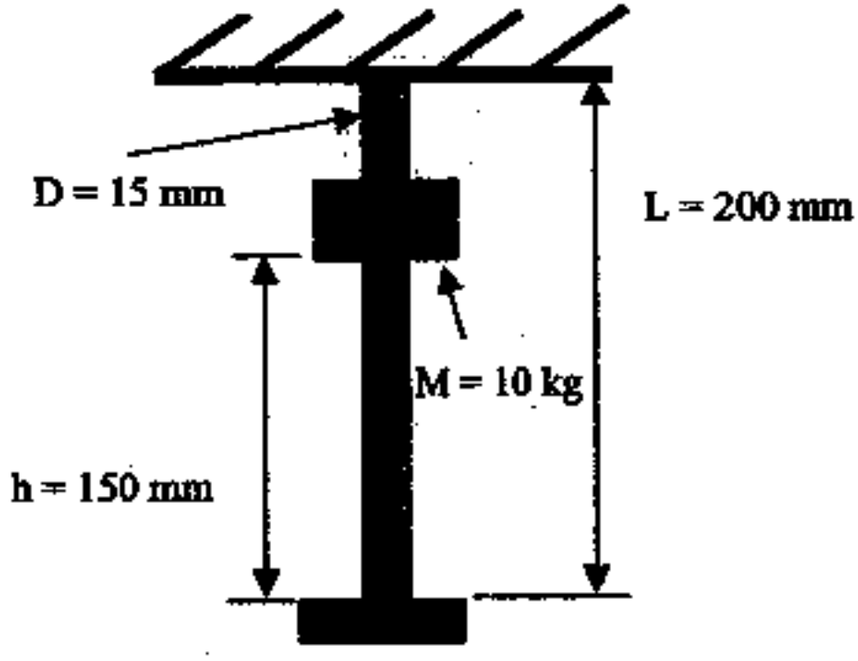
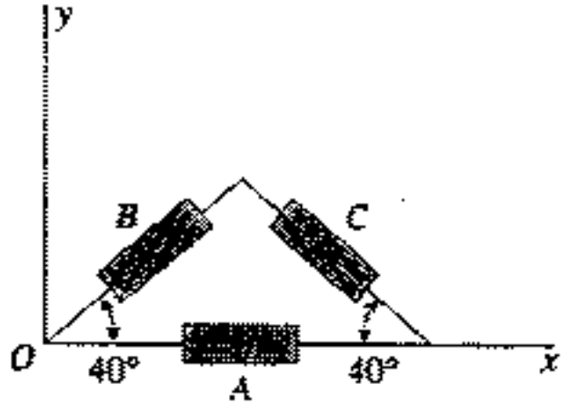
1. Explain the following terminology in detail : (20%)
   (a) engineering stress
   (b) allowable stress
   (c) moment-area method
   (d) Euler load

2. A round prismatic steel bar (E = 210 GPa) of length L = 200 mm and diameter D = 15 mm hangs vertically from a support at its upper end. A sliding collar of mass M = 10 kg drops from a height h = 150 mm onto the flange at the lower end of the bar without rebounding. (a) Calculate the maximum elongation of the bar due to impact, (b) Calculate the maximum tensile stress. (20%)



3. A solid circular bar with an diameter of 80 mm is subjected to a torque T = 4.0 kN-m. The bar is made of aluminum alloy 7075-T6. Determine the maximum shear, tensile, and compressive stress in the bar and show these stresses on sketches of properly oriented stress elements. (20%)

4. The strains on the surface of an experimental device made of pure aluminum (E = 70 GPa, ν = 0.33) and tested in a space shuttle were measured by means of strain gages. The gages were oriented as shown in the figure, and the measured strains were $\varepsilon_a = 1100 \times 10^{-6}$, $\varepsilon_b = 1500 \times 10^{-6}$, $\varepsilon_c = -40 \times 10^{-6}$. Determine the stress components σ_x, σ_y and γ_{xy}. (20%)



5. A beam ABC of length L rests on three identical spring supports at points A, B, and C. The flexural rigidity of the beam is EI, and each spring has stiffness k. If the load P is applied as shown in figure, determine the reactions R_A, R_B, and R_C. (20%)