



Name: Roll No.:

Branch: Signature of Invigilator:

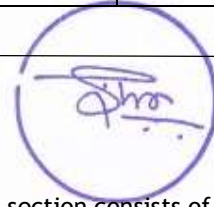
Semester: VIth

Date: 02/05/2022 (MORNING)

Subject with Code: EE359 INTRODUCTION TO RELIABILITY ENGINEERING

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS : B. TECH.
BRANCH : PROD.

SEMESTER : VI
SESSION: SP/2022

SUBJECT: EE359 INTRODUCTION TO RELIABILITY ENGINEERING

TIME : 2 HOURS

FULL MARKS: 50

INSTRUCTIONS :

1. The question paper contains 20 MCQ questions (Part-A), the mark of each MCQ question is indicated and 5 subjective questions (Part-B) each of 4 marks.
 2. Candidates must attempt all.
 3. The missing data, if any, may be assumed suitably.
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Part-A (MCQ Types, Tick appropriate answer)

[30]

1. Which of the following mentioned standard Probability density functions is applicable to discrete Random Variables? [1]
 - a) Gaussian Distribution
 - b) Poisson Distribution
 - c) Rayleigh Distribution
 - d) Exponential Distribution

2. Mutually Exclusive events- [1]
 - a) Contain all sample points
 - b) Contain all common sample points
 - c) Does not contain any sample point
 - d) Does not contain any common sample point

3. A table with all possible value of a random variable and its corresponding probabilities is called- [2]
 - a) Probability Mass Function
 - b) Probability Density Function
 - c) Cumulative distribution function
 - d) Probability Distribution

4. A variable that can assume any value between two given points is called- [1]
 - a) Continuous random variable
 - b) Discrete random variable
 - c) Irregular random variable
 - d) Uncertain random variable

5. If a variable can certain integer values between two given points is called - [1]
 - a) Continuous random variable
 - b) Discrete random variable
 - c) Irregular random variable
 - d) Uncertain random variable

6. The expected value of a discrete random variable 'x' is given by- [2]
a) $P(x)$
b) $\sum P(x)$
c) $\sum x P(x)$
d) 1
7. Which of the following is not a phase of "bathtub curve" of hardware reliability? [2]
a) Useful Life
b) Burn-in
c) Wear-out
d) Time
8. How is reliability and failure intensity related to each other? [2]
a) direct relation
b) inverse relation
c) no relation
d) none of the mentioned
9. What is MTTF ? [1]
a) Maximum time to failure
b) Mean time to failure
c) Minimum time to failure
d) None of the mentioned
10. The reliability of the entire system is called - [1]
a) Partial reliability
b) Isolated reliability
c) Closed reliability
d) System reliability
11. What does the graph of 'bathtub curve' represent? [2]
a) Failure rate v/s Mean
b) Failure rate v/s Time
c) Failure rate v/s Distance
d) Failure rate v/s Velocity
12. For a steady state large system reliability prediction which of the following distribution is normally used? [1]
(a) Poisson (b) Exponential (c) Normal (d) Weibull

13. Parts in use during the "wear out" portion of the part life cycle curve will exhibit: [2]
(a) A constant failure rate.
(b) A low failure rate
(c) A decreasing failure rate
(d) An increasing failure rate.

14. Binomial and Poisson are the two most important _____ distribution. [1]

15. Reliability is a measure of how quality changes over time. [1]
a) True
b) False

16. Let A and B be two events such that the occurrence of A implies occurrence of B, But not vice-versa, then the correct relation between P(A) and P(B) is? [2]
a) $P(A) < P(B)$
b) $P(B) \geq P(A)$
c) $P(A) = P(B)$
d) $P(A) \geq P(B)$

17. A and B are two events such that $P(A) = 0.4$ and $P(A \cap B) = 0.2$ Then $P(A \cup B)$ is equal to - [2]
a) 0.4
b) 0.2
c) 0.6
d) 0.8

18. Out of the following values, which one is not possible in probability? [2]
a) $P(x) = 1$
b) $\sum x P(x) = 3$
c) $P(x) = 0.5$
d) $P(x) = -0.5$

19. If 'X' is a continuous random variable, then the expected value is given by- [2]
a) $P(X)$
b) $\sum x P(x)$
c) $\int X P(X)$
d) No value such as expected value

20. Reliability is the probability of a system or service to perform its intended function satisfactorily over a specific period of time under specific conditions. [1]
a) True
b) False

Part-B (Subjective Types)

[4x5]

1. Find out the system reliability for a series and parallel configuration with two components.
2. Define maintainability and availability and compare it with reliability.
3. Draw and explain bath tub curve.
4. What is redundancy? How system reliability can be improved by the help of redundancy. Explain with suitable example.

OR

To test the strength of a new glue, ten similar structures constructed using the glue were subjected to a continuous vibratory load, and the duration of survival of each structure was noted, the values obtained being the following:

Specimen number	Hours of survival	Specimen number	Hours of survival
1	60	6	55
2	62	7	59
3	58	8	62
4	50	9	54
5	61	10	55

Calculate the mean time to failure (MTTF) from this data.

5. Consider a series of tests conducted under certain stipulated conditions on 1000 electronic components. The total duration of the tests is 19 hours. The number of components that fail during each hourly interval is given in the table below-

Time	No. of failure
0-1	130
1-2	83
2-3	75
3-4	68
4-5	62

5-6	56
6-7	51
7-8	46
8-9	41
9-10	37
10-11	34
11-12	31
12-13	28
13-14	64
14-15	76
15-16	62
16-17	40
17-18	12
18-19	04

For this case, find failure density and reliability for each period.

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