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) A "limit switch" is typically used for:

(a) Measuring temperature

(b) Detecting the end of motion or position limits

(c) Measuring pressure of a fluid

(d) Controlling motor speed wirelessly

(ii) The workspace shape of a robot with a Cylindrical configuration (RPP) is:

(a) A Sphere

(b) A Cube

(c) A Cylinder with a hollow center

(d) A Pyramid

(iii) In robot programming, "PTP" stands for:

(a) Point-To-Point control

(b) Process-Time-Path

(c) Position-Tracking-Protocol

(d) Program-To-Processor

(iv) Which PLC language uses blocks with inputs on the left and outputs on the right, representing logical functions?

(a) Instruction List

(b) Structured Text

(c) Function Block Diagram (FBD)

(d) Sequential Function Chart

(v) An AS/RS (Automated Storage and Retrieval System) primarily improves:

(a) Welding speed

(b) Inventory management and space utilization

(c) Robot gripping force

(d) PLC processing speed

(vi) A "Pitch" movement in a robot wrist refers to:

(a) Rotation around the vertical axis

(b) Up and down movement of the wrist

(c) Rotation around the arm axis

(d) Linear extension of the arm

(vii) Which sensor is based on the Seebeck effect?

(a) RTD

(b) Thermocouple

(c) Thermistor

(d) Strain Gauge

SECTION B (Theory)

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

Q.2

(A) Explain the different types of PLC Programming methods and detail the standard IEC 1131-3 Symbols used for I/O devices. [7]

(B) Explain the construction, working, and applications of Stepper Motors and Servo Motors used as actuators. [7]

Q.3

(A) Describe the working principle and industrial uses of Relays and Directional Control Valves as common output devices in control circuits. [7]

(B) Explain the concept and need for Automated Guided Vehicles (AGVs). Describe the various AGV Guided Technologies. [7]

Q.4

(A) Describe the main Components of an Automated Storage/Retrieval System (AS/RS) and explain their function in modern logistics. [7]

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

Q.5

(A) List and describe the different Joint Notations and Types of Joints (L, O, R, T, V) found in a robot arm. [7]

(B) Explain the working principle and typical applications of Robot Control Systems: Point-to-Point (PTP), Continuous Path (CP), and Intelligent Control. [7]

Q.6

(A) Explain the application of robots in Arc Welding. Describe the essential Arc Welding Application commands and the importance of Weld Parameters. [7]

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

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

(a) Selection parameters of a PLC

(b) Robot Manipulator vs Mobile Robot

(c) Application of Tactile Sensors

(d) Role of Communication Protocols in automation

(e) CAD/CAM in Robotics

SOLUTIONS FOR PAPER 3

MCQ Answer Key:

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

Short Answer/Model Answer Hints:

- **Q.2(A):** Ladder, FBD, ST, IL, SFC. Symbols: NO/NC contacts, Coils.
- **Q.2(B):** Stepper (discrete steps), Servo (continuous feedback control).
- **Q.3(A):** Relay: Switch high voltage with low voltage. DCV: Control fluid direction (Cylinders).
- **Q.3(B):** Material transport. Tech: Wire (Inductive), Laser (Reflectors), Tape.
- **Q.4(A):** Racks, S/R Crane, Pallets, I/O Station.
- **Q.4(B):** Compare Speed, Power, Accuracy, Maintenance.
- **Q.5(A):** L (Linear), O (Orthogonal), R (Rotational), T (Twisting), V (Revolving).
- **Q.5(B):** PTP (start/end only - Pick place), CP (trajectory - Welding), Intelligent (Sensors - Bin picking).
- **Q.6(A):** Commands (ARCON/OFF), Params (Volts/Amps/Speed).
- **Q.6(B):** Evolution: Mechanical -> Electronic -> Digital -> AI.
- **Q.7:** (a) I/O count, Memory, Speed. (b) Fixed base arm vs Moving base. (c) Touch/Pressure sensing. (d) Linking devices (Profibus/Ethernet). (e) Design and Path planning.