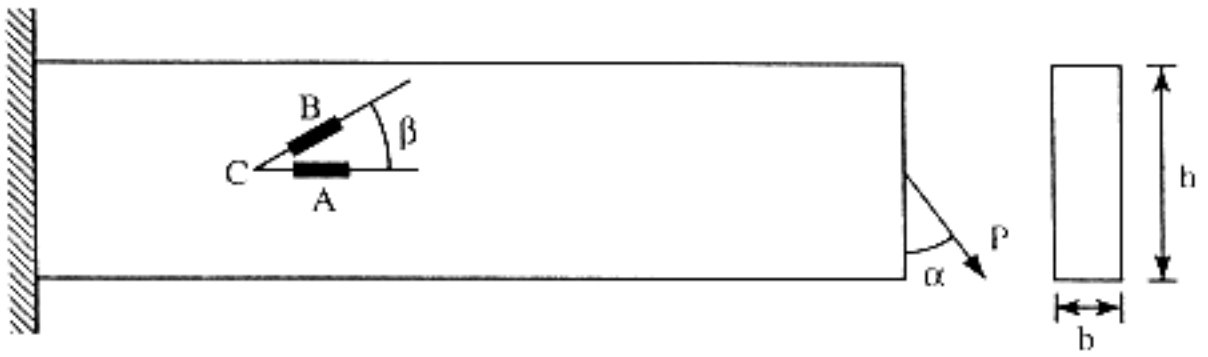
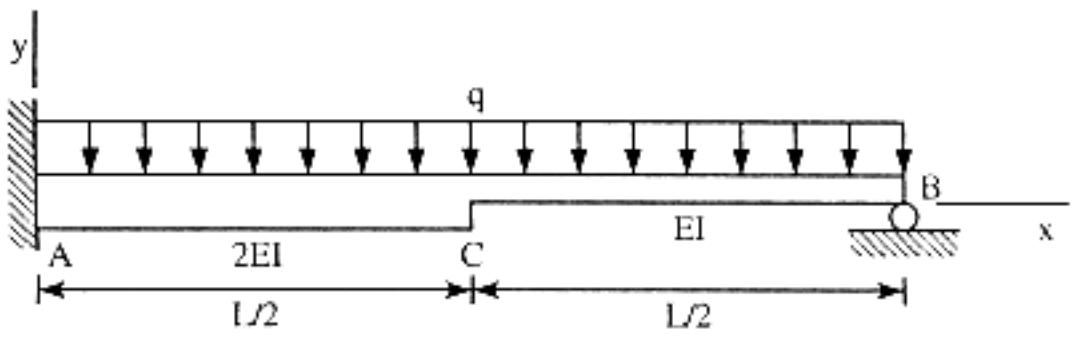
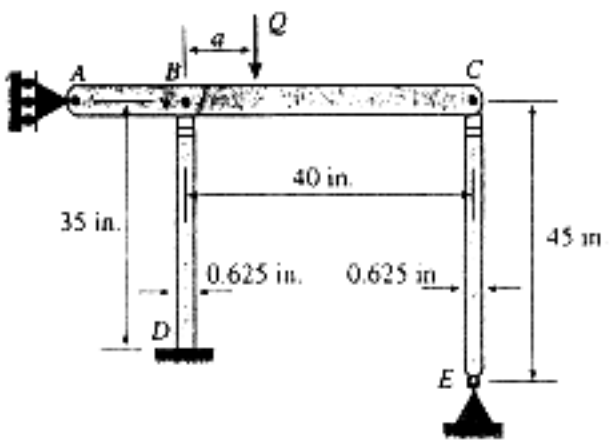
1. A cantilever beam of rectangular cross section (b = 25 mm, h = 100 mm) is loaded by a force P that acts at the midheight of the beam and is inclined at an angle α to the vertical. Two strain gages are placed at point C, which also is at the midheight of the beam. Gage A measures the strain in the horizontal direction and gage B measures the strain at an angle $\beta = 60^{o}$ to the horizontal. The measured strains are $\varepsilon_a = 125\times10^{-6}$ and $\varepsilon_b = -375\times10^{-6}$. Determine the force P and the angle α, assuming the material is steel with E = 200 GPa and ν = 1/3. (20%)



2. A nonprismatic propped cantilever beam AB with flexural rigidity 2EI from A to C and EI from C to B is subjected to an uniform load of intensity q. (i) Use the 4th order differential equations to derive the deflection curve v(x) of the beam AB. (ii) Determine all reaction moment and forces at points A and B. (20%)



3. The horizontal beam ABC is supported by columns BD and CE. The beam is prevented from moving horizontally by the roller supported at end A, but vertical displacement at end A is free to occur. Each column is pinned at its upper end to the beam. Both columns are solid steel bars ($E = 30\times10^{6}$ psi) of square cross section with width equal to 0.625 in. A load Q acts at distance *a* from column BD. (a) If the distance *a* = 10 in., what is the critical value Q_{cr} of the load? (b) If the distance *a* can be varied between 0 and 40 in., what is the maximum possible value of Q_{cr}? What is the corresponding value of the distance *a*? (20%)



(背面仍有題目，請繼續作答)

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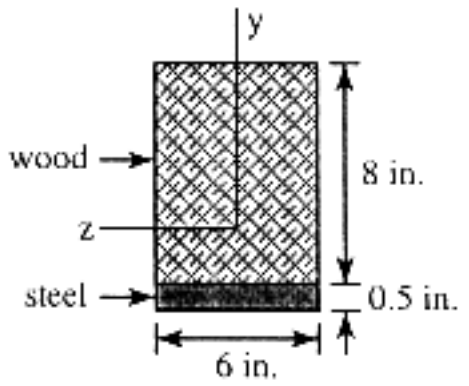
4. A composite beam is constructed of a wood beam reinforced on the lower side by a steel plate. The modulus of elasticity for the wood is $E_w = 1.2\times10^6$ psi and for the steel is $E_s = 30\times10^6$ psi. Find the allowable bending moment M_{allow} for the beam if the allowable stress in the wood is $\sigma_w = 1.5$ ksi and in the steel is $\sigma_s = 15$ ksi. (20%)



5. A composite bar of square cross section with dimensions 2b×2b is constructed of two different materials having moduli of elasticity E_1 and E_2. The two parts of the bar have the same cross-sectional dimensions. The bar is compressed by forces P acting through rigid end plates. The line of action of the loads has an eccentricity e of such magnitude that each part of the bar is stressed uniformly in compression. Determine: (a) the axial force P_1 and P_2 in the two parts of the bar, (b) the eccentricity e of the loads, and (c) the ratio of the stresses σ_1 and σ_2 in the two parts of the bar. (20%)