

Total No. of Questions : 8]

SEAT No. :

P4938

[Total No. of Pages :2

[4959]-1079
B.E. (Electrical)
(b) : Robotic & Automation
(2012 Pattern)

Time : 2.½ Hours]

[Maximum Marks : 70

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Define Degree of freedom and spatial resolution. [6]
b) Explain translational transformation with example. [6]
c) What are the different rules for establishing link coordinate frames. [8]

OR

- Q2)** a) Write the concept of yaw, pitch and roll. [6]
b) Explain rotational transformation with example. [6]
c) Show how to add two vectors represented in homogeneous coordinates with different scale factors. What is the scale factor of the result? [8]

- Q3)** a) Derive rotation in the y-z plane and the z-x plane using the geometric approach. [8]
b) Derive the rotation formula using vector technique. [8]

OR

- Q4)** a) Explain multiple reference frames in space. Draw sketches if necessary. [8]
b) A point $[1;2;3]^T$ is desired to rotate around z axis by 60° and then around y axis by -90° . Find the resultant point after rotation. [8]

P.T.O.

- Q5)** a) Explain relationship between transformation matrix and angular velocity. [8]
b) Explain joint position controls (JPC) with neat sketch. [9]

OR

- Q6)** a) Explain Jacobian for prismatic and revolute joint for manipulator design. [8]
b) Explain resolved motion position controls (RMPC) with neat sketch. [9]

- Q7)** a) Explain servo-control system in detail. [8]
b) Explain underwater robot design with neat sketch. [9]

OR

- Q8)** a) Explain parts sorting robot with neat sketch. [8]
b) Explain selection criteria for sensors used, drives and actuators used in manipulator design. [9]

