

SAMPLE PAPERS
DIPLOMA FIFTH SEMESTER EXAMINATION 2025 (JUT)
AUTOMATION & ROBOTICS
DIPLOMA WALLAH

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Full Marks: 70 marks | Time: 3 Hours

Instructions:

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

SECTION A (Compulsory)

Q.1 Multiple Choice Questions (7 × 2 = 14 Marks)

(i) Which type of robot drive system is known for cleanliness and is commonly used in small robots for precise tasks, but lacks high force capability?

- (a) Hydraulic Drive
- (b) Pneumatic Drive
- (c) Electric Drive
- (d) Mechanical Drive

(ii) The number of independent movements a robot manipulator can perform is known as:

- (a) Work Volume
- (b) Payload
- (c) Degrees of Freedom (DOF)
- (d) Repeatability

(iii) In PLC programming, a "retentive" timer:

- (a) Resets automatically when power is lost
- (b) Maintains its accumulated time value even if the rung goes false
- (c) Cannot be reset
- (d) Counts input pulses instead of time

(iv) Which of the following is an example of a "Contact" sensor?

- (a) Limit Switch
- (b) Inductive Sensor

(c) Ultrasonic Sensor

(d) Photoelectric Sensor

(v) An AGV (Automated Guided Vehicle) system that uses a camera to follow a painted line or tape on the floor uses which guidance technology?

(a) Wire guidance

(b) Inertial guidance

(c) Optical/Visual guidance

(d) Laser guidance

(vi) The IEC 1131-3 standard defines which of the following as a graphical programming language for PLCs?

(a) Ladder Diagram (LD)

(b) C++

(c) Python

(d) Assembly Language

(vii) What is the function of an "End Effector" in robotics?

(a) To supply power to the robot

(b) To process sensor data

(c) To interact with the environment (grip or work)

(d) To store the robot program

SECTION B (Theory)

(Answer any FOUR questions from Q.2 to Q.7)

Q.2

(A) Discuss the key development milestones in the history of automation technology and analyze the effects of automation on people (employment, skills). [7]

(B) Explain the working principle and application of Timer functions (On-Delay and Off-Delay) and Counter functions in PLC programming. [7]

Q.3

(A) Describe the working principle and industrial application of different types of Input Devices: Strain Gauges, Pressure Sensors, and Resistive Temperature Detectors (RTDs). [7]

(B) Explain the principle of operation for Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC). Why are they crucial in automation? [7]

Q.4

(A) Draw the Block Diagram of an Embedded System and explain the role of each component. List at least four key Applications of Embedded Systems in the automotive sector. [7]

(B) Define Flexible Manufacturing Systems (FMS). Explain the different types of FMS and detail the essential Components of FMS. [7]

Q.5

(A) Describe the Basic Components of an Industrial Robot (Base, Link, Joint, Wrist, End effector, Actuator, Sensor, Controller). Draw a neat diagram. [7]

(B) Define Degree of Freedom (DOF). Explain the six basic degrees of freedom (Forward/Back, Up/Down, Left/Right, Pitch, Yaw, Roll). [7]

Q.6

(A) Differentiate between the three main types of Robotic Drives: Electric, Pneumatic, and Hydraulic Drives. [7]

(B) What are End Effectors? Differentiate between Grippers and Tools. List the factors considered for selecting a Gripper. [7]

Q.7 Write Short Notes on ANY FOUR of the following: (4 × 3.5 = 14 Marks)

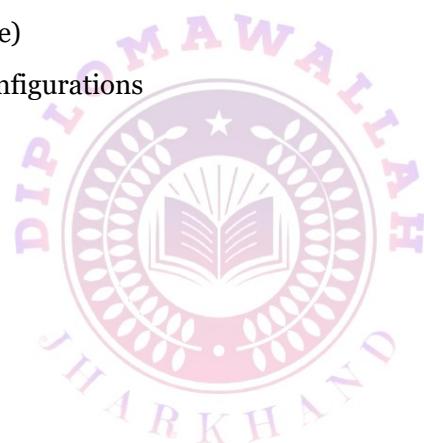
(a) SCADA system relation to automation hierarchy

(b) Via Point vs Process Point

(c) Encoders (Working & Use)

(d) Types of FMS Layout Configurations

(e) Smart Sensors



SOLUTIONS FOR PAPER 2

MCQ Answer Key:

(i) b, (ii) c, (iii) b, (iv) a, (v) c, (vi) a, (vii) c

Short Answer/Model Answer Hints:

- **Q.2(A):** History: Mechanics -> Relay -> PLC -> AI. Effects: Job displacement vs Job creation (higher skill).
- **Q.2(B):** TON (Delay start), TOF (Delay stop), CTU (Count up), CTD (Count down).
- **Q.3(A):** Strain Gauge (Resistance change with deformation), Pressure (Piezoelectric/Diaphragm), RTD (Temp-Resistance linearity).
- **Q.3(B):** ADC: Sensor (Analog) -> CPU (Digital). DAC: CPU (Digital) -> Actuator (Analog).
- **Q.4(A):** Processor, Memory, I/O, Timer. Auto Apps: ABS, ECU, Airbag, Infotainment.
- **Q.4(B):** Flexible routing/processing. Types: Dedicated, Random order. Components: Workstation, Material handling, Control.
- **Q.5(A):** Diagram showing Arm, Wrist, Base, Controller.
- **Q.5(B):** 3 Translations (X,Y,Z) + 3 Rotations (Pitch, Yaw, Roll).
- **Q.6(A):** Electric (Accurate, clean), Hydraulic (Strong, messy), Pneumatic (Fast, weak/compliant).
- **Q.6(B):** Gripper: Physical hold. Tool: Process (Weld/Paint). Factors: Part weight, shape, material.
- **Q.7:** (a) Supervisory level for data acq. (b) Via (pass through), Process (stop/act). (c) Position feedback. (d) Inline, Loop, Robot-centered. (e) Sensor + Signal processing.