

IV B.Tech I Semester Supplementary Examinations, November 2005
ROBOTICS
 (Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. State some applications of Robotics in various fields including agriculture, medical and defense areas. [16]
2. What are the different robot applications in industries? Explain in detail. [16]
3. (a) Define Translation transformation and explain how the coordinate of the vector changes. [8]
 (b) A point P (5,5) lies in a 2-D reference frame. The point has to move along the line at an angle 45° for a distance of 10 units. What are the coordinates of the final position of the point? [8]
4. Considering a jointed arm robot manipulator with its x, y and z axes aligned with a reference Cartesian co-ordinate frame but located at $\{x, y\} = \{3 \text{ mt}, -2 \text{ mt}\}$ the end of arm of the robot is currently at $\{x, y, z\} = \{4 \text{ mt}, 1 \text{ mt}, 2 \text{ mt}\}$ relative to the reference co-ordinate frame. As end effector is 0.5 mt in length is attached to the end of arm is pointing vertically down. Relative to the tip of the end effector is a cube with 15 mm on a side and with its nearest corner positioned 0.5 mt in the x direction 1 mt in y direction and 0 mt in z direction from the tip of the end effector. For the above description make the sketch of work volume cell. [16]
5. Find the manipulator jacobian matrix $J(q)$ of the two-axis planer articulated robot shown in figure1. [16]

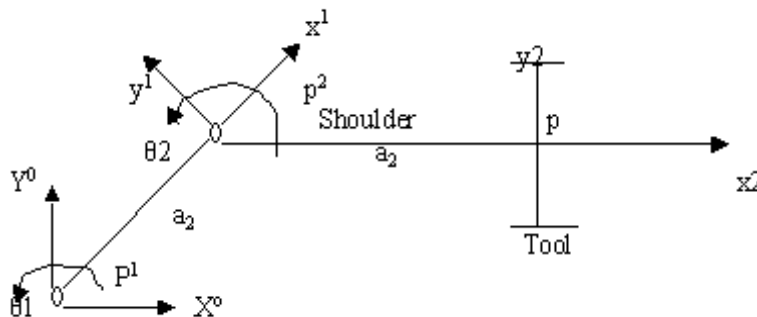


Figure 1:

6. Develop the general expressions for kinetic energy and potential energy of an element of a robotic manipulator. [16]

7. (a) Explain the different methods of splitting a joint trajectory. [8]
(b) A single link rotary robot is required to move from $\theta(0) = 45^\circ$ to $\theta(2) = 90^\circ$ in 2 seconds. The joint velocity and acceleration are both zero at the initial and final positions. What is the highest degree polynomial that can be used to accomplish the motion? What is the lowest degree polynomial that can be used to accomplish the motion? [8]
8. (a) With a neat sketch explain the working of a resolver. [10]
(b) What are the advantages and disadvantages of resolver? [6]
