5. DEFLECTION OF BEAMS

For design purpose, a beam should be so designed that it has adequate stiffness so that the deflections are within permissible limits.

Stiffness of beam is inversely proportional to deflection.

METHODS OF DETERMINING DEFLECTION OF BEAM

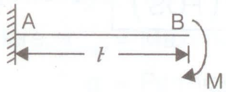
- Double integration method.
- Moment area method
- Strain energy method
- Conjugate beam method

DEFLECTION OF BEAM UNDER DIFFERENT LOADING/SUPPORT CONDITION

- Notation used

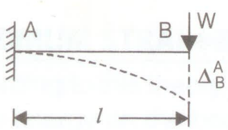
θ_B^A = Slope at B w.r.t A

Δ_B^A = Deflection at B w.r.t A

- 

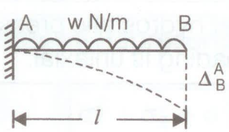
Deflection $(\Delta_B^A) = \dfrac{Ml^2}{2\,EI}$

Slope $(\theta_B^A) = \dfrac{Ml}{EI}$

- 

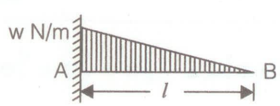
Deflection $(\Delta_B^A) = \dfrac{Wl^3}{3\,EI}$

Slope $(\theta_B^A) = \dfrac{Wl^2}{2\,EI}$

- 

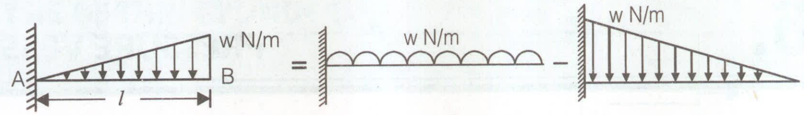
Deflection $(\Delta_B^A) = \dfrac{wl^4}{8EI}$

Slope $(\theta_B^A) = \dfrac{Wl^3}{6\,EI}$

- 

Deflection $(\Delta_B^A) = \dfrac{wl^4}{30EI}$

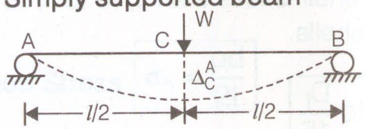
Slope $(\theta_B^A) = \dfrac{Wl^3}{24\,EI}$

- 

Deflection $(\Delta_B^A) = \dfrac{Wl^4}{8\,EI} - \dfrac{Wl^4}{30EI}$

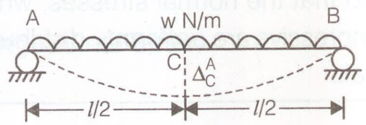
Slope $(\theta_B^A) = \dfrac{Wl^3}{6EI} - \dfrac{Wl^3}{24EI}$

- Simply supported beam



Deflection $(\Delta_C^A) = \dfrac{Wl^3}{48\,EI}$

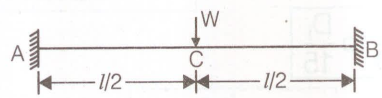
Slope $(\theta_C^A) = \dfrac{Wl^2}{16\,EI}$

- 

Deflection $(\Delta_C^A) = \dfrac{5\,wl^4}{384\,EI}$

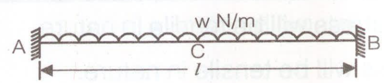
Slope $(\theta_C^A) = \dfrac{Wl^3}{24\,EI}$

- Fixed Beam



$\theta_A = \theta_B = 0$

Deflection$(\Delta_c) = \Delta_{max} = \dfrac{Pl^3}{192\,EI} = \dfrac{1}{4} \times \Delta_{max}$ in S.S beam



$\theta_A = \theta_B = 0$

Deflection$(\Delta_c) = \Delta_{max} = \dfrac{Wl^4}{384\,EI} = \dfrac{1}{5} \times \Delta_{max}$ in S.S beam

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