Question Paper

Exam Date & Time: 03-Jun-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY JUNE 2023

INDUSTRIAL AUTOMATION [ICE-4302]

Marks: 50   **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Missing data may be suitably assumed

1)		Illustrate the variations in the input and output image table of PLC processor memory when two input and two output devices are connected. [CO1, PO1, PO1, BL4]	(2)
	A)		
	B)	Implement 8:1 multiplexer in PLC using ladder diagram. [CO2, PO1, PO2, PO3, PO6, BL3]	(4)
	C)	Draw a ladder logic diagram to control the motor output as per the given logic in Figure. Make use of start and stop pushbuttons, 4 switches to turn on and off 2 motors (M1, M2), and a buzzer (B1) [CO2, PO1, PO2, PO3, PO6, BL3].	(4)

START PUSH BUTTON

SWITCH 1 ⟶ M1 ON, M2 ON, B1 ON

SWITCH 2 ⟶ M1 OFF, M2 ON, B1 ON

SWITCH 3 ⟶ M1 ON, M2 OFF, B1 ON

SWITCH 4 ⟶ M1 ON, M2 ON, B1 OFF

STOP BUTTON ⟶ ALL STOP

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2)	A)	The home automation system is built using PLC. Several timers work together in PLC to meet the desired operation. A motor is to be run after 15 sec of delay when a particular input is given. A TON timer is used to meet the objective. When the accumulator count is 10 sec, there is a power failure. Contrast the operation of a motor with a timing diagram, if a retentive ON delay timer is used instead of a TON timer [CO2, PO1, PO2, PO3, PO6, BL4].	(3)
	B)	Write a program to implement the process illustrated in the Figure. An up-counter must be programmed as part of a batch-counting operation to sort parts automatically for quality control. The counter is installed to divert 1 part out of every 1000 for quality control or inspection purpose. The circuit operates as follows:	(4)

- A start/stop pushbutton station is used to turn the conveyor motor on and off.

- A proximity sensor counts the parts as they pass by on the conveyor.

- When a count of 1000 is reached, the counter's output activates the gate solenoid, diverting the part to the inspection line

- The gate solenoid is energized for 2 sec, which allows enough time for the part to continue to the quality control line.

- The gate returns to its normal position when the 2 sec time period ends.

- The counter resets to 0 and continues to accumulate counts.

- A reset pushbutton is provided to reset the counter manually. [CO3, PO1, PO2, PO3, PO6, BL3]

Quality control line

Parts conveyer line

Proximity switch

Gate solenoid drive
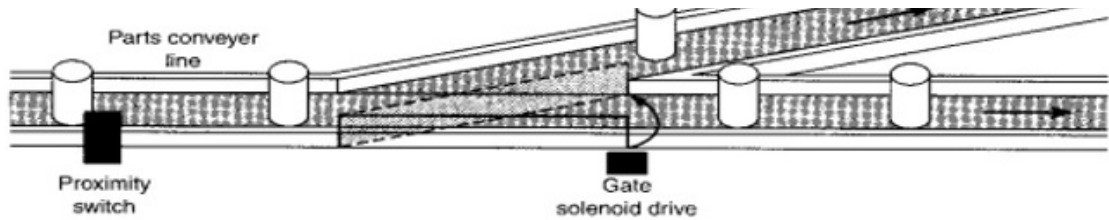
C) Write a program to implement the control for bottle filling station. The system operation as follows: (3)

- Master ON push button is pressed to turn ON the system.

- System is put in Auto mode by pressing the Auto mode push button.

- Conveyor starts to move.

- Conveyor stops if the bottle reaches the filling station.

- Bottle stays in filling station for 5 seconds.

- After 5 seconds conveyor starts to move.

- Bottle reaches the next station thus turning off the conveyor.

- Here bottle is sealed in 5 seconds.

- After 5 seconds conveyor starts to move.

- Operation continues. The master OFF push button is used to turn off the system.

- An emergency push button will reset the operation at any instant [CO3, PO1, PO2, PO3, PO6, BL3].

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3) Compare the operation of 4 - 20 mA and Fieldbus system's [CO4, PO1, PO2, BL4]. (3)

A)

B) A MODBUS message sent from a master to a slave contains the address of the slave, the 'command', the data, and a checksum (LRC or CRC). A bit stream 1101011011 must be transmitted using the standard CRC method. The generator polynomial is x^4+x+1. What is the actual bit string transmitted? [CO4, PO1, PO2, BL3] (4)

C) The temperature transmitter is calibrated for 4 mA - 20 mA for the temperature range of 30°C to 80°C. During the operation, there is a need to change its working range to 40°C - 80°C. Identify the suitable protocol which can do this calibration at the field and explain its operation [CO4, PO1, PO2, BL3]. (3)

4) Explain the operation of the Profibus protocol. Name different types of standards used in the physical layer of the same. [CO4, PO1, PO2, BL2]. (3)

A)

B) Explain the generalized DCS system with a diagram [CO5, PO1, BL2]. (5)

C) What are the different communication paradigms of the Fieldbus? [CO4, PO1, PO2, BL2] (2)

5) An ON/OFF level control process is to be designed in a SCADA simulator. Write a suitable logic to implement this with necessary declarations and visuals of the HMI screen. [CO5, PO1, BL3] (5)

A)

B) Explain the operation of MODBUS. [CO4, PO1, PO2, BL2]. (3)

C) Compare PLC with DCS (any 2 comparisons) [CO5, PO1, BL4]. (2)

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