1. A rigid bar of weight W hangs from three equally spaced vertical wires (length $L=3a$): two of steel and one of aluminum (see Fig. 1). The wires also support a load P acting at $x = a/2$ on the bar. The diameter of the steel wires is d_s, and the diameter of the aluminum wire is $d_a=2d_s$. Assume Young's moduli of aluminum and steel are E_a and E_s respectively, $E_s=3E_a$. Find the stresses in the steel wires and in the aluminum wire, respectively. (25%)
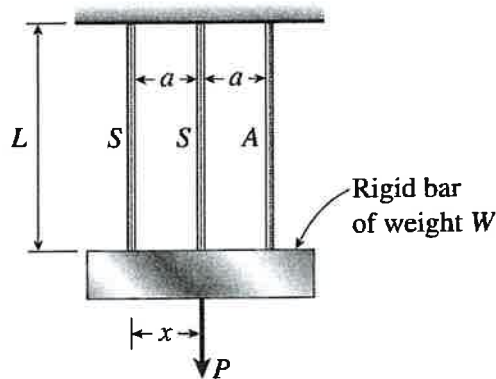

Fig. 1

2. A steel pipe of thickness t_s and an aluminum pipe of thickness t_a are securely bonded together to form the composite beam shown in Fig.2. The modulus of elasticity is E_s for the steel and E_a for the aluminum. Knowing that the composite beam is bent by a moment M, determine the maximum stress (a) in the aluminum, (b) in the steel. (25%)
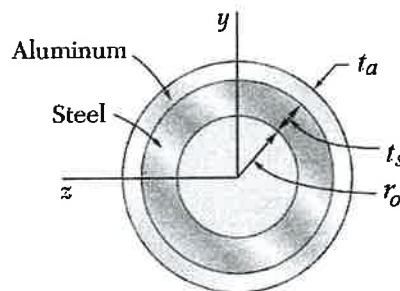

Fig. 2

3. Derive the equation of the deflection curve for beam AB, carrying a triangularly distributed load of maximum intensity q_o (see Fig.3). Also, determine the maximum deflection δ_{max} of the beam. (The flexural rigidity of beam AB is EI) (25%)
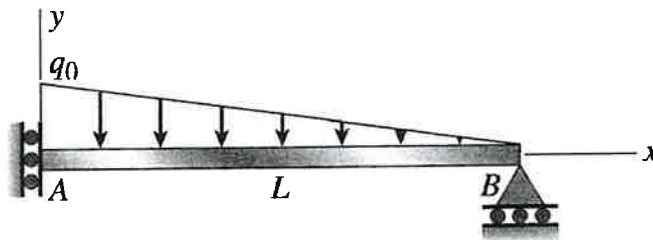

Fig.3

4. An L-shaped bracket lying in a horizontal plane supports a load P=600 N (see Fig.4). The bracket has a hollow rectangular cross section as shown. 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, maximum compressive stress, and maximum shear stress at point A, which is located on the top of the bracket at the support. (25%)
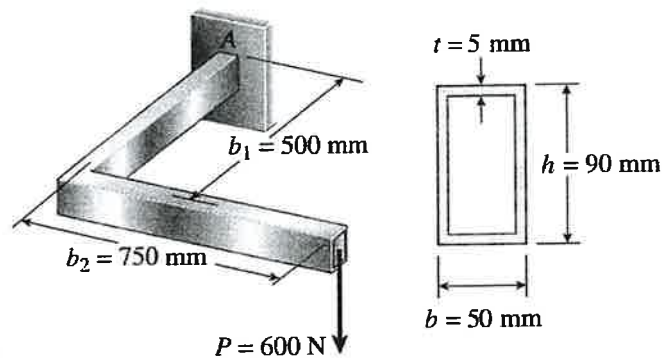

Fig. 4