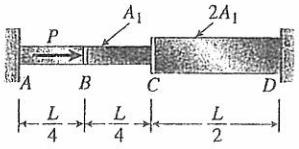
國立臺灣大學99學年度碩士班招生考試試題

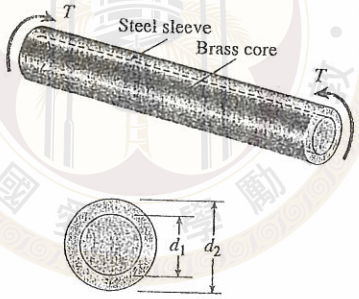
(20%) 1. The axially loaded bar *ABCD* is held between rigid supports. The bar has cross-sectional area A_1 from *A* to *C* and $2A_1$ from *C* to *D*.

(a) Derive formulas for the reactions R_A and R_D at the ends of the bar. (10%)

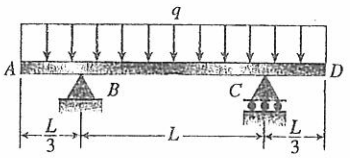
(b) Determine the displacements δ_B and δ_C at points *B* and C, respectively. (10%)



(15%) 2. The composite shaft is manufactured by shrink-fitting a steel sleeve over a brass core so that the two parts act as a single bar in torsion. The outer diameters of the two parts are d_1 = 40 mm for the brass core and d_2 = 50 mm for the steel sleeve. The shear moduli of elasticity are G_b = 36 GPa for the brass and G_s = 80 GPa for the steel. Assuming that the allowable shear stresses in the brass and steel are τ_b = 48 MPa and τ_s = 80 MPa, respectively, determine the maximum permissible torque T_{max} that may be applied to the shaft.



(15%) 3. Beam *ABCD* is simply supported at *B* and *C* and has overhangs at each end. The span length is *L* and each overhang has length *L*/3. A uniform load of intensity *q* acts along the entire length of the beam. Draw the shear-force and bending-moment diagrams for this beam.



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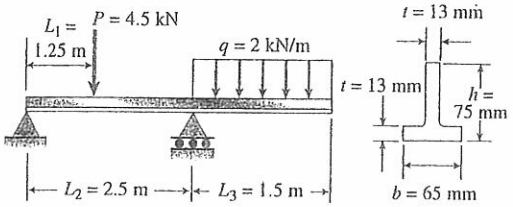
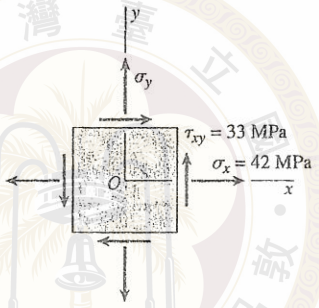
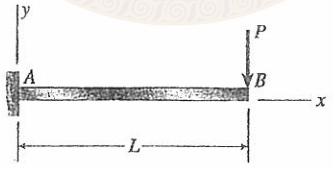
(15%) 4. A beam of T-section is supported and loaded as shown in the figure. The cross section has width b = 65 mm, height h = 75 mm, and thickness t = 13 mm. Determine the maximum tensile and compressive stresses in the beam.



(20%) 5. At a point on the surface of a machine component the stresses acting on the x face of a stress element are σ_x = 42 MPa and τ_{xy} = 33 MPa. What is the allowable range of values for the stress σ_y if the maximum shear stress is limited to τ_0 = 35 MPa?



(15%) 6. Derive the equation of the deflection curve for a cantilever beam AB supporting a load P at the free end. Also, determine the deflection δ_B and angle of rotation θ_B at the free end.



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