In-Class Test (#3)

Name _____
Student Number _____

ROBOTICS 4K03

INSTRUCTOR NAME: Fengjun Yan

DURATION OF EXAMINATION: 50 MINS

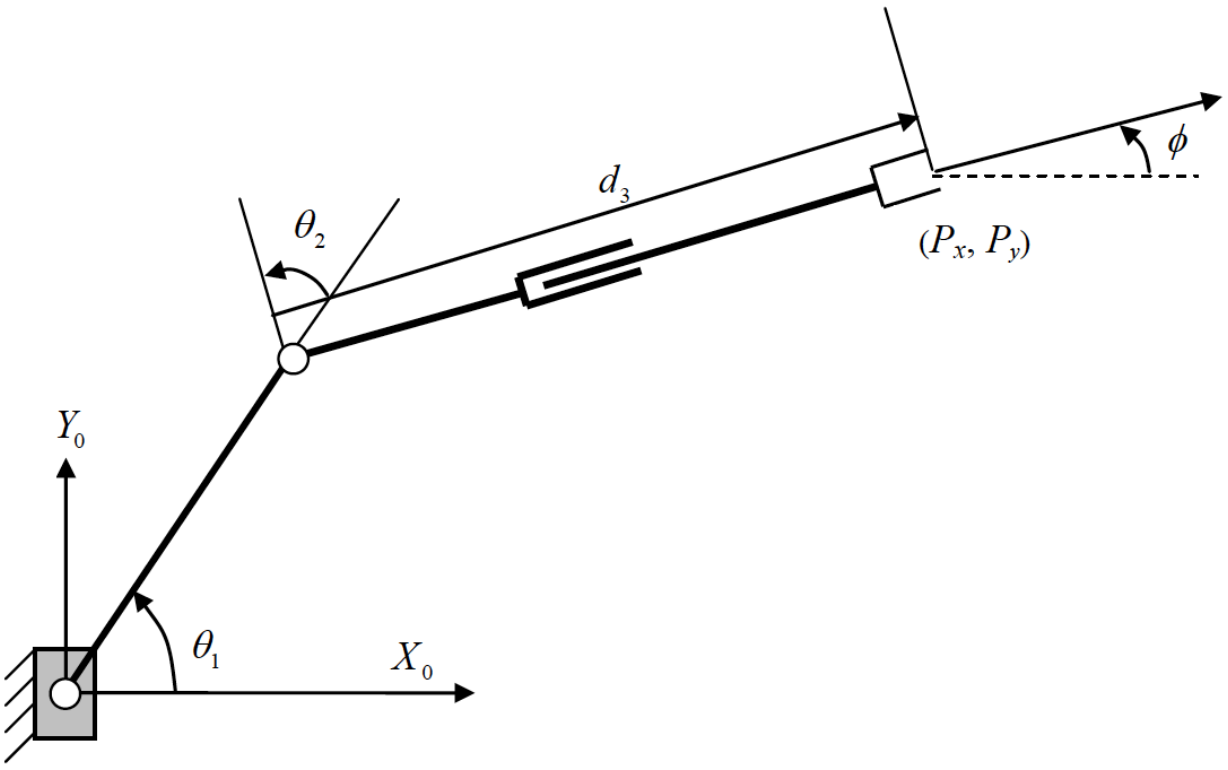
Nov. 15th, 2021

THIS EXAMINATION PAPER INCLUDES 2 PAGES AND 2 QUESTIONS.

Use of Casio FX-991 calculator.

Questions:

1. (45 points) A RRP planar robot is shown in the following figure. Its joint variables are θ_1 and θ_2, and d_3. Its end-effector position and orientation are given by P_x and P_y, and ϕ. Derive the inverse kinematics equations for this robot.



2. (55 points)

The planar PPR robot shown in the figure operates in the vertical plane (*i.e.* gravity acts in the $-Y_0$ direction). The masses of the links are concentrated at points A, B and C as shown.

Derive the Lagrangian function L and calculate the force/torque for the *i*th joint only. (*i depends on the first letter of your Last Name: i=1, when the first letter of your Last Name is from A-I; i=2, when the first letter of your Last Name is from J-R; i=3, when the first letter of your Last Name is from S-Z*)