GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3161709

SUB NAME : **Safety Instrumented System**

Semester – VI

Type of course:

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Sr No.	Course Content	Hrs	Weightage %
1	Introduction of safety instrumented system Safety Instrumented system, Confusion in the industry, industry guidelines-standards and regulations, standards are changing their direction, things are not as obvious as they may seem	3	10
2	Design Lifecycle Hindsight/Foresights, Findings of the HSE, Design life cycle, SIS design & Engineering ,Installation, commissioning and validation, operation and maintenance, decommissioning	2	7
3	Process control vs. safety control : Control and safety defined, process control-active/dynamic, safety control-passive/dormant, separation of control and safety systems, Common cause and systematic/functional fallers	2	10
4	Protection layers: Prevention layers, mitigation layers, Diversifications	3	10
5	Developing the Safety requirement specifications Introduction, why are 44%n of accidents caused by incorrect specifications?, ANSI/ISA-84.00.01.2004,part 1-3 requirements, documenting the specifications requirements.	3	10
6	Determining SIL Introduction, common issues, evaluating risk, Safety integrity level,SIL determination methods(ALARP and Risk matrix, risk graph, LOPA)	3	10
7	Choosing a technology Phumatic systems, relay systems, solid state systems, microprocessor/PLC(software based)systems, issues related to system size, issue related to system complexity, communication with other systems,certified vs prior use	2	8
8	Initial system evolution Things are not as obvious as they may seem, why systems should be analyzed before they are built, need to get failere rate information, failure	4	15

	modes, metrics, degree of modeling accuracy, modeling methods, the real impact of redundancy, analysis of a relay system, non redundant PLC system, TMR systems, Field devices, fault tolerance requirements, Sample SIS design cookbook, Engineering tools available for analyzing system performance		
9	Issue relating to field devices Introduction, importance of field devices, Sensors, Final elements, Redundancy, Design requirements of field devices, Installation concerns, Wiring of field devices	2	10
10	Engineering a system General management considerations, General hardware consideration, General software consideration	2	10

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Able to explain Safety instrumented system and SIL, choosing technlology	
CO-2	Able to analyze the safety specification for process control and safety control of various processes	
CO-3	Will be able to analyze failure of field devices and apply modifications	

Text Books

1. Safety Instrumented Systems:Design,Analysis and Justification 2nd edition by Paul Gruhn,P.E. and Harry L. Cheddie,P.E. Published by ISA.(ISBN -13 978-1-55617-956-3)
2. Safety Instrumented Systems: A Life Cycle Approach by Paul Gruhn and Simon Lucchini
3. Safety Instrumented System Design: Techniques and Design Verification by William M. Goble

Reference Book

1. Safety Instrumented Systems Verification: Practical Probabilistic Calculations by William M. Goble
2. Safety Integrity Level Selection: Systematic Methods Including Layer of Protection analysis by Eric William Scharpf