
B.E. (Full Time) DEGREE END SEMESTER EXAMINATIONS, MAY 2012
INDUSTRIAL ENGINEERING BRANCH
SIXTH SEMESTER – (REGULATIONS 2009)

(17)

IE9353 - RELIABILITY ENGINEERING

Duration:3 hours Max. marks =100

PART A (10x2=20 marks)

Answer all questions.

1. What is the probability of having a spare when required during time t, when the system has an operating unit with three interchangeable spares?
2. The time to failure of an aircraft subsystem is modeled by a two parameter Weibull distribution with shape parameter=0.6 and scale parameter=600. What is the fraction of subsystems expected to survive t= 2500 hrs?
3. List out the steps involved in constructing a histogram to record the failure pattern.
4. The failure rate of a device is 0.00345 failures per hour. If two standby devices are added to the system, what is the MTBF of the system?
5. State the differences between 'a priori probability' and 'a posteriori probability' of failure.
6. Define maintainability.
7. Compute inherent availability of a component which has MTBF=200 hr and MTTR=8 hr.
8. How do you conduct a reliability test (with replacement of failed items) which is terminated upon the occurrence of pre-assigned number of failures?
9. Compare the MTBFs of a two unit parallel system and a two unit standby system.
10. Show the idealized Reliability growth curve.

PART B (5x16=80 marks)

Answer all questions.

11. Given two components, each having a constant failure rate of 0.10 failures per hour and a constant repair rate of 0.20 repair per hour, compute point availability, interval availability and steady state availability for both series configuration and parallel configuration.

12.A. Each test-fix-cycle in a reliability growth monitoring of a new product is 60 hr of testing. The number of failures per cycle observed during each cycle are recorded as follows: 30, 21, 12, 7, 5, 3, 1. Determine the current MTTF and the additional test time required to obtain an MTTF goal of 16 hr.

[OR]

12B. Discuss about the methods and procedures adopted while planning a reliability allocation program.

13.A i) A mechanical system has four subsystems viz. A, B, C and D all connected in parallel, with MTBFs of 105, 400, 510 and 650 hours respectively. Find the system MTBF and the reliability for a 10 hour operating time. Draw the reliability graph using the reliability estimates for 30 hrs, 60 hrs, 90 hrs and 120 hrs of operation. (8 marks)

ii) There are four units connected in parallel in a system. If the system performance requires three out of four units functioning at any point in time, derive the system reliability expression assuming that R_1, R_2, R_3 and R_4 are the reliabilities of these four units in the system. (8 marks)

[OR]

13.B i) What is a survival graph? What are the types of survival curves? (4 marks)

ii) Construct a survival graph using the failure data given below. Can you make a guess about the type of failure distribution this data follows? (12 marks)

Time interval	No. of failures
0-1	2
1-2	16
2-3	22
3-4	41
4-5	11
5-6	9
6-7	4

14.A Discuss in detail the application of fault tree analysis for reliability assessment of a complex chemical industry.

[OR]

14.B i) Define each of the following with an example of your choice: (4x3=12 marks)

- Mutually exclusive events
- Non-mutually exclusive events
- Independent events
- Dependent events

ii) The characteristic life (alpha) in Weibull probability density function, is the value of that time for which the cumulative percentage of failures is 63.2%. Why? (4 marks)

15.A. i) Derive the system reliability expression for a two unit standby system. (10 marks)

ii) Derive the Mean Time To Failure equation for a two unit standby redundant system. (6 marks)

[OR]

15.B. Write short notes on the following:

i) Bartlett's goodness of fit test

ii) Kolmogorov-Smirnov goodness of fit test