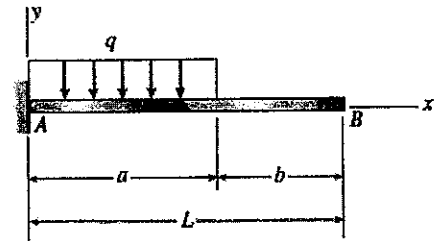


※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Derive the equations of the deflection curve for a cantilever beam AB carrying a uniform load of intensity q over part of the span (see figure). Also, determine the deflection δ_B at the end of the beam. (Note: Use the second-order differential equation of the deflection curve.) (20%)

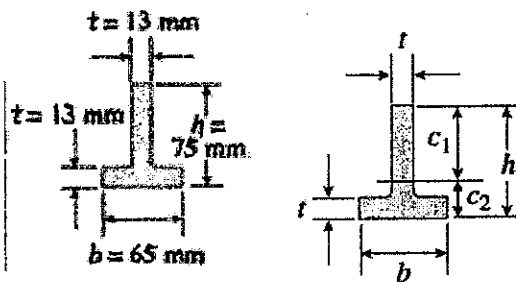
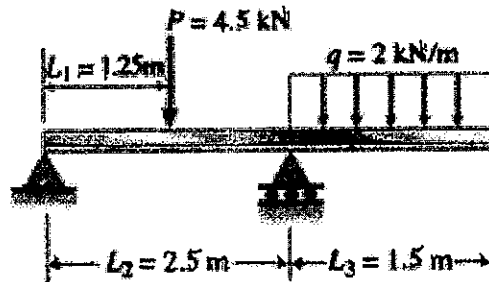


2. $\sigma_x = 50 \text{ MPa}$, $\sigma_y = 0 \text{ MPa}$, $\tau_{xy} = 10 \text{ MPa}$
Using Mohr's circle, determine (a) the principal stresses and (b) the maximum shear stresses and associated normal stresses. Show all results on sketches of properly oriented elements (20%)

3. A beam of T-section is supported and loaded as shown in the figure.

The cross section has width $b = 65 \text{ mm}$, height $h = 75 \text{ mm}$, and thickness $t = 13 \text{ mm}$.

Determine the maximum tensile and compressive stresses in the beam. (20%)

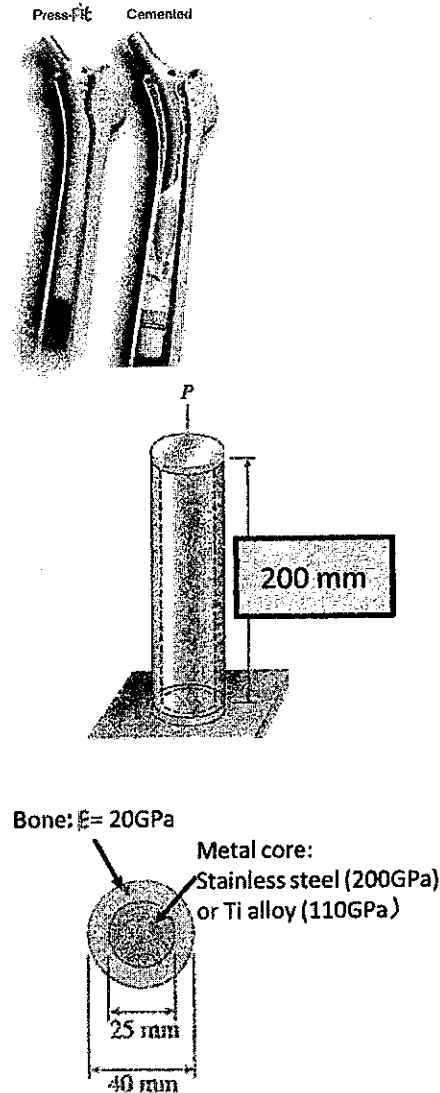


$c_1 = 50.2 \text{ mm}$, $c_2 = 24.8 \text{ mm}$, $I = 850195 \text{ mm}^4$

4. A cylindrical assembly similar to **hip prosthesis** consisting of a metal core and a bone collar is compressed by a load P (see figure). The length of the bone collar and metal core is 200 mm, the diameter of the core is 25 mm, and the outside diameter of the collar is 40 mm. The metal for core used is either stainless steel or titanium alloy. Also, the moduli of elasticity of the stainless steel, Ti alloy and bone are 200, 110 and 20 GPa respectively.

(a) If this prosthesis needs sustain 400N of loading daily. **What are the displacement of bone** for the core metal is (1) stainless steel or (2) Ti alloy respectively?

(b) What is the **maximum permissible load P_{max}** if the allowable stresses in the stainless steel and Ti alloy are 80 MPa and 120 MPa, respectively? (20%)



5. When doctor drilling a hole in a patient's bone, the pilot hole for bone screw with a bit diameter $d = 4.0$ mm.

(a) If the resisting torque supplied by the bone is equal to 0.3 N m, what is the **maximum shear stress in the drill bit**?

(b) If the shear modulus of elasticity of the steel is $G = 75$ GPa, what is the **rate of twist of the drill bit (degrees per meter)**? (20%)

