7. Explain in detail : **8+7**

(a) Matrix multiplication method

(b) Stochastic t.p.m. method

to evaluate the reliability of a system.

Unit IV

8. (a) Explain the following :

(i) Modified and Renewal Processes

(ii) Renewal function and Renewal density. **10**

(b) Derive renewal equation for renewal process. **5**

9. (a) Define time up to the *r*th renewal (S_r) and find its asymptotic distribution with mean 'μ' and variance σ^2. **8**

(b) Find the variance of the number of renewals. **7**

Roll No. ..... **Total Pages : 04**

LMDQ/M-24 7514

RELIABILITY AND RENEWAL THEORY

ST-403 & ST-404(ii)

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory.

Compulsory Question

1. (i) Define hazard rate. Give an example.

(ii) Differentiate between perfect and imperfect switching.

(iii) Explain the concept of redundancy.

(iv) Define 'minimal cuts sets'.

(v) Differentiate between backward and forward recurrence times. **3×5=15**

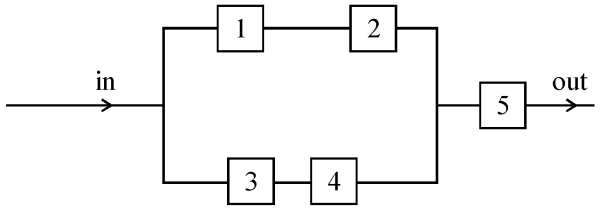
Unit I

2. (a) Define reliability of a component. Obtain its mathematical formulation. If hazard rate of a device is $\lambda(t) = \frac{1}{\sqrt{z}}$, find mean time to failure.

(b) Discuss Linear and non-Linear hazard models. Also obtain their reliability. **7**

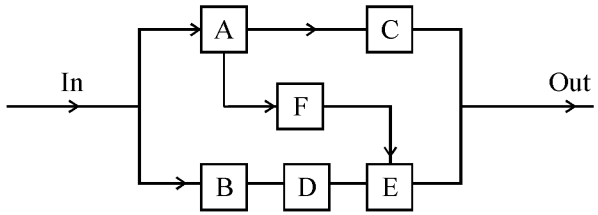
3. (a) Compare the reliability of a 2-component system each having a failure rate of 0.02 f/hr after a time of 10 hr for (i) Parallel redundant and (ii) standby redundant with a 100% reliable sensing and change over device. **10**

(b) Calculate the reliability of the system shown in figure with non-identical components : **5**

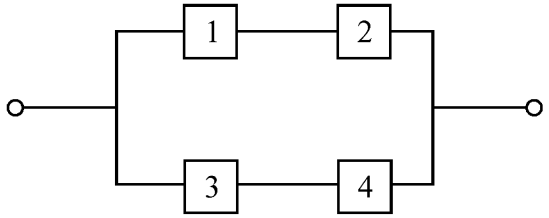


Unit II

4. Explain conditional probability approach to evaluate the reliability of a complex system. By using this method, evaluate the reliability of the system shown in the figure :



5. (a) Find the expression for reliability of the system shown below, when it is operating in the wearout period : **7**



(b) With the help of an example, explain cut set method to find the reliability of a system. **8**

Unit III

6. Consider a 2-out-of-2 system each with Constant failure rate λ and constant repair rate μ. At any time 't' the system must be in one of the following three states (S_i; $i = 0, 1, 2$) with probability $p_i(t)$:

S_0 : both components are working

S_1 : One component has failed and under repair, other component is operative.

S_2 : both components have failed.

The boundary conditions are given by :

$$p_i(o) = \begin{cases} 0 & \text{if } i = 1, 2 \\ 1 & \text{if } i = 0 \end{cases}$$

Obtain reliability and mean time to failure. **15**