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Section B

Subject Fluid mechanics

Exam Mid term

Department Civil

Semister 4th

Question No 1

Part (a)

Viscosity :-

Viscosity is the properties of fluid which opposses the relative motion between the two surface of the fluid.

Different fluid have different viscosity depend upon the intermolecular force in fluid

Example :-

Honey has great viscosity than water

Unit :-

The unit of viscosity is Paise

2)

Newton equation of viscosity:-

It state that

"The shear stress in a flowing fluid is directly proportional to the rate of shear strain.

Mathematically:-

$$\tau \propto \frac{du}{dy}$$

$\tau \rightarrow$ Shear stress

$$\tau \propto \frac{du}{dy}$$

change the sign of Proportion-ality

3)

$$\tau = \mu \frac{du}{dy}$$

μ = viscosity (Dynamic viscosity)

$$\mu = \tau \frac{dy}{du}$$

⇒ The fluid which follows "Newton's law of viscosity" are called "Newton fluid"

4)

Part (B) in Question (1)

Density:

=> Density of fluid is its mass per unit volume of fluid

It is denoted by "ρ"

unit:

kg/m^3 => $\boxed{\rho = m/V}$

Specific weight:

=> It is a weight per unit volume of fluid

It is represented by $\gamma = w/V$

unit:

$\gamma = N/m^3$

Specific volume:

It is the volume occupied by unit mass of fluid

$$V_s = \frac{V}{m} = \frac{1}{\rho}$$

Relation b/w density and Specific weight

As $\gamma = \frac{W}{V} \rightarrow (a)$

we know that $W = mg$

$$\gamma = \frac{mg}{V} \rightarrow (b)$$

$$\rho = \frac{m}{V} \rightarrow \text{Put in } (b)$$

$$\gamma = \rho g \Rightarrow \boxed{\rho = \frac{\gamma}{g}}$$

(6) Part © in Question (1)

Given data:

Specific volume of gas $v = 0.72\ m^3/kg$

Required data:

Specific weight in $N/m^3 = ?$

Sol:

As we know that

$$v = \frac{1}{\rho}$$

So density "ρ" $= \frac{1}{v}$

$$\rho = \frac{1}{0.72} \Rightarrow \boxed{1.389\ kg/m^3}$$

Specific weight "w"

$$\gamma = \rho \times g$$

$$\gamma = 1.389 \times 9.81$$

$$\boxed{\gamma = 13.62\ N/m^3}$$

(7)

(a) Ans ...

Question NO = 2

Part (a)

Pressure::

=> It is defined as the average of any three mutually perpendicular normall compressive stress at a point i.e

$$P = \frac{P_x + P_y + P_z}{3}$$

In a frictionless fluid, no shear stresses can occurs that point for any motion of the fluid. and also at that point the pressure is the same in all direction

unit Pascal => 1Pa = 1N/m²

Diagram

Absolute and gage Pressure:

If Pressure is measured to obsolute Zero. it is called obsolute Pressure.

When it is measured relative to atmospheric Pressure as base it is called gause Pressure

Absolute Pressure uses obsolute Zero as its Zero Point, while gause Pressure uses atmospheric Pressure as its Zero Point.

If Pressure is bElow atmospheric it is designed as vaccum

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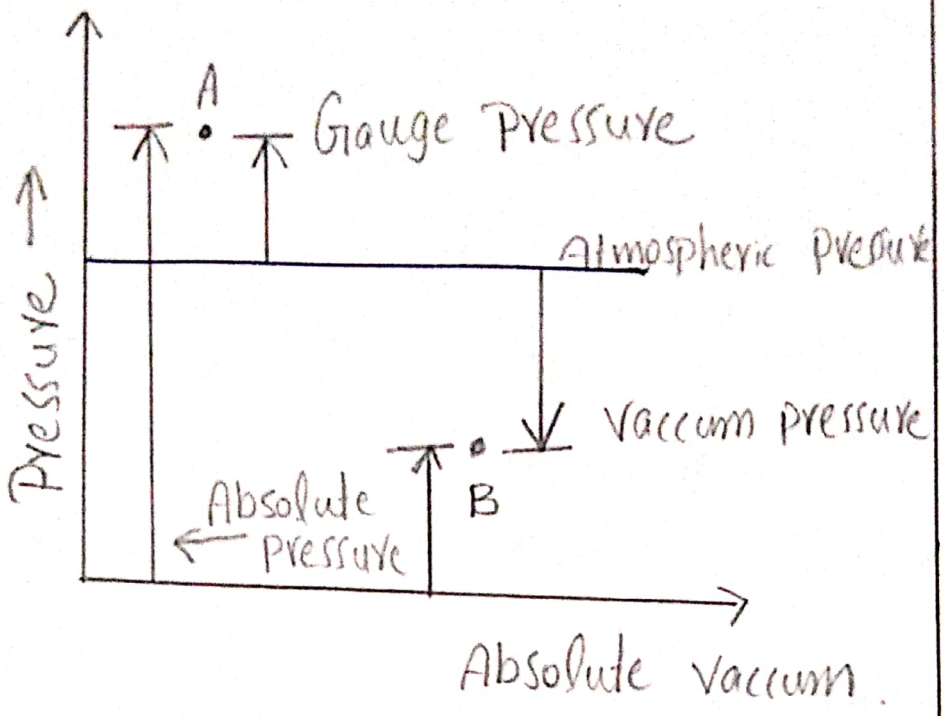
Diagram



$$P_{abs} = P_{atm} + P_{gauge}$$

(10)

Question No # 2

Part (b)

Given data

Lenth = 1500mm = 1.5m

Breadth = 1500 mm = 1.5 m

Depth = 7933mm = 7.933 m

unit wt of water = $9.81 KN/m^3$

Required data:

⇒ a = net Pressure, P = ?

⇒ b = Location of Force

⇒ c = If water level drop half of depth. Find P and location of Force

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Sol:

1) Net Pressure

$$P = \gamma h$$

$$P = 9.81 \times 7.933$$

$$\boxed{P = 77.822\ kN/m^2}$$

2) Force Application (centroid)

$$\bar{y} = \frac{h}{3}$$

$$\bar{y} = \frac{7.933}{3}$$

$$\boxed{\bar{y} = 2.644\ m}$$

3) Half depth :

Pressure at half depth, p'

$$p' = \gamma \frac{h}{2}$$

$$p' = 9.81 \times \frac{7.933}{2}$$

$$\boxed{p' = 38.911 \text{ kN/m}^2}$$

Centroid

$$\bar{y}' = \frac{h}{2} \times \frac{1}{3}$$

$$\bar{y}' = \frac{7.933}{2} \times \frac{1}{3}$$

$$\boxed{\bar{y}' = 1.321 \text{ m}}$$