※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

Note:

1. The solutions may not necessarily appear in order. Mark, however, the number of problems for your solutions clearly.
2. Examinees are responsible to present the problem numbers and answers clearly, cleanly, and precisely.
3. Examinees are responsible to present detailed derivations and calculations, otherwise will receive zero credit.

1. 20pts A horizontal force of $P = 100$ N is just sufficient to hold the crate from sliding down the plane, and a horizontal force of $P = 350$ N is required to just push the crate up the plane. Determine the coefficient of static friction (μ_s) between the plane and the crate, and find the mass (m) of the crate. *Write your final answer in the form:* $(\mu_s, m) =$ (____ , ____) (10pts each).

2. 15pts The disk B has a mass of 20 kg and is supported on the smooth cylindrical surface by a spring having a stiffness of $k = 400$ N/m and unstretched length of $l_0 = 1$ m. The spring remains in the horizontal position since its end A is attached to the small roller guide which has negligible weight. Determine the angle θ for equilibrium of the roller. *Write your final answer in the form:* $\boldsymbol{\theta} =$ _____ (in degrees).

3. 20pts A homogeneous block rests on top of the cylindrical surface. Derive the relationship between the radius of the cylinder, r, and the dimension of the block, b, for stable equilibrium. *Write your final answer in the form:* The relation is _____ .

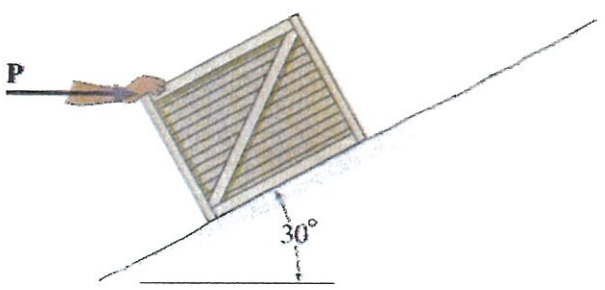


Figure of Prob. 1

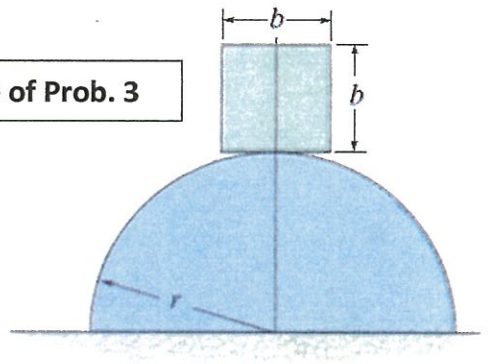


Figure of Prob. 3

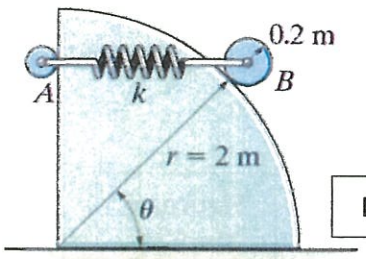


Figure of Prob. 2

（請接背面）

4. 20pts Two uniform rods, each of weight $m = 600$ g and length $l = 200$ mm, are welded together to form the assembly shown. Knowing that the constant of each spring is $k = 120$ N/m and that end A is given a small displacement and released, determine the frequency (f) of the resulting motion. *Write your final answer in the form:* $f =$ _____ .

5. 20pts A 40-kg flywheel of radius $R = 0.5$ m is rigidly attached to a shaft of radius $r = 0.05$ m that can roll along parallel rails. A cord is attached as shown and pulled with a force **P**. Knowing the centroidal radius of gyration is $k = 0.4$ m and the coefficient of static friction is $\mu_s = 0.4$, determine the largest magnitude of **P** for which no slipping will occur. *Write your final answer in the form:* **P** = _____ .

6. 5pts A Block is traveling with a speed v_0 on a smooth surface when the surface suddenly becomes rough with a coefficient of friction of μ causing the block to stop after a distance d. If this block were traveling twice as fast, that is, at a speed $2v_0$, how far will it travel on the rough surface before stopping? (a) $d/2$ (b) d (c) $\sqrt{2}d$ (d) $2d$ (e) $4d$. (*Must give explanation to support your answer.*)

Figure of Prob. 4

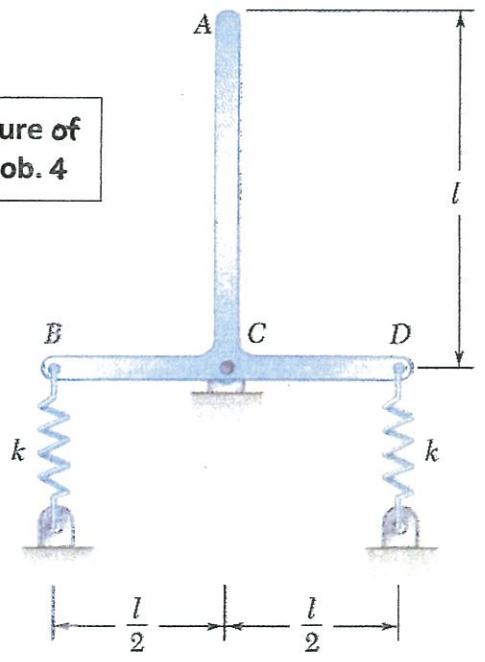


Figure of Prob. 5

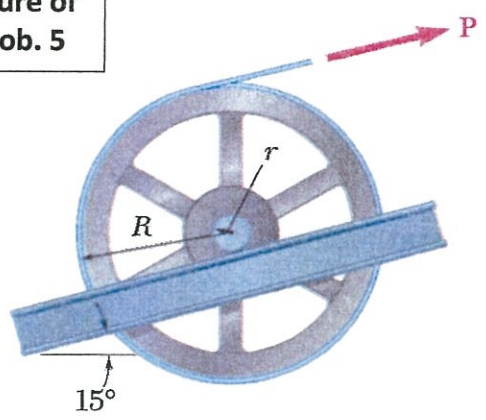
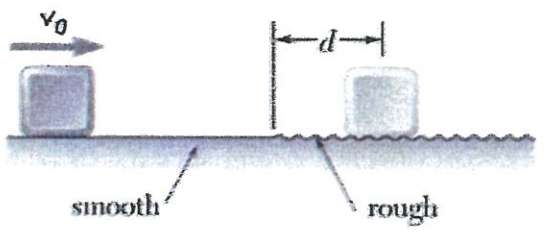


Figure of Prob. 6



試題隨卷繳回