1. Translate the following sentences into Chinese

(a) The concept of product liability states that the manufacturer of an article is liable for any damage or harm that results because of a defect. And it doesn't matter whether the manufacturer knew about the defect, or even could have known about it. **(8%)**

(b) Statics is the study of the equilibrium of solid bodies or of systems of solid bodies. Equilibrium prevails if a body is at rest or is in uniform motion in a straight line. Rigid bodies in Statics are bodies of which the deformation so small that the points at which force is applied undergo negligible displacement. **(7%)**

(c) If the virtual displacement is considered consistent with the constraints imposed by the supports and connections, all reactions and internal forces are eliminated and only the work of the loads, applied forces, and friction forces need to be considered. We may take advantage of this characteristic of the method of virtual work to solve many problems involving machines and mechanisms. **(10%)**

2. (a) A 3-D body is in equilibrium if it is at rest or in uniform motion. Try to express the linearly independently scalar equations of equilibrium. **(5%)**

(b) A bearing-supported shaft carries two gears (i.e. gear A and C) as shown in the following sketch. The resultant gear force $P_A = 1000$ lbf, acts at an angle of $20°$ from the y axis. Draw the shearing force and moment diagrams of the shaft in the various planes. **(20%)**
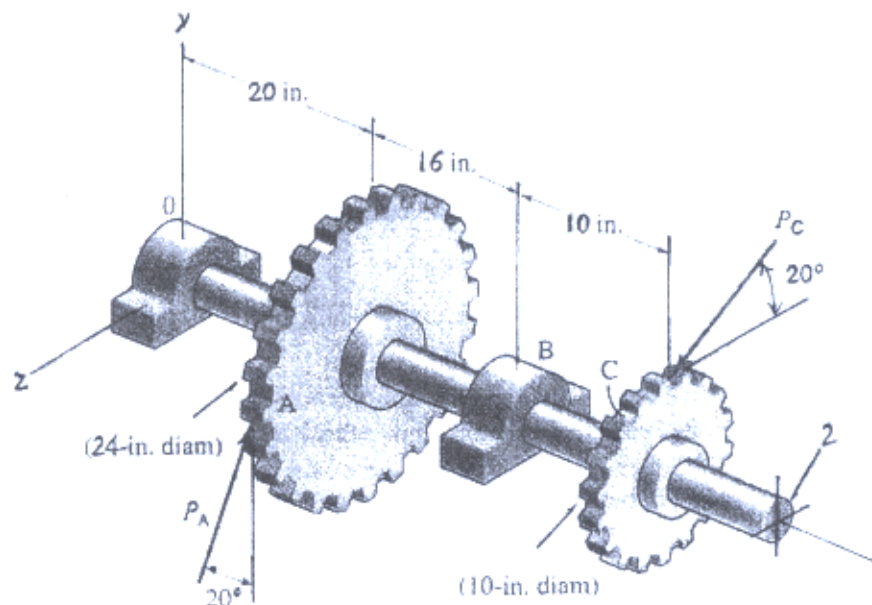

Figure 1: Problem 2

(背面仍有題目,請繼續作答)

E E02 5-3

3. In the planetary-gear system as shown in the figure, the radius of pitch circle for Sun Gear A is r_a, and the radius of pitch circle for Planet Gear B, C, D is r_b. A clockwise moment M_A is applied to Gear A. If the system is to be in equilibrium, please determine the following moments by using M_A, r_a, and r_b

(a) Moment M_S which is applied to the spider BCD at Center O. **(8%)**

(b) Moment M_E which is applied to Gear E at Center O. **(8%)**

In a particular case, $M_E=2.4M_A$ and the center distance between Gear A and B is *85 mm*.

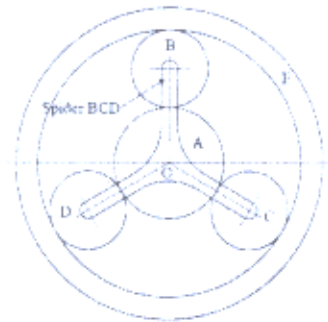(c) Please compute radius of pitch circle for the Gear A, B, and E. **(9%)**

Figure 2: Problem 3

4. A uniform block of mass *m* is at rest on an incline at an angle θ, as shown in the figure. The coefficient of friction between the block and the incline is μ. In Case 1, P_S is the maximum side-push force which can be applied to the block in the direction as shown before slipping starts. Similarly, P_d is the maximum down-push force in Case 2 before shipping begins. Here, θ, P_S and P_d are equal or greater than zero.

(a) Please derive the relationship between P_S and P_d is

$$P_d = P_s \sqrt{\frac{\mu\cos\theta - \sin\theta}{\mu\cos\theta + \sin\theta}} \quad \text{and} \quad P_d \leq P_s \quad \textbf{(20\%)}$$

(b) If the coefficient of friction μ is 0.2 and $P_d=P_S$, find the **possible** inclined angle θ. **(5%)**
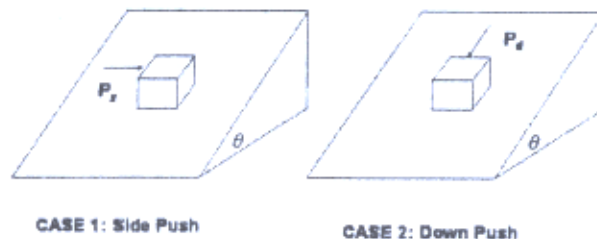

CASE 1: Side Push   CASE 2: Down Push

Figure 3: Problem 4