Code: 20ME4702E

## IV B.Tech - I Semester – Regular Examinations - DECEMBER 2023

# INDUSTRIAL ROBOTICS
## (MECHANICAL ENGINEERING)

Duration: 3 hours                     Max. Marks: 70

Note:  1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level                     CO – Course Outcome

|   |   |   | BL | CO | Max. Marks |
|---|---|---|----|----|-----|
| | | **UNIT-I** | | | |
| 1 | a) | Explain anatomy of robot with neat sketch. | L2 | CO1 | 7 M |
| | b) | Classify the types of robots based on work volume. | L2 | CO1 | 7 M |
| | | **OR** | | | |
| 2 | a) | Explain the working of Stepper motor. | L2 | CO1 | 7 M |
| | b) | How can a robot end effectors be used as a tool? Explain. | L2 | CO1 | 7 M |
| | | **UNIT-II** | | | |
| 3 | a) | A vector V= 2i+5j+3k is rotated by 60° about Z-axis and translated by 3, 4 and 5 units in the X, Y and Z directions respectively. Find the vector with reference to the reference frame. | L2 | CO1 | 7 M |
| | b) | Derive the Lagrange Euler formulation for the dynamic model of a manipulator. | L3 | CO2 | 7 M |

| | | **OR** | | | |
|---|---|---|---|---|---|
| 4 | a) | Determine the manipulator Jacobian matrix. | L2 | CO1 | 7 M |
| | b) | What is the role of D-H rotation? Explain its importance solving forward Kinematics. | L3 | CO2 | 7 M |

## UNIT-III

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|---|---|---|---|---|---|
| 5 | a) | Explain trajectory planning in robots and its importance. | L2 | CO1 | 7 M |
| | b) | What are the methods of programming a robot? Explain in brief. | L2 | CO3 | 7 M |
| | | **OR** | | | |
| 6 | a) | The second joint of a SCARA manipulator is required to move from $\theta_2 = 30°$ to $120°$ in 10 seconds. Find the cubic polynomial to generate the smooth trajectory for the joint. What is the maximum velocity and acceleration for this trajectory? | L3 | CO1 | 7 M |
| | b) | Explain various important features of robot programming languages. | L2 | CO3 | 7 M |

## UNIT-IV

| | | | | | |
|---|---|---|---|---|---|
| 7 | a) | What do you understand by 'slip sensors' for robot grippers? | L2 | CO1 | 7 M |
| | b) | Explain Range sensor with a neat sketch. | L2 | CO4 | 7 M |
| | | **OR** | | | |
| 8 | a) | Explain Acoustic sensor with a neat sketch. | L2 | CO1 | 7 M |
| | b) | Briefly explain the tasks performed by a robotic vision system. | L2 | CO4 | 7 M |

| | | UNIT-V | | | |
|---|---|---|---|---|---|
| 9 | a) | Discuss robot application for welding a machine loading. | L2 | CO1 | 7 M |
| | b) | Describe the spray coating operation with robot system. | L2 | CO4 | 7 M |
| | | OR | | | |
| 10 | a) | Differentiate between industrial and micro robots. | L2 | CO1 | 7 M |
| | b) | List out the recent developments in robotics. | L2 | CO4 | 7 M |