Practice Problem Set 5: Engineering Mechanics (NMEC101)
Application of Friction

Instruction: Figure numbers correspond to the problem numbers.

1. The 10-kg block A is at rest against the 50-kg block B as shown. The coefficient of static friction μ_s is the same between blocks A and B and between block B and the floor, while friction between block A and the wall can be neglected. Knowing that P = 150 N, determine the value of μ_s for which motion is impending.

2. The position of the automobile jack is controlled by a screw ABC that is single-threaded at each end (right-handed thread at A, left-handed thread at C). Each thread has a pitch of 2 mm and a mean diameter of 7.5 mm. If the coefficient of static friction is 0.15, determine the magnitude of the couple ***M*** that must be applied to raise the automobile.

3. In the gear-pulling assembly shown, the square-threaded screw AB has a mean radius of 0.0234 m and a lead of 0.006 m. Knowing that the coefficient of static friction is 0.10, determine the couple which must be applied to the screw to produce a force of 1000 N on the gear. Neglect friction at end A of the screw.

4. A differential band brake is used to control the speed of a drum which rotates at a constant speed. Knowing that the coefficient of kinetic friction between the belt and the drum is 0.30 and that a couple of magnitude 125 N. m is applied to the drum, determine the corresponding magnitude of the force P that is exerted on end D of the lever when the drum is rotating (a) clockwise, (b) counterclockwise.

5. The drum brake shown permits clockwise rotation of the drum but prevents rotation in the counterclockwise direction. Knowing that the maximum allowed tension in the belt is 4.5 kN, determine (a) the magnitude of the largest counterclockwise couple that can be applied to the drum, (b) the smallest value of the coefficient of static friction between the belt and the drum for which the drum will not rotate counterclockwise.

6. A recording tape passes over the 20-mm-radius drive drum B and under the idler drum C. Knowing that the coefficients of friction between the tape and the drums are μ_s = 0.40 and μ_k = 0.30 and that drum C is free to rotate, determine the smallest allowable value of P if slipping of the tape on drum B is not to occur.

7. Solve Q. 6 assuming that the idler drum C is frozen and cannot rotate.

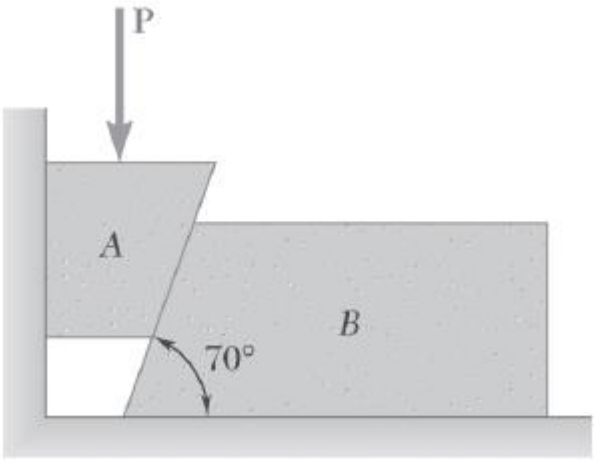

Fig. 1

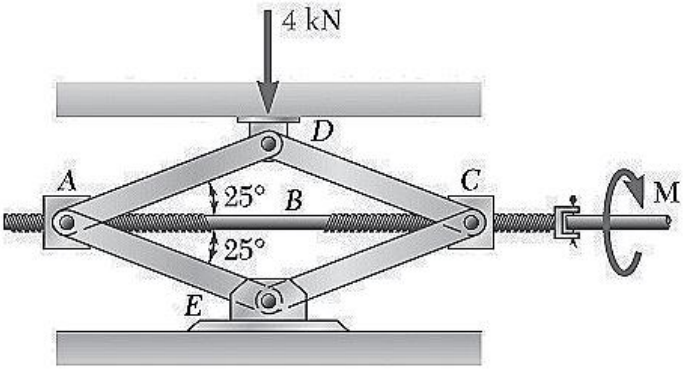

Fig. 2

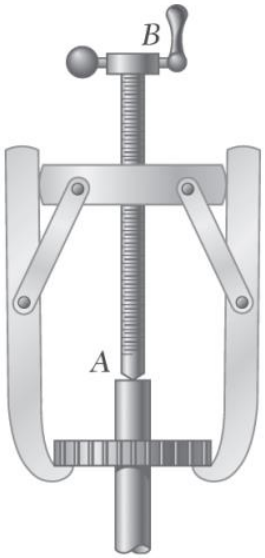

Fig. 3

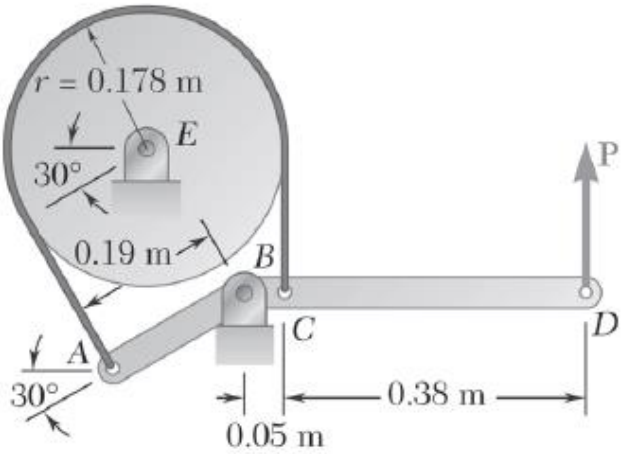

Fig. 4

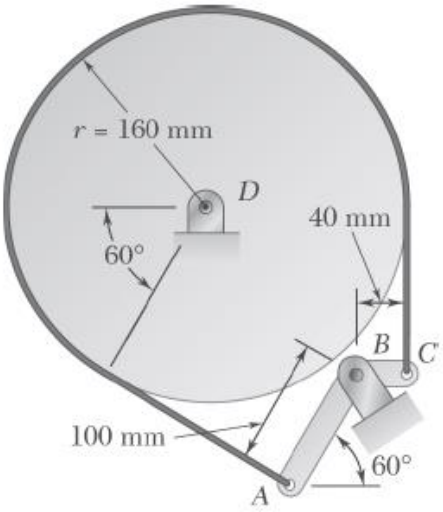

Fig. 5

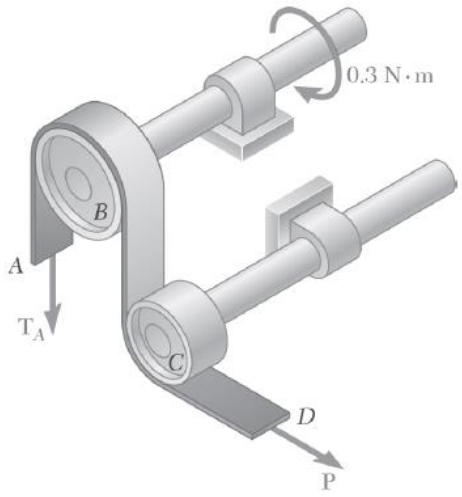

Fig. 6-7