PVP 12

Code: **MEMD2T3**

I M.Tech - II Semester – Regular/Supplementary Examinations – JULY - 2017

ADVANCED ROBOTICS
(MACHINE DESIGN)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) Briefly enumerate a chronology of historic events in the development of robotics. 7 M

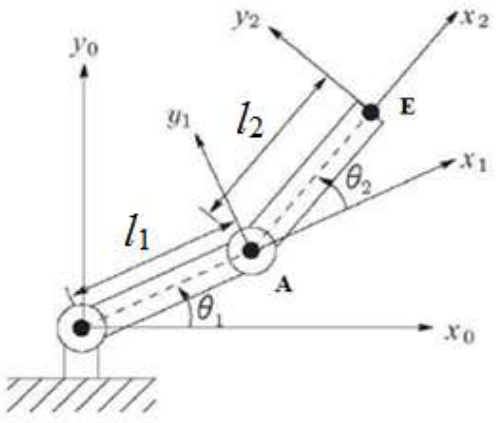
   b) Sketch and explain various types of joints used in robots. 7 M

2. a) Given two points a_{oxyz} $(4,3,2)^T$ and b_{oxyz} $(6,2,4)^T$ are the coordinates with respect to the reference coordinate system, determine the corresponding points a_{uvw} and b_{uvw} with respect to the rotated OUVW coordinate system, if it has been rotated 60° about the OZ axis. 7 M

   b) A vector P = 3i-2j+5k is first rotated by 90° about x-axis, then by 90° about z-axis. Finally it is translated by -3i+2j-5k. Determine the new vector P. 7 M

3. Find the values of θ_1 and θ_2 of the R-R planar manipulator, shown in figure, in order to reach the point E on the end effector given by X_E = 16 cms and Y_E = 13 cms, using D-H

convention. Take l_1 = 15 cms and l_2 = 10 cms. 14 M



4. a) Explain differential motions of a frame. 7 M

   b) Compute the Jacobian matrix for a Planar RR manipulator. 7 M

5. Determine the dynamic model of a one-DOF, one-axis planar manipulator with one rotary joint (the inverted pendulum). Assume the link to be a thin cylinder (slender member) with length L and mass m acting at the centroid of the link. Obtain the solution using Lagrange-Euler formulation. 14 M

6. a) Explain the cubic polynomial trajectory for planning trajectory interpolation between two points in a work space. 7 M

   b) A one-degree of freedom manipulator with rotary joint is to move from 113° to 210° in 7 seconds. Find the coefficients of the cubic polynomial to interpolate a smooth trajectory. 7 M

7. a) Explain the various characteristics of actuating systems. Discuss the stiffness and compliance in robotic manipulators. 7 M

b) With the aid of a sketch, state and explain the working principle of stepper motor. Briefly describe the advantages and disadvantages of using stepper motors as robot actuators. 7 M

8. a) Discuss the following characteristics in the light of robotic sensors: response, weight, accuracy, sensitivity, and linearity. 6 M

b) With the aid of sketch, write short notes on LVDT and potentiometer. 8 M