Name :- Ibrar Ahmad.

ID No. :- 7914

Section :- 'A'

Subject :- Fluid Mechanics

Instructor :- Abdul Waheed

Submission date :- 23/04/2020.

Question No. 01 (a)

Define viscosity? derive Newton equation of viscosity.

Ans

Viscosity:-

Viscosity is a term which shows that how easily a fluid can flow.

Def: It is the property of a fluid which resists relative motions of its ~~layers~~ adjacent layers.

This resistance is due to the cohesion and molecular momentum exchanged between fluid layers.

Its unit is 'paise'.

→

Newton equation of Viscosity:

This states that,

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

mathematically;

$$\tau \propto \frac{du}{dy} \quad (\tau = \text{shear stress})$$

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

where 'μ' is the viscosity

and $\Rightarrow$

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

$\frac{du}{dy}$ = Rate of shear deformation.

Q: No. 02 (b)

Define density, Specific Volume, Specific weight?.

Ans

- **Density:**

It is defined as "the mass per unit volume of a fluid."

OR

"the ratio of mass to the volume of fluid."

mathematically; $\rho = \frac{m}{V} = \frac{kg}{m^3}$

m = mass

V = Volume.

ρ = density.

Its unit is kg/m^3

- **Specific volume:-**

It is defined as "the volume per unit mass of a fluid."

OR

"the ratio of volume to the mass of fluid."

mathematically;

$$\text{Specific vol.} = \frac{V}{m} = \frac{1}{\rho} = \frac{1}{\text{density}}.$$

its unit is m^3/kg.

- **Specific weight:-**

"It is defined as "The weight of a fluid ~~to its volume~~ per unit its volume." OR

'The ratio of weight to volume of fluid."

→

mathematically;

$$w = \frac{mg}{V} = \rho g \qquad \left(\because \frac{m}{V} = \rho\right)$$

Its unit is N/m^3.

Q No. 01 (C)

If Specific volume of gas is $0.72\ m^3/kg$, what is its specific weight in N/m^3.

Sol:-

~~As we know;~~

Given:

Specific vol. $= 0.72\ m^3/kg$

Specific wt. $= ?$

As we know $V = \frac{1}{\rho}$

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

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

$$\Rightarrow \rho = 1.38\ kg/m^3$$

Now As $w = \rho g$

$$\Rightarrow w = 1.38 \times 9.81$$

$$\Rightarrow \boxed{w = 13.54\ N/m^3}$$

Question No.02 (a) (7)

Define pressure? what is absolute and guage pressure.

Ans:- Pressure:-

The force applied perpindicularly on the surface of an object per unit area.

Its S.I unit is "pascal".

mathematically; $P = F/A$

Guage pressure:

It is the pressure taken relative to atmospheric pressure.

It is taken as positive for pressure above atmospheric pressure and negative for pressure below atmospheric pressure.

Absolute pressure:-

The total pressure at a point in a fluid. It is the sum of the guage pressure and atmospheric pressure. →

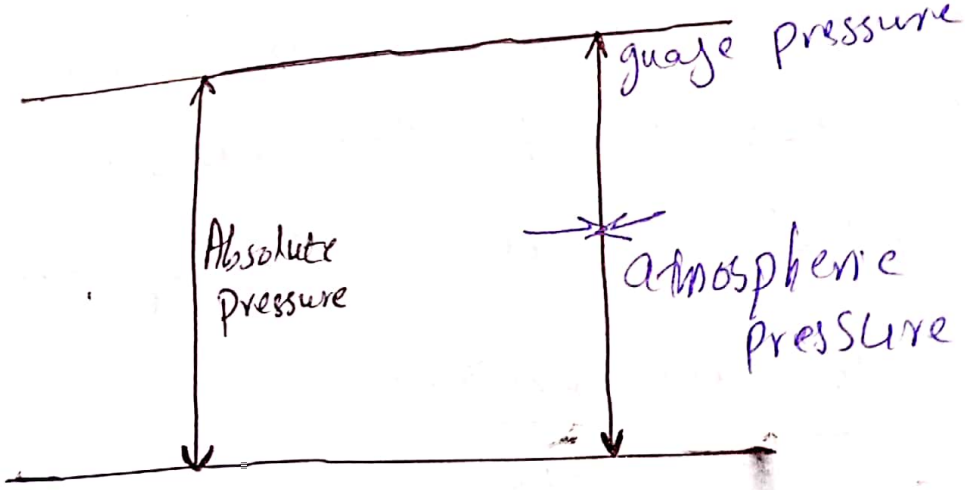
mathematically;

$$P_{abs} = P_g + P_{atmo.}$$

Question No. (02) (6)

A water tank having dimensions of 1500mm x 1500mm. Depth of water is equal to your student ID number in mm. What is the net pressure on the wall of the Container.

find the location of force application?. If water tank level drops to half of the depth, What will be force and point of application of force.



(9)

Sol:- Given $l = 1.5m$ (1500mmx5000mm)

Breadth = 1.5m

Depth = My ID = 7914mm $\Rightarrow$ 7.914m

Unit weight of Water = 9.8 kN/m³

Req:-

→ Net pressure = ?

→ location of force = ?

→ if water level drops to half of depth find p and location of force.

Soi

Soi Net pressure; $p = \gamma h$

$p = 9.81 \times 7.914$

$p = 77.5572 \text{ kN/m}^2$

Force application.

$$\bar{y} = \frac{h}{3} = \frac{7.914}{3}$$

$$\bar{y} = 23.742 \text{ m}$$

~~half depth;~~

~~Pressure~~ →

Half depth

Pressure at half depth $= p' = \frac{\gamma h}{2}$

$\Rightarrow p' = \frac{9.8 \times 7.914}{2}$

$\Rightarrow \boxed{p' = 38.8181 \text{ kN/m}^2}$

centroid at half-depth;

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

$\bar{y} = \frac{h}{6}$

$\bar{y} = \frac{7.914}{6}$

$\boxed{\bar{y} = 1.319 \text{ m}}$

##

THE END