Reg. No.																

Question Paper Code	14737

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Third Semester

M.E. - Industrial Safety Engineering

24PISEL301 - RELIABILITY ENGINEERING

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	MTBF stands for: a) Mean Time Before Failure b) Mean Total Breakdown Frequency c) Mean Time Between Failures d) Maintenance Time Between Failures	1	K1	CO1
2.	A posteriori reliability assessment is based on: a) Theoretical assumptions b) Actual performance data c) Design specifications only d) Market demand	1	K2	CO1
3.	Maintainability mainly affects: a) Repair duration b) Product design cost c) Production quantity d) Market value	1	K2	CO1
4.	Which distribution is symmetric about its mean? a) Weibull b) Gamma c) Exponential d) Normal	1	K1	CO2
5.	Gamma distribution is mainly useful when: a) Failures occur in stages b) Hazard rate is zero c) Data are symmetric d) Failure rate is constant	1	K2	CO2
6.	In a Weibull probability plot, curved data points indicate: a) Perfect fit b) Incorrect distribution assumption c) Constant hazard rate d) No failures	1	K3	CO2
7.	Which configuration provides the highest reliability? a) Series system b) Parallel system c) Single component system d) Open loop system	1	K1	CO3
8.	Parallel redundancy improves reliability because: a) Components are removed b) Backup paths are available c) System operates slower d) Repair time increases	1	K2	CO3
9.	If the probability of failure of a machine is updated after inspection data, which method is used? a) Monte Carlo method b) Bayes' theorem c) Weibull plotting d) FMEA	1	K3	CO3
10.	Reliability testing during product development improves: a) Failure detection b) Packaging design c) Advertising quality d) Inventory size	1	K1	CO4

11.	Why are non-parametric methods preferred in some reliability studies?		1	K2	CO4
	a) They need large assumptions	b) They can analyze data without assuming distributions			
	c) They eliminate failures completely	d) They reduce testing time to zero			
12.	A machine shows increasing maintenance cost after 5 years. Which method helps determine the best replacement time?		1	K3	CO4
	a) Reliability allocation	b) Replacement model			
	c) Reliability growth model	d) Hazard plotting			
13.	Which of the following is used to identify workplace hazards?		1	K1	CO5
	a) SWOT analysis	b) HAZOP study			
	c) Break-even analysis	d) EOQ analysis			
14.	A factory identifies a chemical leak hazard with high severity and high probability. What should be the first action?		1	K3	CO5
	a) Ignore the issue	b) Reduce workforce			
	c) Implement immediate control measures	d) Increase production			
15.	In an industry, preventive maintenance is scheduled every month to reduce unexpected breakdowns. This practice mainly improves		1	K3	CO6
	a) Downtime	b) Reliability and availability			
	c) Production waste	d) Labor absenteeism			
16.	A chemical plant uses reliability analysis to avoid hazardous accidents. This application mainly relates to		1	K3	CO6
	a) Industrial safety	b) Inventory management			
	c) Marketing strategy	d) Wage administration			

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)

Answer ALL Questions

17.	Explain how maintainability influences system availability in industrial equipment.	3	K3	CO1
18.	Analyze why Weibull distribution is preferred over normal distribution in reliability analysis.	3	K4	CO2
19.	Compare the performance of series and parallel systems with respect to reliability and redundancy.	3	K3	CO3
20.	Analyze the relationship between reliability testing and product quality improvement.	3	K4	CO4
21.	Analyze the causes and consequences of fire hazards in chemical industries.	3	K4	CO5
22.	Demonstrate the application of redundancy in improving reliability of power systems.	3	K3	CO6

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Analyze the relationship between reliability, failure rate, MTBF, and availability in industrial systems with suitable examples.	11	K4	CO1
		OR			
	b)	Examine the factors affecting system effectiveness and analyze methods to improve effectiveness in industrial systems.	11	K4	CO1

24.	a)	Demonstrate and explain the procedure of probability plotting techniques for failure data analysis. Illustrate the method using suitable numerical data and identify the appropriate life distribution.	*11*	*K3*	*CO2*
		OR			
	b)	Illustrate the complete procedure for reliability data analysis using Weibull distribution. Apply the method to a given set of sample data and estimate reliability measures.	*11*	*K3*	*CO2*
25.	a)	Using Bayes' theorem, explain how reliability predictions are updated based on new failure information. Solve a suitable numerical problem involving conditional probability and posterior reliability estimation.	*11*	*K3*	*CO3*
		OR			
	b)	Construct a Fault Tree Analysis (FTA) for a boiler system failure. Identify basic events, intermediate events, and top events. Determine the minimal cut sets using logic gates.	*11*	*K3*	*CO3*
26.	a)	Analyze the importance of reliability and life cycle analysis in industrial decision-making with appropriate case studies.	*11*	*K4*	*CO4*
		OR			
	b)	Analyze the relationship between reliability testing, maintenance planning, and product life cycle cost.	*11*	*K4*	*CO4*
27.	a)	Demonstrate the implementation of a complete industrial safety management program for reducing operational risks.	*11*	*K3*	*CO5*
		OR			
	b)	Apply quantitative and qualitative risk analysis techniques for evaluating workplace safety in an engineering industry.	*11*	*K3*	*CO5*
28.	a)	Apply reliability engineering methods to improve the performance of an electronic manufacturing system.	*11*	*K3*	*CO6*
		OR			
	b)	A production plant experiences frequent equipment failures. Apply preventive maintenance strategies to improve reliability and reduce downtime.	*11*	*K3*	*CO6*