[Note: refer to the figures on bottom for the corresponding problems]

1. The horizontal beam is supported by springs at its ends. If the stiffness of the spring at A is k_A = 5 kN/m, determine the required stiffness of the spring at B so that if the beam is loaded with the 800-N force, it remains in the horizontal position both before and after loading. (15 points)

2. Determine the horizontal and vertical components of force that pins A and B exert on the two-member frame. Set F = 500 N. (15 points)

3. The cylinder shown is of weight W and radius r, and the coefficient of static friction μ_s is the same at A and B. Determine the magnitude of the largest couple **M** which can be applied to the cylinder if it is not to rotate. (15 points)

4. The masses of blocks A, B, and C are m_A = m_C = 10 kg, and m_B = 5 kg. Knowing that P = 200 N and neglecting the masses of the pulleys and the effect of friction, determine (a) the acceleration of each block, (b) the tension in the cable. (15 points)

5. A thin circular rod is supported in a **vertical plane** by a bracket at A. Attached to the bracket and loosely wound around the rod is a spring of constant k = 40 N/m and undeformed length equal to the arc of circle AB. A 200-g collar C, not attached to the spring, can slide without friction along the rod. Knowing that the collar is released from rest when θ = 30°, determine (a) the maximum height above point B reached by the collar, (b) the maximum velocity of the collar. (20 points)

6. Pin P is attached to the collar shown; the motion of the pin is guided by a slot cut in bar BD and by the collar that slides on rod AE. Rod AE rotates with a constant angular velocity of 5 rad/s clockwise and the distance from A to P increases at a constant rate of 2 m/s. Determine at the instant shown (a) the angular acceleration of bar BD, (b) the relative acceleration of pin P with respect to bar BD. (20 points)
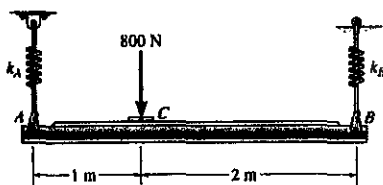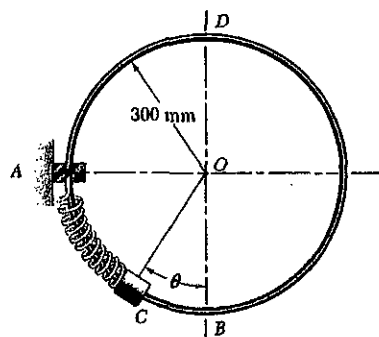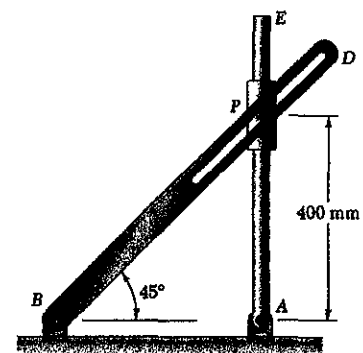

Problem 1
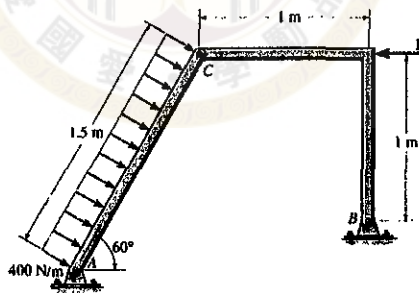
Problem 2
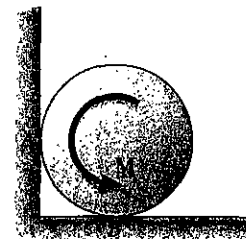
Problem 3

Problem 4

Problem 5

Problem 6

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