國立臺北科技大學 103 學年度碩士班招生考試

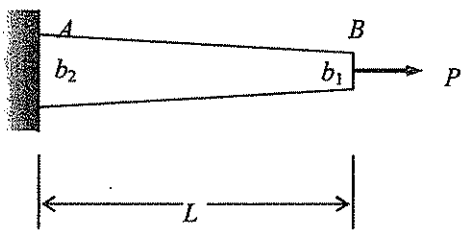
系所組別：3110 土木工程系土木與防災碩士班甲組

第二節　材料力學　試題

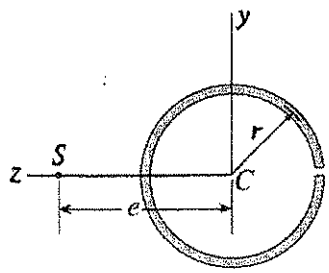
注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

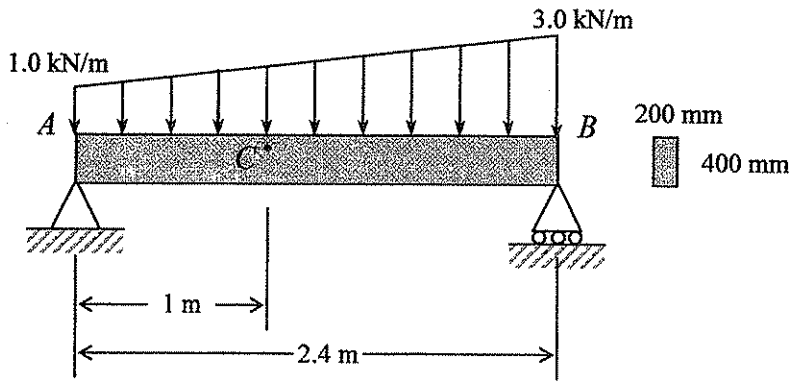
1. A tapered bar AB of rectangular cross section and length L is acted upon by a force P. The width of the bar varies uniformly from b_2 at end A to b_1 at end B. The thickness t is constant. (Modulus of elasticity = E)
   a. Determine the strain energy U of the bar. (25%)
   b. Determine the elongation δ of the bar by equating the strain energy to the work done by the force P. (5%)



2. The cross section of a slit circular tube of constant thickness t is shown in the figure. Calculate the distance e from the center of the circle to the shear center S. (20%)



3. A simply supported beam AB supports a trapezoidally distributed load (see figure). The intensity of the load varies form 1.0 kN/m at support A to 3.0 kN/m at support B.
   a. Draw the shear-force and bending-moment diagrams for this beam. (15%)
   b. Determine the normal stress σ_c and shear stress τ_c at point C, which is located 100 mm below the top of the beam and 1 m from support A, if the beam has a rectangular cross section with width $b = 200$ mm and height $h = 400$ mm. (15%)



4. A stepped shaft ABC consisting of solid circular segments is subjected to two torques of magnitudes 4000 N-m and 3000 N-m, as shown in the figure. The length of each segments is 400 mm and the diameters of the segments are 100 mm and 60 mm. the material is steel with shear modulus of elasticity $G = 80$ GPa. Calculate the maximum shear stress τ_{max} in each shaft and the angle of twist ϕ_C (in degrees) at end C. (20%)