Question No 1

Q:- Define Viscosity? Derive newton equation of viscosity.

Viscosity:-

Viscosity is the property of fluid which opposses the relative motion between the two surfaces of the fluid. Different fluid have different viscosity depends upon the intermolecular force in fluid.

Example:-

Honey has great viscosity than water → (H_2O)

Newton Equation OF Viscosity:-

It states that.

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

Mathmatically:-

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

$\tau \rightarrow$ shear stress.

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

Change the sign of propotionality

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

μ = Viscosity (Dynamic Viscosity)

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★ The fluid which follows "Newton's law of Viscosity" are called "Newtonian fluid"

Part B.

b- Define density, specific weight and specific volume. Show relation between Density and specific weight.

Density :-

→ Property of fluid.

Density can be define as "mass per unit volume of a fluid."

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\rho = \frac{m}{V} = \frac{Kg}{m^3}$$

Specific Weight :-

"Specific weight is the weight possessed by unit volume of a fluid."

Denoted by 'w"

$$w = \frac{\text{weight}}{\text{Volume}}$$

$$w = \frac{N}{m^3}$$

Relation Between Density & Specific Weight

As $w = \frac{W}{V}$

we know that $W = mg$.

$$w = \frac{mg}{V}$$

$$\boxed{w = \rho g}$$

$\therefore \rho = \frac{m}{V}$

$\rho \rightarrow$ density

Specific Volume

→ property of fluid.

Specific volume is the volume of a fluid (V) occupied per unit mass (m).

→ It is the reciprocal of density

Specific Volume $V = \frac{V}{m}$

$$V = \frac{m^3}{kg}$$

$$\boxed{V = \frac{1}{\rho}}$$

Part C

C:- If Specific Volume of gas is $0.72 m^3/kg$. What is specific weight in N/m^3?

Given Data:-

Specific Volume of gas $V = 0.72 m^3/kg$.

Required Data:-

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

Solution:-

As we know that.

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

So density "ρ" $= \frac{1}{V}$

$$\rho = \frac{1}{0.72}$$

$$\boxed{\rho = 1.389 \ kg/m^3}$$

Specific weight "w" $= \rho \times g$.

$$w = 1.389 \times 9.8$$

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

Question No 2:-

(a) Define Pressure? What is absolute and gauge pressure?

Pressure:-

Definition:-

Pressure is defined as;

"The force applied perpendicular to the surface of an object per unit area over which that force is distributed.

Unit:-

The SI unit of pressure is "Pascal (Pa)".

Gauge Pressure:-

Definition:-

Gauge Pressure is the pressure relative to atmospheric pressure. Gauge Pressure is positive for pressures above atmospheric pressure and negative for pressures below it.

Mathematically:-

Total pressure or absolute pressure is thus the sum of gauge pressure and atmospheric pressure.

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

where

P_{abs} = Absolute pressure.

P_g = Gauge Pressure.

P_{atm} = Atmospheric pressure.

Absolute Pressure:-

Definition:-

It is the total pressure at a point in a fluid equalling the sum of gauge pressure and the atmospheric pressure.

Mathematically:-

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

- P_{abs} → Absolute Pressure.
- P_g → Gauge Pressure.
- P_{atm} → atmospheric pressure.

Example:-

For example,

If your tire gauge reads 39 psi (pounds per square inch) then the absolute pressure is 39psi plus 14.7 psi (P_{atm} in psi) or 53.7 psi (equivalent to 337 kPa).

Question No 21:-

Part b

Given Data:-

Length = 1500 mm = 1.5 m.

Breadth = 1500 mm = 1.5 m.

Depth = 7.926.

unit wt of water = 981 KN/m³

Required Data:-

a = net pressure, P = ?

b = Location of force.

C = If water level drops half of depth. find P and location of force.

Solution:-

1:- Net Pressure:-

$P = \gamma h$.

$P = 9.81 \times 7.926$.

$\boxed{P = 77.75406}$.

2:- Force Application (centroid):-

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

$\bar{y} = \frac{7.926}{3}$

$\boxed{\bar{y} = 2.642 \text{ m}}$

Half Depth:-

Pressure at half depth, P'.

$$P' = \gamma \frac{h}{2}.$$

$$P' = 9.81 \times \frac{7.926}{2}$$

$$\boxed{P' = 38.877 \frac{KN}{m^3}}$$

Centroid

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

$$\bar{y}^{-1} = \frac{7.926}{2} \times \frac{1}{3}.$$

$$\boxed{\bar{y}^{-1} = 1.321\ m}$$