Civil Engineering Licensure Exam – Mock Exam (Day 44: Reinforced Concrete – Beams, Columns, Slabs)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Reinforced Concrete – Beams, Columns, Slabs
- 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. In a singly reinforced concrete beam, reinforcement is provided:

    (a) In the tension zone only
    (b) In the compression zone only
    (c) In both the tension and compression zones
    (d) At the neutral axis

2. The purpose of stirrups in a reinforced concrete beam is to:

    (a) Resist shear forces
    (b) Resist bending moments
    (c) Reduce deflection

(d) Increase compressive strength

3. A short column fails primarily due to:

   (a) Crushing
   (b) Buckling
   (c) Shear failure
   (d) Torsional failure

4. The minimum thickness of a two-way slab is primarily governed by:

   (a) Deflection criteria
   (b) Shear strength
   (c) Column capacity
   (d) Bending moment

5. The balanced reinforcement ratio in an RC beam ensures:

   (a) Simultaneous yielding of steel and crushing of concrete
   (b) Higher steel strength than concrete strength
   (c) Brittle failure of concrete before steel yields
   (d) The beam remains elastic at ultimate load

Section B: Problem-Solving

1. A singly reinforced concrete beam has an effective depth of 500 mm and a width of 300 mm. If the tensile reinforcement consists of three 25 mm diameter bars, determine the area of steel reinforcement.

2. A reinforced concrete beam carries a moment of 120 kN·m. If the section has an effective depth of 450 mm and a width of 300 mm, determine the required tensile reinforcement assuming $f'_c = 25$ MPa and $f_y = 415$ MPa.

3. A reinforced concrete column carries an axial load of 1000 kN. If the column has a cross-section of 400 mm × 400 mm, determine the required area of longitudinal reinforcement assuming a steel ratio of 1.5

4. A two-way slab has a span of 6 m × 4 m and is subjected to a live load of 5 kN/m². Determine the factored moment at the midspan.

5. A short concrete column is designed with a load capacity of 2000 kN. If the concrete strength is $f'_c = 30$ MPa and steel yield strength is $f_y = 420$ MPa, determine the required gross area of the column.