ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

M.Tech II-Semester Regular Examinations, May 2016

ROBOTICS

(MACHINE DESIGN)

Date: **Time: 3 hours** **Max Marks: 60**

Answer ONE Question from each unit
All questions carry equal marks
All parts of the question must be answered at one place only

UNIT-I

1. (a) Explain various classifications of Robots in detail. **(6 M)**
   (b) What is the resultant rotation matrix for a rotation of 60^0 about the fixed X-axis, followed by a rotation of 45^0 about the Y-axis, followed by rotation of 30^0 about the Z-axis. Find the direction of screw axis and angle of rotation. **(6M)**

OR

2. (a) Sketch a robotic system showing the various elements and explain the function of each element. **(6 M)**
   (b)Explain homogeneous coordinate transformations. **(6 M)**

UNIT-II

3. Obtain the direct and inverse kinematic analysis of SCORBOT robot shown in fig.1. **(12 M)**

OR

4. (a)Discuss briefly about Successive screw displacements. **(6 M)**
   (b)Derive the direct kinematics of a 3-DOF Planar manipulator shown in fig.2 **(6 M)**

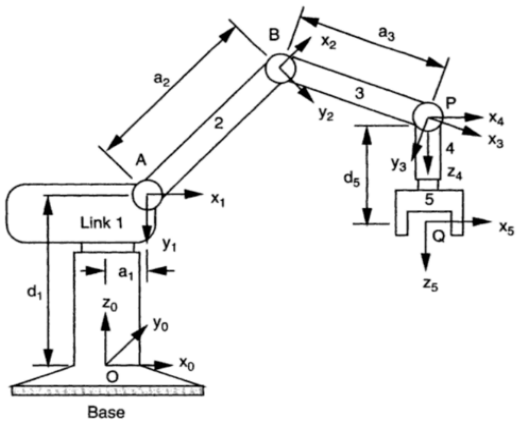

FIG. 1

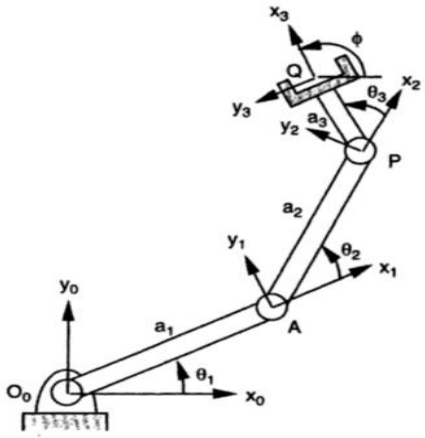

FIG. 2

UNIT-III

5. Fig.3 shows the schematic diagram of planar 2-DOF five bar manipulator that is constructed with one prismatic and four revolute joints. Find the end effecter position Q as function of the two input joint variables, d_1 and θ_2 . **(12 M)**

OR

6. Explain how the possible manipulator postures corresponding to given end-effecter location of planar 3-DOF, 3RRR parallel manipulator shown in fig.4 can be determined. **(12 M)**

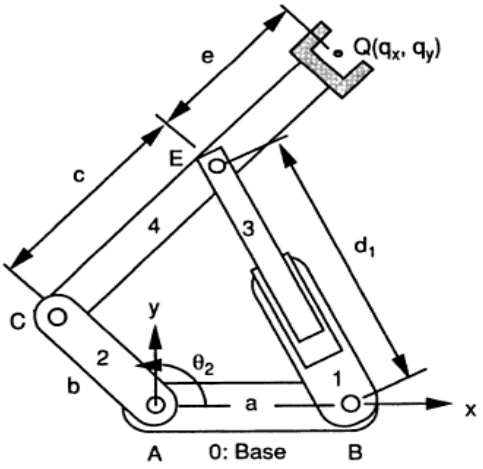

FIG. 3

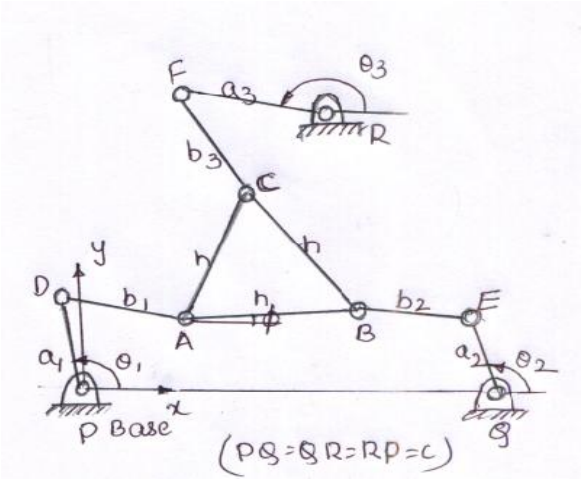

FIG. 4

UNIT-IV

7. What is a Jacobian? Discuss about Conventional Jacobian and Screw -based Jacobian with simple example. **(12 M)**

OR

8. Derive the Conventional Jacobian of a planar 2-DOF manipulator shown in fig.5 **(12 M)**

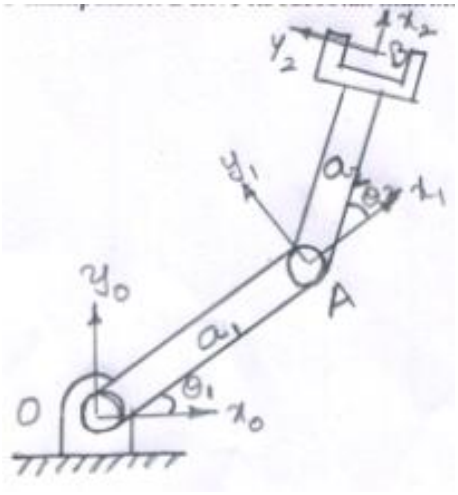

FIG.5

UNIT-V

9. (a)A single link robot with a rotary joint is motionless at $\theta=30^0$ .It is desired to move the joint in a smooth manner to $\theta=80^0$ in 6 seconds. Find the coefficients of a cubic which accomplishes this motion and brings the manipulator to rest at the goal. Plot the position, velocity and acceleration of the joint as a function of time. **(6 M)**

(b)Explain various textual programming methods in robot? **(6 M)**

OR

10. (a)What is collision free path planning. **(6 M)**

(b)Differentiate between online programming and off line programming. **(6 M)**