Fluid Mechanics

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Sec :- A

Paper :- Fluid Mechanics.

QNo 1

* Part – a *.

Ans:- 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.

e.g Honey has great viscosity than water.

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 proportionality

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

μ = viscosity (Dynamic viscosity).

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

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

* part - b →

- **Density :-**

→ Property of fluid.

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

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

$\rho = \frac{m}{V} = kg/m^3$.

- **Specific Weight :-**

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

Denoted by 'w'.

$w = \frac{\text{Weight}}{\text{Volume}} = N/m^3$

Relation between Density & Specific Weight.

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

We know that $W = mg$

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

$\boxed{w = \rho g}$ $\because \rho = \frac{m}{V}$

$\rho \rightarrow$ 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 volum $V = \frac{V}{m} = \frac{m^3}{kg}$.

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

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* **part – c**

Given data

Specific volume of gas 'V' = 0.72

Required data :-

Specific weight in N/m^3 = ?

Solution :- As we know that

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

So density "ρ" $= \frac{1}{V}$

$= \frac{1}{0.72} \Rightarrow$ 1.389 kg/m

Specific weight "W" $= \rho \times g$

$= 1.389 \times 9.8$

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

Question No 2

(5)

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

Pressure:

Definition:

Pressure is defined as;

"The force applied perpendicular as 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 atmesphesic Pressure. Gauge Pressure is positive for pressures above atmospheric pressure and negative for pressures below it.

Mathematically:

Total Pressure ~~and~~ 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} = Atmosphesic Pressure.

ABsalute Pressure:

Definition:

It is the total pressure at a Point in a fluid equalling the sum of gauge Pressure and the atmosphesic Poessure.

Mathematically:

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

P_{abs} → Absolute pressure

P_g → Gauge Pressure

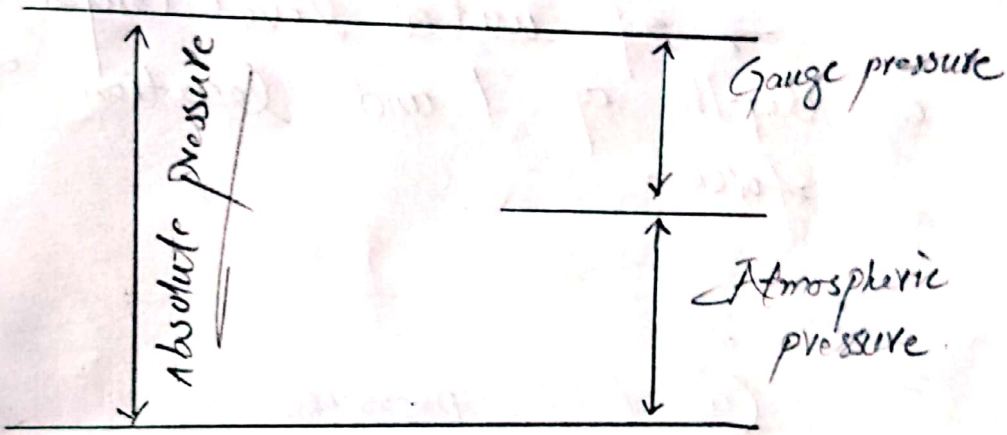
P_{atm} → atmosphesic Pressure

Example :-

for example,

If your tire gauge reads 39 Psi (Painds Per Squase inch) them the absolute Pressure is 39 Psi plus 14.7 Psi (Patm in Psi) or 53.7 Psi (equivalent to 337 KPa)

Diagram



(b) A water tank having dimension of 150cm x 150cmm. Depth of water in tank is equal to your student ID number in mm - What is the net Pressure on the wall of water tanks. Find the location of force application.?. If the water take level drop to the half the depth, what will be the force and point of application of force —?.

Given data :-

Length, l = 1500mm = 1.5m

Breadth, b = 1500 = 1.5m

And Depth which is my ID number

So d = 7899mm = 7.899m

Unit weight of water = $9.81 kN/m^3$

Required data :-

→ Net pressure "P" = ?

→ Location of force = ?

→ If water level drops half of depth of P and location of force.

Solution :-

(a) Net pressure

As we know that

$$P = \gamma h$$

as $\gamma = 9.81$, $h = 7.899$

$$P = 9.81 \times 7.899$$

$$\Rightarrow 77.498 \ kN/m^2$$

(b) Force Application Centroid :

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

$$\bar{y} = \frac{7.899}{3}$$

$$\boxed{\bar{y} = 2.633 m}$$

(c) Half depth :

pressure at half depth, $P' = \gamma h/2$

$$P' = 9.81 \times \frac{7.899}{2}$$

$$\boxed{P' = 38.7445 kN/m^2}$$

Centroid, $\bar{y} = h/2 \times 1/3$

$$\bar{y} = \frac{7.899}{2} \times \frac{1}{3}$$

$$\boxed{\bar{y} = 1.3165 m}$$