

(Spring 2007-08)

## Lab Assignment #1

Due Thursday, April 17<sup>th</sup>

This assignment should be submitted individually.

1. In this assignment you will develop the dynamic equations of motion of the RRR planar manipulator shown below. These equations of motion will be used in all of the subsequent laboratory assignments. The joints of this manipulator correspond to the joints 2, 3, and 5 of a PUMA 560. Each link,  $i$ , has mass,  $m_i$ , and inertia,  $I_{ZZ_i}$ . Each center of mass is located at  $r_i$  in  $x$ -dir of frame  $\{i\}$ .
  - (a) Find the forward kinematics of this manipulator from base to the end-effector. In other words, find  ${}^0_E T$ .
  - (b) Find the Jacobian matrix for the end-effector.
  - (c) Find the kinetic energy matrix,  $M(\Theta)$ .
  - (d) Find the Coriolis matrix,  $B(\Theta)$ .
  - (e) Find the centrifugal matrix,  $C(\Theta)$ .
  - (f) Find the gravity vector,  $G(\Theta)$ .

