Indian Statistical Institute, Bangalore
M.S. (QMS) First Year
Second Semester - Reliability, Maintainability and Safety-II
Final Exam

Time: 3 hours   Date: 28/04/2023   Maximum Marks: 50

1. Explain different types of warranty schemes with examples.

[10]

2. Define ROCOF. How ROCOF can be used to determine whether a system is improving or deteriorating?

[5 + 5 = 10]

3. Consider the following system

x_1	x_2	x_3	x_4	$\phi(\vec{x})$	x_1	x_2	x_3	x_4	$\phi(\vec{x})$
0	0	0	0	**0**	0	1	1	0	**0**
1	0	0	0	**0**	0	1	0	1	**0**
0	1	0	0	**0**	0	0	1	1	**0**
0	0	1	0	**0**	1	1	1	0	**1**
0	0	0	1	**0**	1	1	0	1	**1**
1	1	0	0	**0**	1	0	1	1	**1**
1	0	1	0	**0**	0	1	1	1	**0**
1	0	0	1	**0**	1	1	1	1	**1**

   a) Draw the reliability block diagram.
   b) Write the minimum path sets and minimum cut sets.
   c) Give the structure function $\phi(\vec{x})$ for this system using minimum cut sets or minimum path sets.
   d) If the component lifetime follows exponential distribution with parameter $\lambda_i, i = 1,2,3,4$, find the system reliability.
   e) What could be the maximum and minimum reliability of any system using these four components?

[1 + 2 + 2 + 4 + 1 = 10]

4. Consider a renewal process with underlying exponential distribution $F(t) = 1 - e^{-\lambda}$. Compute the expected number of renewals in (0, t].

[10]

5. Consider an HPP *{N(t), t ≥ 0}* with rate λ. Let *p* denote the probability of failure developing into a consequence *C* and $N_C(t)$ denote the number of consequence failures in (*0, t*]. Obtain the mean number of *C* failures in (*0, t*].

[10]

6. Write short notes on the following

   a) Availability and Maintainability
   b) Renewal process

[5 = 5 = 10]