PVP 14

Code: ME7T4B

IV B.Tech - I Semester – Regular/Supplementary Examinations
JANUARY - 2022

ROBOTICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22 M

1.

a) What are the major components of a robot and list their functions.
b) How is a robot end-effector specified?
c) Explain the various characteristics of Hydraulic actuating system.
d) Discuss the use of transformations in solving the kinematics of a robot.
e) Compare direct kinematics and inverse kinematics.
f) Explain the manipulator Jacobian.
g) What are the Control modes of a manipulator in a trajectory planning problem?
h) Discuss the characteristics of robotic sensors in the light of accuracy and sensitivity.
i) What is meant by Proximity and Range sensing?
j) What is the use of AML as a manufacturing language for assembly operations?
k) What are the basic rules followed in the use of robots in assembly?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.
3 x 16 = 48 M

2. a) Compare the size of the work volumes of the robots having polar, cylindrical and cartesian anatomy configuration. Assume that the robots have equal link lengths. Which configuration has the largest work volume? 8 M

b) What are the socio-economic issues in using robots to replace human workers from workplace? Explain. 8 M

3. a) Develop a 3 × 3 rotation matrix for rotation of a point about *x*-axis by an angle 'θ'. Find the resultant rotation matrix that represents a rotation of 'φ' angle about the *y*-axis followed by a rotation of 'α' angle about the *z*-axis followed by a rotation of 'θ' angle about the *x*-axis. 8 M

b) Develop an orthonormal link coordinate system for a manipulator with *n* links, using Denavit-Hartenberg (D-H) representation. 8 M

4. a) Compare Lagrangian formulation and Newton-Euler formulation for obtaining dynamic equations. Using the Lagrangian method, derive the equation of motion for the two-degree of freedom planar robot. 8 M

b) Describe and compare the two common approaches used to plan manipulator trajectories. 8 M

5. a) How do you sense the positional accuracy of a robot? Identify and explain the suitable type of sensors to measure the position with the help of a sketch. 8 M

b) Discuss the capabilities and limitations of Lead through methods of robot programming. 8 M

6. a) Identify and justify the type of robot that would be most suitable for the following processing applications:
i) Unload 1000-kg items from a die casting machine.
ii) Install integrated circuit chips on a printed circuit board. 8 M

b) Discuss the role of robots in inspection and quality control. 8 M