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2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS
POWER SYSTEM RELIABILITY
(ELECTRICAL & ELECTRONIC ENGINEERING)

APR/MAY 2006

TIME : 3 HR
MARK : 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is a random variable? Discuss briefly any two continuous distributions applicable in reliability engineering ?

(b) A lot containing 7 components is sampled by a quality inspector ; the lot contains 4 good components and 3 defective components. A sample of 3 is taken by the inspector . Find the probable value of number of good components in this sample.

2. (a) From fundamentals establish that Poisson distribution is a limiting case of binomial distribution .

(b) The life in hours of an electronic gadget is normally distributed with parameters μ = 160 hours and some , what would be the maximum allowable value for s if the life of the gadget is to have a probability 0.80 of being between 120 hrs and 200 hrs.

3. (a) Distinguish between fully redundant and partially redundant configurations with suitable examples

(b) A system consists of two sub-stations in series. System 1 has four possible operating levels and System 2 has three possible operating levels as shown in the following table.

SYSTEM 1 SYSTEM 2
Output Probability Output Probability
100% 0.80 100% 0.7
75% 0.10 50% 0.1
25% 0.05 0% 0.2
0% 0.05
Develop an operating level probability table for the system

4. (a) Develop the state space diagram of a three component repairable system with non-identical transitional rates.

(b) If in the above system, the transitional rates are identical then evaluate the expressions for equivalent failure rate and equivalent repair rates of the system if the components are having identical capacities.

(c) Explain what is meant by mission oriented system and hence develop the state space diagram for 2 components and derive expressions for limiting state probabilities if the components are having identical capacities and transition rates.

5. (a) Explain the recursive relation to be used for finding cumulative probabilities when a unit is to be removed from the system.

(b) A generating station consists 4 units each having a forced outage rate of 0.15 and

capacity of each is 15 Mw. Develop the cumulative capacity outage probability table. Now if one unit is removed, develop the modified table using recursive relation.

6. A system consists of two 80 MW and one 100 MW generating units with forced outage rates of 0.03 for all. The monthly load duration curve is assumed to be a straight line, varying from 100% to 20% of peak load in 100 hrs. The peak load is 200 MW. Find the loss of load probability.

7. (a) Find the minimum number of redundant components each having reliability necessary to achieve a system reliability of 0.95. There is a common mode failure probability of 0.03.

(b) Derive the expression for the MTTF for the load sharing system as defined.

8. (a) Consider a system having G generating units and L transmission units and number of unavailability of generating units are AG and unavailability of lines is AL. compute the expressions for the failure probability.

(b) Explain Monte Carlo simulation technique for the reliability assessment of bulk power system.