(1)

NAME = SULEMAN HAKEEM

I.D = 16757

SUBJECT = FLUID MECHANICS

Q No 1)

a) Define Viscosity? Derive newton eq of Viscosity?

ANSWER :-

VISCOSITY :-

Viscosity is the quantity that describes a fluid's resistance to flow.

OR

Viscosity is resistance of a fluid (liquid or gas) to a change in shape, or movement of neighbouring portions relative to one another. Viscosity denotes opposition to flow.

UNIT :-

Unit is

$dyne \cdot S/cm^2$

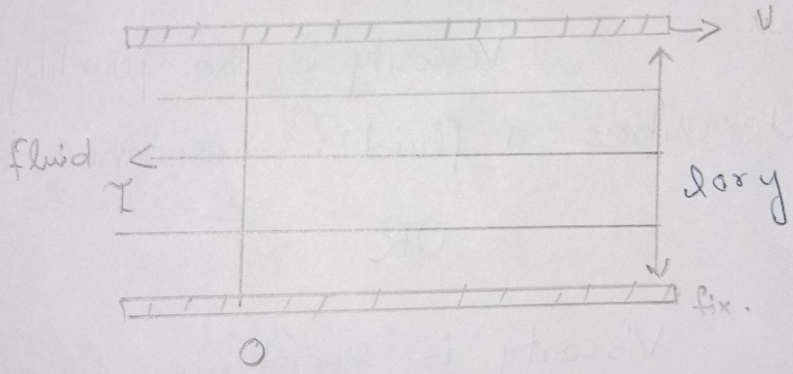
(2) NEWTON'S EQ OF VISCOSITY :-

According to this law

Shear stress $\tau = \mu \frac{dv}{dy}$.

where μ is proportionality factor, called the viscosity of fluid and dv/dy is velocity gradient.

Derivation :—



$\tau \propto$ velocity gradient

$\tau \propto \frac{v - 0}{l}$

$\tau = \mu \frac{v}{l}$

$\tau = \mu \frac{dv}{dl}$

OR

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

Q1) b) **DENSITY :-**

Density of fluid is its mass per unit volume of fluid.

UNIT :-

Denoted by ρ

Unit is Kg/m^3.

*) **SPECIFIC WEIGHT :-**

It is weight per unit volume of fluid.

UNIT :-

Unit is N/m^3

denoted by γ.

*) **SPECIFIC VOLUME :-**

It is volume occupied by unit mass of fluid.

UNIT :-

m^3/Kg.

Relation between Density and Specific weight :-

As we know that

$$\gamma = \frac{w}{V} \quad \therefore \text{where } w = mg$$

Thus

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

As wel have

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

Thus

$$\gamma = \rho \times g \quad \text{or}$$

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

C) If speeific volume of gas is $0.72\ m^3/kg$. What is specfic weight in N/m^3?

Solution :-

Given =

specific volume = $0.72\ m^3/kg$.

To find :-

specific weight = ?

Solution :-

As we know that

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

$$\gamma = \frac{w}{v} \quad \text{where } w = mg$$

Thus $\gamma = \frac{m}{v} \times g \qquad \therefore \rho = \frac{m}{v}$

$$\gamma = \rho \times g \rightarrow (*)$$

Now $U = 0.72\ m^3/kg$

As lo knowthat

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

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

putting valus $\rightarrow (*)$

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

as value $g = 9.8\ m/s^2$

$$\gamma = \frac{1}{0.72\ m^3/kg} \times 9.8\ m/s^2$$

$$\gamma = \frac{9.8\ m/s^2}{0.72} = \frac{9.8\ m \times kg}{0.72\ m^3 \times s^2}$$

$$= \frac{9.8\ N}{0.72\ m^3} \qquad \boxed{= 13.611\ N/m^3}$$

Question = 2. (6)

a) Pressure:-

The force applied perpendicular to the Surface of an abject per unit area over which that force is distributed.

UNIT:-

SI Base unit $1N/m^2$ $1kg/(m.s^2)$

SI Unit Pascal

Formula:-

$P = F/A$.

ABSOLUTE PRESSURE:-

Absolute pressure that is relative to the zero pressure in the empty air-free space to the universe. This refrence pressure is the ideal or absolute vacum it is denoted with the Subscript "abs".

GAUGE PRESSURE :-

The gauge pressure is defined as the difference between an absolute pressure and the prevailing atmospheric pressure. it is denoted with Subscript "e" Pe and it is calculated as follows.

Formula =

$$Pe = Pabs - Pamb.$$

Question = 2

PART = B.

GIVEN DATA :-

Dimension of water tank = 1500mm x 1500mm.

$\frac{1500}{1000} = 1.5m.$

d = 16757 = 16.757 m

To Find :-

→ Net pressure = ?

→ location of force = ?

→ Half Depth = ?

Solution:-

$P = \gamma h$

$\gamma_{water} = 9.81\ KN/m^3$

$P = 9.81 \times 16.757$

$= 164.39\ KN/m^2$

Thus force acting on walls

$F = P \times A \rightarrow (i)$

Area of wall on which forces is acting =

1.5×16.757

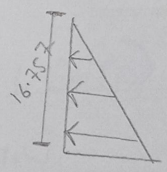
$= 25.14 m^2$.

Putin $\rightarrow (i)$

$F = 164.39 \times 25.14$

$= 4132.76 KN$.

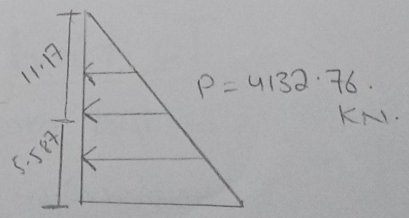
And as the pressure increases downwords the center of force is given by;



$\Rightarrow \bar{x} = \frac{2}{3} h$ (from to surface)

$= \frac{2}{3} \times 16.757 = 11.17m$

or $16.757 - 11.17 = 5.587m$ from bottom.



If water level drops to half

★ $F = \gamma h A = 9.81 \times \frac{16.757}{2} \times \left(1.5 \times \frac{16.757}{2}\right)$

$= 1032.98 KN.$

And $\bar{x} = \frac{h}{3} = \frac{16.757/2}{3}$

$= 2.79m$