Civil Engineering Licensure Exam – Mock Exam (Day 38: Beam Deflections and Elastic Stability)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Beam Deflections and Elastic Stability
- Total Questions: 10 (Multiple Choice & Problem-Solving)
- Show complete solutions for problem-solving questions.

Section A: Multiple Choice Questions (MCQs)

Choose the best answer.

1. The deflection of a simply supported beam carrying a concentrated load at midspan is given by:
   (a) $\delta = \frac{PL^3}{48EI}$
   (b) $\delta = \frac{5wL^4}{384EI}$
   (c) $\delta = \frac{wL^4}{8EI}$
   (d) $\delta = \frac{3PL^3}{48EI}$
2. The slope at the free end of a cantilever beam subjected to a concentrated load at the tip is given by:
   (a) $\theta = \frac{PL^2}{2EI}$

(b) $\theta = \frac{wL^3}{6EI}$

(c) $\theta = \frac{PL^3}{3EI}$

(d) $\theta = \frac{5PL^3}{48EI}$

3. The moment-area method is used to determine:

   (a) The deflection of a beam

   (b) The maximum shear stress in a beam

   (c) The bending moment at a point

   (d) The axial load in a column

4. The critical buckling load for a pin-ended column is given by:

   (a) $P_{cr} = \frac{\pi^2 EI}{L^2}$

   (b) $P_{cr} = \frac{\pi EI}{L}$

   (c) $P_{cr} = \frac{EI}{L^2}$

   (d) $P_{cr} = \frac{\pi^2 E}{L^2}$

5. A beam deflects the most at:

   (a) The location of the maximum bending moment

   (b) The location of the maximum shear force

   (c) The supports

   (d) The centroid of the section

Section B: Problem-Solving

1. A simply supported beam of span 6 m carries a point load of 20 kN at midspan. Determine the maximum deflection using the formula $\delta = \frac{PL^3}{48EI}$ where $EI = 50 \times 10^6$ N·m².

2. A cantilever beam of length 3 m carries a uniformly distributed load of 5 kN/m. Determine the maximum deflection using $\delta = \frac{5wL^4}{384EI}$, given that $EI = 40 \times 10^6$ N·m².

3. A column with an effective length of 4 m has a moment of inertia of 8×10^6 mm^4 and a modulus of elasticity of 200 GPa. Determine the critical buckling load.

4. A simply supported beam of span 4 m carries a triangular load varying from zero at one end to 6 kN/m at the other end. Using the moment-area method, determine the approximate deflection at midspan.

5. A steel column is fixed at one end and free at the other. If its effective length is 3 m and it has a radius of gyration of 50 mm, determine the slenderness ratio.