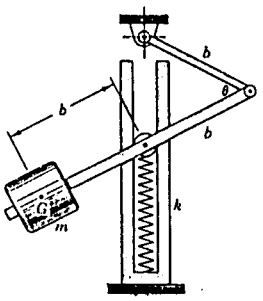
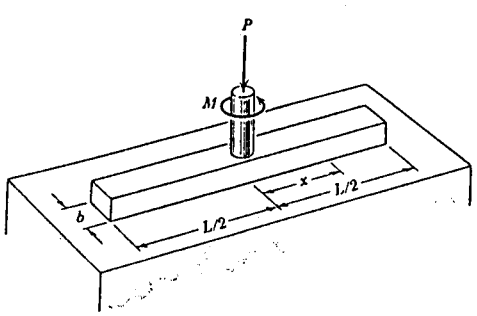
ENGINEERING MECHANICS - STATICS

20% 1. In the mechanism shown below, the spring of stiffness k would be uncompressed for the position equivalent to $\theta = 0$. Determine the equilibrium positions and specify the stability conditions for each. Neglect the mass of the links compared with the mass m of the cylinder with center of mass at G.



20% 2. The bar is subjected to the negative wrench consisting of the force P and the couple M, as shown in the following figure. The coefficient of friction between the bar and the supporting surface is μ. The width b of the bar is small compared with its length. Determine the moment M of the wrench which will turn the bar if the pressure p between the bar and the supporting surface (a) is constant, (b) varies linearly with x according to $p = kx$, and (c) varies according to $p = p_0 + kx^2$ where p_0 and k are constants.



20% 3. Briefly discribe the following terms

(1) Rigid body

(2) Coriolis acceleration

(3) Center of percussion

(4) Principal axes of inertia

(5) Euler's equations

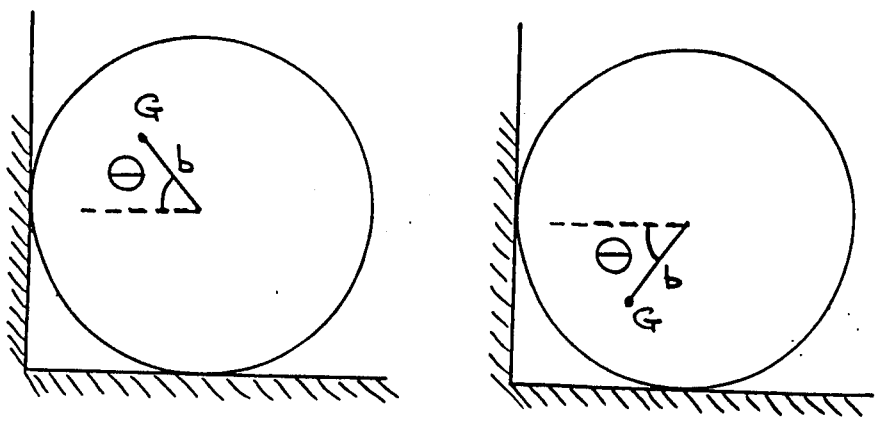
(6) Inertial System

(7) Perigee and Apogee

(8) Natural frequency

20% 4. A heavy elevator is descending vertically at a uniform speed $V_o\, m/sec.$ A light ball is bouncing vertically up and down the floor of the elevator. It is found that the time between each bounce is a constant equal to T seconds. Deduce the coefficient of resistitution between the ball and floor.

20% 5. A circular disc (lamina) of radius R has a mass center G at distance b from the geometric center. Initially the disc is held at rest in contact with a smooth vertical wall and a smooth horizontal floor. It is released from rest in the positions shown below. Is the initial angular acceleration the same in both cases? Justify your answer carefully. (Note that the disc is initially touching the vertical wall and may or may not remain in contact.)



The angle θ is the same in both cases.