國立中央大學 111 學年度碩士班考試入學試題

所別： 機械工程學系 碩士班 固力與設計組(一般生)
機械工程學系光機電工程 碩士班 光機組(一般生)

科目： 材料力學

1. A bar made of concentric, circular bars that are firmly bonded together to act as a single member, as shown in **Figure 1**. The tube B and core A have different properties.

   E_a, E_b = Young's moduli for inner and outer parts, respectively

   G_a, G_b = shear moduli for inner and outer parts, respectively

   d_a, d_b = diameters for inner and outer parts, respectively

   J_{pa}, J_{pb} = polar moments of inertia for inner and outer parts, respectively

   α_a, α_b = coefficient of thermal expansion for inner and outer parts, respectively. $\alpha_a > \alpha_b$

   L = length of the composite bar

   (1) If the composite bar is acted upon by an axial load P, what axial forces are carried by the tube and core? **(8%)**

   (2) If the composite bar is acted upon by a total torque T, find the maximum shear stresses in the tube and core. **(8%)**

   (3) If the composite bar is uniformly heated and the temperature increases 50°C, what axial forces are induced in the tube and core? **(9%)**

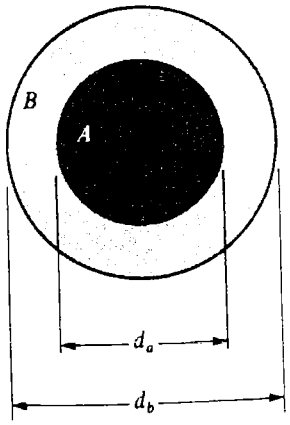

Figure 1

注意:背面有試題

2. Solve the following problems.

(1) Draw the shear and moment diagrams for the beam shown in **Figure 2 (a)** where $\mathbf{M_0}$ = 22.5 kN·m and L=1.5 m **(10%)**

(2) Also determine the absolute maximum bending stress in the beam provided the beam has the cross section area shown in **Figure 2 (b)**. **(15%)**

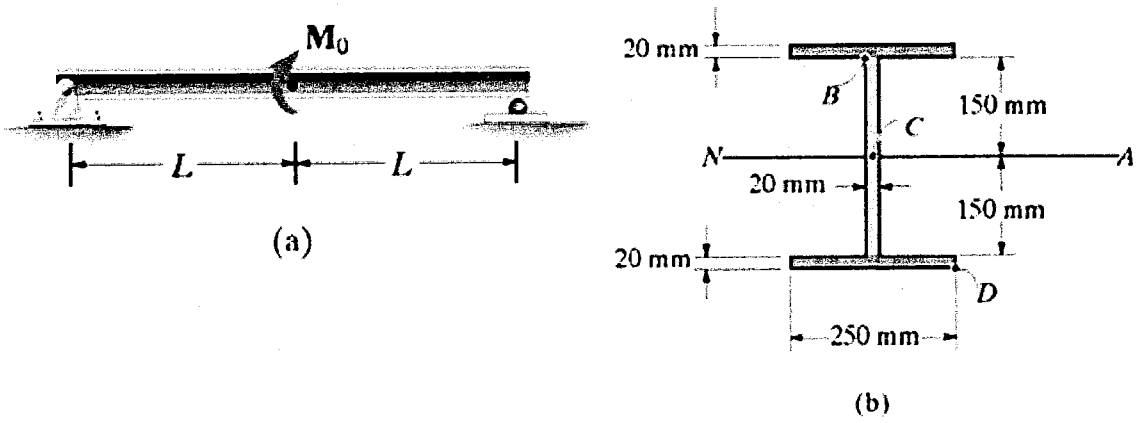

Figure 2

注意:背面有試題

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3. As shown in **Figure 3**, the overhanging beam supports a uniformly distributed load (w_0) over its entire length. The beam has a flexural rigidity of *EI*.
(i) Determine the ratio *b/a* for which the deflection at the midpoint of the beam length (i.e. origin of the *x-y* cordiante system) is zero. **(20%)**
(ii) Following part (i), determine the deflection at the right end of the beam. **(5%)**

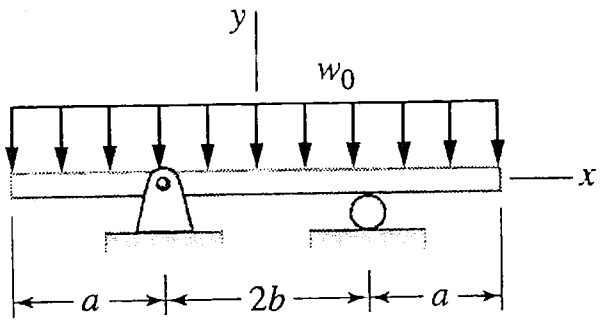

Figure 3

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4. Several forces are applied to the pipe assembly shown in **Figure 4**. Knowing that the pipe has inner and outer diameters equal to 44 mm and 48 mm, respectively, determine the normal and shearing stresses at (a) point *H* **(12%)**;
(b) point *K*. **(13%)**

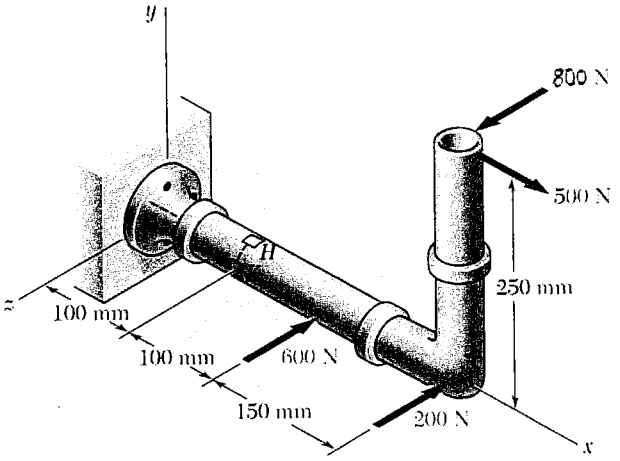

Figure 4

注意:背面有試題