

III B. Tech I Semester Regular Examinations, Dec/Jan – 2022-23
INDUSTRIAL ROBOTICS
 (MechanicalEngineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
 All Questions Carry Equal Marks

UNIT-I

1. a) Write a short note on the following characteristics of manipulator: [7M]
 (i) Precision of motion (ii) Speed of response and stability
 - b) Differentiate between hydraulic, electrical and pneumatic drives. [7M]
- (OR)**
2. a) Define automations. Write the differences between fixed automation and programmable automation. [7M]
 - b) Explain the working principle of stepper motor with neat sketch. [7M]

UNIT-II

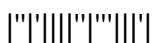
3. a) Write the differences between forward kinematics and inverse kinematics. [7M]
 - b) Explain the following: [7M]
 i) Euler angles ii) Equivalent angle axis representation
- (OR)**
4. Discuss the features of Cartesian and spherical robot and also find the D-H matrix for spherical robot. [14M]

UNIT-III

5. a) What do you mean by manipulator Jacobean? What is the importance of it in the motion analysis. [7M]
 - b) Define singularities of a manipulator? How are they classified? Explain with an example. [7M]
- (OR)**
6. Using the Lagrangian method, derive the equations of motion for the three degree of freedom planar robot arm. [14M]

UNIT-IV

7. Using the grid work for a robot with one rotational and one linear axis, show the path taken by the robot if it is directed to move between the following sets of points in the grid using linear interpolation. [14M]
 (i) Point (1, 2) and point (5, 6)
 (ii) Point (3, 1) and point (7, 2)
 (iii) Point (2, 3) and point (7, 9)



(OR)

8. a) Explain about importance of Robot trajectory planning. [7M]
- b) Compute the trajectory of a robot manipulator is given by $\theta(t) = a_0 + a_1t - a_2t^2 + a_3t^3$. When $t = 1$ sec. the initial position, velocity and acceleration are 45m, 10 m/s and 4 m/s² respectively. When $t = 3$ sec. the final position, velocity and acceleration are 80m, 25m/s and -6 m/s² respectively. [7M]

UNIT-V

9. a) In which type of production, robots are preferred for material handling function? Explain. [7M]
- b) Explain the operation of absolute and incremental optical encoder used in robot as a feedback device. [7M]
- (OR)
10. a) Explain about functioning of DC tachometer as a feedback device with neat sketch. [7M]
- b) Discuss in detail about the design of Remote centered devices used for processing Operations. [7M]

