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B.M.S. College of Engineering, Bengaluru-560019

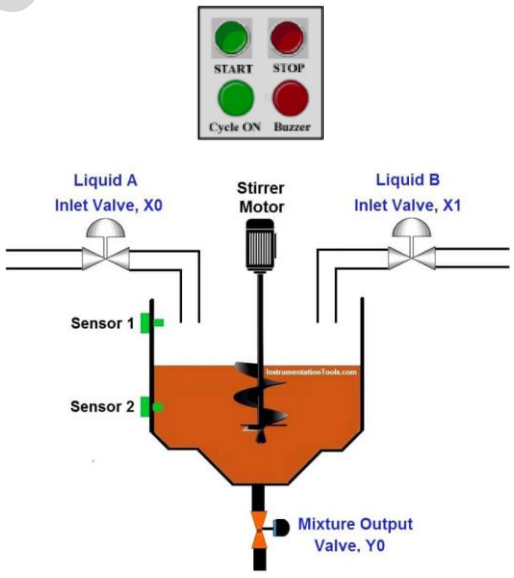
Autonomous Institute Affiliated to VTU

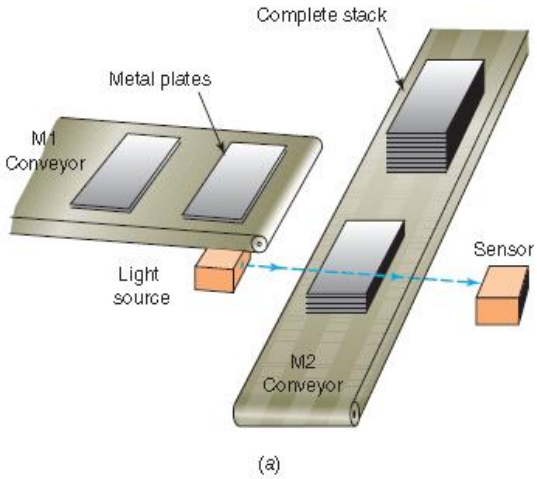
July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 19EI6PCAPC **Max Marks: 100**
Course: Automation in Process Control **Date: 05.07.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Compare and illustrate the distinctions between different types of automation	*CO1*	*PO1*	**05**
	b)	What are the key components and operational advantages of Direct Digital Control (DDC) systems in building automation	*CO1*	*PO1*	**05**
	c)	Suggest a suitable method to interface analog input/output devices with a PLC and summarize briefly	*CO3*	*PO4*	**06**
	d)	Suggest a suitable seal-in to be used while automating a particular process.	*CO2*	*PO2 PO3*	**04**
		UNIT-II			
2	a)	Develop a ladder program for the following application shown in Fig 2(a) using appropriate logic as per IEC 61131.3 standards. Summarize the sequence of operation.  Fig 2(a)	*CO2*	*PO2 PO3*	**07**

		b)	Draw the timing diagram and describe the working of on-delay timer.	*CO2*	*PO2 PO3*	**06**
		c)	Develop a ladder program as per IEC 61131.3 standards to simulate Automatic Stacking Program as depicted in Fig 2(c) and summarize the sequence of operation.  Fig 2(c)	*CO2*	*PO2 PO3*	**07**
			UNIT - III			
	3	a)	A heating process involves a thumbwheel switch connected to the input module indicating temperature in degree Celsius. It is required to display the temperature values in Fahrenheit. Implement a suitable ladder logic (as per IEC 61131-3 standards) using math instructions to convert the recorded temperature in Celsius to Fahrenheit for display and justify the operation.	*CO2*	*PO2 PO3*	**07**
		b)	Design a suitable logic in compliance with the IEC 61131.3 standards to control multiple motors in a sequential process plant with different delay intervals.	*CO2*	*PO2 PO3*	**07**
		c)	Develop a suitable logic to illustrate the use of SQI instructions in a practical context.	*CO2*	*PO2 PO3*	**06**
			UNIT - IV			
	4	a)	It is required to facilitate effective monitoring and control of processes in a petrochemical plant, specifically addressing temperature control, pressure regulation, flow monitoring, and batch processing. Propose a suitable DCS architecture for this scenario and provide a justification for its selection	*CO3*	*PO4*	**08**
		b)	What are the main functional elements or components that constitute a Distributed Control System (DCS)?	*CO3*	*PO4*	**06**
		c)	Enumerate the key features of DCS that have contributed to its popularity in the industrial world?	*CO3*	*PO4*	**06**

			OR			
	5	a)	Explain how the three stages of risk analysis can be used to manage risks in a project	*CO4*	*PO2 PO6 PO7*	**05**
		b)	Propose an Overall Safety Life Cycle (SLS) plan that follows the IEC 61508-1 standards to ensure the integration of safety considerations throughout the entire lifecycle of equipment	*CO4*	*PO2 PO6 PO7*	**08**
		c)	Propose a Layer of Protection Analysis (LOPA) methodology for the chemical process industry to serve as a risk assessment tool to evaluate the necessity of implementing Safety Instrumented Systems (SIS) involving the handling of hazardous materials.	*CO4*	*PO2 PO6 PO7*	**07**
			UNIT - V			
	6	a)	Propose a suitable SCADA structure for Duke Energy, an American energy company that serves millions of customers, to monitor and control its power grid with regards to reliability, efficiency, and security. Justify your recommendation by analyzing the components of the proposed SCADA structure and their potential impact on the company's operations.	*CO3*	*PO4*	**09**
		b)	Explain the Monolithic SCADA Systems.	*CO3*	*PO4*	**05**
		c)	Analyze and compare the characteristics and functionalities of Programmable Logic Controllers (PLCs) and Supervisory Control and Data Acquisition (SCADA) systems from an engineering perspective	*CO3*	*PO4*	**06**
			OR			
	7	a)	Evaluate the role and significance of an input and output instrumentation system, as well as the interface system of Human-Machine Interface (HMI), within a process control environment. Analyze the design considerations, functionality, and interplay between these systems, and assess their impact on data acquisition, control signal generation, operator engagement, and system performance.	*CO3*	*PO4*	**08**
		b)	Propose ways to implement the instrumentation, control, and human interface components in an automation system.	*CO3*	*PO4*	**06**
		c)	Identify areas where an HMI could be improved by following the six principles.	*CO3*	*PO4*	**06**

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