Civil Engineering Licensure Exam – Mock Exam (Day 47: Plastic Analysis and Composite Construction)

February 24, 2025

Instructions

- Time Limit: 60 Minutes

- Coverage: Plastic Analysis and Composite Construction

- 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 plastic moment capacity of a section is determined using:

   (a) The plastic section modulus
   (b) The elastic section modulus
   (c) The ultimate shear stress
   (d) The buckling strength of the section

2. The shape factor in plastic analysis is defined as:

   (a) The ratio of the plastic moment to the elastic moment
   (b) The ratio of the plastic modulus to the yield stress
   (c) The ratio of the plastic strain to elastic strain

(d) The ratio of the ultimate stress to the yield stress

3. A fully plastic hinge forms in a beam when:

    (a) The entire section reaches yield stress

    (b) The maximum shear stress is exceeded

    (c) The beam fails due to deflection

    (d) The shear force is maximum

4. In a plastic mechanism, the number of plastic hinges required for collapse in a simply supported beam is:

    (a) One

    (b) Two

    (c) Three

    (d) Four

5. Composite construction typically involves:

    (a) A combination of steel and concrete

    (b) Using only reinforced concrete

    (c) The use of timber with concrete

    (d) The use of aluminum and wood together

Section B: Problem-Solving

1. A steel beam has a plastic section modulus of $Z_p = 600 \times 10^3$ mm³. If the yield strength of steel is 250 MPa, determine the plastic moment capacity.

2. A beam with an elastic section modulus of $S = 500 \times 10^3$ mm³ has a shape factor of 1.2. Determine the plastic section modulus.

3. A simply supported beam with a span of 6 m is subjected to a uniform load of 40 kN/m. Determine the collapse load assuming a plastic hinge forms at midspan.

4. A composite steel-concrete beam has an effective width of 500 mm and a depth of 150 mm. Determine the moment of inertia if the concrete modulus of elasticity is 30 GPa and the steel modulus is 200 GPa.

5. A continuous beam has two spans of 5 m each and carries a uniform load of 20 kN/m. Determine the number of plastic hinges required for collapse.