



**B.E. DEGREE EXAMINATIONS: APRIL/MAY 2024**

(Regulation 2018)

Fourth Semester

**ELECTRICAL AND ELECTRONICS ENGINEERING**

U18EEI4205: PLC Automation

**COURSE OUTCOMES**

- CO1: Describe the architecture of PLC.  
 CO2: Understand the working of PLC analog input and output devices.  
 CO3: Program on basic ladder logic diagram using timer and counters.  
 CO4: Understand the interface of PC with PLC and hardware implementation

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

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|---|-----|-------------------|
| 1. Differentiate Programmable logic controllers and Computers.  | CO1 | [K <sub>2</sub> ] |
| 2. What are the key selection criteria to be considered when choosing a PLC for a specific application?   | CO1 | [K <sub>2</sub> ] |
| 3. Draw the internal circuitry of an opto-isolator. What is the main function of an opto-isolator in a PLC system?  | CO2 | [K <sub>2</sub> ] |
| 4. Differentiate fixed and modular type PLC.  | CO1 | [K <sub>2</sub> ] |
| 5. Classify the following devices into input and output devices with respect to PLC:<br>i) Thermocouple ii) Motor iii) Proximity Sensor iv) Solenoid Valve  | CO2 | [K <sub>2</sub> ] |
| 6. Develop a PLC ladder logic program to control a LED with two push button based on the following conditions: The LED should turn on if any one of push button is pressed. The LED should turn off if both push buttons are either pressed or released simultaneously. | CO3 | [K <sub>3</sub> ] |
| 7. Develop a ladder logic to Turn "ON" a solenoid valve after a time period of 5 secs.  | CO3 | [K <sub>3</sub> ] |
| 8. Draw the functional block diagram of down counter in PLC.  | CO3 | [K <sub>2</sub> ] |
| 9. What are the functions of interlocks in PLC programming?   | CO3 | [K <sub>2</sub> ] |
| 10. Enumerate the function of JUMP to Subroutine function with an example.  | CO3 | [K <sub>2</sub> ] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

11. a) Describe the architecture of a standard PLC system with neat diagram. 8 CO1 [K<sub>2</sub>]  
 b) Explain with neat diagram the PLC input module and input interfacing circuit. 8 CO2 [K<sub>2</sub>]
12. a) Explain the concept of scanning in PLC and its role in program execution. In a high-speed PLC based material handling system how does the scan time affects the response of the system. 8 CO1 [K<sub>2</sub>]  
 b) Develop the Ladder Logic diagram for AND, OR, NAND, NOR and EXOR Gate with truth table using siemens S7-1200 PLC. 8 CO3 [K<sub>2</sub>]
13. a) Explain the PLC programming languages such as ladder logic, function block diagrams, and structured text with relevant examples. 8 CO3 [K<sub>2</sub>]  
 b) In an elevator control system, the opening and closing of doors are controlled by a set of sensors (A, B, C) as inputs. The following truth table defines the logic for controlling the elevator doors based on the status of the sensors (A, B, C) as inputs and the opening, closing of doors as outputs :

Sensor A	Sensor B	Sensor C	Door Open	Door Close
0	0	0	0	1
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	0

- i) Determine the Boolean expressions for controlling opening and closing of the elevator doors ii) Simplify the Boolean expressions iii) Construct the ladder diagram

14. a) Explain any two on/off input switching devices and output on/off devices used in PLC. 8 CO2 [K<sub>2</sub>]  
 b) Develop a truth table for a safety system in a chemical processing plant with three gas sensors (A,B,C) as input and the following three outputs: alarm, 8 CO3 [K<sub>4</sub>]

ventilation fans and emergency shutdown. If anyone sensor detects hazardous gas levels, an alarm should be sounded. If any two sensors detect hazardous gas levels simultaneously, an alarm should be sounded, and ventilation fans should be activated to remove the gas. If all three sensors detect hazardous gas levels, an alarm should be sounded, ventilation fans should be activated, and an emergency shutdown of the plant should be initiated. Construct truth table, Simplify the logic and implement it in ladder logic.

15. a) Describe any two arithmetic and program control instructions used in PLC programming, with examples. 8 CO3 [K<sub>2</sub>]
- b) The circuit has a start (normally open) and stop (normally closed) button as input. Draw the ladder diagram using the timer block for the following conditions:  
 To turn on the motor after a delay of 5 seconds after pressing the start switch, and to turn on the lamp after a delay of 5 seconds after the motor is turned on. Motor should be turned off after delay of 3 seconds when stop switch is opened. 8 CO4 [K<sub>4</sub>]
16. a) Explain the Input and Output Sequencer Instruction with their block representation. 8 CO3 [K<sub>2</sub>]
- b) Develop a ladder diagram for the following process: A machine has been designed to wrap boxes of chocolate. The Boxes arrive at the machine on a conveyor belt. The list below shows the process step in sequence: 8 CO4 [K<sub>4</sub>]
1. Boxes (A) are manually inserted on a conveyor by the operator. The push button (B) is pressed by the operator and the conveyor starts (Y1) moving. Process stops operating when the stop button (C) is momentarily pressed.
  2. The box arrives and is detected by an optical sensor(D). After this the conveyor is stopped after 5 sec and the box is clamped (Y2) in the place .
  3. Then a wrapping machine (Y3) is turned ON for 2 secs to wrap the chocolates.

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