1. Using the conjugate-beam method, determine the deflection at point D of the beam shown in Figure 1 and the slope at the point just to the right of the pin at B. The flexural rigidity EI = constant. (25%)

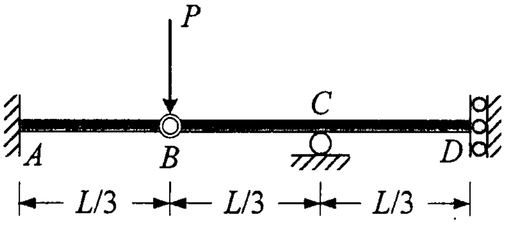

Figure 1

2. Determine the absolute displacement of joint B of the truss shown in Figure 2. Take the modulus of elasticity E = 200 GPa and the cross-sectional area A =120 mm^2 for all members. (25%)

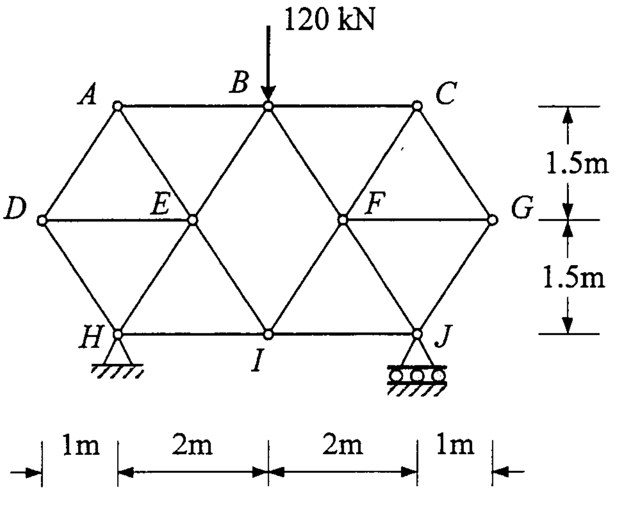

Figure 2

3. By using the moment-distribution method, draw the moment diagram on the compression sides of the members for the frame shown in Figure 3. The flexural rigidity EI is constant throughout the frame. (25%)

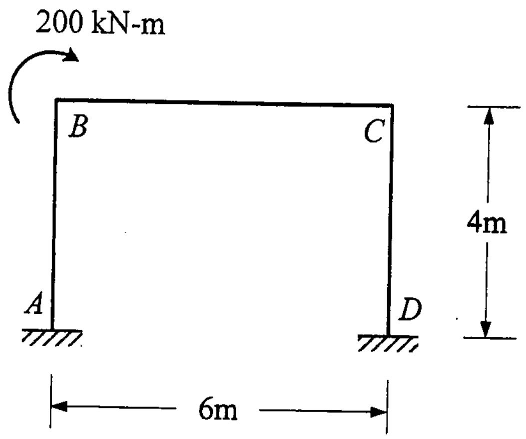

Figure 3

4. Determine the stiffness matrix for the tapered beam shown in Figure 4. The modulus of elasticity E is constant and the moment of inertia I of the cross-sectional area is $I_0(1+x/L)^3$ with I_0 = constant. The numbers and their associated arrows as shown in the figure indicate the nodal (or joint) displacements and their corresponding forces. (25%)

The following formulas for integrals may help:

$$\int \frac{x\,dx}{(a+bx)^3} = \frac{1}{b^2}\left[-\frac{1}{a+bx} + \frac{a}{2(a+bx)^2}\right]$$

$$\int \frac{x^2\,dx}{(a+bx)^3} = \frac{1}{b^3}\left[\ln(a+bx) + \frac{2a}{a+bx} - \frac{a^2}{2(a+bx)^2}\right]$$

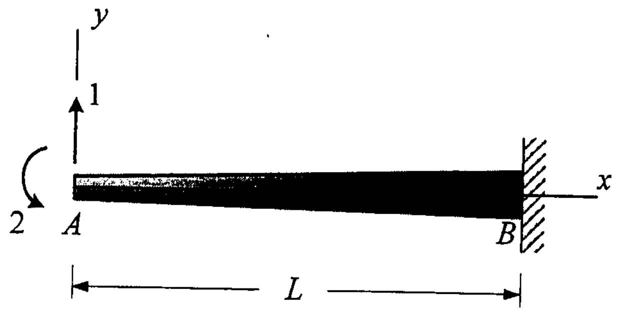

Figure 4