ME562 – Spring 2020
Purdue University
West Lafayette, IN

Homework Set No. 7

Due date: Friday, May 1, 11:59pm

- Please include this cover sheet as the first page of your homework submission.
- Submit homework file on Gradescope.

Name _____

PUID _____

Problem 7.1 _____

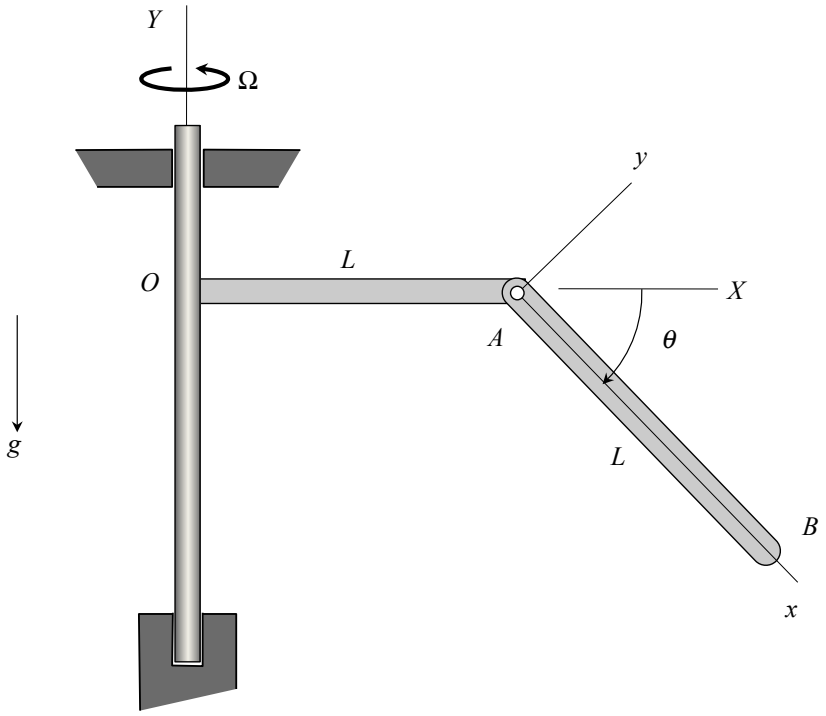
Problem 7.2 _____

Problem 7.3 _____

Problem 7.4 _____

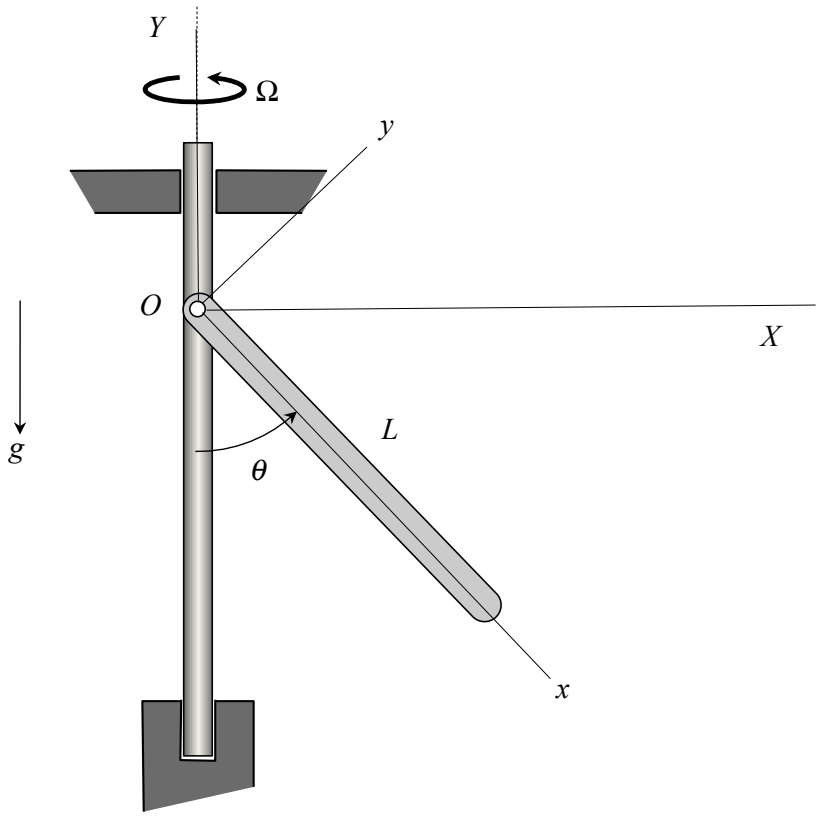
TOTAL _____

Problem 7.1 – 10 points



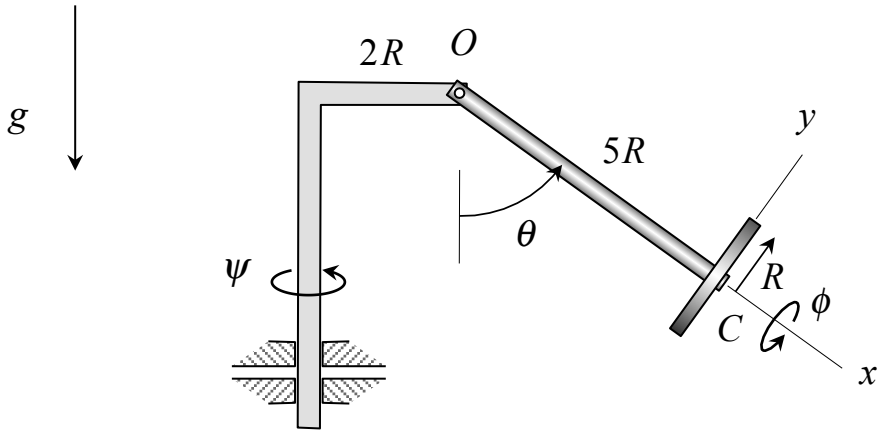
A thin homogeneous bar, AB, of mass m, is pinned to arm OA. Arm OA is welded to the vertical shaft, as shown. The vertical shaft is constrained to be rotating with a constant speed of Ω. Using Lagrange's equations, the differential equation of motion of arm AB in terms of the angle θ.

Problem 7.2 – 10 points



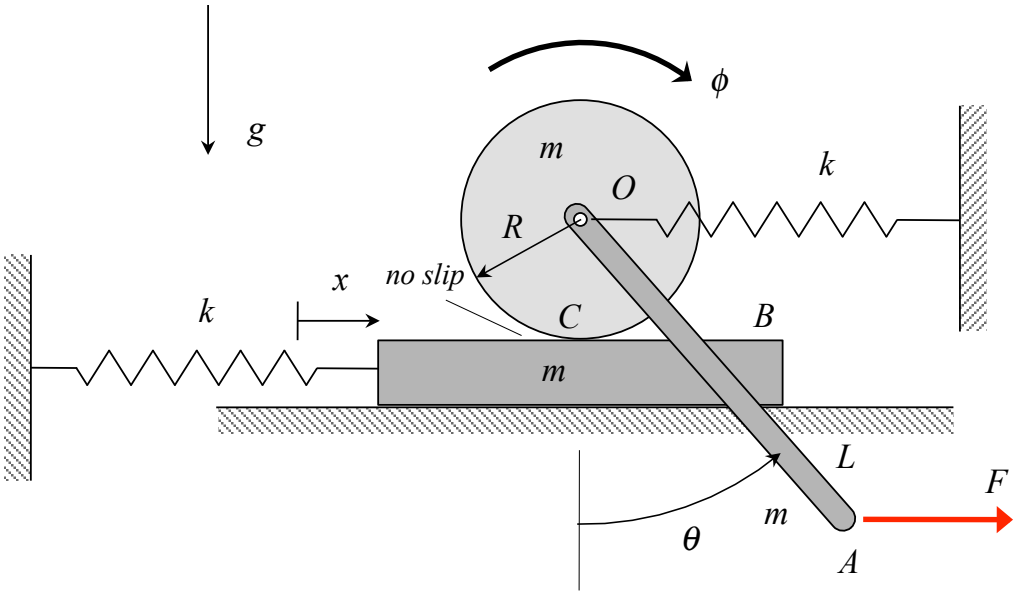
A thin, homogeneous bar of mass m is pinned to a vertical shaft at end O. The vertical shaft is allowed to rotate freely. The bar is released with initial conditions of: $\theta(0)=10°$, $\dot{\theta}(0)=4\,rad/sec$ and $\Omega(0)=10\,rad/sec$. Using an energy approach, determine the total angular velocity of the bar when $\theta=90°$. Use $L=2m$.

Problem 7.3 – 10 points



A thin disk of mass *m* and radius *R* is allowed to rotate about end C of shaft OC with *constant* angular speed of $\dot{\phi}$, with the orientation of shaft relative to the vertical being θ. Shaft OC has a mass of *m*. The rotation of the L-shaped shaft is rotating is represented by the angle ψ. Assume that OC is aligned with the symmetry axis of the disk. Using Lagrange's equations, develop the equations of motion for the system.

Problem 7.4 – 10 points



Consider the system shown above made up of a homogeneous disk, a thin homogeneous bar OA and a block. The surface on which the block slides is smooth; however, the disk rolls without slipping on the block. The springs are unstretched when $x = \phi = 0$. Using Lagrange's equation, develop the equations of motion for the system.