

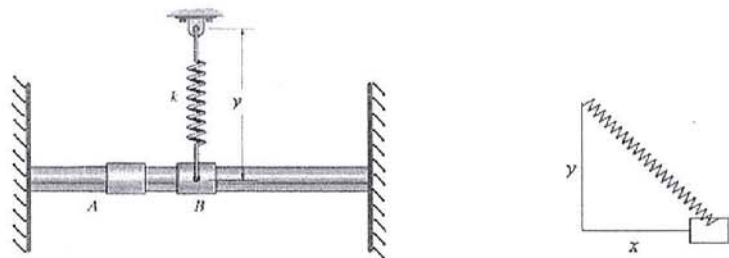
國立臺灣科技大學102學年度碩士班招生試題

系所組別：機械工程系碩士班甲組

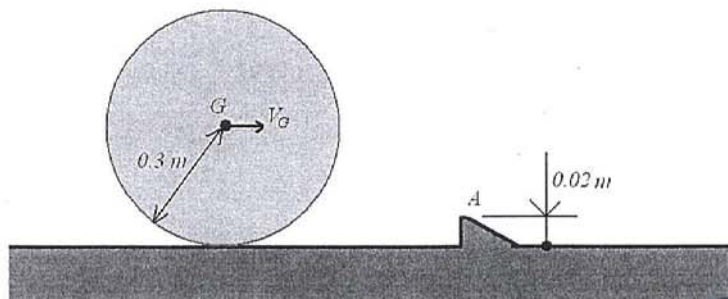
科目：材力與動力

(總分為100分)

1. The collar B of mass $m_B = 5 \text{ kg}$ is at rest, and when it is in the position shown the spring is unstretched as $y = 1.2 \text{ m}$. If another collar A of mass $m_A = 1 \text{ kg}$ strikes it so that B slides a distance $x = 0.5 \text{ m}$ on the smooth rod before momentarily stopping, determine the velocity of A just after impact, and the average force exerted between A and B during the impact if the impact occurs in time $\Delta t = 0.05 \text{ sec}$. The coefficient of restitution between A and B is $e = 0.8$, the spring has the stiffness $k = 0.5 \text{ kN/m}$, and the acceleration of gravity is $g = 9.81 \text{ m/s}^2$. (25 %)



2. The 0.5 kg disk has a radius of gyration of $k_G = 0.212 \text{ m}$ about an axis passing through its mass center G . Assuming that the wheel does not slip or rebound, determine the minimum velocity V_G it must have to just roll over the obstruction at A . (25 %)



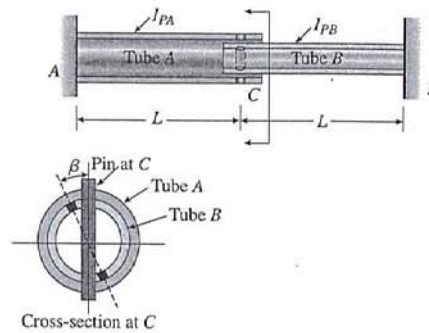
國立臺灣科技大學102學年度碩士班招生試題

系所組別：機械工程系碩士班甲組

科目：材力與動力

(總分為100分)

3. A hollow circular tube A (outer diameter d_A) fits over the end of a circular tube B (outer diameter d_B), as shown in the figure. The far ends of both tubes are fixed. Initially, a hole through tube B makes an angle β with a line through two holes in tube A. Then tube B is twisted until the holes are aligned, and a pin (diameter d_p) is placed through the holes. When tube B is released, the system returns to equilibrium. Assume that the shear moduli of both tubes G are the same; the polar moment of inertia $I_{PA} = 2I_{PB} = I$, and $d_A = 10/9d_B = d$. Find the maximum value of β if the shear stress in the pin τ_p cannot exceed τ_a , and find the maximum value of β if the magnitude of the shear stress in the tubes τ_t cannot exceed $3\sigma_a/2$, and the magnitude of the normal stress in the tubes σ_t cannot exceed σ_a . (25%)



4. A beam of T-section is supported and loaded as shown in the figure. Determine the principal stresses and the maximum shear stress at point C which is 2.4m away from the left end of the beam. (25%)

