Riverside Institute of Technology

Faculty of Engineering

Department of Mechanical Engineering

Assignment 3: Beam Deflection

MECH 301: Mechanics of Materials

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LOGO

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1 Problem Statement

A simply supported beam of length $L = 4\,\text{m}$ carries a uniformly distributed load $w = 12\,\text{kN/m}$ over its entire span. Determine the maximum bending moment and the maximum deflection, given a flexural rigidity $EI = 5.2 \times 10^{6}\,\text{N}\cdot\text{m}^2$.

2 Reaction Forces

By symmetry, each support carries half the total load:

$$R_A = R_B = \frac{wL}{2} = \frac{12 \times 4}{2} = 24\,\text{kN}.$$

3 Maximum Bending Moment

For a simply supported beam under a uniformly distributed load, the maximum bending moment occurs at midspan:

$$M_{\max} = \frac{wL^2}{8} = \frac{12 \times 4^2}{8} = 24\,\text{kN}\cdot\text{m}.$$

4 Maximum Deflection

The maximum deflection of a simply supported beam under a uniformly distributed load also occurs at midspan:

$$\delta_{\max} = \frac{5wL^4}{384\,EI} = \frac{5 \times 12{,}000 \times 4^4}{384 \times 5.2 \times 10^{6}} \approx 0.0154\,\text{m} = 15.4\,\text{mm}.$$

5 Conclusion

The beam experiences a maximum bending moment of $24\,\text{kN}\cdot\text{m}$ and a maximum deflection of approximately $15.4\,\text{mm}$ at midspan. Both values should be checked against the allowable stress and deflection limits specified in the applicable design code before the beam section is finalised.