SAMPLE PAPERS

DIPLOMA FIFTH SEMESTER EXAMINATION 2025 (JUT)

INDUSTRIAL AUTOMATION

DIPLOMA WALLAH

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Full Marks: 7 marks 0 | Time: 3 Hours

Instructions:

- Question No. 1 is compulsory.
- Answer any **FOUR** questions from the remaining (Q.2 to Q. 7 marks).

SECTION A: MULTIPLE CHOICE QUESTIONS (Compulsory)

Q. 1. Choose the most appropriate answer for the following: (7 *2 = 14 Marks)

i. Which type of PLC instruction is most commonly used to transfer a data word from an input register to a holding register?

a) JUMP

b) MCR

c) MOV

d) Shift Register

ii. A primary safety component used to shut down power to an entire PLC control panel in an emergency condition is the:

a) Fuse

b) SMPS

c) E-Stop button (wired to safety relay)

d) Start button

iii. The main difference between a PLC and an RTU is that an RTU is specialized for:

a) High-speed local machine control.

b) Advanced motion control.

c) Data acquisition and telemetry over long distances.

d) Graphical user interface design.

iv. To achieve proportional positioning control, the most appropriate motor system is:

a) Stepper motor with open loop.

b) Standard AC induction motor.

c) Servo motor system.

d) DC shunt motor.

v. Which level of automation hierarchy includes the sensors, actuators, and primary process instrumentation?

a) Control Level

b) Supervisory Level

c) Enterprise Level

d) Field Level

vi. Which instruction in PLC programming is used to compare a value (e.g., a measured temperature) against both a high limit and a low limit simultaneously?

a) NEQ

b) EQU

c) LIM

d) GRT

vii. Which is NOT an advantage of Industrial Automation?

a) Increased safety

b) Increased complexity in maintenance

c) Improved product quality

d) Reduced human intervention

Q. 2.

A. Describe the different levels/hierarchy of Industrial Automation. Illustrate the structure using a clear organizational block diagram . [7 Marks]

B. Write a detailed note on the common causes of PLC failure and the classification of faults (Hardware vs. Software Faults). Describe the troubleshooting resources. [7 Marks]

Q. 3.

A. Explain the fundamentals of Servo Motors and their application in motion control systems. Differentiate between Servo Drives and general AC Drives based on their operation and application areas. [7 Marks]

B. Describe the structure, parameters, and functionality of various Timer Instructions used in PLCs. Specifically, explain the working of the Retentive On-Delay Timer (RTO). [7 Marks]

Q. 4.

A. What is SCADA (Supervisory Control and Data Acquisition)? Explain its core objectives, primary functions, and key applications in real-time monitoring and control. [7 Marks]

B. Write a comparative note on three major Industrial Communication Protocols (e.g., Modbus, Profibus, Ethernet) detailing their usage and characteristics. [7 Marks]

Q. 5.

A. Explain the Five Critical Steps involved in PLC Program Development (e.g., Define Task, Define I/O, Develop Logical Sequence, etc.). [7 Marks]

B. Discuss the key criteria (Selection Criteria) that must be considered when selecting a suitable PLC for a specific industrial application. [7 Marks]

Q. 6.

A. What are the necessary safety precautions that must be followed during the physical installation of a PLC system? Explain the system's power requirements, and the essential roles of safety circuitry like Master Control Relay (MCR). [7 Marks]

B. Describe the SCADA hardware components, focusing specifically on the functions, hardware, and software of Remote Terminal Units (RTUs). How do RTUs differ from PLCs? [7 Marks]

Q. 7. Write short notes on any FOUR of the following: (4 *3.5 = 14)

A. Define the role of the Master Terminal Unit (MTU) in a SCADA system.

B. List three commonly used communication standards and protocols in industrial drives.

C. Importance of wire size and cable labelling during PLC I/O installation.

D. How does IIoT (Industrial IoT) differ from consumer IoT?

E. Distinguish between Count Up (CTU) and Count Down (CTD) instructions in PLC programming.

ANSWER KEY AND MODEL SOLUTIONS (Paper 2)

MCQ Answer Key (Q. 1)

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
i.	(c)	ii.	(c)	iii.	(c)	iv.	(c)
v.	(d)	vi.	(c)	vii.	(b)		

Short Answer Solutions (Q. 7)

Part	Concept & Key Points (3.5 Marks Each)
A	**Role of MTU:** The MTU is the central hub/server in the SCADA system, located in the control room. Its role is to interface with operators, manage the database, handle communication with RTUs, and process data for graphical display, alarming, and reporting.
B	**Protocols in Industrial Drives:** Modbus RTU/TCP (Common for parameter setting/monitoring), Profibus DP (High speed for field devices), and Ethernet/IP (Modern, high bandwidth).
C	**I/O Installation Importance:** Proper **wire size** (gauge) prevents overheating and voltage drop. Clear **cable labelling** is essential for safety, maintenance, and rapid troubleshooting, ensuring the correct wire is connected to the right terminal.
D	**IIoT vs. Consumer IoT: Consumer IoT** focuses on personal convenience, entertainment, and home automation (e.g., smart speaker). **IIoT** focuses on industrial processes, mission-critical operations, harsh environments, high reliability, data security, and generating business value (e.g., predictive maintenance).
E	**CTU vs. CTD: CTU (Count Up)** increments its accumulator value by one every time the input transitions from FALSE to TRUE until it reaches the preset value (PV). **CTD (Count Down)** decrements its accumulator value by one from the preset value every time the input transitions from FALSE to TRUE until it reaches zero.

Model Answers for Long Questions (Q. 2-Q. 6)

- **L3 (Automation Hierarchy):** Describe the five levels (Enterprise, Management, Supervisory, Control, Field) and their functions. **Required Diagram:** Levels of Industrial Automation Hierarchy.

- **L10 (Servo vs. AC Drives): Servo Drive:** Controls position/velocity/torque, uses high-resolution feedback (encoder), highly dynamic, used in robotics/CNC. **AC Drive:** Controls speed (V/f), minimal feedback, low cost, used in fans/pumps.
- **L15 (Protocols Comparison):** Compare Modbus (Simple, Serial/TCP, widely compatible) vs. Profibus (Medium/High speed, complex, strong diagnostics, primarily Siemens) vs. Industrial Ethernet (Highest speed, high data volume, IP-based, best for network integration).
- **L12 (RTU vs. PLC): RTU Focus:** Telemetry, long-distance communication (via radio/cellular), handling smaller I/O counts, often battery-backed. **PLC Focus:** High-speed, deterministic control loops, large I/O counts, fixed wiring.
