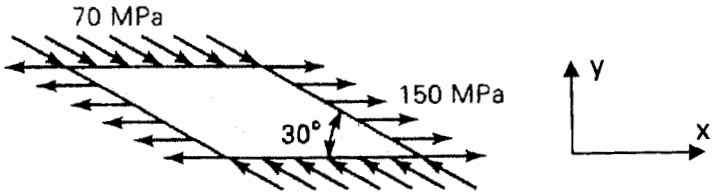
※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Problem 1

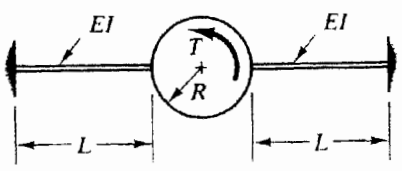
(a) Consider a thin skewed plate subjected to a uniform distribution of stress along its side. Please calculate its σ_x, σ_y, and τ_{xy} and find the principal stresses. (10 Points)



(b) A solid steel shaft of circular cross section, 0.02 m in diameter, yields when a torque of 400 N·m is applied. A circular tank, 1.0 m in diameter and made of the same material, is to contain certain internal pressure $\boldsymbol{p}$=3.0 MPa. What wall thickness $\boldsymbol{t}$ is required for a safety factor of 2.0? You should use both Tresca and maximum distortional energy theories for carrying on the calculations. (15 Points)

Problem 2

Consider the following figure, two slender beams are built-in to a rigid disk and to rigid walls. Please find the rotation stiffness of the system. The rotation stiffness is defined as the ratio between the applied torque T and the rotation angle of the rigid disk. (25 Points)



(背面仍有題目,請繼續作答)

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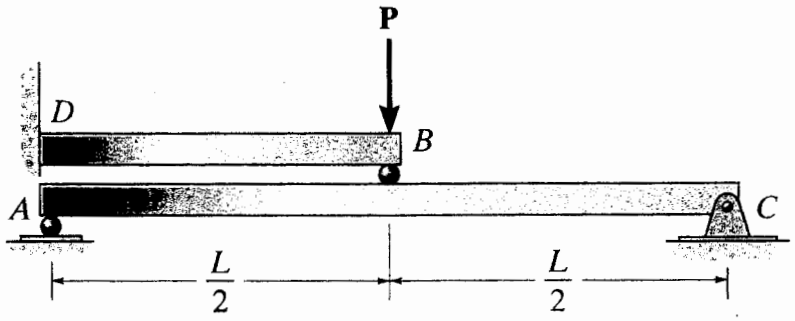
Problem 3

The beam assembly shown is subjected to a concentrated load P at point B. Determine the support reactions at the fixed end D by using Castigliano's theorem (alternative solution approach is not allowed). For both beams: cross-sectional area is A, area moment of inertia is I, the Young's modulus is E, and the Poisson's ratio is ν. (20 Points)



Problem 4

Consider a slender rod subjected to uniform temperature increase T_0 and tension σ_0 as shown. The Young's modulus, Poisson's ratio, and coefficient of thermal expansion of the rod are E, ν, and α, respectively. If the rod is constrained in the out-of-plane direction such that it's under plane strain condition, the rod extension and volume change as results of the thermomechanical load are ΔL_1 and ΔV_1, respectively; and if the rod is under plane stress condition, the rod extension and volume change are ΔL_2 and ΔV_2, respectively.

(a) Determine $\Delta L_2/\Delta L_1$. (20 Points)

(b) Determine $\Delta V_2/\Delta V_1$, assuming the rod is incompressible. (10 Points)