Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 41: Problem-Solving on Stress-Strain Relationships)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Young's modulus is: **(a) The ratio of stress to strain in the elastic region**
2. Poisson's ratio is: **(a) Lateral strain to axial strain**
3. A ductile material exhibits: **(a) Significant plastic deformation before failure**
4. Hooke's law states: **(a) Stress is proportional to strain within the elastic limit**
5. Ultimate tensile strength (UTS) is: **(a) The maximum stress a material can withstand before breaking**

Section B: Problem-Solving Solutions

1. Normal stress in the steel rod:

$$\sigma = \frac{F}{A} = \frac{60,000}{150 \times 10^{-6}}$$
$$= 400 \text{ MPa}$$

2. Strain in the cylindrical bar:

$$\varepsilon = \frac{\Delta L}{L} = \frac{1.2 \times 10^{-3}}{1.5}$$
$$= 8 \times 10^{-4}$$

3. Axial strain in the concrete column:

$$\varepsilon = \frac{\sigma}{E} = \frac{20 \times 10^{6}}{25 \times 10^{9}}$$
$$= 8 \times 10^{-4}$$

4. Poisson's ratio:

$$\nu = \frac{\text{lateral strain}}{\text{axial strain}} = \frac{3 \times 10^{-4}}{1.5 \times 10^{-3}}$$
$$= 0.2$$

5. Ultimate tensile strength (UTS):

$$UTS = \frac{F}{A} = \frac{80,000}{250 \times 10^{-6}}$$
$$= 320 \text{ MPa}$$