Answer Key: Civil Engineering Licensure Exam – Mock Quiz (Day 48: Concrete and Steel Structures)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. The primary function of reinforcement in concrete: **(a) Resist tensile forces**
2. The effective depth of a beam is measured from: **(a) The top fiber to the centroid of reinforcement**
3. Lateral-torsional buckling is prevented by: **(a) Providing lateral bracing**
4. The typical yield strength of structural steel: **(a) 250 MPa**
5. Shear reinforcement in reinforced concrete beams: **(a) Stirrups**

Section B: Problem-Solving Solutions

1. Total area of steel reinforcement:

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

$$= 3 \times \frac{\pi (20)^2}{4}$$

$$= 942 \text{ mm}^2$$

2. Maximum bending moment for simply supported beam:

$$M_{\max} = \frac{wL^2}{8}$$

$$= \frac{30 \times 8^2}{8}$$

$$= 240 \text{ kN·m}$$

3. Effective length of steel column:

$$\lambda = \frac{L_{\text{eff}}}{r}$$

$$50 = \frac{L_{\text{eff}}}{100}$$

$$L_{\text{eff}} = 5000 \text{ mm} = 5.0 \text{ m}$$

4. Axial stress in the concrete column:

$$\sigma = \frac{P}{A}$$

$$= \frac{1200 \times 10^3}{400 \times 10^4}$$

$$= 30 \text{ MPa}$$

5. Required stirrup spacing:

$$S = \frac{A_v f_y d}{V_u}$$

$$= \frac{\pi(12)^2/4 \times 415 \times 500}{100 \times 10^3}$$

$$= 165 \text{ mm}$$