

Code: 17MEMD2T4

**I M.Tech - II Semester – Regular/Supplementary Examinations
OCTOBER - 2020**

**ADVANCED ROBOTICS
(MACHINE DESIGN)**

Duration: 3 hours

Max. Marks: 60

Answer the following questions.

1. a) Classify robots according to control method and explain in detail about each type. 6 M

 - b) List out the present and future applications of robot and explain atleast two current applications in detail. 9 M
- (OR)
2. a) Find the transformation matrices for the following operations on the point $2i+8j+3k$ and find final position of point. 8 M
 - i) Rotate 30° about x-axis and then translate -5 units along y-axis.
 - ii) Translate 2 units along y-axis and rotate 60° about z- axis.

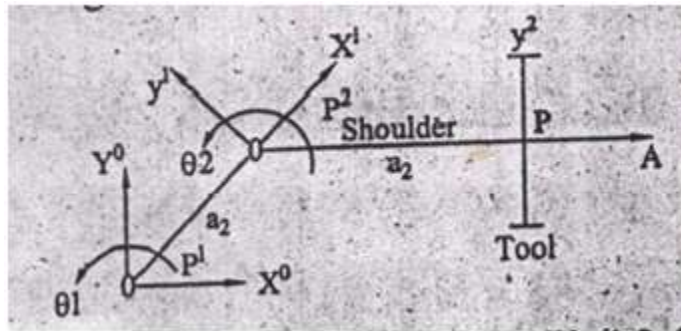
 - b) Describe representation of rigid body with respect to a reference frame. 7 M

3. a) Write short notes on: 6 M
- i) Direct and inverse kinematics
 - ii) DH convention

- b) Derive the kinematic equations for the 3DoF Jointed arm robot giving co-ordinate frame diagram and the kinematic parameters. 9 M

(OR)

4. Find the manipulator Jacobean matrix $j(q)$ of the two-axis planer articulated robot shown in figure. 15 M



5. a) What is Lagrangian? Give derivation of Lagrangian-Euler formulation of joining force/torque for single link manipulator of given length and mass. 9 M

- b) Explain the following briefly as applied to robot arm dynamics analysis. 6 M

- i) Kinematic energy
- ii) Potential energy
- iii) Joint velocities

(OR)

6. a) Explain the following terms: 6 M
- i) Trajectory
 - ii) Joint space trajectory planning.

b) A single link robot with a rotary joint is motionless at $\Theta_0=15^0$ it is desired to move the joint in a smooth manner to $\Theta_f=75^0$ in 3sec. Find the coefficients of a cubic polynomial which accomplishes this motion and brings the arm to rest at the goal. 9 M

7. a) Draw a pole zero map for the following transfer function

$$TF = \frac{s(s+3)}{(s+5)(s+2)(s^2+4s+5)}$$

8 M

b) Explain about proportional-plus-integral controllers. 7 M

(OR)

8. a) Differentiate pneumatic, hydraulic and electric actuators.

6 M

b) Explain the following: 9 M

- i) Potentiometer
- ii) Resolver
- iii) Encoders