國立成功大學

114學年度碩士班招生考試試題

編　號：53

系　所：機械工程學系

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。

Problem 1 (20 Pts)

The steel beam is subjected to a load of 12 kN, as shown in Fig. 1. Determine the principle stress and axis at point A due to the loading.

Problem 2 (15 Pts)

The shaft has a radius of 20 mm and is made of A314 steel (G_{A314}: 80 GPa) in Fig. 2. Determine the strains in the x` and y` direction if a torque T = 4 kN·m is applied to the shaft.

Problem 3 (15 Pts)

Initially, gaps between the A-36 steel plate and the rigid constraint are shown in Fig. 3. Determine the normal stresses σ_x and σ_y in the plate if the temperature increases by $\Delta T = 80°F$. (α_{A-36}: $5.6(10^{-6})(1/°F)$, E_{A-36}: $30(10^3)$ksi, ν_{A-36}: 0.3)

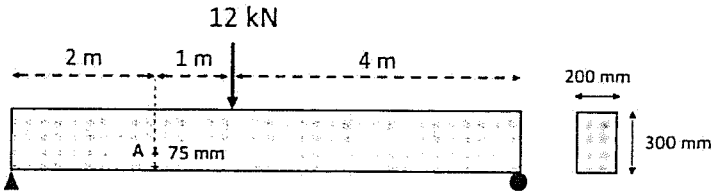

Fig. 1

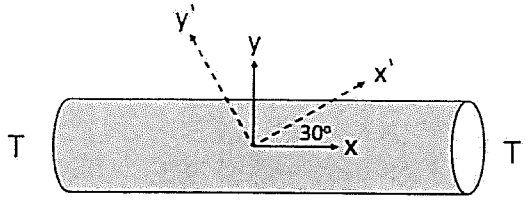

Fig. 2

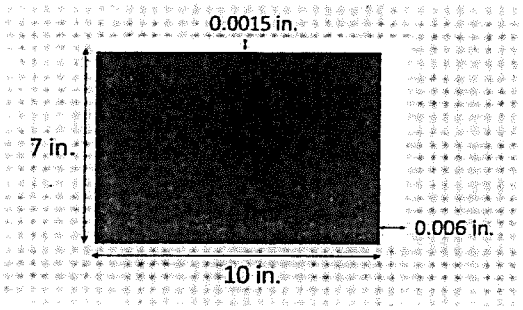

Fig. 3

Problem 4 (10 Pts)

The beam with the cross-section as shown in Fig. 4 is made of elastic perfectly plastic material. Determine the plastic moment that can be applied, $a = 50$ mm, $E = 200$ GPa, and $\sigma_Y = 230$ MPa.

Problem 5 (20 Pts)

The column with constant EI has the end constraints as shown in Fig. 5. (a) Determine the transverse deflection $v(x)$. (b) By observing the solution of $v(x)$, determine if buckling would occur and the smallest critical values of P and M when it happens.

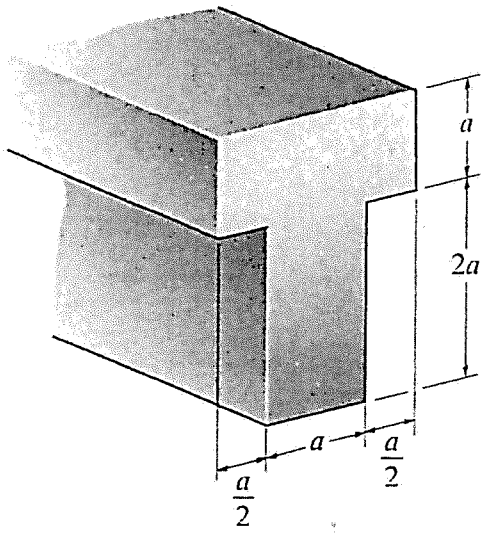

Fig. 4

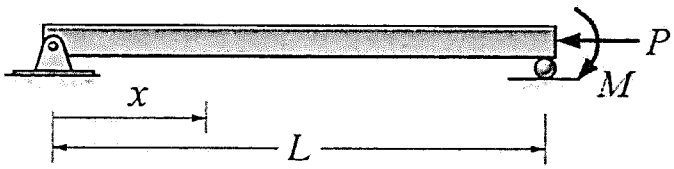

Fig. 5

Problem 6 (20 Pts)

A semicircular metal wire as shown in Fig. 6 is built-in to the wall at point A, simply-supported on the bottom at point B, and subjected to load P at mid-span-point C. The wire has a circular cross-section of radius r, $r << R$. Young's modulus and Poisson's ratio of the wire are E and ν, respectively. The cross-sectional area moment of inertia about the bending neutral axis is $\pi r^4/4$. Determine the deflection δ_C at point C and the support reaction at point B by using Castigliano's theorem (alternative solution approach is not allowed).

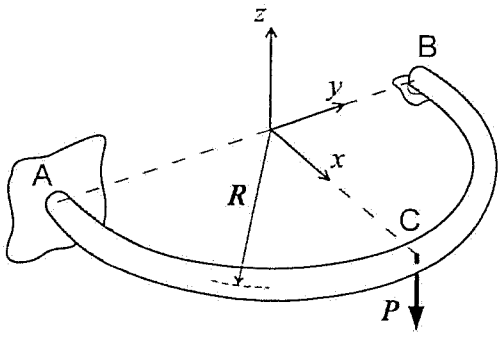

Fig. 6