Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 15: Fluid Mechanics – Properties, Static Forces, and Pressure)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Unit of dynamic viscosity: **(a) Pascal-second (Pa·s)**

2. Specific weight of water: **(a) 9.81 kN/m³**

3. Pascal's Law explains: **(a) Pressure intensity is equal in all directions**

4. Absolute pressure at 5 m depth:

$$P = P_{\text{atm}} + \rho g h$$

$$= 101.3 + (1000 \times 9.81 \times 5)/1000$$

$$= 101.3 + 49.05 = 150.35 \text{ kPa}$$

   (d) 150.35 kPa

5. The center of pressure is: **(b) Below the centroid of the surface**

Section B: Problem-Solving Solutions

1. Hydrostatic force on tank bottom:

$$F = \rho g h A$$

$$= (1000 \times 9.81 \times 3) \times (\pi \times 1.2^2)$$

$$= 353,431.68 \text{ N} = 353.43 \text{ kN}$$

2. Hydrostatic force on vertical plate:

$$F = \rho g h_c A$$

$$h_c = \frac{2 + (2 + 1.5)}{2} = 3.25 \text{ m}$$

$$A = 1.5 \times 2.5 = 3.75 \text{ m}^2$$

$$F = (1000 \times 9.81 \times 3.25) \times 3.75$$

$$= 119.7 \text{ kN}$$

3. Pressure difference using a manometer:

$$\Delta P = \gamma h$$

$$= (13.6 \times 9.81 \times 1000) \times 0.25$$

$$= 33.34 \text{ kPa}$$

4. Gauge pressure in pipeline:

$$P_{\text{gauge}} = P_{\text{absolute}} - P_{\text{atm}}$$

$$= 250 - 101.3 = 148.7 \text{ kPa}$$

5. Center of pressure of a submerged rectangular gate:

$$y_{\text{cp}} = \frac{h + h + H}{3}$$

$$= \frac{0 + 4}{3} = \frac{4}{3} = 1.33 \text{ m below centroid}$$

Final depth from surface $= 2 + 1.33 = 3.33$ m