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

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Reinforcement in a singly reinforced beam is provided: **(a) In the tension zone only**
2. The purpose of stirrups in an RC beam: **(a) Resist shear forces**
3. A short column fails due to: **(a) Crushing**
4. Minimum thickness of a two-way slab is governed by: **(a) Deflection criteria**
5. The balanced reinforcement ratio ensures: **(a) Simultaneous yielding of steel and crushing of concrete**

Section B: Problem-Solving Solutions

1. Area of steel reinforcement:

$$A_s = n \times \frac{\pi d^2}{4}$$

$$= 3 \times \frac{\pi (25)^2}{4}$$

$$= 1472 \text{ mm}^2$$

2. Required tensile reinforcement:

$$A_s = \frac{M}{0.87 f_y d}$$

$$= \frac{120 \times 10^6}{0.87 \times 415 \times 450}$$

$$= 722.6 \text{ mm}^2$$

3. Required area of longitudinal reinforcement:

$$A_s = \rho A_g$$

$$= 0.015 \times (400 \times 400)$$

$$= 2400 \text{ mm}^2$$

4. Factored moment for two-way slab:

$$M_u = wL^2/8$$

$$= (5 \times 6^2)/8$$

$$= 22.5 \text{ kN·m}$$

5. Required gross area of short concrete column:

$$P_n = 0.85 f'_c A_g$$

$$2000 = 0.85 \times 30 \times A_g$$

$$A_g = \frac{2000}{0.85 \times 30}$$

$$= 78,431 \text{ mm}^2 \approx 280 \times 280 \text{ mm}$$