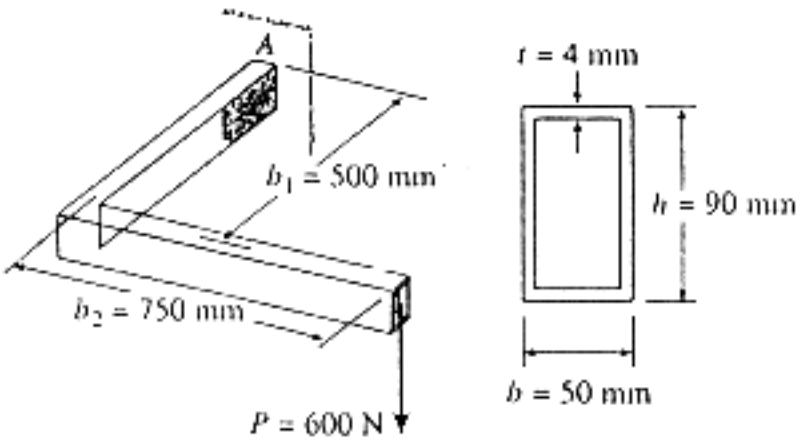
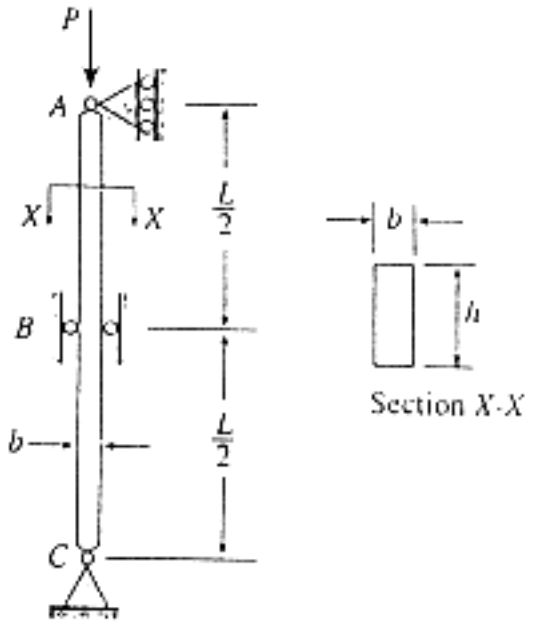
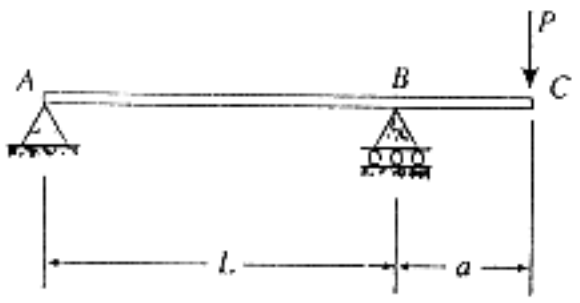
1. An L-shaped bracket lying in a horizontal plane supports a load $P = 600$ N (see figure). The bracket has a hollow rectangular cross section with thickness $t = 4$ mm and outer dimensions $b = 50$ mm and $h = 90$ mm. The centerline lengths of the arms are $b_1 = 500$ mm and $b_2 = 750$ mm. Considering only the load P, calculate the maximum tensile stress σ_t, maximum compressive stress σ_c, and maximum shear stress τ_{max} at point A, which is located on the top of the bracket at the support. (30%)



2. A rectangular column with cross-sectional dimensions b and h is pin-supported at ends A and C (see figure). At midheight, the column is restrained in the plane of the figure but is free to deflect perpendicular to the plane of the figure. Determine the ratio h/b such that the critical load is the same for buckling in the two principal planes of the column. (20%)



3. A beam ABC with simple supports at A and B and an overhang BC supports a concentrated load P at the free end C (see figure). (a) Determine the strain energy U stored in the beam due to the load P. (b) From the strain energy, find the deflection δ_C under the load P. (c) Calculate the numerical values of U and δ_C if the length L is 8 ft, the overhang length a is 3 ft, the beam is a W 10 × 12 steel wide-flange section, and the load P produces a maximum stress of 12,000 psi in the beam. (Use $E = 29 \times 10^6$ psi.) (20%)



4. A bar of rectangular cross section is loaded and supported as shown in the figure. The distance between supports is $L = 1.5$ m and the height of the bar is $h = 120$ mm. The deflection δ at the midpoint is measured as 2.5 mm. What is the maximum normal strain ϵ at the top and bottom of the bar? (30%)