

Code: ME7T1

IV B.Tech - I Semester – Regular Examinations – November 2015

**ROBOTICS
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) What is a robot? Discuss Industrial and Non Industrial applications of robots in detail. 6 M
b) Explain components of robot with neat sketch. 8 M
2. a) What is difference between work space and work volume? 4 M
b) Write the differences between hydraulic, pneumatic & electric actuators. 10 M
3. Derive all the three fundamental principle rotational matrices. In case of mapping between rotated frames prove that $R^{-1} = R^T$. 14 M
4. For the given manipulator shown in the Figure-1 determine the joint displacements required for the tool point position and orientation given by the following transformation matrix. The dimensions are shown in the Figure-1. 14 M

$$T = \begin{bmatrix} 0.5 & 0 & -0.866 & -48 \\ 0.866 & 0 & 0.5 & 27.7 \\ 0 & -1 & 0 & 84 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

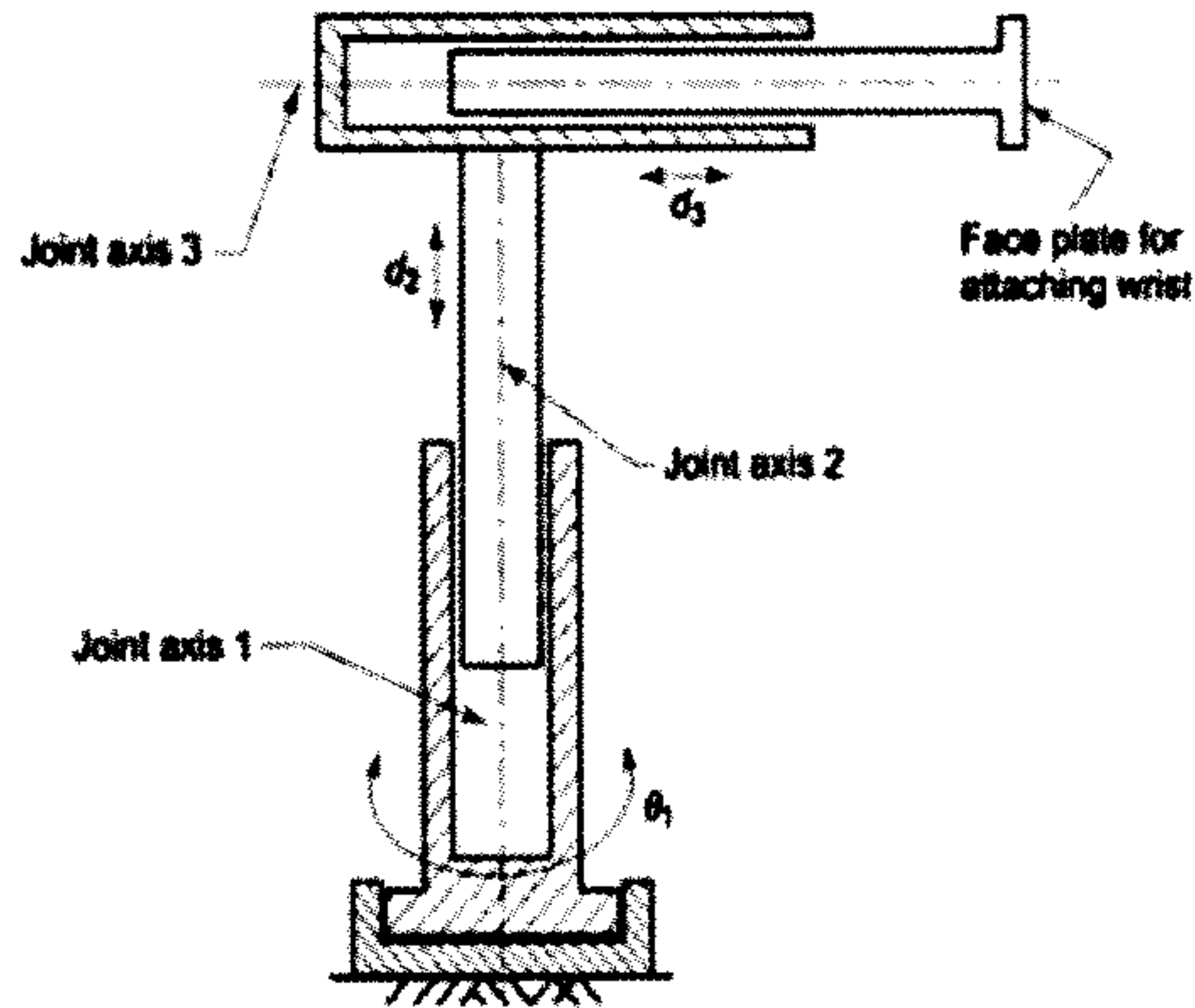


Figure-1

5. Using Lagrange-Euler formulation, derive the expression for the joint torques of a planar revolute jointed robotic manipulator having unequal links as shown in the Figure-2.

14 M

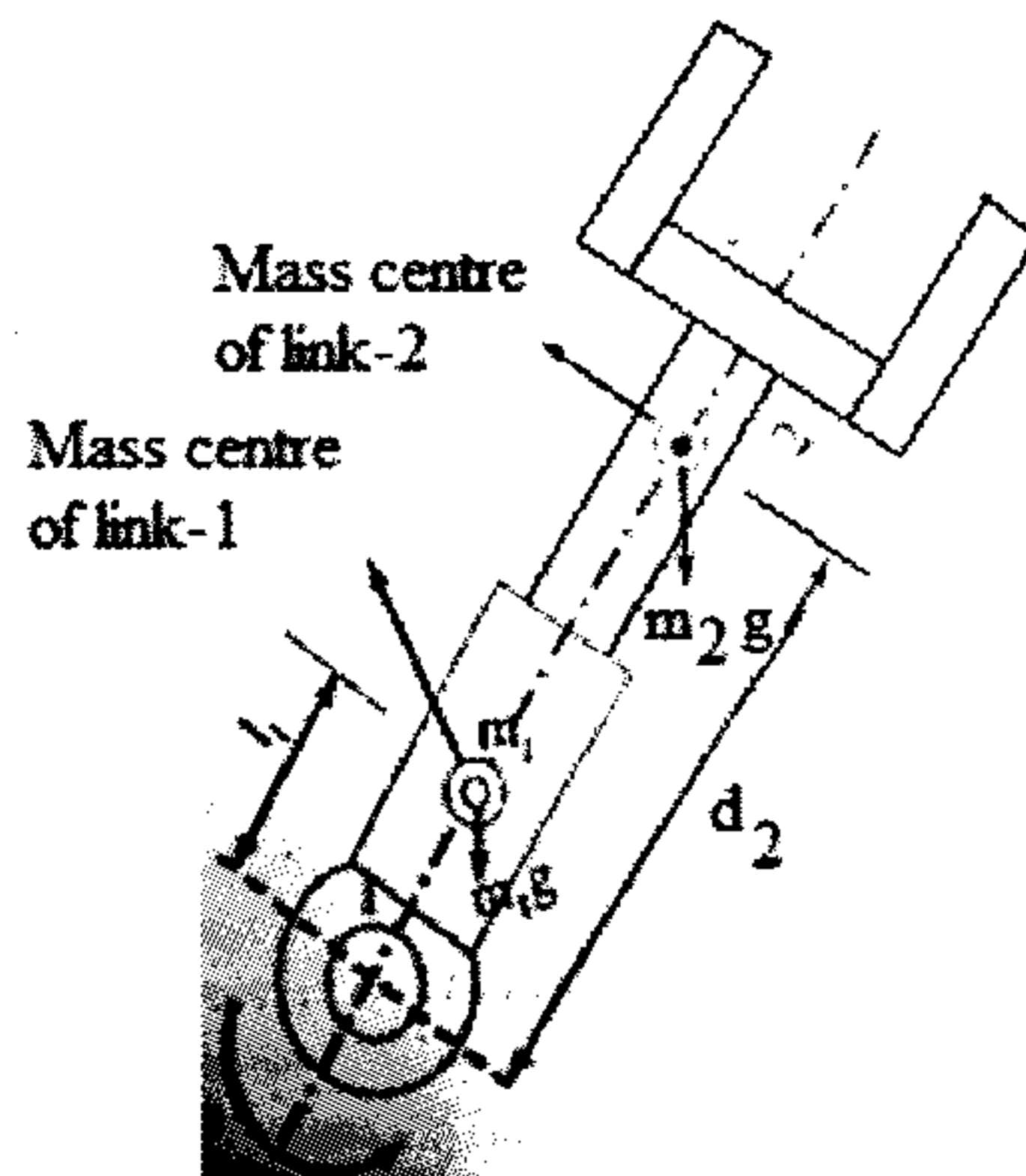


Figure-2

6. The trajectories of a particular joint is specified as follows, path points in degrees: 15, 40, 30, 15. The duration of these three segments should be 3, 1, 4 respectively. Assume a linear path with parabolic blends and an acceleration of 60 degree/sec². Calculate all segment velocities, blend times and linear times for the trajectory. 14 M
7. What are different types of encoders? Explain them briefly. 14 M
8. a) Discuss the material transfer applications of robot. 7 M
- b) Discuss the advantages and benefits of robot arc welding. 7 M