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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

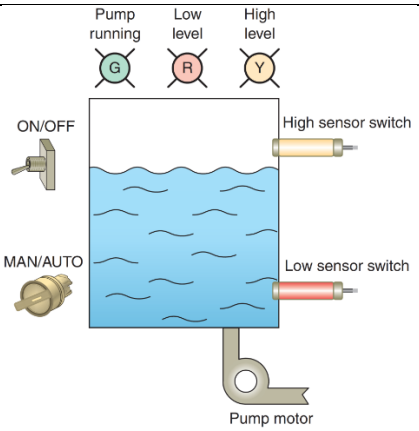
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**

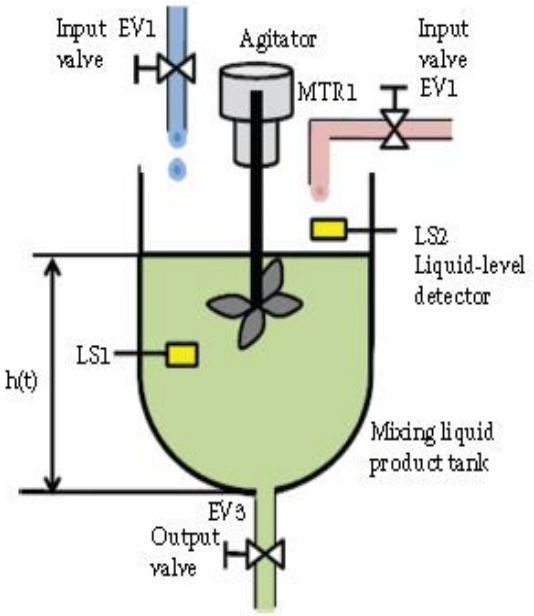
Course Code: 23EI6PCPSA **Max Marks: 100**

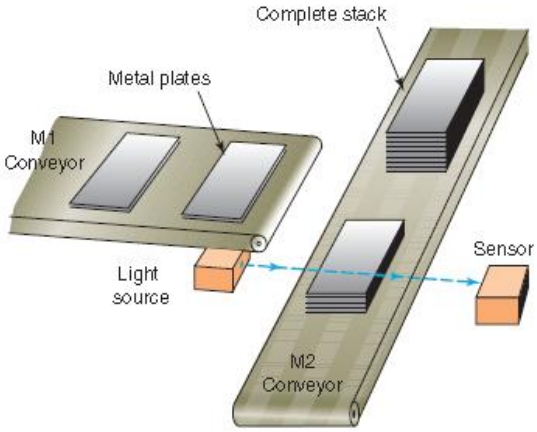
Course: Process Automation

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.

			CO	PO	Marks
		UNIT - I			
1	a)	Illustrate the hierarchical structure of an automation system using a diagram, clearly explaining the purpose and function of each level in the automation pyramid.	*CO1*	*PO1*	**06**
	b)	Explain the various types of automation, highlighting their distinctive features and applications.	*CO1*	*PO1*	**09**
	c)	Explain the Dual-Computer System for Direct Digital control system	*CO1*	*PO1*	**05**
		OR			
2	a)	Explain how the PLC single scan cycle is used to process a ladder logic program, from reading inputs to updating outputs.	*CO1*	*PO1*	**06**
	b)	Explain the recommended wiring configurations for connecting both current-sourcing and current-sinking field devices to the DC input/output modules of a PLC	*CO1*	*PO1*	**08**
	c)	Explain the various types of Programmable Logic Controllers (PLCs) currently available in the market.	*CO1*	*PO1*	**06**
		UNIT - II			
3	a)	 Fig 3(a)	*CO2*	*PO2* *PO3*	**09**

			Design a PLC program using ladder logic or function block diagrams as per IEC standards for the process as shown in Fig 3(a) and summarize the operation.			
		b)	Design a concise ladder logic diagram for a fluid pump system (Tank A to B) with momentary start/stop, requiring normally closed PS1 to start. The pump latches on with Start. Stop button stops it. Within 5 seconds of starting, normally closed PS2 and PS3 must be closed. If PS2 or PS3 opens, the pump stops immediately, and a 14-second restart delay is enforced. Show the safety interlock and restart delay clearly.	*CO2*	*PO2* *PO3*	**06**
		c)	Explain the operational differences between NOTC and NOTO timers, accompanied by relevant timing diagrams	*CO2*	*PO2* *PO3*	**05**
			OR			
	4	a)	 Fig 4(a) Design a PLC program using ladder logic or function block diagrams as per IEC standards for the process as shown in Fig 4(a) and summarize the operation.	*CO2*	*PO2* *PO3*	**09**
		b)	Design an IEC 61131-3 compliant ladder program for an annunciator flasher circuit utilizing an on-delay timer. Briefly explain the operational sequence	*CO2*	*PO2* *PO3*	**06**
		c)	Explain the operation of retentive timers, accompanied by relevant timing diagrams	*CO2*	*PO2* *PO3*	**05**

			UNIT - III			
	5	a)	 Fig 5(a) Design a ladder logic or sequential flow chart as per IEC standards illustrating the Automatic stacking control process as shown in Figure 5(a). Explain briefly the working of the program.	*CO2*	*PO2* *PO3*	**07**
		b)	"Cascading counters prove particularly useful in processes that necessitate tracking or controlling events or quantities that exceed the counting capacity of a single counter". Design a suitable ladder program to justify the statement and summarize the execution of the program.	*CO2*	*PO2* *PO3*	**08**
		c)	Explain how BCD output interface module can be connected to a seven-segment LED display board.	*CO2*	*PO2* *PO3*	**05**
			OR			
	6	a)	Design a ladder logic program employing a Sequencer Compare (SQC) instruction to implement a sequential activation based on input conditions and explain the execution of the program.	*CO2*	*PO2* *PO3*	**09**
		b)	Design a PLC program that can manage inventory for three different products on a single conveyor line, considering varying storage capacities for each product.	*CO2*	*PO2* *PO3*	**06**
		c)	Explain the various Math Instructions used in PLC	*CO1*	*PO1*	**05**
			UNIT - IV			
	7	a)	Explain the concept of "Hierarchy of Plant Operations" within the context of a DCS. How does a DCS typically align with these operational levels?	*CO3*	*PO4* *PO6*	**10**
		b)	Describe the importance of design considerations while suggesting a typical DCS architecture.	*CO3*	*PO4* *PO6*	**10**
			OR			

	8	a)	Suggest the key functional components of a Distributed Control System (DCS) work together to achieve process control and automation in industries.	*CO3*	*PO4* *PO6*	**10**
		b)	Explain the similarities and differences between embedded based interface compared to a desktop-based interface.	*CO3*	*PO4* *PO6*	**10**
			UNIT - V			
	9	a)	Describe briefly the main components that collectively form a complete SCADA system.	*CO3*	*PO4* *PO6*	**10**
		b)	Identify and describe how each of the following SCADA components would be deployed and utilized in a Distribution Monitoring and Control applications.	*CO3*	*PO4* *PO6*	**10**
			OR			
	10	a)	How does an Operator/Mimic Panel differ with the software-based visualization of an Operator Station? Explain with suitable diagrams	*CO3*	*PO4* *PO6*	**10**
		b)	How does a Human-Machine Interface (HMI) facilitate the connection and communication with both input and output instrumentation devices in an industrial control system?	*CO3*	*PO4* *PO6*	**10**

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