

Code: ME7T4B

IV B.Tech - I Semester – Regular Examinations – October 2017

ROBOTICS
(MECHANICAL ENGINEERING)

Duration: 3 hours

Max. Marks: 70

PART – A

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

11x 2 = 22 M

1. a) What is the essential feature that distinguishes soft automation from hard automation?
- b) Where is the end-effector connected to the manipulator?
- c) Discuss the relative merits and demerits of hydraulic actuator systems.
- d) Why homogeneous coordinates are required in modeling of robotic manipulators?
- e) What are the parameters for a link for kinematic modeling? Which of these parameters are variable and which are constant for a revolute joint and a prismatic joint?
- f) Explain the differential motions of a robot.
- g) Explain the two common approaches used to plan manipulator trajectories.
- h) Discuss the objectives of sensors in robotic sensory devices.
- i) Differentiate between tactile and non-tactile sensors.
- j) Explain the need of branching in a robot program.
- k) What are the possible robot applications in manufacturing industries?

PART – B

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

2. a) Explain pitch, yaw and roll motions of a robot wrist, with the help of sketches. 8 M
- b) Justify whether a gripper or an end-of-arm tooling is appropriate for the following tasks: 8 M
- (i) Welding
 - (ii) Scraping paint from a glass pane.
 - (iii) Drilling a hole.
 - (iv) Tightening a nut of automobile engine.
3. a) Develop the homogenous transformation matrix for a rotation of 90° about the z – axis, followed by a translation of (3, 7, 9). 8 M
- b) Formulate the forward kinematic model for 2-DOF RR type Planar Robot. 8 M
4. a) Develop the Jacobian matrix for a cylindrical configuration manipulator. 8 M

- b) Build the dynamic model for a one-DOF, one-axis planar manipulator with one rotary joint (the inverted pendulum) using Lagrange-Euler formulation. Assume the link to be a thin cylinder (slender member) with length L and mass m acting at the centroid of the link. 8 M
5. a) List the situations where robot will require non contact type sensors. Identify suitable non contact sensors for these applications and explain the working of any one sensor. 8 M
- b) Explain the manipulator motion commands in AML robot programming language. 8 M
6. a) Explain about the important items to be considered in deciding the use of robots in 8 M
- (i) Manufacturing operation
- (ii) Hazardous operation
- b) Discuss the application of robots in assembly operations. 8 M