CLL231: Minor-I

Total morks:25 **Duration: 1hr: 10 min**

Each question has marks assigned (B) for derivation and for the numerical answer (I).

1) A manometer containing oil is attached to a tank filled with air (Figure 1). If the oil-level difference between the two columns is 1.5m and the atmospheric pressure is 101 kPa, determine the (a) **Gauge** and (b) **Absolute** pressure of the air in the tank.

Marks: 1+1

2) The pressure difference between an oil pipe and water pipe is measured by a double-fluid manometer, as shown in figure 2. For the given fluid heights and density, calculate the pressure difference $\Delta P = P_B - P_A$.

*Marks: **1**+1*

3) A steady, two-dimensional (in the xy-plane) velocity field is given by

$$\vec{V} = (0.523 - 1.88x + 3.94y)e_i + (-2.44 + 1.26x + 1.88y)e_j$$

   a) Verify that this flow is **incompressible** in nature.
   b) Calculate the **acceleration** at the point (x, y) → (4,1)

*Marks: **1**+(**1**+1)*

4) The velocity in a flow field is given by

$$\vec{V} = (4x)e_i + (5y + 3)e_j + (3t^2)e_k$$

a) Determine the equation of the **Streamline** that passes through the origin.
b) Determine **Pathline** of a particle at a location (x,y,z)→(1,1,3) at time (t=1) sec?

*Marks: (**1**+1) + (**1.5**+1.5)*

5) The flow of water from a reservoir is controlled by a 1.5 m wide L-shaped gate hinged at point A, as shown in Fig. 3. If it is desired that the gate open when the water height is 3.5m, determine the mass of the required weight W.

*Marks: **2.5**+2.0*

6) Consider a large cubic ice block floating in seawater. The specific gravities of seawater and ice are 1.04 and 0.85, respectively. If a 30 cm high portion of the ice block extends above the surface of the water, determine the height of the ice block below the surface.

*Marks: **2.0**+1.5*

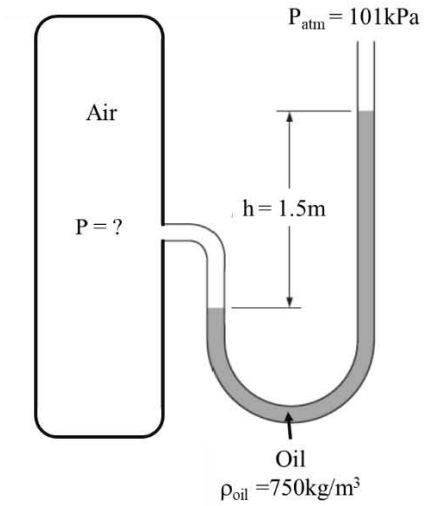
7) A 1.0 m diameter cylindrical mass, W, is connected to a 2 m wide rectangular gate as shown in Fig. 4. The gate is to open when the water level, ***L***, drops below 2.5 m. Determine the required value for W. Neglect friction at the gate hinge and the pulley.

*Marks: **3.0**+2.0*

Constants:

Density of water :1000 Kg/m^3

g = 9.81 m/s^2



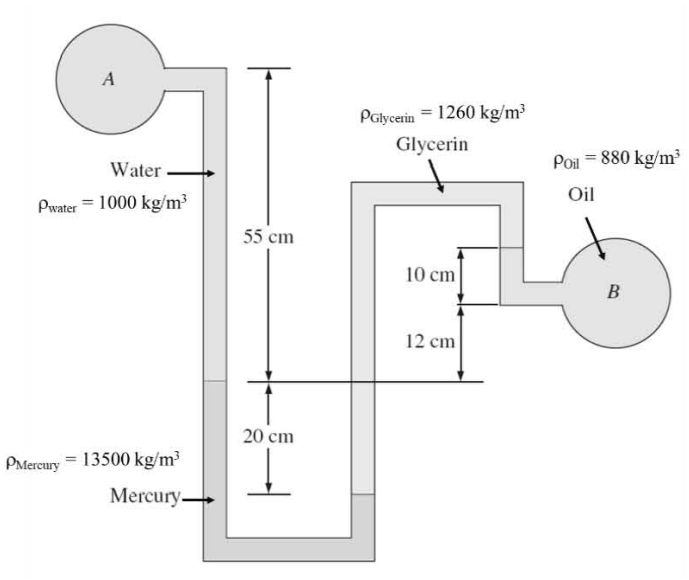


Figure 1 **Figure 2**

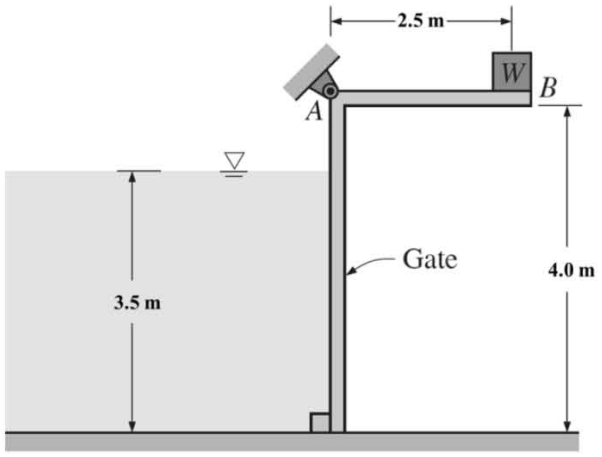


Figure 3

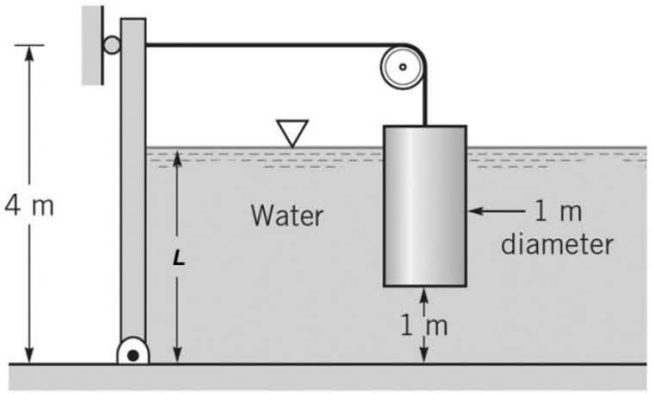


Figure 4