

## Chapter 1

### Introduction

#### Answers to Review Questions

##### 1.1

1. Reliability is the probability of a device performing its function over a specified period of time and under specified operating conditions.
2. A component is an integral item which is nonmaintained. A system denotes an assembly of several components which may be maintained or nonmaintained.
3. The graph of failure rate versus time of any mechanical or electronic or other component is known as the bath-tub curve.
4. Failures in early stages of life of a product occur due to manufacturing defects and poor quality control procedures used. As these defective products are replaced or repaired (during the warranty period), the failure rate decreases as time progresses.
5. Because failures occur due to random causes.
6. In mechanical components: due to fatigue brought by a deterioration due to cyclic loading.
7. Air compressor:  $6 \times 10^{-6}$  per hour; Ball bearings:  $1.1 \times 10^{-6}$  per hour; Brakes:  $4.3 \times 10^{-6}$  per hour.
8. AC generator:  $0.8 \times 10^{-6}$  per hour; DC generator:  $36.8 \times 10^{-6}$  per hour; Neon lamp:  $0.49 \times 10^{-6}$  per hour
9. Static, fatigue, creep, corrosion, wear and instability (buckling) modes.
10. Factor of safety = (mean strength/mean load). It is considered inadequate because the same factor of safety implies different values of reliability in different situations.
11. Advisory Group on Reliability of Electronic Equipment. The report recommends that reliability testing must be made an integral part in the development of new systems.
12. Air travel: 9 per year per million persons; Road travel (motor vehicles): 300 per year per million persons.

13. IEEE Transactions on Reliability, Reliability Engineering and System safety.
14. Failure of S. S. Schenectady T-2 tanker: Due to brittle fracture.

## 1.2

1. F
2. T
3. F
4. T
5. F

## 1.3

1. Infant
2. Random
3. Increases
4. Strength, Load

## 1.4

- 1 – c
- 2 – e
- 3 – b
- 4 – a
- 5 – f
- 6 – d