EXAM... MID TERM

SUBJECT FLUID MECHANICS

Date 19th April, 2020.

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Subject: Fluid Mechanics I

Q No. 1 (a) Define Viscosity? Derive newton equation of viscosity.

Ans.

VISCOSITY:-

Viscosity can be defined as: "The property of fluids due to which they resist their flow is called viscosity."

Viscosity is the consistency of fluid. It is the Fluid's resistance to the flow.

A Fluid is considered viscous when it shows opposition or resistance to the flow. This happens because of the molecular arrangement, bounded together tightly. While a fluid flows easily is considered as less viscous. This is also because of the loosely bounded arrangements of the molecules. So fluids with high viscosity shows more resistance as compared to the less viscous fluids.

Example:-
cooking oil, mobile oil, honey etc are the examples of viscosity. They are viscous than water & petrol. ~~or ether~~

NEWTON'S EQUATION OF VISCOSITY:-

viscosity is usually represented using Newtons equation for Fluids, similar to newton 2nd law of motion. So the formula of viscosity is mainly expressed as,

$$\frac{F}{A} = \eta\left(\frac{dv}{dr}\right)$$

where F = Force and A = area So F/A is another definition of viscosity (dv/dr) represents the "Sheer rate", "η" is the constant unit equal to 0.00089 Pa s (Pascal·second), which is dynamic measurement unit of viscosity.

Equation:-

$$F \propto \frac{AU}{Y}$$

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

μ = co-efficient of viscosity

$\frac{F}{A} = \frac{\mu u}{y}$

$\frac{F}{A}$ = shear Stress

τ = shear stress

$\tau = \frac{\mu v}{y}$

For Dry.

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

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

This is called Newton's equation of viscosity

Q No. 1(b) Define density, specific weight and specific volume. Show relation between Density and specific weight?

Ans. **DENSITY:-**

Density can be defined as **"the mass per unit volume"**

Mathematically:-

It can be written as:

$P = \frac{m}{v}$. "P" is the density. m = mass. and v = volume.

Representation:-

Symbolically it is represented as (P).

UNIT:-

The S.I unit of density is (kg/m^3) kilogram per meter cube.

SPECIFIC WEIGHT :-

"Specific weight is the weight per unit volume of Fluid."

Representation:-

Symbolically it is represented by gamma 'γ'.

Mathematically:-

It can be written as

$$\gamma = \frac{w}{v}$$

Unit:-

The S.I unit of specific weight is (n/m^3) newton per meter cube.

SPECIFIC VOLUME:-

"The volume occupied by unit mass of fluid is known as specific volume."

It is inversely related to density.

Representation:-

Mathematically it is represented as $\nu = \frac{V}{m}$.

Unit:-

Its unit is m^3/kg.

RELATION BETWEEN DENSITY AND SPECIFIC WEIGHT:-

As we know that,

$$\gamma = \frac{w}{v}$$

where $w = mg$

Now, $\gamma = \frac{mg}{v}$

where ρ is density

So,

$$\gamma = \rho g \quad \text{or} \quad \rho = \frac{\gamma}{g}$$

γ = specific weight

ρ = Density

Q No. 1 (C) If specific volume of gas is 0.72 m^3/kg what is specific weight in ~~m^3~~ N/m^3?

SOLUTION:-

Given that,

specific volume, $V = 0.72\ m^3/kg$

we have to find

specific weight, $\gamma = ?$

As,

$$V = 1/\rho$$

$$\rho = 1/V$$

$$\rho = 1/0.72$$

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

Now,

$$\gamma = \rho g$$

$$\gamma = 1.38 \times 9.81$$

$$\gamma = 13.54\ N/m^3$$

So,

The specific weight is = $13.54\ n/m^3$.

Q No. 2

(a) Define Pressure? what is an absolute and guage pressure?

Ans **PRESSURE:-**

Pressure can be defined as, "the amount of force applied on a surface per unit area is called Pressure".

It can also be defined as, "the ratio of the force to the area (over which the force is exerted)."

It is represented by 'P'.

Mathematically:-

It can be written as

$P = F/A$

where F = force and 'A' is the area

Unit:-

The S.I unit of Pressure is Pascal, Symbolically represented as (Pa).

$1 Pa = 1 / Nm^2$.

Dimension:-

$ML^{-2}T^{-2}$

TYPES OF PRESSURE:-

There are four types of pressure.

1) Atmospheric Pressure.
2) Absolute Pressure.
3) Differential Pressure.
4) Guage Pressure.

ABSOLUTE PRESSURE:-

Absolute Pressure is a pressure that is related or relative to the zero pressure in an empty, air free space of the universe. This refrence pressure is the ideal or absolute vaccum.

Representation:-

It is represented as "P_{abs}" (with subscript "abs").

Guage Pressure:-

The guage pressure is defined as the difference between an absolute pressure and the prevailing atmospheric (P_{amt}). It is denoted with subscript "e". Pe and is calculated as:-

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

Q No.2 (b) A water tank having dimensions of 1500mm x 1500mm. Depth of the water tank is equal to your student ID number in mm. what is the net pressure force on wall of water tank? Find the location of force application? If the water level drops to the half of the depth, what will be the force and point of application of force?

SOLUTION:-

Given Data:-

Length, l = 1500mm = 1.5m

Breadth, b = 1500mm = 1.5m

Depth, h = 7964mm = 7.964m

Unit weight of water = 9.81 kN/m^3

Required Data:-

(a) Net pressure = ?

(b) location of force = ?

(c) If water level drops half of depth, Find P and location of force.

(a) Net Pressure :-

$$P = \gamma h$$

$$P = 9.81 \times 7.964$$

$$P = 78.126 \ KN/m^2$$

(b) $\bar{y} = h/3$

$$\bar{y} = \frac{7.964}{3}$$

$$\bar{y} = 2.654 \ m$$

(c) Pressure at half depth.

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

$$P' = 9.81 \times \frac{7.964}{2}$$

$$P' = 39.063 \ KN/m^2$$