

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER- VI EXAMINATION – SUMMER 2026

Subject Code:3161709

Date:26-05-2026

Subject Name: Safety Instrumented System

Time: 10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) List out the various industry guidelines, standards and regulations for safety instrumented system.	03
	(b) Describe the confusion in the industry for the safety instrumented system.	04
	(c) Explain the SIS design lifecycle in detail.	07
Q.2	(a) List out the mitigation layers and explain any one of them.	03
	(b) Give the comparison between process control and safety control.	04
	(c) Explain common cause and functional failures with suitable example Also discuss why process control and safety control should be separated in the context of common cause failures.	07
	OR	
	(c) Diversification of multiple protection layers reduces the risk. Justify this statement with necessary arguments.	07
Q.3	(a) Define Risk Reduction Factor (RRF). Why Risk Reduction Factor is a better metric as compared to Probability of Failure on Demand (PFD) for safety availability?	03
	(b) Differentiate between voluntary and involuntary risks with suitable example.	04
	(c) Explain Risk Graph method for SIL determination in detail.	07
	OR	
Q.3	(a) Explain human reliability with reference to protection layer.	03
	(b) For choosing a technology for SIS, discuss the issues encountered related to system size.	04
	(c) Explain ALARP for SIL determination in detail.	07
Q.4	(a) List out the sources for failure rate information. Explain any one of them in brief.	03
	(b) Describe general guidelines to minimize wiring problems.	04
	(c) List out the contributing factors for the accidents caused by incorrect specifications. Explain each of them in brief.	07
	OR	
Q.4	(a) Explain TMR systems in context of safety PLCs	03
	(b) Discuss about Fault Trees modeling method.	04
	(c) Discuss about V-model of software development.	07

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| Q.5 | (a) | Describe the criteria to be considered for the final element design requirements. | 03 |
| | (b) | Discuss about safe/dangerous failures in context of failure modes. | 04 |
| | (c) | Discuss the advantages and disadvantages for choosing relay based systems in SIS? | 07 |
| OR | | | |
| Q.5 | (a) | Compare demand and continuous mode safety systems. | 03 |
| | (b) | Explain partial stroking of valves. | 04 |
| | (c) | Explain sensor design requirements in detail. | 07 |
