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PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations - March 2026

Date: 12- 03-2026

Time: 02:00pm - 03:30pm

School: SOE	Program: CSE - ALL - Free Elective		
Course Code: EEE3102	Course Name: Fundamentals of Industrial Automation		
Semester: VI	Max Marks: 50	Weightage: 25%	

CO - Levels	C01	C02	C03	C04	C05
Marks	26	24			

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	Define Automation	2 Marks	L1	C01
2	List six distinct advantages that PLCs offer over conventional relay-based control systems.	2 Marks	L2	C01
3	Identify four tasks in addition to relay switching operations that PLCs are capable of performing.	2 Marks	L2	C01
4	List the five programming languages defined by IEC 61131-3.	2 Marks	L1	C02
5	What are the primary status bits for a timer?	2 Marks	L1	C02

Part B

Answer the Questions.

Total Marks 40M

6.	a.	Illustrate the block diagram of a CPU of PLC and explain the operating principles and the sequence of operations in the scan cycle.	10 Marks	L2	C01
Or					
7.	a.	Explain PLC Memory Design, addressing types, and different memory storage technologies	10 Marks	L2	C01

8.	a.	Differentiate PLC-based control systems from conventional relay-based control systems and examine the advantages of PLC systems.	10 Marks	L2	CO1
Or					
9.	a.	With suitable circuitry, explain the discrete AC I/O modules in detail with their applications	10 Marks	L2	CO1

10.	a.	<p>A PLC-based pumping system uses a combination of on-delay and off-delay timer instructions, as shown in Figure 1, to control the transfer of fluid from Tank A to Tank B. The process requires that pressure switch PS1 must be closed before the operation can begin. When the start push button is pressed, the pump must start and remain running even after the button is released, while pressing the stop push button must immediately stop the pump. In addition, pressure switches PS2 and PS3 must both remain closed starting 5 seconds after the pump has begun running; if either PS2 or PS3 opens after this point, the pump must shut down and must not be allowed to restart for 14 seconds. The control program must therefore incorporate suitable timing, permissive, and interlocking logic to ensure safe operation. Apply your understanding of on-delay and off-delay timer functions to design a PLC Ladder logic program for this pumping process to implement the required control sequence.</p>	10 Marks	L3	CO2
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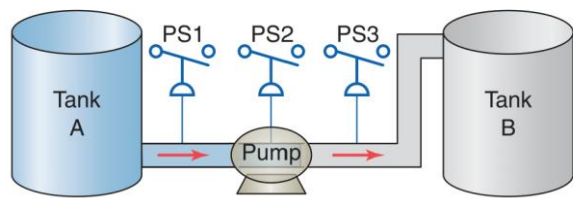
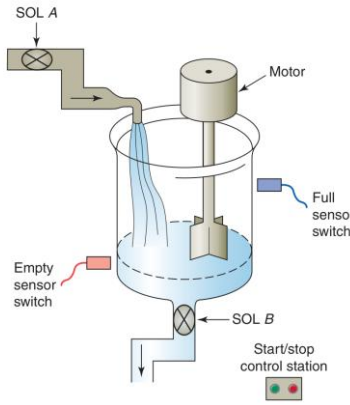


Figure 1

Or					
11.	a.	<p>A PLC-based control system requires three motors to be turned off sequentially at fixed time intervals after an input switch is opened. The system uses three off-delay timers (T4:1, T4:2, and T4:3) with different preset time values. When the input switch is closed, all motors must turn on immediately. When the switch is opened, each timer should begin timing and the motors must turn off one after another at the end of their respective delay periods, creating a staggered shutdown sequence.</p> <p>Using the description above, explain the operating principle of an off-delay timer in this context and develop the ladder logic diagram required to implement the sequential shutdown of the three motors.</p>	10 Marks	L3	CO2

12.	a.	<p>A PLC-based batch process (Figure 2) controls a single tank using start/stop pushbuttons, two solenoid valves, an agitator motor, and level sensors. The system shall operate as follows: a normally open Start pushbutton and a normally closed Stop pushbutton are used to initiate and halt the process; pressing Start must energize Solenoid A to fill the tank; as the tank fills, the Empty level sensor closes, and when the tank becomes full the Full level sensor closes, at which point Solenoid A must de-energize; the Agitate motor must then start automatically and run for 3 minutes to mix the liquid; when agitation stops, Solenoid B must energize to empty the tank; when the tank is completely empty, the Empty sensor opens to de-energize Solenoid B; the cycle can then be restarted by pressing Start again.</p> <p>Apply your knowledge of PLC sequencing and timer instructions to design this control strategy and develop the complete ladder logic program that implements the required sequence.</p>  <p style="text-align: center;"><i>Figure 2</i></p>	10 Marks	L3	CO
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Or

13.	a.	<p>Programmable Logic Controllers (PLCs) are often used to implement time-of-day clocks using combinations of timers and cascaded counters. In such a system, a repeating timer may be configured to generate fixed time intervals (for example, one-minute increments), and each completed interval can be used to advance a minute counter. When the minute counter reaches its preset value, an hour counter can be incremented, and when the hour counter reaches its own preset value, the system can automatically reset to begin a new 24-hour cycle.</p> <p>By using the above description, Apply your understanding of PLC timer and counter functions to design a complete ladder logic program for a 24-hour time-of-day clock that measures and displays hours and minutes using cascaded counters triggered by a fixed-interval timer.</p>	10 Marks	L3	CO
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