

MECH 7610 ADVANCED DYNAMICS

EXAM 2

March 24, 2020

General Instructions

Solve each problem fully showing your work. Clearly indicate the answer(s) to each problem. State all assumptions used in your analyses.

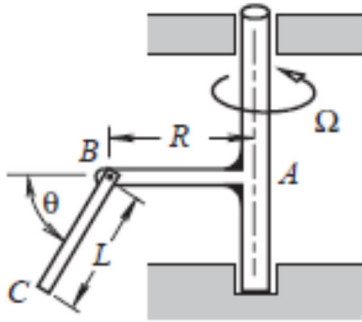
75 minutes are allotted for the exam.

You may use one side of a single 8 ½ X 11 sheet of paper for notes. Otherwise, the exam is close book and closed notes.

Name: _____

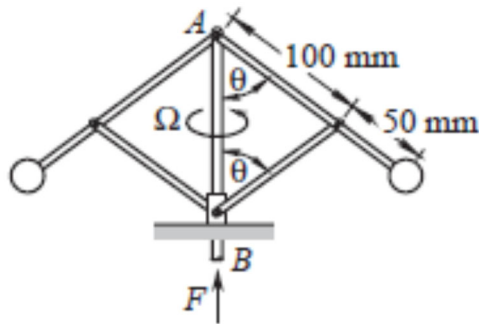
1. Bar BC is pivoted from the end of the T-bar. The system rotates about the vertical axis at the constant speed Ω . The bar BC is attached by a frictionless pin connection at B. BC is a uniform slender bar with mass m and length L .

Derive the differential equation of motion for the angle of elevation, θ . (55 points)



2. The flyball governor consists of two 500-g spheres connected to a parallelogram linkage. The shaft, which passes through the collar supporting the linkage, rotates freely. The mass of the links is negligible. The system is initially rotating at 900 RPM about the vertical axis with $\theta=75^\circ$. A constant upward force is applied to the shaft causing point A to move upward and θ to decrease.

For the conditions described above, determine the angular velocity of this system when $\theta=15^\circ$. (55 points).



3. The uniform cylinder of mass m , radius R , and height H is free to rotate by angle β relative to the gimbal, which rotates about the horizontal axis at a constant precessional rate of Ω . Assume w is less than $H/2$.

Develop an expression for the kinetic energy of the system described above and shown below. (55 points).

