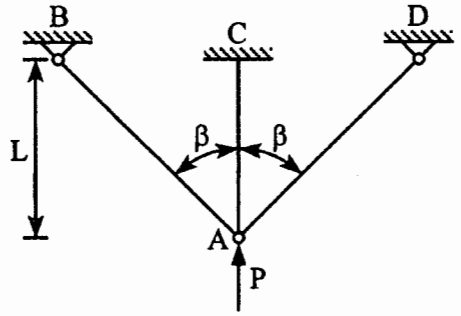
系所組別：土木工程學系甲、丙、丁組

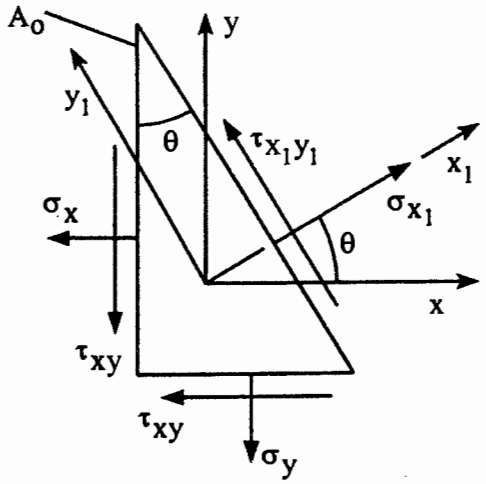
考試科目：材料力學　　考試日期：0222，節次：1

※ 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。

1. A three-bar truss is subjected to a compressive force P at point A. All the members are assumed to behave linearly and have the same modulus of elasticity E, cross section area A, and moment of inertia I. (i) What is the moment at point C? (5%) (ii) Calculate the axial forces in all the members and indicate whether they are tensile forces or compressive forces? (10%) (iii) If the force P is continuously increased, calculate the magnitude of P associated with the buckling of the first member in the system. (10%)



2. (a) Use the stresses σ_x, σ_y, τ_{xy} acting on the wedge-shape element to derive the stress transformation equations for σ_{x_1} and $\tau_{x_1y_1}$. Assume that the area of the left-hand side face (i.e., the negative x face) is A_o. (15%) (b) Use the equations obtained in (a) to prove that the angle θ_s of the maximum shear stress direction must satisfy the expression $\tan 2\theta_s = -(\sigma_x - \sigma_y)/(2\tau_{xy})$. (5%)



(背面仍有題目,請繼續作答)

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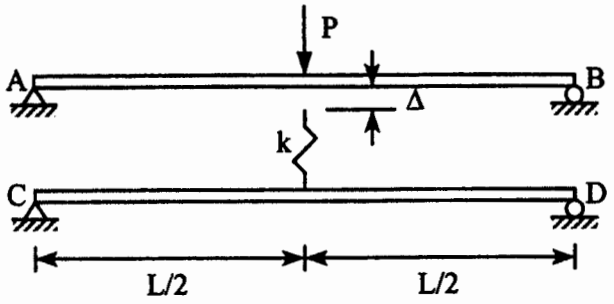
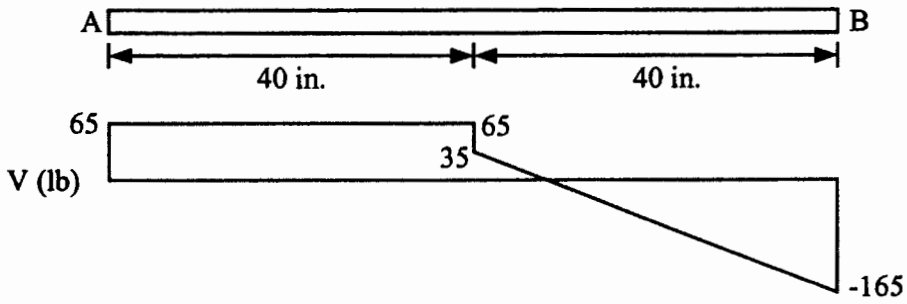
3. Two simply supported beams AB and CD have the same length L and bending rigidity EI. There is a spring (with spring constant k) at the midspan of beam CD and the gap between the spring and the beam AB is Δ. Beam AB is subjected to a concentrated force P at the midspan and the deflection of beam AB under the concentrated force P is greater than Δ. Calculate the force in the spring. (20%)



4. The shear-force diagram of a beam AB is shown below. Draw all the loads (including directions, magnitudes, and units) and the bending moment diagram on the beam. (15%)



5. A solid circular bar having diameter d is to be replaced by a rectangular tube having cross-sectional dimensions $d \times 2d$ to the median line of the cross section. (i) Determine the required thickness of the tube so that the maximum shear stress in the tube will not exceed the maximum shear stress in the solid bar. (10%) (ii) Calculate the torsion constant J for the rectangular tube. (10%)