

M.Tech II Semester Supplementary Examinations January/February 2017

ROBOTICS

(Common to MD and CAD/CAM)

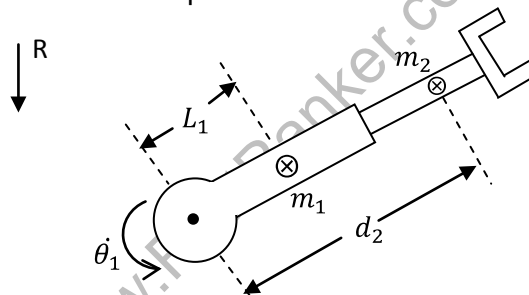
Time: 3 hours

Max. Marks: 60

Answer any FIVE questions
All questions carry equal marks

- 1 What are the five major components of a robot? Explain the purpose of each.
- 2 Explain the kinematic equations by using homogeneous transformations.
- 3 Explain the following:
 - (a) Forward and inverse kinematics of robots.
 - (b) Degeneracy and dexterity.
- 4 (a) Show the sketch of a spherical robot.
 (b) A robot is having a rotation about the global coordinate frame Z by an angle of 300, then rotation about the global coordinate frame Y by an angle of 500, then translation about the global coordinate frame x by 10 units then give the final position of link with respect to the base of the robot after taken up the above movements.
- 5 The links of an RP manipulator shown in figure below have inertia tensors:

$$c1_I = \begin{bmatrix} I_{xx1} & 0 & 0 \\ 0 & I_{yy1} & 0 \\ 0 & 0 & I_{zz1} \end{bmatrix} \quad c1_I = \begin{bmatrix} I_{xx2} & 0 & 0 \\ 0 & I_{yy2} & 0 \\ 0 & 0 & I_{zz2} \end{bmatrix}$$
 and total mass m_1 and m_2 . The center of mass of link 1 is located at a distance l_1 from the joint 1 axis, and the center of mass of link 2 is at the variable distance d_2 from the joint 1 axis. Use Lagrangian dynamics to determine the equation of motion for this manipulator.



- 6 (a) What are the basic actuator systems used in commercially available industrial robots?
 (b) Explain the construction features of any one mechanical gripper.
- 7 The trajectory of a particular joint is specified as follows: Path points in degrees: 10, 35, 25, 10. The duration of these three segments should be 2, 1, 3 seconds, respectively. The magnitude of the default acceleration to use at all blend points is 50 degrees/s². Calculate all segment velocities, blend times and linear times.
- 8 Explain the following:
 - (a) Strain gauge.
 - (b) LVDT.
 - (c) Tachometer.
