Civil Engineering Licensure Exam – Mock Exam (Day 46: Steel Structures – Beams, Columns, and Connections)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Steel Structures – Beams, Columns, and Connections
- 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 primary function of a steel beam in a structure is to:
   (a) Resist bending and shear forces
   (b) Support axial compression loads
   (c) Prevent lateral buckling of a structure
   (d) Reduce deflection in columns
2. The slenderness ratio of a steel column is defined as:
   (a) The ratio of effective length to the radius of gyration
   (b) The ratio of length to width
   (c) The ratio of moment of inertia to cross-sectional area

(d) The ratio of yield strength to the applied force

3. In bolted steel connections, the failure mode due to excessive tension in the bolts is called:

   (a) Bolt rupture

   (b) Bearing failure

   (c) Shear failure

   (d) Block shear failure

4. The plastic section modulus Z_p is used in steel beam design to determine:

   (a) The plastic moment capacity of the beam

   (b) The elastic stress distribution

   (c) The maximum axial stress

   (d) The shear strength of the connection

5. The lateral-torsional buckling of a steel beam occurs when:

   (a) The compression flange is not laterally braced

   (b) The tension flange is overstressed

   (c) The beam experiences high shear force

   (d) The beam is subjected to concentrated loads

Section B: Problem-Solving

1. A W-section steel beam has a plastic section modulus of 500×10^3 mm^3. If the yield strength of steel is 250 MPa, determine the plastic moment capacity of the beam.

2. A steel column has an effective length of 3.5 m and a radius of gyration of 100 mm. Determine the slenderness ratio.

3. A bolted steel connection consists of four M20 bolts in double shear. If the allowable shear stress of the bolts is 140 MPa, determine the total shear capacity of the connection.

4. A steel beam carries a uniform load of 25 kN/m over a simply supported span of 6 m. Determine the maximum bending moment.

5. A steel column is subjected to an axial load of 800 kN. If the cross-section of the column has an area of 400 cm^2, determine the axial stress in the column.