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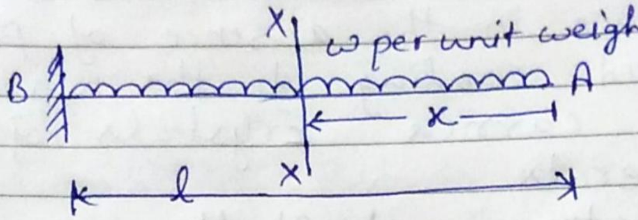
Section-4

Ans-1 Cantilever beam with uniformly distributed load.



(i) Let us consider a beam AB length l carrying uniformly distributed load w per unit length. Take section XX at a distance x from the free end A.

(ii) Moment at XX section,

$$M_x = -wx \frac{x}{2} = -\frac{wx^2}{2} \quad \text{——— } (1)$$

(iii) We know that $M_x = EI \frac{d^2y}{dx^2}$ ——— (2)

(iv) Eq (1) & Eq. (2) both are equal.

$$EI \frac{d^2y}{dx^2} = \frac{wx^2}{2}$$

(v) Integrate the equation,

$$EI \frac{dy}{dx} = -\frac{wx^3}{6} + C_1 \quad \text{——— } (3)$$

(vi) Again integrate $EIy = -\frac{wx^4}{24} + C_1x + C_2$ ——— (4)

(vii) Boundary conditions,
when $x = l,\ y = 0,\ \frac{dy}{dx} = 0$

(viii) So from eq. (3), applying boundary condition.

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$$EI \times 0 = -\frac{\omega l^3}{6} + C_1$$

$$C_1 = \frac{\omega l^3}{6}$$

(ix) Applying boundary condition in eq. (4) after putting the value of C_1, we get

$$EI \times 0 = -\frac{\omega l^4}{24} + \frac{\omega l^3}{6} \times l + C_2$$

$$C_2 = -\frac{\omega l^4}{8}$$

(x) Put the values of C_1 and C_2 in eq. (4)

$$EIy = -\frac{\omega x^4}{24} + \frac{\omega l^3}{6} x - \frac{\omega l^4}{8}$$

This is deflection eq.

(xi) Deflection at free end $(x = 0)$, $y = -\frac{\omega l^4}{8EI}$