國立成功大學

115學年度碩士班招生考試試題

編　號：72

系　所：土木工程學系

科　目：材料力學

日　期：0203

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. The structure shown in **Figure 1** consists of a horizontal rigid bar *ABCD* supported by two steel wires, one of length L and the other of length $3L/4$. Both wires have cross-sectional area A and are made of **elastic-perfect-plastic (EPP) material** with yield stress σ_y and modulus of elasticity E. A vertical load P acts monotonically downward at the end D of the bar. Determine the "**residual displacement at end point D, δ_{DR}**", when the maximum displacement at end D first reaches $3\sigma_y L/E$, and then the vertical load P is totally removed. (25%)

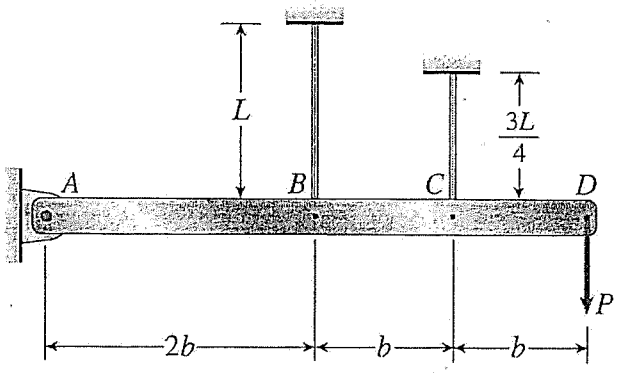

Figure 1

2. A sign with dimensions of 2.0 m ×1.2 m is supported by a hollow "square-shaped" tube pole having a dimension b = 158 mm and a thickness t = 20 mm in **Figure 2**. The sign is offset 0.5 m from the centerline of the pole, and its lower edge is 6.0 m above the ground. Determine the "**principal stresses σ_1 at point A**" at the base of the pole due to a wind pressure of 2.0 kPa against the sign. (25%) Note: A dashed line means the middle line.

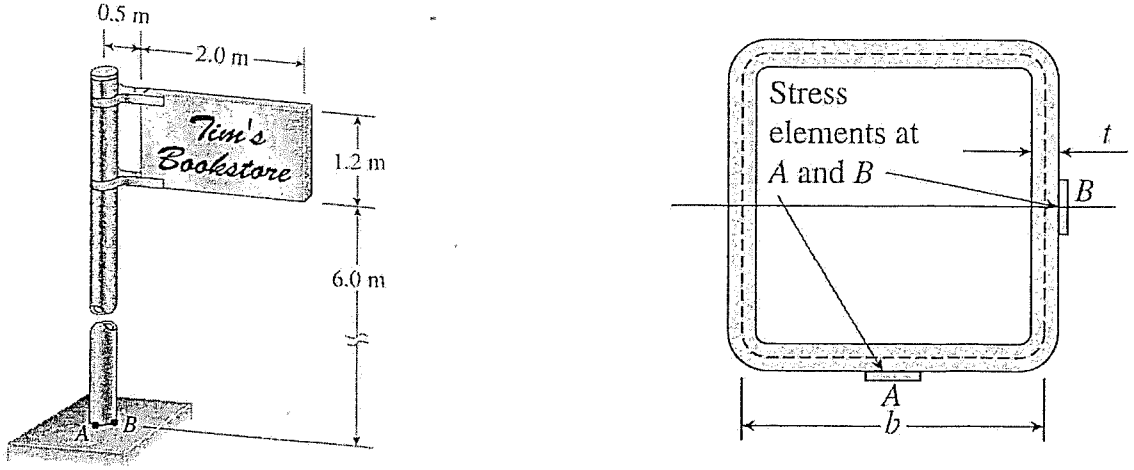

Figure 2

3. The column AB in **Figure 3**, with a constant flexural rigidity EI, has pin supports at A and B. Considering only bending effects in the analysis (i.e., disregarding the effects of axial deformations), derive the "**buckling equation**" for this column with the rotational stiffness β_R at end B. using the assumptions of ideal, slender, prismatic, and linearly elastic columns (Euler buckling). Buckling occurs in the plane of the figure unless stated otherwise. (25%)

Hint:

$v =$ deflection in the y direction

$M_B =$ moment at end B

$\theta_B =$ angle of rotation at end B (positive clockwise)

$H =$ horizontal reactions at ends A and B

$k^2 = P/EI$

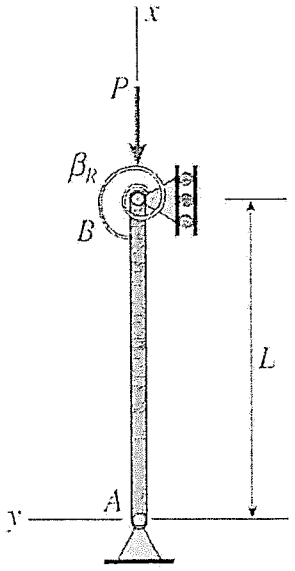

Figure 3

4. A beam ABC has a constant flexural rigidity EI, with simple supports at A and B, and an overhang BC supports a concentrated load P at the free end C (**Figure 4**). Use **only** the "**Strain Energy Method**" to find the "**deflection at end C, δ_c**", along the direction of the vertical load P. Any other methods to find δ_c will not be graded. (25%)

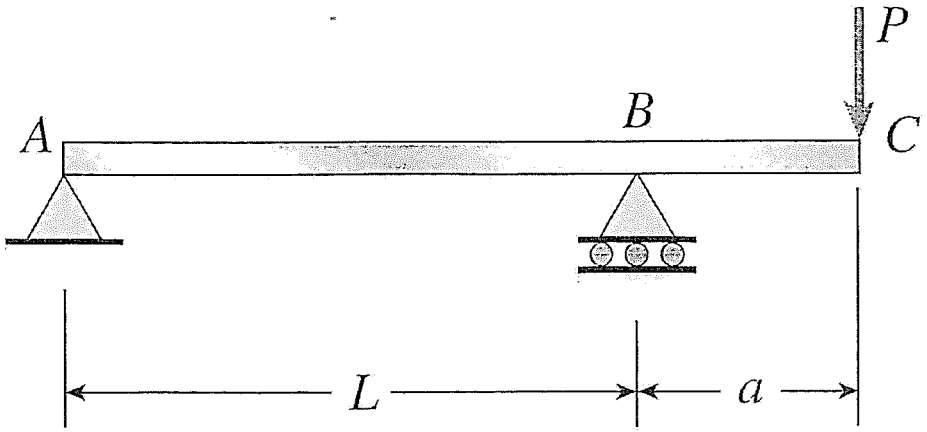

Figure 4