(1) The rigid bar BDE is supported by two links AB and CD. Link AB is made of aluminum (E = 60 GPa) and has a cross sectional area of 300 mm^2; link CD is made of steel (E = 180 GPa) and has a cross sectional area of 400 mm^2. For the 30-kN force shown in the Figure 1, determine the deflection of E. (20%)

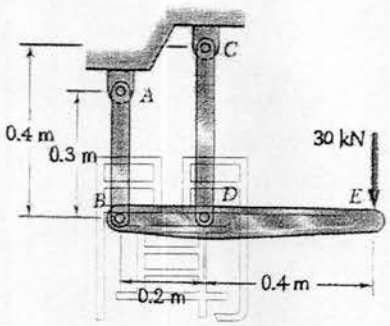

Figure 1

(2) A cantilever beam *AB* carries three equally spaced concentrated loads, as shown in the Figure 2. Obtain formulas for the angle of rotation θ_B (12%) and deflection δ_B at the free end of the beam (13%).

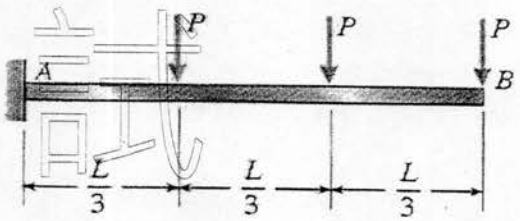

Figure 2

(3) The beam is subjected to the loading shown in the Figure 3. Determine its required cross-sectional dimension a, if the allowable bending stress for the material is $\sigma_{allow} = 150$ MPa. (25%)

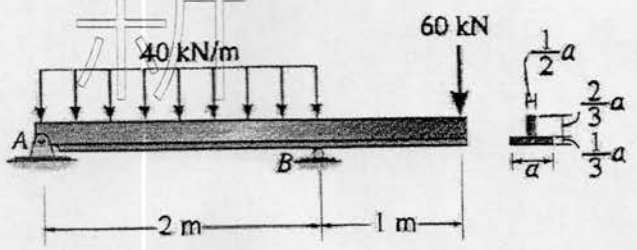

Figure 3

(4) The axially loaded bar ABCD shown in the Figure 4 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 (7%) and R_D (7%) at the ends of the bar. (b) Determine the displacements δ_B (8%) and δ_C (8%) at points B and C, respectively (with modulus of elasticity E).

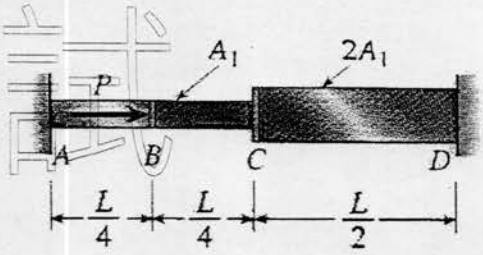

Figure 4