Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 25-05-2026 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** CSE -ALL (OPEN ELECTIVE)	
Course Code : EEE3102	**Course Name:** FUNDAMENTALS OF INDUSTRIAL AUTOMATION	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	C06
Marks	14	24	22	14	14	12

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. **10Q x 2M=20M**

1.	Identify the four steps of a typical PLC processor scan cycle.	**2 Marks**	**L1**	**CO1**
2.	Define the term "logical rack" in the context of PLC I/O addressing.	**2 Marks**	**L1**	**CO1**
3.	Explain the function of XIC and XIO instructions in Ladder Diagram logic.	**2 Marks**	**L2**	**CO2**
4.	State the purpose of the "Preset" and "Accumulated" time in a timer.	**2 Marks**	**L2**	**CO2**
5.	Describe how a Move (MOV) instruction is used for data handling in a PLC.	**2 Marks**	**L2**	**CO3**
6.	List three characteristics of a process that make it a candidate for SCADA.	**2 Marks**	**L1**	**CO4**
7.	Define the role of a Master Terminal Unit (MTU) in a SCADA hierarchy.	**2 Marks**	**L1**	**CO4**
8.	State the four core requirements of a Local Control Unit (LCU).	**2 Marks**	**L1**	**CO5**
9.	Define "Hot Standby" as it relates to DCS redundancy.	**2 Marks**	**L1**	**CO5**

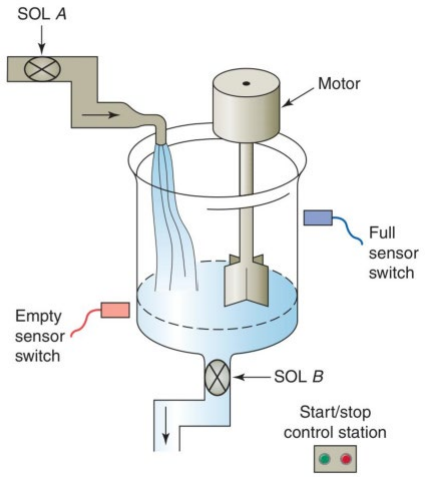
10.	Explain the role of a "Historian" database in real-time data acquisition.	**2 Marks**	**L2**	**CO6**

Part B

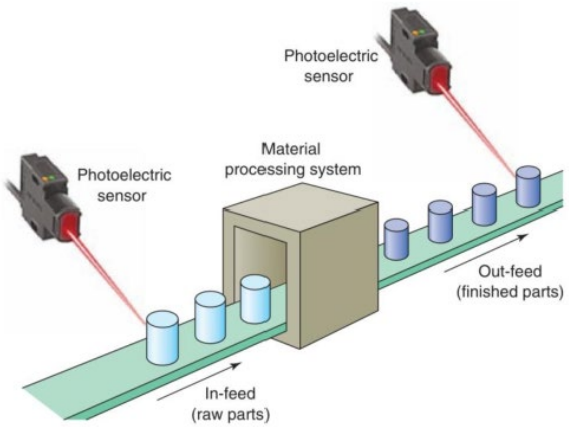
Answer the Questions. **Total Marks 80M**

11.	**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**	**CO1**
		Or			
12.	**a.**	With suitable circuitry, explain the discrete I/O modules in detail with their applications	**10 Marks**	**L2**	**CO1**

13.	**a.**	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. 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.	**20 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	A PLC-based batch process (Figure) 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. The control design must incorporate appropriate permissives, interlocks, and timing to ensure safe, deterministic sequencing. 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.	**20 Marks**	**L3**	**CO2**

15.	**a.**	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. The program must ensure accurate interval generation, reliable counter rollover, and continuous operation without manual intervention. 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.	**20 Marks**	**L3**	**CO3**
		Or			
16.	**a.**	Figure below illustrates the operation of the up/down- counter program used to provide continuous monitoring of items in process. An in-feed photoelectric sensor counts raw parts going into the system, and an out-feed photoelectric sensor counts finished parts leaving the machine. The number of parts between the in-feed and out-feed is indicated by the accumulated count of the counter. Counts applied to the up-input are added, and counts applied to the down-input are subtracted. Develop a ladder program for the following operation - Before start-up, the system is completely empty of parts, and the counter is reset manually to 0.	**20 Marks**	**L3**	**CO3**

		- When the operation begins, raw parts move through the in-feed sensor, with each part generating an up count. - After processing, finished parts appearing at the out-feed sensor generate down counts, so the accumulated count of the counter continuously indicates the number of in-process parts. - The counter preset value is irrelevant in this application. It does not matter whether the counter outputs are on or off. The output on-off logic is not used. We have arbitrarily set the counter's preset values to 50  			

17.	**a.**	Explain with a block diagram the operation of a multichannel analog multiplexed DAS.	**10 Marks**	**L2**	**CO4**
		Or			
18.	**a.**	Describe the typical architecture of the SCADA system. Explain the function of each major building block and include a diagram to illustrate how these components interface with one another.	**10 Marks**	**L2**	**CO4**

19.	**a.**	What is a Local Control Unit (LCU) and what are its hardware requirements and their configuration in details with neat sketch.	**10 Marks**	**L2**	**CO5**
		Or			
20.	**a.**	Explain the core value and architecture of OPC (OLE for Process Control).	**10 Marks**	**L2**	**CO5**

21.	**a.**	Explain the process of alarm rationalization in detail and analyze the essential attributes required to construct an authorized Master Alarm Database (MADB).	**10 Marks**	**L2**	**CO5**
		Or			
22.	**a.**	Detail the technical steps and architectural considerations required to integrate PLC/DCS controllers with SCADA/HMI systems, focusing on network topology, tag naming, and communication protocols.	**10 Marks**	**L2**	**CO5**