ID# 7970

Section:- B

Que:no(01)

a) Define viscosity? Derive Newton Equation of Viscocity.

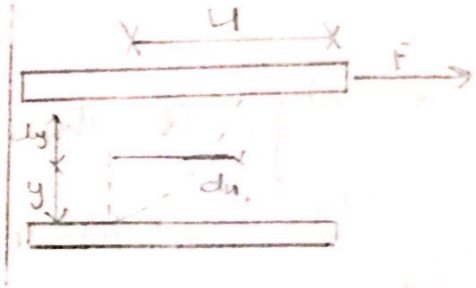
Ans:- Viscocity:-*

* Viscocity is the property of fluid by which it imparts resistance to fluid motion by offering resistance to movement of one layer over another.
* For liquids, it coresponds to the informal concept of "thickness" for example, syrup has a higher viscocity than water.
* Viscocity can be canceptualized as quantifying the internal frictional force that arises between adjacent layer of fluid. That are in relative motion.
* As the temp goes up the viscosity decreases.

→ Consider two plates parallel placed at a distance Y and space between plates are filled with fluid. Lower surface is assumed to be stationary while upper moved with velocity "U"

Thus:

$$F \propto \frac{AU}{Y} \Rightarrow F = \frac{\mu AU}{Y}$$



Or

$$\frac{F}{A} = \frac{\mu U}{Y}$$

$$\tau = \frac{\mu U}{Y}$$

Shear Stress

For dy the velocity will be du

Thus:- $\tau = \mu \frac{du}{dy}$

The above equation is called Newton equation of viscosity.

Que: no (02)

Part (a)

1. Density :- *

* Density of fluid is its mass per unit volume of fluid.
* **Symbol:** ρ or ρ (the lower case Greek letter rho)

Unit: kg/m^3

Mathematically;

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

Dimension:

$$L^{-3}M.$$

2. Specific Weight :- *

* It is weight per unit volume of fluid.

Represented by γ

Unit: N/m^2

Mathematically; $\gamma = \frac{w}{V}$

3. Specific Volume:

* In Thermodynamics, the specific volume of a substance is the ratio of the substance's volume to its mass.
* It is reciprocal of density and intrinsic property of matter as well. Specific volume is defined as the number of cubic meter occupied by one kilogram of a particular substance

Unit: (m^3/kg)

Mathematically;

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

Relation:-*

As $\gamma = \frac{w}{V}$ where $w = mg$

Thus $\gamma = \frac{mg}{V}\rho$, $\rho = \frac{m}{V}$

So $\gamma = \rho \times g$ or $\rho = \frac{\gamma}{g}$

Que:no#01

(C)

If Specific volume of gas is $0.72\ m^3/kg$ what is Specific weight in N/m^3 ?

Solution:-* Data;

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

Specific weight, γ = ?

→As from Specific Volume:

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

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

$$\rho = \frac{1}{0.72} = 1.388\ kg/m^3$$

As from Relation we know

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

#6

$$\gamma = \rho \times g$$

$$\gamma = 1.38 \times 9.8$$

$$\gamma = 13.524\ N/m^3$$

Que:no#2
(a)

Define pressure? what is absolute & gage pressure.

Ans: **Pressure:-***

* It is the force applied perpendicular to the surface of an object per unit area over which that force is distributed

→ Various units are used to express pressure. Some of these derive from a unit of force divided by a unit area.

SI Unit: Pascal (Pa). For Example, is one newton per square meter (N/m^2)

• Absolute And Gage Pressure:-

* Absolute pressure is a pressure that is relative to zero pressure in the empty; air-free space of the universe. This reference pressure is the ideal or absolute vaccum. It is denoted with the subscript "abs" P_{abs}

atm + pressure at any point in fluid

* When it is measured relative to atmosphere Pressure as base it is called gage pressure.

$$P_{ab} = P_{atm} + P_{gage}.$$

* The gage pressure is defined as the difference between an absolute pressure (P_{abs}) and the prevailing atmospheric pressure (P_{atm}). It is denoted with the subscript "e"; P_e

Calculated As Follows:-

$$P_e = P_{abs} - P_{amb}.$$

Que: no #2

(b)

A water tank having dimension of 1500mm x 1500mm Depth of the water tank is equal to your ID in mm. What is the net pressure force on wall of water tank? Find the location of Pressure

*If the water level drops to the half of the depth what will be the force and point of application of force?

Given

Solution:- Data;

Length = 1500 mm = 1.5m

Breadth = 1500mm = 1.5m

Depth, h = 7970mm = 7.97m

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

: Required:

Net Pressure = ?

Location of Force

If water level drop half of depth what will be "P" and location of "F"

i- Pressure: *

At → $p = \gamma h$

$p = 9.81 \times 7.97$

$p = 78.185\ KN/m^2$

ii- Force Application: * (Centroid)

$\bar{y} = \frac{h}{3} \Rightarrow \frac{7.97}{3}$

$\bar{y} = 2.656m$

iii- Half Depth: * (Pressure)

$P = \gamma \times \frac{h}{2}$

$P = 9.81 \times \frac{7.97}{2}$

$P = 39.092\ KN/m2$

Centriod: *

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

$\bar{y} = \frac{7.97}{2} \times \frac{1}{3} = 1.3283\ m.$