Sr. No. of QP: 244 E Roll No.

Unique Paper Code: 236451

Name of the Course: BA (Prog)

Name of the Paper: Queueing Theory and Reliability Theory

Semester: IV

Duration: 3 Hrs Max. Marks: 75

Instructions:

1. Write your roll. No. on the top immediately after receipt of this question paper.
2. Answer five questions in all attempting at least two from each section.
3. All questions carry equal marks
4. Simple calculators are allowed

Section A (Queueing Theory)

1. (a) Define a queue. With respect to a queueing system, explain the following;
   (i) Input process
   (ii) Queue discipline
   (iii) Reneging and
   (iv) Jockeying. 2,2,2,2,2

   (b) If the arrival process follows Poisson Distribution with rate λ, then what is the probability of having zero and 'n' units in the system at time't'. 2

   (c) Explain Kendall's notation of queueing system. 3

2. Derive the steady state probability solution of the number of units in a generalized birth - death queueing model. Derive queue with ample server as a particular case. 10,5

3. (a) How a steady state solution differs from a transient one? Can we derive one given the other? 3,2

   (b) For the same traffic intensity, show that the expected number of units in the system for an M/M/1 is less than the expected number of units in the system for M/M/2. 5

   (c) Derive the waiting time distribution of a customer in the system in the case of M/M/1/∞/FCFS system. 5

4. (a) A supermarket has two girls at the sales counter. If the service time for each customer is exponential with mean 4 minutes, and if people arrive in a Poisson fashion at the rate of 10 an hour,

i. What is the probability of having to wait for service?
ii. Find the average queue length and the average number of units in the system. 2,3,3

(b) Derive finite source queue, m(say) as a particular case of generalized birth and death queueing model. 5

(c) Give some real life application of queueing theory. 2

Section B (Reliability Theory)

5. (a) Define the reliability and MTBF of a system. Find the reliability, hazard rate and MTBF for the distribution:
$f(t) = \lambda e^{-\lambda t},\ t \geq 0.$ 3,9

(b) Let the failure time distribution for a certain component be exponential with parameter λ. Determine the probability that the component fails in first 10 hours of its operations. 3

6. (a) Derive the reliability and MTBF of a 2-unit parallel system with identical components under the assumption that failure rates are constant for each component. 5,4

(b) Show that the failure rate of the series system is equal to the sum of the failure rates of its components. 6

7. (a) Explain the difference between age replacement, corrective maintenance and preventive maintenance. 8

(b) Compare a series, parallel and standby system. 7

8. Define a series-parallel and parallel-series system. Find the failure rate and MTBF of a series-parallel system under the assumption that all the components have identical exponential failure time density functions. 3,3,4,5