國立臺北科技大學

九十二學年度機電整合研究所入學考試

工程力學試題

填准考證號碼

注意事項：

1 本試題共【5】題，配分共 100 分。
2 請按順序標明題號作答，不必抄題。
3 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. Three smooth cylinders each of weight W and radius r are stacked on the smooth planes as shown in Fig. P1. The centers of the cylinders form an equilateral triangle. Determine

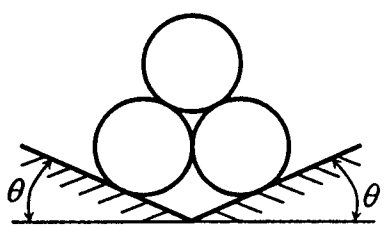

Fig. P1

(1) the minimum angle θ for equilibrium, (15%)

(2) the reactions on planes while the θ is minimum for equilibrium. (5%)

2. Three identical bars, each of length l, are arranged and supported in a horizontal plane, as shown in Fig. P2. Each bar supports the end of another at its mid-point so that DEF is an equilateral triangle with sides of length $l/2$. Determine

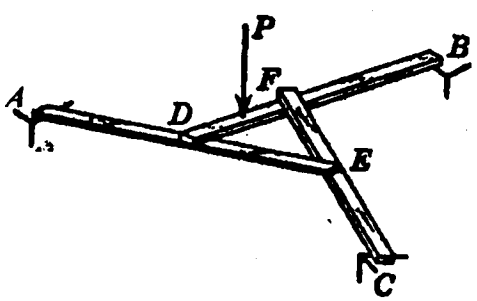

Fig. P2

(1) the reactions at A, B, C and (10%)

(2) the interactions at D, E, F, (10%)

due to a vertical load P applied midway between D and F on the bar DB. Express solutions in fractional form of load P. Neglect the weights of the bars.

3. The pin at B in the Fig. P3 is fixed to a collar which moves along the vertical post. The pin is free to slide in a smooth cut in bar AC. Derive an expression for
   (1) the linear velocity v and (8%)
   (2) the acceleration a (12%)
   of the collar in terms of length l, θ, angular velocity ω, and angular acceleration α of the bar AC.

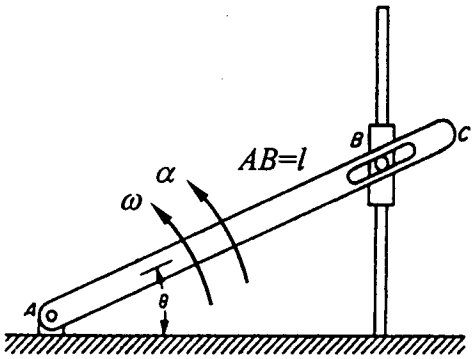

Fig. P3

4. A slender rod of length L and mass m shown in Fig. P4 is released from rest when $\theta = 0°$.
   (1) Determine as a function of θ the normal and frictional forces which are exerted on the ledge at A as it falls downward. (15%)
   (2) At what angle θ does it begin to slip if the coefficient of static friction at A is μ? (5%)

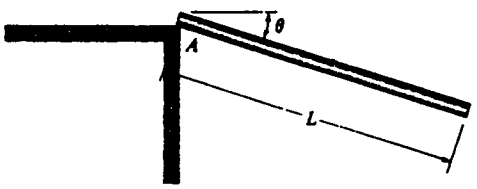

Fig. P4

5. At the time the clutch is engage in Fig. P5, two shafts with inertias I_1, I_2 are rotating at the angular velocities Ω_1, Ω_2, respectively. If Ω_1 is greater than Ω_2, the system on the right will be accelerated when the two shafts are clutched together. Upon engagement assume that the clutch slips, but applies a constant torque of T. Derive an expression in terms of Ω_1, Ω_2, I_1, I_2, and T for
   (1) the time t required for the two shafts to be rotating at the same velocity, (10%)
   (2) the total energy E dissipated during the clutching operation. (10%)
   Neglect any effects due to torsional vibration.

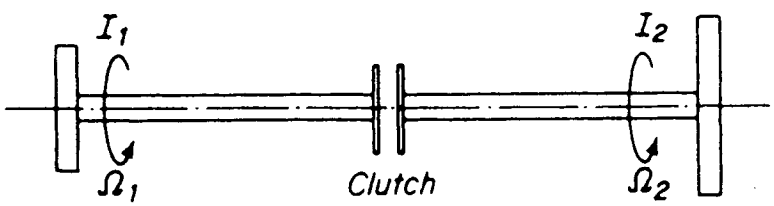

Fig. P5