define the following terms:
- (i) Tie sets (ii) Cut sets (iii) Minimal Cut Sets (iv) Minimal tie sets
- Describe the method of cut set for reliability evaluation. (10+10=20)
4. (a) Explain the concept of maintainability and its equation. What are the factors affecting maintainability? How does the inventory control of spares affect the maintainability of the system.
- (b) Explain availability, describe the measure of availability. (10+10=20)
5. (a) Define failure rate and express it in terms of reliability. A sample of 200 resistors is subjected to testing. Five failures are found at the end of 500 hours. Six more at the end of 800 hours, 2 more at the end of 1200 hours, 6 more at the end of 1800 hours and no further failures are found when the test is terminated at the end of 2400 hours.
- (i) Estimate the MTBF if failed resistors are replaced when found.
- (ii) Estimate the MTBF if no replacements are made.

- (b) A component has a reliability of 0.9 for a mission time of 50 hrs. What is the reliability for a mission time of 100 hrs and 500 hrs? (10+10=20)
6. (a) An electronic system can fail in two mutually exclusive failure modes, i.e., type I (open mode) and type II (short mode). The open and short modes constant failure rates are $\lambda_1 = 0.002$ and $\lambda_2 = 0.004$ failures/hour, respectively. Calculate the value of the following items for a 100 hr mission:
- (i) System reliability
 - (ii) Open mode failure probability
 - (iii) Short mode failure probability
- (b) Calculate the system reliability and MTBF of standby system. (10+10=20)
7. (a) Explain the process of measurement and prediction of human reliability.
- (b) Explain Bay decomposition method for reliability evaluation.
- (c) What is the structure of value engineering? Give any one technique for value engineering. (7+7+6=20)
8. Explain the following:
- (a) Monte Carlo method
 - (b) Mission availability
 - (c) Intrinsic availability
 - (d) Reliability Management (4×5=20)