SUBJECT = FLUID MECHANICS

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SECTION: A

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PAPER SOLVED.

THANKS 4-

Q.No 1:-

a) Define viscosity derive newton equation for viscosity.

Ans:- Viscosity:- viscosity is the property of fluid which opposes the relative motion b/w the two surfaces of the fluid. Different fluid have different viscosity depends upon the intermolecular forces in fluid.

eg:- Honey has great viscosity than water.

Newton equation of viscosity.

States That:- Shear stress in a fluid is directly to shear strain.

Mathematically..

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

$\tau \rightarrow$ shear stress.

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

Change the sign

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

$\mu =$ viscosity (dynamic viscosity)

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

Newtons law of viscosity also called Newtons fluids..

* Part-b ⇒

⇒ **Density** :- Define as "Mass per unit volume" known as density.

$$\text{Density} = \frac{\text{Mass}}{\text{volume}}.$$

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

unit : $\frac{kg}{m^3}$

* **Specific weight** :- Also known as unit weight. is the weight per unit volume of material. Specific weight of water on earth at 4c°. which is 9.807 kn/m³ or 62.43 lbf/ft³. Also used for relative density.

Denoted by w.

$$w = \frac{\text{weigth}}{\text{volume}} = N/m^3$$

Relationship b/w Density & Specific weight.

Density is simply mass per unit volume of a body where Specific weight per unit volume of a body.

e.g :- A body will have same density in moon but will have different specific weight.

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

We know that. $w = mg$.

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

As we know that.

$$w = \rho g.$$

$$\rho = \frac{m}{V}. \quad \rho = \text{Known as density.}$$

* **Specific volume:-** Reciprocal of density.

Stated as → volume of a fluid occupied per unit mass.

"$v = \frac{V}{m}$."

$V = m^3$

$m = kg.$

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

$$\left(v = \frac{1}{\rho}\right)$$

* Part. C. Numericals.

Given data:- $V = 0.72\ m^3/kg$.

Required data:- Specific weight in $N/m^3 = ?$

Solution:- As we know that

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

So density $\rho = \frac{1}{V}$.

putt the given the data.

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

As we know that.

Specific weight "W" $= \rho \times g$. $g = (9.8)$

$= 1.389 \times 9.8$.

$= \boxed{13.62\ N/m^2}$

QUESTION NO # 2.

a) Define pressure? what is absolute and guage pressure?

ANS:-

Pressure:- pressure means how much something is pushing on something else.
expressed as "force per unit area".

$$P = \frac{F}{A}$$

It can also define as the thrust (compressive force acting perpendicularly to the surface of the body) acting per unit area.

Unit:- Pascal (Pa)

Dimension:- $ML^{-1}T^{-2}$

Symbols:- p, P.

Guage pressure:- Guage pressure is the relative of atmospheric pressure.

#) Guage pressure is zero refrenced against ambient air pressure. So it is equal to absolute pressure minus atmospheric pressure negative sign are usally omitted.

#) Guage pressure is positive for above atmospheric pressure but negative in below atmospheric pressure.

⇒ Total pressure or absolute pressure is the sum of guage pressure and atmospheric pressure.

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

where: P_{abs} = Absolute pressure.

P_g = Guage Pressure

P_{abn} = Atmospheric pressure.

ABSOLUTE PRESSURE :- Total pressure at a point in a fluid equalling the sum of guage pressure and the atmospheric pressure.

⇒ Absolute pressure is zero referenced against a perfect vaccum.

Mathematically :-

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

P_{abs} : Absolute pressure.
P_g : Guage pressure.
P_{atm} : atmospheric pressure.

Example :- If your tire guage reads 39 psi then the absolute pressure is 39 psi plus 14.7 psi or 53.7 psi (equivalent to 337 kPa).

QUESTION NO: 2.
Part NO: b).

Given datas-

Length = 1500mm = 1.5m
Breadth = 1500mm = 1.5m
Depth = 7889
unit of water = 981 kN/m^3

Required datas:-

a) = net pressure, (P) = ?
b) = location of force.
c) = if water level drop half of depth. Find "P" and location of force.

Solution:- a) Net pressure :-

$$P = \gamma h$$
$$P = 9.81 \times 7889.$$
$$\boxed{P = 77391.09}$$

b) : location of force.

$$y' = \frac{h}{3}$$
$$y' = \frac{7889}{3}$$
$$\boxed{y' = 2629.6m}$$

c) :- half depth :-

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

$$p' = 9.81 \times \frac{7889}{2}$$

$$p' = \boxed{38,695.545 \text{ kN/m}^2.}$$

Centroid :-

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

$$y' = \frac{7889}{2} \times \frac{1}{3}$$

$$y' = \frac{7889}{6}$$

$$y' = \boxed{1319.83}$$

THE END :-