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Subject Name ⇒ Fluid Mechanics I.

Semester ⇒ Senior.

Date ⇒ 16 - April - 2020.

IQRA NATIONAL UNIVERSITY.

Q No 1

* Part-a *

Viscosity:

Viscosity is the property of fluid which opposses the relative motion betwee 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 is states that:-

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

Mathematically

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

$\tau \rightarrow$ Shear stress

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

Change the sign of proportionality

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

μ = viscosity (Dynamic viscosity)

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

* The fluids which flows "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".

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

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

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 $W = mg$

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

$$W = \rho g \qquad \because \rho = \frac{m}{V}$$

$\therefore \rho \Rightarrow$ 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 $V = \frac{V}{m} = \frac{m^3}{kg}$

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

PART "C"

Given Data

Specific volume of gas $v = 0.72 \, m^3/g$

Required:

Specific weight in $N/m^3 = ?$

Solution:

As we know that

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

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

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

Specific weight $w = \rho \times g$

$$= 1.389 \times 9.8$$

$$= 13.62 \, N/m^3$$

Q NO# 02:- Part A.

pressure :→

pressure is define as force per unit area. It is usually more convenient to use pressure rather than force to determine the influences upon fluid is called pressure.

Absolute pressure:-

Absolute pressure is define as total pressure at a point in a fluid equaling the sum of the gauge by the atmosphevic pressure is called absolute pressure.

Gauge pressure:-

Gauge pressure it can be define as the analysis of an applied force by a fluid on a surface pressure is typically measured in units of force per unit of surface area it is called gauge pressure.

QNO# 02 Part = 'B'.

Given Data :-

length = 1500 mm = 1.5m.

Breadth = 1500 mm = 1.5m.

Depth = 7671.

unit wt of water = 9.81 KN/m³

Required Data.

⇒ a = Net pressure = P = ?

⇒ b = Location of force.

⇒ c = if water level drop half of depth find p & location of force.

Sol:-

1) Net pressure :-

$p = \gamma h$.

$p = 9.81 \times 7.671$

$p = 75.25 \ KN/m^2$.

2) Force Application (centroid).

$\bar{y} = h/3$

$\bar{y} = \frac{7.671}{3}$

$\bar{y} = 2.557 \ m$.

3) half depth.

pressure at half depth 'P'.

$P' = \gamma h/2$

$P' = 9.81 \times \frac{7.671}{2}$

$p' = 37.62\ KN/m^2$.

Centroid.

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

$$y^{-1} = \frac{7.671}{2} \times \frac{1}{3}$$

$$y^{-1} = 3.8355 \times 0.33$$

$$\boxed{y^{-1} = 1.265\ m}$$