

Code: AE5T6FE1, IT5T5FE2, CS5T5FE3, EE5T6FE3, EM5T6FE2

**III B.Tech - I Semester – Regular Examinations - November 2014**

**ROBOTICS**  
**(Common for AE, CSE, IT, EEE, ECM)**

Duration: 3 hours

Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Briefly describe the functions of four basic components of a robot. 7 M  
b) What is degree of freedom? Explain the DOF of different types of robot arms. 7 M
2. How do you classify robot end-effectors? Discuss in detail. 14 M
3. a) State and prove the properties of rotation transformation matrix. 7 M  
b) Perform the following operations for the vector  $8i+3j-k$ .
  - i) Rotate the vector about y-axis by  $30^\circ$
  - ii) Translate the vector along z-axis by 10 units and
  - iii) Rotate the vector about z-axis by  $60^\circ$ .7 M
4. Derive the forward kinematics equation using the DH convention for the three link planar manipulator (RRR) shown in the figure 1. 14 M

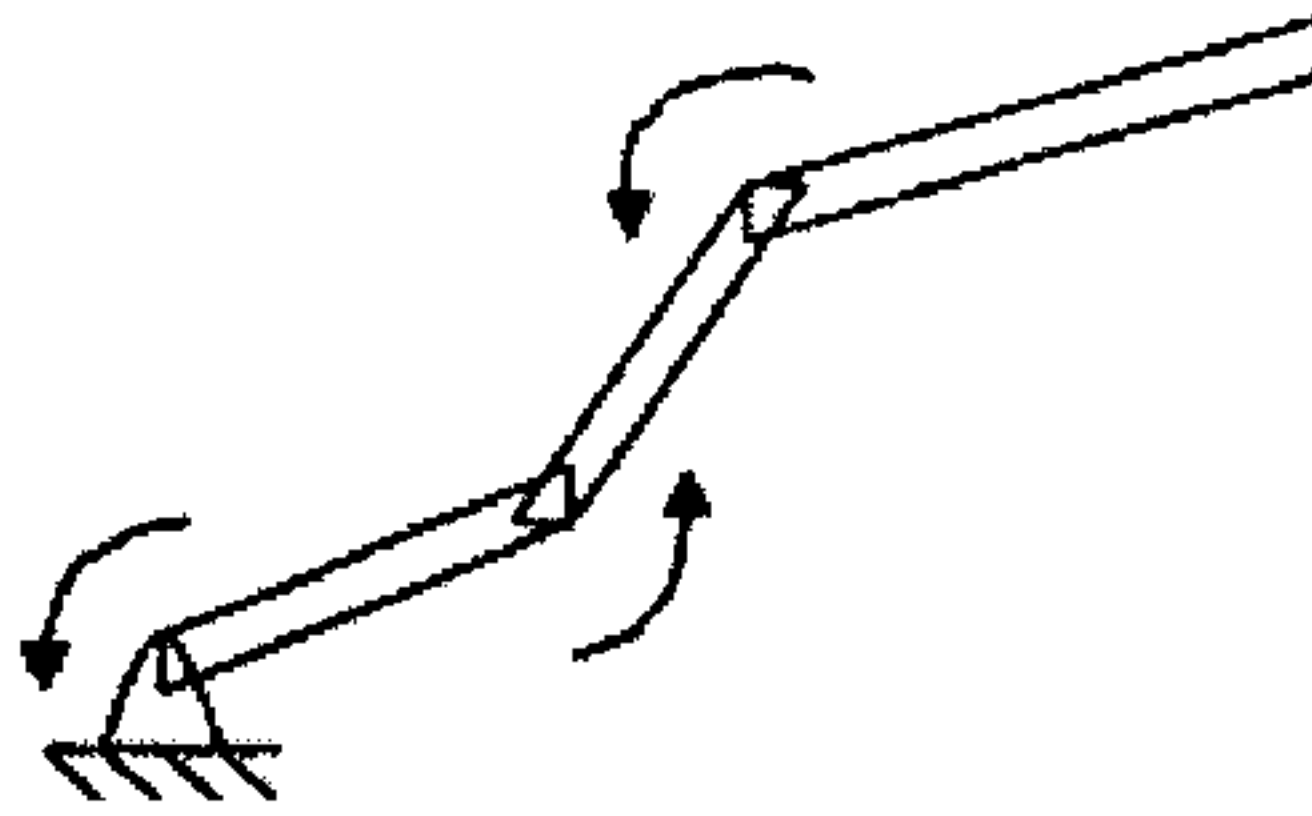


Figure 1

5. Define a geometric Jacobian. Compute the Jacobian matrix for a planar R-R robotic manipulator. 14 M
  
6. a) Explain the various steps in trajectory planning. 7 M
  - b) A one-degree of freedom manipulator with rotary joint is to move from  $113^\circ$  to  $210^\circ$  in 7 seconds. Find the coefficient of the cubic polynomial to interpolate a smooth trajectory. Plot the position, velocity and acceleration variation as a function of time. 7 M
  
7. What is the function of a sensor? Explain about tactile, proximity and range sensors. 14 M
  
8. a) Explain the use of robots in material handling applications. 7 M
  - b) Discuss the applications of a robot in automated assembly operations. 7 M