國立成功大學

110學年度碩士班招生考試試題

編　號：103

系　所：土木工程學系

科　目：材料力學

日　期：0202

節　次：第 1 節

備　註：可使用計算機

※ 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. As shown in Figure 1(a), axial loads are applied to a two-element rod system whose elements both behave according to the nonlinear force-elongation curve in Figure 1(b). Determine expressions for δ_B and δ_C in terms of the load P and the element stiffness constant k. (20%)

Figure 1(a)　　　　　　Figure 1(b)

$P = k\delta^{\frac{1}{2}}$
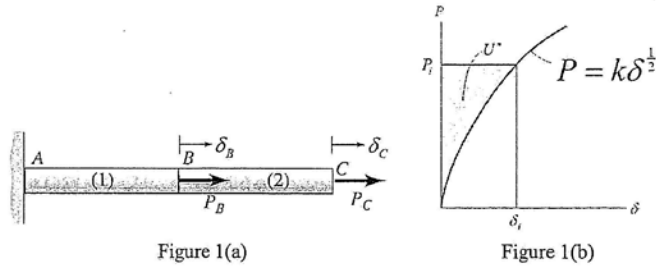
2. One mild-steel and one cast-iron torsion bar were tested individually to failure in a pure torsional condition in a torsion testing machine. What are the failure angles of the cracks until each bar breaks into two pieces? Discuss the type of stress that caused the failure of the mild-steel and cast-iron bar, respectively, by using a stress element to determine the normal stress and the shear stress on an inclined cut, as shown in Figure 2. (20%)
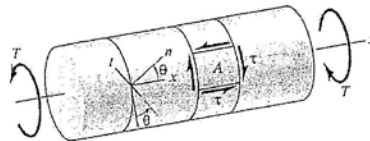

Figure 2

3. A beam with a rectangular cross-section of width b and height h, as shown in Figure 3(a), is made of a material whose stress-strain curve (in tension and compression) is approximately the form shown in Figure 3(b). Let $\sigma_1 = 0.8\sigma_y$、$\sigma_2 = \sigma_y$、$\varepsilon_1 = 0.5\varepsilon_y$、$\varepsilon_2 = \varepsilon_y$. Determine the shape factor f. (20%)
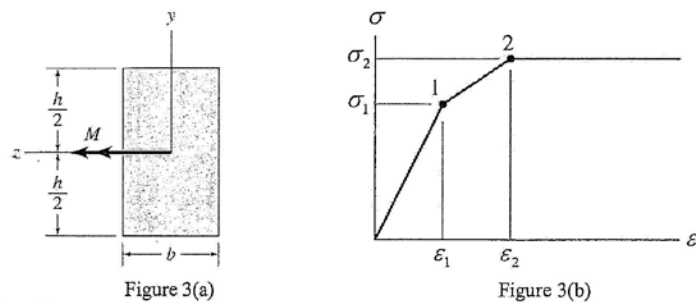

Figure 3(a)　　　　　　Figure 3(b)

4. Determine the buckling load of the fixed-free column shown in Figure. 4. The portion of the column from A to B is flexible, with the modulus of elasticity E and moment of inertia I, but the portion of the column from B to the point of application of the load P can be considered to be perfectly rigid. The length of BC is 20 percent of AB, that is, $a = 0.2$. (20%)
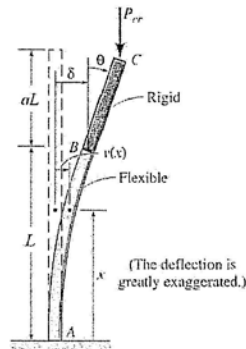

Figure 4

5. The components of plane stress at a point on the surface of a member made of structural steel, ASTM-A36 (yielding stress $\sigma_y = 250\,\text{MPa}$), are shown in Figure 5. $\sigma_{yy} = 0\,\text{MPa}$、$\sigma_{xy} = \sigma_{yx} = -100\,\text{MPa}$. What is the maximum normal stress σ_{xx} for this state of stress so that a safety factor is one as predicted by the maximum-distortion-energy failure criterion? (20%)
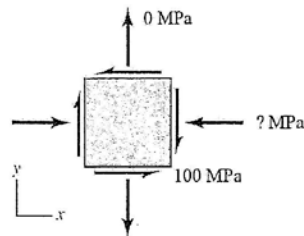

Figure 5