

※ 若題目條件不足可自行作必要假設。請依序作答。 Make your assumptions if necessary. Write the answers in order.

1. (20 points) Please explain:

- What is the **Degree of freedom (DOF)** and **Degree of indeterminacy (DOI)**? (5pts)
- For a cantilever beam, what is the *DOF* for the fixed end and the free end? (5pts)
- In structural analysis, what are E (modulus of elasticity) and I (moment of inertia)? (5pts)
- How does EI affect the structural design? Please provide a brief example. (5pts)

2. (20 points) Determine the forces in members, i. e., F_{BD} , F_{CE} , F_{CF} , and F_{CD} of the truss shown in Figure 1. Please also state if the members are in tension or compression. (5 pts each)

3. (20 points) There is a steel cantilever beam as shown in Figure 2-1. Assume the support at A is fixed. The beam features an I-shaped cross-section, as shown in Figure 2-2, and has $E = 210$ GPa. Additionally, the spring connected to this system has a stiffness $k = 3.6$ N/mm. Please determine:

- The displacement at B, i.e., Δ_B . (10pts)
- Force in the spring, i.e., B_y . (10pts)

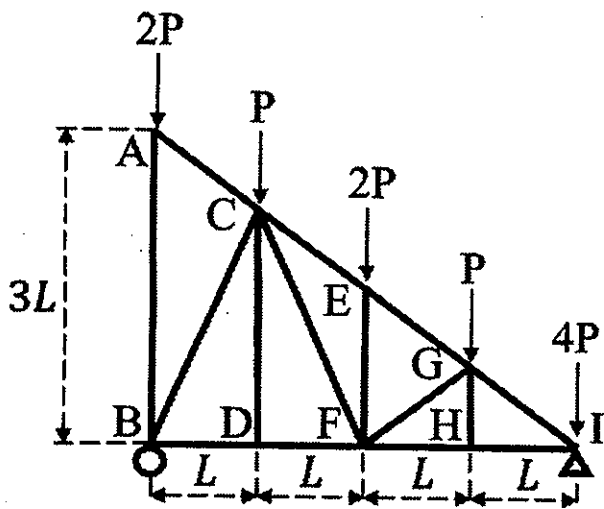


Figure 1

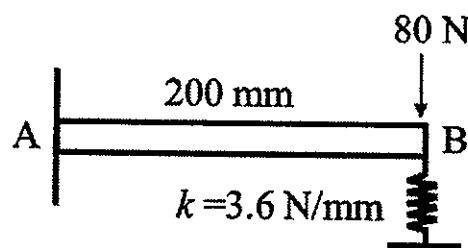


Figure 2-1

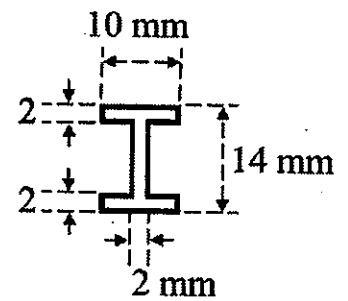


Figure 2-2

4. (20 points) Please use the **virtual work method** to determine the displacement at C, i.e., Δ_c in Figure 3. E is constant; however, please note that there are two different sections ($I_{AB} = I$, $I_{BC} = I_{CD} = 2I$) in Figure 3. Failure to use the specified method to answer will result in 0 points.

5. (20 points) Please use the **slope deflection method** to determine the moments at the supports, i.e., M_{AB} and M_{DC} , of the frame shown in Figure 4. EI is constant for each member. Note that the frame will move sideways to the right. Failure to use the specified method to answer will result in 0 points.

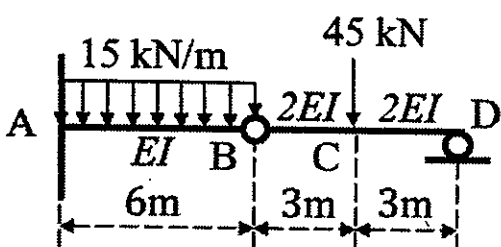


Figure 3

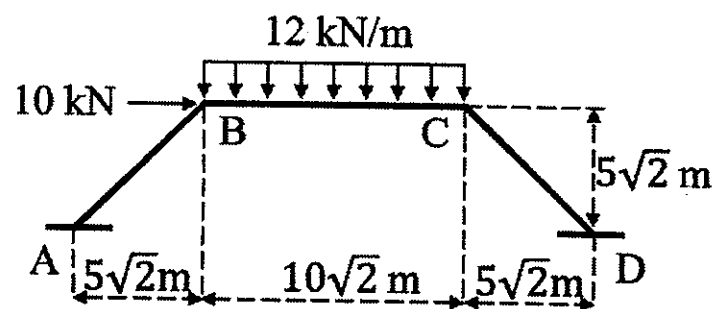


Figure 4