

N.B. : (1) Question No. 1 is compulsory.

(2) Attempt any four questions out of remaining six questions.

(3) Assume suitable data wherever required.

1. (a) Compare the five basic robot configuration according to the work envelope and applications. 5
- (b) Explain Reach and Stroke of a robot. 5
- (c) Discuss Total Work Envelope (TWE) and Dexterous Work Envelope (DWE) of two axis articulated planar robot. 5
- (d) Compare area descriptor and line descriptor. 5
2. (a) Explain the significance of TCV vector in the solution of Inverse Kinematic. 5
- (b) Discuss the general properties of the solutions of the Inverse Kinematic. 5
- (c) Develop IK analysis of 2-axis planar articulated robot. 10
3. (a) Explain D-H algorithm. Develop the D.K. analysis of 4 axis SCARA robot. 15
- (b) Explain screw Transformations. 5
4. (a) Define Joint space work envelope (JSWE) and Tool Trajectory. 5
- (b) Explain work space fixtures required in the robotic work cell. 5
- (c) Discuss work envelope of a four axis SCARA robot. 10
5. (a) Explain how straight line motion can be obtained using an articulated robot. 10
- (b) Explain linear interpolation with parabolic blends. Discuss its advantages over piecewise linear interpolation. 10
6. (a) Discuss edge detection technique. Explain the significance of edge threshold  $\epsilon$ . 10

(b)

0	0	1	1	0	0
1	1	1	1	1	1
0	0	1	1	0	0

For the above image shown calculate area, centroid, first order moments, second order moments, central moments and principal angle.

7. Write short notes on the following :-

- (a) Region growing and region labelling
- (b) Shrink and swell operator
- (c) Task planning problem
- (d) NC and CNC machines.