Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023**

**Subject Code:2161709 Date:12-07-2023**

**Subject Name:Programmable Logic Controller**

**Time:10:30 AM TO 01:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Describe the benefits offer by PLC over conventional Relay logic control in the Industrial Automation. | **03** |
| | **(b)** | Explain following Specification of PLC<br>(1) Scan Time( 2) IO's of PLC ( 3) Resolution (4) Network Protocols | **04** |
| | **(c)** | Draw Functional block diagram of PLC and enumerate it in details | **07** |
| **Q.2** | **(a)** | Draw and describe Rack/Slot based addressing format of PLC. | **03** |
| | **(b)** | Draw and describe symbols used to prepare Ladder Logic Diagram (LLD) for PLC programming. | **04** |
| | **(c)** | What are the needs of I/O Module for PLC operation? Explain Analog Input and Output module with neat sketch. | **07** |
| | | **OR** | |
| | **(c)** | What is the demand of Special I/O Modules in PLC operation? Explain working of stepper motor type special module. | **07** |
| **Q.3** | **(a)** | Describe operation of following electromagnetic control relay<br>(1) Latching relay (2) Contactor (3) Solenoid Valve. | **03** |
| | **(b)** | Explain memory Image table of the PLC. | **04** |
| | **(c)** | Prepare Ladder Logic Diagram (LLD) for latching of Motor start scheme. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | What are the differences between counter and timer instruction? Explain with suitable example. | **03** |
| | **(b)** | Explain ADD, SUB, MUL and DIV instruction | **04** |
| | **(c)** | Develop Ladder logic diagram for each of the following Boolean expressions using AND, OR, and NOT gates:<br>(a) $Y= (AB +C) (C \bar{D})$<br>(b) $Y= A + CD$<br>(c) $Y= ( A+ B ) (\bar{C} +D)$ | **07** |
| **Q.4** | **(a)** | List 4 things to be considered for preventive maintenance of PLC | **03** |
| | **(b)** | Draw and design LLD to generate square waveform with 30% duty cycle at digital output terminal when toggle switch is ON. Note the total time is 10 sec. | **04** |
| | **(c)** | Prepare LLD to control Traffic light towards only North direction by Turning ON green Lamp for 25 sec, Next turning ON yellow Lamp for 3 sec, and finally turning ON Red Lamp for 45 sec. Repeat it continuously. Note at a time only one lamp to be ON. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | The counter instructions of PLCs are normally retentive. What does you means by it? | **03** |

**(b)** Differentiate **TON** timers versus **TOFF** timers instruction with suitable example **04**

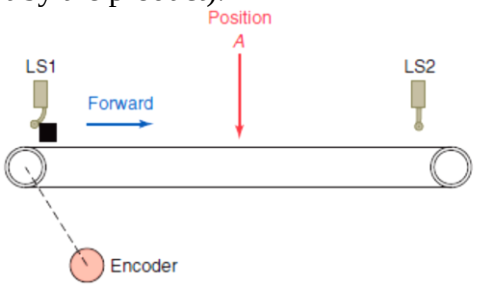
**(c)** Develop LLD for conveyor belt system

1). Product in position (limit switch **LS1** contacts close).

2). The start button is pressed and the conveyor motor starts to move the product forward toward position *A* (limit switch **LS1** contacts open when the actuating arm returns to its normal position)

3). The conveyor moves the product forward to position *A* and stops (position detected by 8 off to-on output pulses from the encoder, which are counted by an up-counter).

4). A time delay of 10 s occurs, after which the conveyor starts to move the product to limit switch **LS2** and stops (**LS2** contacts close when the actuating arm is hit by the product). **07**




**Q.5** **(a)** What do you understand by referring Jump returnable and Jump with nonreturnable instruction? Describe it in brief. **03**

**(b)** Prepare LLD for COMPARE PLC Function that will energize a pilot light output anytime the value stored at Data_2 is not the same as that stored at Data_6. **04**

**(c)** Write a ladder program to transfer data in 7 registers starting from FR0100 to other 7 holding register starting from IR0200. **07**

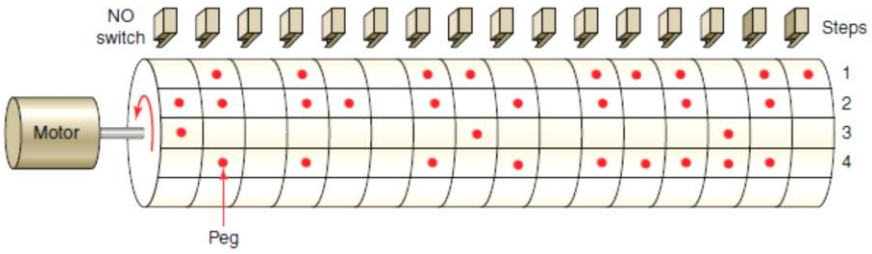
**OR**

**Q.5** **(a)** Enlist data handling Function. Describe for data move and rotate instructions. **03**

**(b)** Prepare LLD for following.

A FAN is to be STARTed and STOPed from any one of the three location. Each location has a START and STOP Button. **04**

**(c)** Construct an equivalent sequencer data table for the 4-steps of the mechanical drum-operated sequencer shown in the figure. **07**

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