

C.U.SHAH UNIVERSITY

Winter Examination-2018

Subject Name: Reliability Engineering

Subject Code: 5TE03REN1

Branch: M.Tech Mechanical (CAD/CAM)

Semester: 3

Date: 27/11/2018

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator and any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

SECTION-I

- Q-1 Attempt the following questions:**
- | | | |
|----|---|-----------|
| a) | What do you mean by MTTR? | 01 |
| b) | Draw bathtub curve used in reliability with usual notation. | 01 |
| c) | State any one fundamental law of probability. | 01 |
| d) | Define MTBF with suitable example. | 01 |
| e) | What do you mean by 'Reliability'? | 01 |
| f) | Define: FR | 01 |
| g) | Define Availability of system. | 01 |
- Q-2 Attempt all questions**
- | | | |
|----|---|-----------|
| a) | 50 components are tested for two weeks. 20 of them fail in this time, with an average failure time of 1.2 weeks. What is the mean time till failure assuming a constant failure rate? | 07 |
| b) | Write the different ways to improve reliability. | 03 |
| c) | What is the difference between reliability and quality? Discuss. | 04 |
- OR**
- Q-2 Attempt all questions**
- | | | |
|----|---|-----------|
| a) | Assume we have an automobile that is operating in its mature phase and has the following failure history:
Time to failure (hours): 100 800 1280 2600
The MTBF is given by: $[100+800+1280+2600] / 4 = 1195$ hours/failure
This gives a constant failure rate of: $1 / 1195 = 0.000836$ failures/hour.
What reliability can be expected from the automobile after 40, 200, 1000, and 5000 hours? | 07 |
| b) | Draw Reliability Block Diagram and explain. | 07 |
- Q-3 Attempt all questions**
- | | | |
|----|---|-----------|
| a) | The components in the system below are exponentially distributed with the | 06 |
|----|---|-----------|



indicated failure rates. Develop an expression for the reliability of the system. What is the system reliability at time = 100 hours?



- b) Prove that in mathematical terms, the hazard rate is the ratio of instantaneous probability density function to the instantaneous reliability function. **08**

OR

Q-3

Attempt all questions

- a) A system consists of four components. If more than two of the components fail, the system fails. If the components have an exponential time-to-fail distribution with a failure rate of 0.000388, what is the reliability of the system at time = 300? What is the system mean time to fail? **07**
- b) What do you mean by K – Out – Of – M – Configuration structure in system reliability? **07**

SECTION-II

Q-4

Attempt the following questions:

- a) What is HASS? **01**
- b) Find availability for an equipment whose ratio of mean time to repair (MTTR) to MTBF is 0.25. **01**
- c) What do you mean by Reliability Allocation? **01**
- d) Define Maintainability. **01**
- e) What is Accelerated life testing? **01**
- f) What impact reliability and maintainability would have on availability? **01**
- g) Define fault tree. **01**

Q-5

Attempt all questions

- a) What are the factors to be considered while designing a life test? Explain the term “burn-in-tests”. **05**
- b) Draw primary event, gate and transfer symbols of faulty trees. **05**
- c) What is Derating Analysis and Why is it Important? **04**

OR

Q-5

Attempt all questions

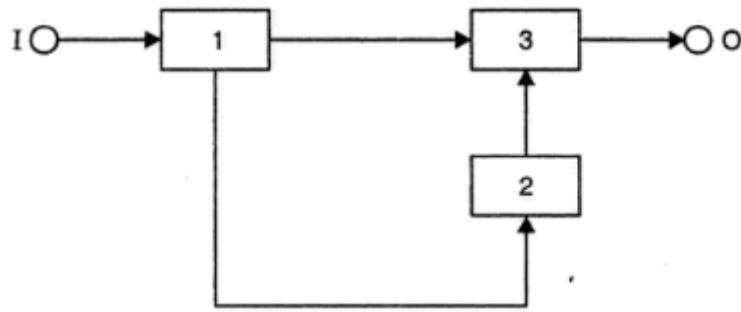
- a) Write the name of different reliability improvement and risk reduction methods. **05**
- b) Write short note on “Reliability certification”. **05**
- c) Write the different responsibility of the reliability engineer. **04**

Q-6

Attempt all questions

- a) For the system shown below figure, calculate the reliability using the tie set and cut set method. **06**





- b) Explain Failure Modes Effects and Criticality Analysis with sequential flow chart. **08**

OR

Q-6

Attempt all questions

- a) Explain Redundancy Techniques used in System Design. **07**
- b) Write different Reliability and Maintainability Testing methods and also explain any one. **07**

