

(一) 填充題 (每格兩分，12%)

(1) In English engineering system, pound force (lb) is defined as (1) , and the gravitational acceleration is given by (2) .

(2) In British Gravitational system, mass (slug) is defined as (3) , so that one pound mass (lbm) is equal to (4) slug.

(3) In SI unit, the force of "Newton" (N) is defined as (5) .

(4) In SI unit, the pressure "Pascal" is defined as (6) .

(二) 簡答題 (10%)

(1) For a system in which there is no transfer of mass across its boundary, give an equation for conservation of energy; explain all the terms in the equation. (4%)

(2) Discuss the difference between the static equilibrium and dynamic equilibrium in three dimensional space. (6%)

(三)計算題 (53%)

1, In Figure 1, all the joints are pinned and all links have the same length L . The central joint is loaded with a force P . The top link has a cross-sectional area of A , and the two lower links have a cross-sectional area of A' . Let F be the force of upper link. (13%)

- (1) Determine the force in the lower links, (5%)
- (2) Find the ratio A/A' that makes the force in all the links equal magnitude. (6%)
- (3) What are the assumptions for solving this problem? (2%)

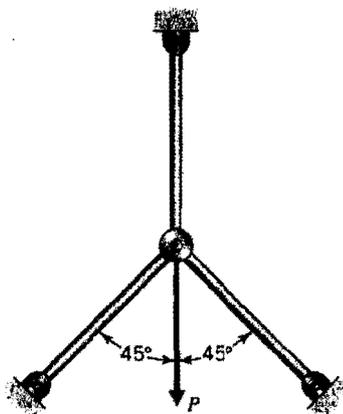


Figure 1

2, A new type of transportation, as shown in Figure 2, requires a person stand on a semicircle ski while pulling a rope with tension P . Assume the weight of the person is W_p and the weight of the semicircle is W_s . The locations of the centroids as well as important dimensions for both the person and the ski are as shown. The ski is tilted with angle θ to the ground with slope ϕ . Static friction coefficient between the shoes of the person and the surface of the ski is μ_p while the static friction coefficient between the ski and the ground is μ_s . Please answer the following questions consider no slip between the ski and the ground. (20%)

- a. Please draw the free-body-diagram of the person and write down the equilibrium equations. (5%)
- b. Please draw the free-body-diagram of the ski and write down the equilibrium equations. (5%)
- c. Determine the critical angles θ and ϕ before slip occurs. (10%)

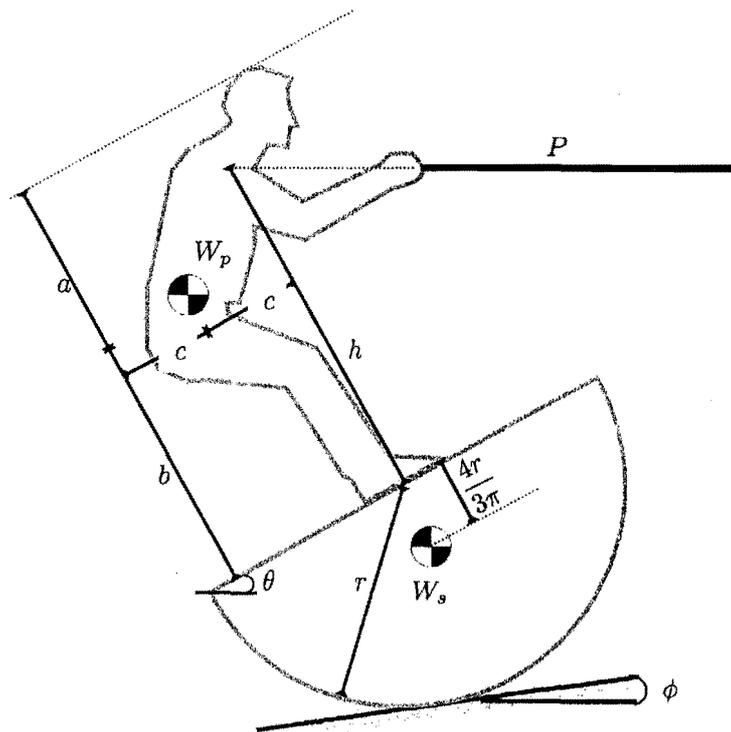


Figure 2

(背面仍有題目,請繼續作答)

3, A Jersey barrier or Jersey wall is a concrete barrier employed to separate lanes of traffic. It is also designed to minimize vehicle damage in cases of incidental contact while still preventing crossover in the case of head-on accidents. Figure 3 shows a standard Jersey barrier. In order to estimate the load this barrier can withstand before tipping over, please answer the following questions: (20%)

- a. Please express the location of its centroid \bar{y} in terms of its geometry ($a, b, c, d, l, h, \theta, \phi$) (10%)
- b. Assuming the overall weight of the barrier is w kg, please determine the minimal force required to tip over the barrier. (10%)

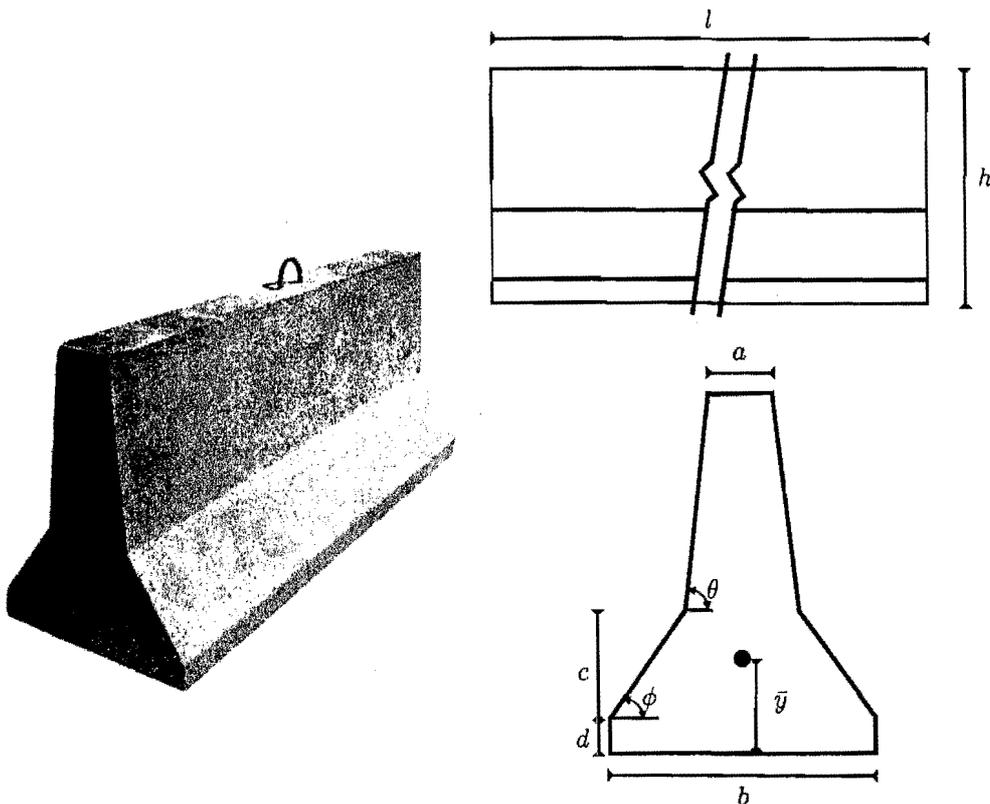


Figure 3

(四)專業英文(25%)

(1) 將下列英文翻譯成中文 (13%)

Personal safety is a consideration that engineerings have always kept in mind but now demands increasing emphasis. In comparison with such relatively straightforward computations as stress and deflection, determination of safety is likely to be an elusive and indefinite matter, complicated by psychological and sociological factors.

(2) 將下列中文翻譯成英文 (12%)

對處於平衡狀態的剛體系統，作用其上的所有外力與力偶，所做的虛功等於零，此稱為虛功原理，該原理可以用來求平衡位置及反力。