B. Haidar

Structural Mechanics (2)

Lecture No-07

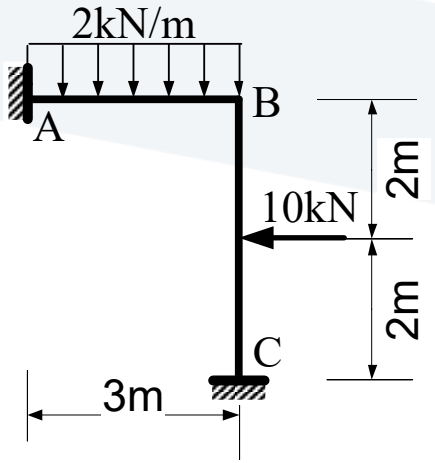
Part-01

Displacement Method for Beams and Frames or Slope-Deflection Method

Displacement Method for Beams and Frames (Slope – Deflection Method)

- Basic Concept of the Slope-Deflection Method and Slope-Deflection Equations.
- Analysis of Continuous Beams.
- Analysis of Frames without Sidesway.
- **Analysis of Frames with Sidesway.**

Ex.3: For the next frame under the given loads, by the slope-deflection method, calculate the reactions, and draw the bending moment, shear force & normal force diagrams. EI is constant.



Solution

1) 1 DKI. The unknown is θ_B .

2) Slope-Deflection Equations:

$M_{AB}=(2EI/3)\,(0+\theta_B-0)+1.5$

$M_{BA}=(2EI/3)\,(0+2\theta_B-0)-1.5$

$M_{BC}=(2EI/4)\,(0+2\theta_B-0)+5$

$M_{CB}=(2EI/4)\,(0+\theta_B-0)-5$

3) Equilibrium Equation:

$M_{BA}+M_{BC}=0 \Rightarrow \quad \theta_B=-1.5/EI$

4) End moments:

$M_{AB}=0.5$ kN.m, $M_{BA}=-3.5$kN.m

$M_{BC}=+3.5$kN.m, $M_{CB}=-5.75$kN.m

5) End shears:

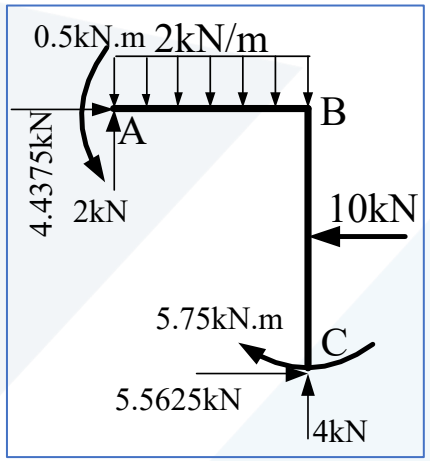
Eq. Eq. of AB

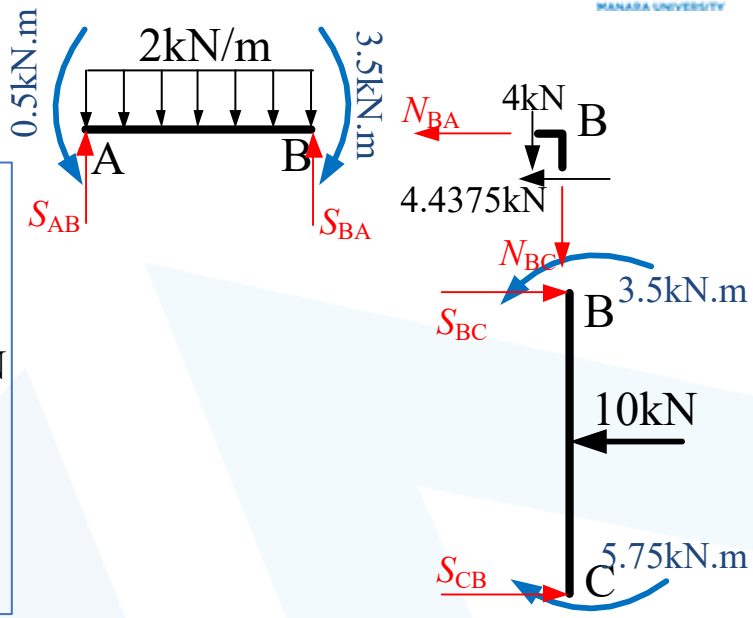
$S_{AB}=2$kN, $S_{BA}=4$kN

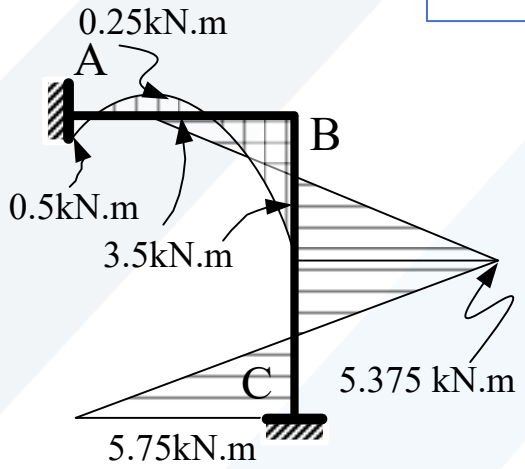
Eq. Eq. of BC

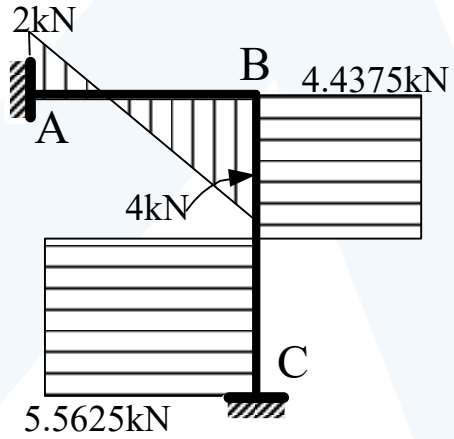
$S_{BC}=4.4375$kN,

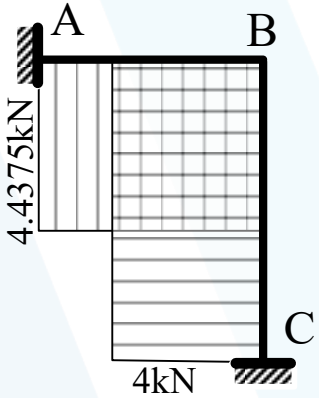
$S_{CB}=5.5625$kN





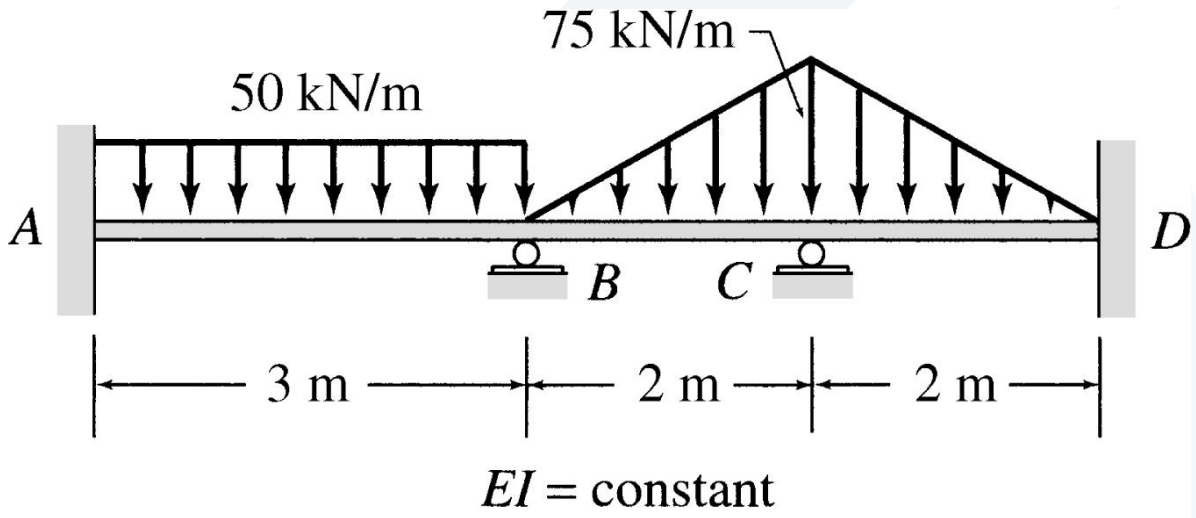






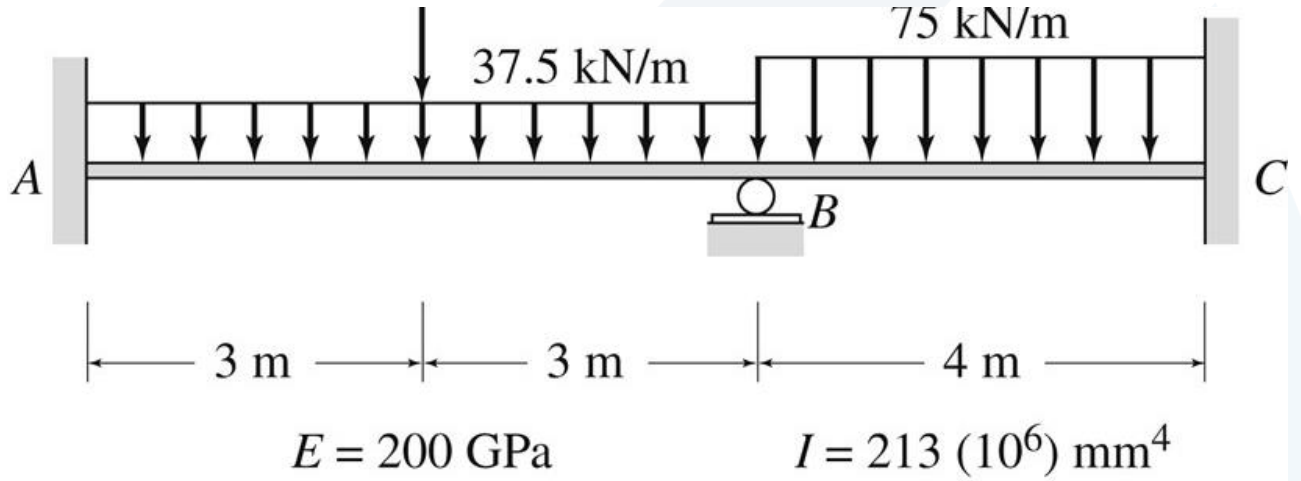
Homework-01

Pr-01: Determine the reactions and draw the shear and bending moment diagrams for the beam shown using slope deflection method.



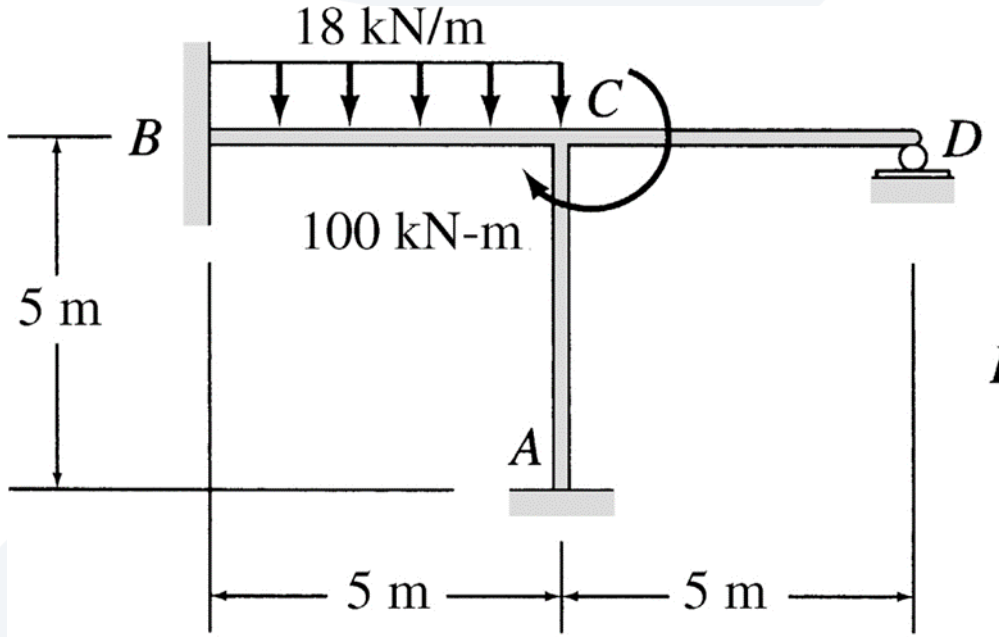
Homework-01

Pr-02: Using slope deflection method, determine the member end moments and the reactions for the beam shown due to the external loading and a settlement of 8 mm at support B, then draw the shear and bending moment diagrams.



Homework-01

Pr-03: Determine the member end moments and the reactions for the frame shown using slope deflection method.



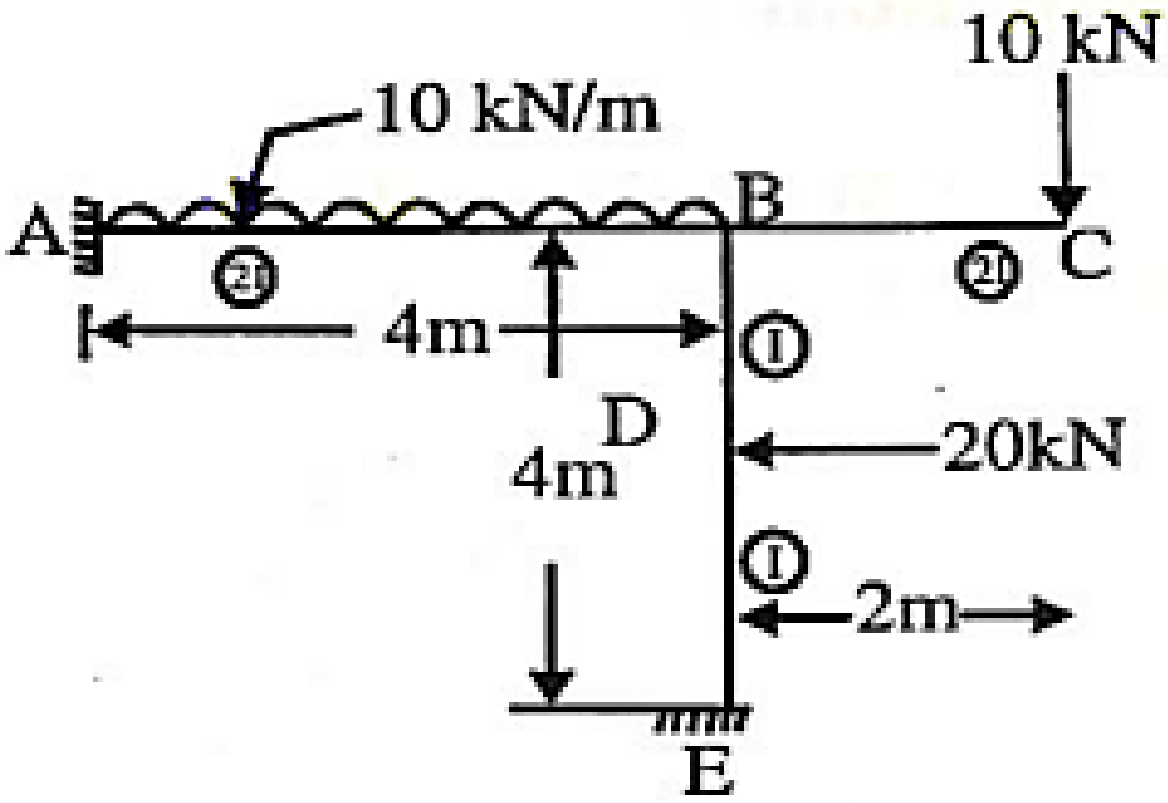
EI = constant

$E = 200$ GPa

$I = 1350 \times 10^6$ mm^4

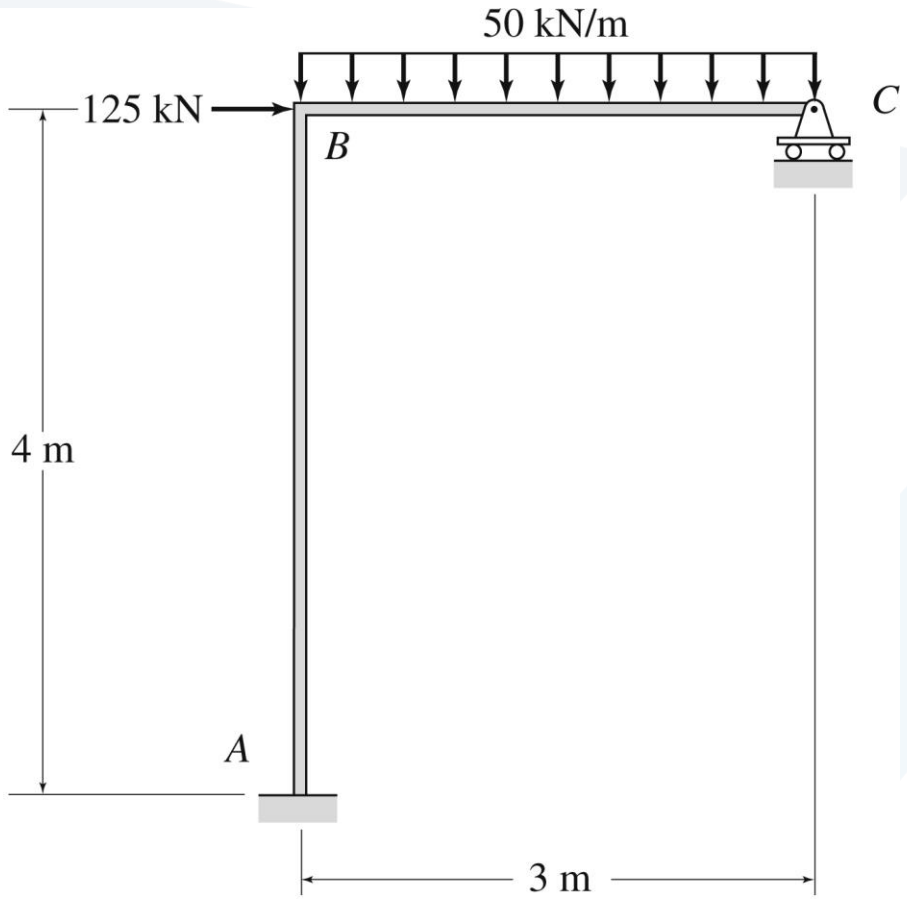
Homework

Pr-01: For the next frame under the given loads, by the slope-deflection method, calculate the reactions, and draw the bending moment, shear force & normal force diagrams.



Homework

Pr-02: For the next frame under the given loads, by the slope-deflection method, calculate the reactions, and draw the bending moment, shear force & normal force diagrams.



EI = constant

Homework

Pr-03: For the next frame under the given loads, by the slope-deflection method, calculate the reactions, and draw the bending moment, shear force & normal force diagrams. (EI=const.)