Solutions to Civil Engineering Licensure Exam – Fluid Mechanics

February 24, 2025

March 2, 2025

1 Multiple Choice Questions (MCQs)

1. **The unit of dynamic viscosity in SI units is:**

   Solution: The SI unit of dynamic viscosity is Pascal-second (Pa·s).

   Video Explanation: Fluid Properties: Viscosity

2. **The specific weight of water at standard conditions is approximately:**

   Solution: The specific weight of water at standard conditions is approximately 9.81 kN/m^3.

   Video Explanation: Civil Engineers Board Exam Reviewer: Fluid Properties

3. **Pressure intensity at a point in a fluid at rest is the same in all directions due to:**

   Solution: This phenomenon is explained by Pascal's Law.

   Video Explanation: Principles of Hydrostatics — Fluid Mechanics

4. **The absolute pressure at a depth of 5 m in water (density = 1000 kg/m^3) is approximately:**

   Solution: The absolute pressure at this depth is approximately 150.35 kPa.

   Video Explanation: Hydrostatic Pressure Calculation Example

5. **The center of pressure of a submerged plane surface is always:**

   Solution: The center of pressure is always below the centroid of the surface.

   Video Explanation: Solved Fluid Mechanics Problem: Hydrostatic Forces on a Gate

2 Problem-Solving

1. **A cylindrical tank with a radius of 1.2 m is filled with water to a height of 3 m. Determine the total hydrostatic force acting on the bottom of the tank.**

   Solution:

   $$F = \rho g h A = (1000)(9.81)(3)(\pi \times (1.2)^2) \tag{1}$$

   $$F \approx 133.4 \text{ kN}$$

   Video Explanation: Fluid Mechanics 3.4 - Solved Example Problem

2. **A plate of 1.5 m $\times$ 2.5 m is submerged vertically in water with its top edge at 2 m below the surface. Determine the total hydrostatic force acting on the plate.**

   Solution:

   $$F = \rho g \bar{h} A = (1000)(9.81)(3.25)(1.5 \times 2.5) \tag{2}$$

   $$F \approx 119.9 \text{ kN}$$

   Video Explanation: Example of Calculating Hydrostatic Pressure Forces

3. **A U-tube manometer contains mercury (specific gravity = 13.6) and is used to measure the pressure difference between two points. If the height difference between the mercury columns is 0.25 m, determine the pressure difference.**

   Solution:

   $$\Delta P = \rho_{Hg} g \Delta h = (13600)(9.81)(0.25) \tag{3}$$

   $$\Delta P \approx 33.4 \text{ kPa}$$

   Video Explanation: Solved Problem: Pressure Difference in a Manometer

4. **A pipeline carries oil (specific gravity = 0.85). If the absolute pressure at a section of the pipe is 250 kPa, determine the gauge pressure.**

   Solution:

   $$P_{gauge} = P_{absolute} - P_{atm} = 250 - 101.3 \tag{4}$$

   $$P_{gauge} \approx 148.7 \text{ kPa}$$

   Video Explanation: Gauge and Absolute Pressure Calculation