國立成功大學

114學年度碩士班招生考試試題

編　號：79

系　所：土木工程學系

科　目：材料力學

日　期：0210

節　次：第 1 節

注　意：1.可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. (25%) A compressive load P is transmitted through a rigid plate to three bars that have identical cross-section area A (see Fig. 1). The middle bar has Young's modulus E=50GPa, but the other bars have Young's modulus E=100GPa. Initially, the middle bar is slightly shorter than the other bars (see Figure). The dimensions are: L=1m, s=1.0mm, A=3000mm².

   (a) Calculate the total strain energy U of the three bars when P=400kN.

   (b) Calculate the total strain energy U of the three bars when P=750kN.
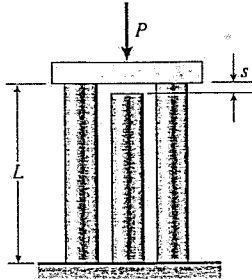

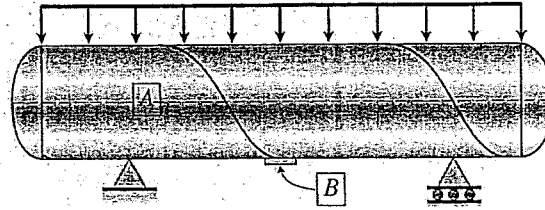Fig.1   Fig. 2

2. (25%) The cylindrical pressure vessel is placed symmetrically on simple supports and is acted on by a uniform distributed load q=150kN/m (see Fig.2). The 6m long tank has an inner radius of r=1.2 m and a wall thickness of t=19mm. The span between two supports is 3.6m. The material is steel with a modulus of E=200GPa and the internal pressure p=720kPa. The effects of distributed load q and internal pressure p are considered. Element A is on the outer surface of the vessel, just to the right of the left –hand support. Element B is located on the bottom surface of the tank at the mid-span.

   (a) Draw state of stress at element A, and find principal stresses and principal directions.

   (b) Draw state of stress at element B, and find maximum shear stress.

3. (25%) A steel beam ABC is simply supported at A and held by a high-strength steel wire at B (see Fig.3). A load P=1 kN acts at the free end C. The wire has axial rigidity EA= 1400 N, and the beam has flexural rigidity EI=90 kNm². What is the deflection C of point C due to the load P?
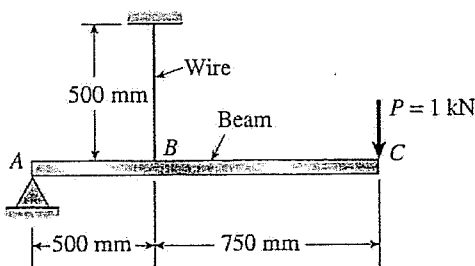

Fig. 3   Fig.4
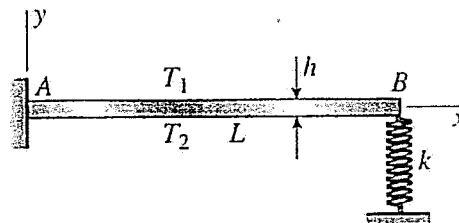
4. (25%) A cantilever beam with flexural rigidity EI, fixed at the left-hand end A and simply supported at the right-hand end B, is subjected to a temperature differential with temperature T_1 on its upper surface and T_2 on its lower surface (see Fig.4). Assume the coefficient of thermal expansion for the beam material is α, and the spring support is unaffected by temperature changes.

   (a) Find all reactions for this beam.

   (b) Determine the deflection curve.