

**Department of Mathematics**

**Probability and Random Processes**

**15B11MA301**

**Tutorial Sheet 9**

**B.Tech. Core**

**Reliability**

**Q.1:** A household appliance is advertised as having more than a 10-year life. If its pdf is given by

$$f(t) = 0.1(1 + 0.050t)^{-3}, t \geq 0$$

- (a) Determine its reliability for the next 10 years, if it has survived a 1-year warranty period.
- (b) What is its MTTF before the warranty period?
- (c) What is its MTTF after the warranty period assuming that it has still survived?

Ans: (a) 0.46; (b) 0.045 year; (c) 19.955 years

**Q.2:** A component has the following hazard rate, where  $t$  is in years:

$$\lambda(t) = 0.44t, \quad t \geq 0$$

- (a) Find  $R(t)$ .
- (b) Determine the probability of the component failing within the first month of its operation.
- (c) What is the design life if a reliability of 0.95 is desired?

Ans: a)  $e^{-\frac{t^2}{5}}$     b) 0.0014    c) 0.5064 years

**Q.3:** The pdf of the time to failure of a system is given by  $f(t) = 0.01, 0 \leq t \leq 100$  days. Find.

- (a)  $R(t)$
- (b) the hazard rate function
- (c) the MTTF
- (d) the standard deviation

Ans: a)  $1 - 0.01t$     b)  $1/(100 - t)$     c) 50    d) 28.86

**Q.4:** Experience shows that the failure rate of a certain electrical component is a linear function. Suppose that after two full days of operation, the failure rate is 10% per hour and after three full days of operation, it is 15% per hour.

- (a) Find the probability that the component operates for at least 30 hours.
- (b) Suppose that the component has been operating for 30 hours. What is the probability that it fails within the next hour?

Ans. (a) 0.3916 (b) 0.0616