IQRA NATIONAL UNIVERSITY

PESHAWAR

ID: 7224

MODULE: 2012 Batch

SUBJECT: fluid mechanics

LECTURER: Engr. Abdul Waheed

QUESTION # 1 PART # A

Define viscosity? Derived newton equation of viscosity?

VISCOSITY: -

It is defined as resistance of fluid to angular or shear deformation.

Fractional resistance of fluid resulted from cohesion and momentum interchange between molecules and fluids.

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

or

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

NEWTON EQUATION OF VESCOSITY: -

It is state that

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

Mathematically; -

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

$\zeta \rightarrow$ *shear stress*

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

change the sign of proportionality

$\zeta = \frac{du}{dy}$

$\mu = viscosity$ *(dynamic viscosity)*

$\mu = \zeta \times \frac{dy}{du}$

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

The fluid which follows "Newton's of viscosity are called Newton fluid".

QUESTION # 1 PART # B

Define density, specific weight and specific volume. Show relation between density and specific weight?

Answer: -

DENSITY: -

Density is defined as mass per unit volume

Density = $\frac{mass}{volume}$

$\dot{\rho} = \frac{m}{v}$ = *kg /m*^{3}

SPECIFIC WEIGHT: -

Weight per unit volume

It is denoted by "w"

V = $\frac{mass}{volume}$

V = *N/m*^{3}

SPECIFIC VOLUME: -

Specific volume is defined as the number of cubic meters occupied by one kilogram of a particular substance. The standard unit is the cubic meter per kilogram .

it is the reciprocal of a density.

Specific volume $V = \frac{volume}{mass}$

RELATION BETWEEN DENSITY AND SPECIFIC WEIGHT

density is simply mass per unit volume of a body, where as specific weight is the weight per unit volume of a body. So, specific weight has a "g" term associated with it. A body will have same density in moon and earth, but will have different specific weights.

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

We know that

W= mg

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

$W = p_g$

$P \rightarrow$ density

QUESTION # 1 PART # C

If specific volume of gas is $0.72 m^3/kg$. what is specific weight in N/m^3.

Given data

Specific volume, $v = 0.72\ m^3/kg$

We have to find,

Specific weight $r_s = ?$

As

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

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

$P = \frac{1}{0.72}$

$P = 1.38\ kg/m^3$

As

$r = pg$

$r = 1.38 \times 9.81$

$r = 13.54N/m^3$ *Answer*

QUESTION # 2 PART # A

Define pressure? What is an absolute and gauge pressure?

Answer: -

PRESSURE:-

Pressure is the force applied perpendicular to the surface of an object per unit area over which that force is distributed. Gauge pressure is the pressure relative to the ambient pressure. Various units are

SI unit: *Pascal*

MATHEMATICALLY

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

P = *pressure*

F = *force*

A = *area*

ABSOLUTE PRESSURE:-

Absolute pressure is a pressure that is relative to the zero pressure in the empty, air-free space of the universe. This

reference pressure is the ideal or absolute vacuum. It is denoted with the subscript "abs": Pabs.

GAUGE PRESSURE :-

The gauge pressure is defined as the difference between an absolute pressure (Pabs) and the prevailing atmospheric pressure (Pamb). It is denoted with the subscript "e": Pe and is calculated as follows: Pe = Pabs – Pamb.

QUESTION # 2 PART # B

A water tank dimension of 1500mm×1500mm depth of a tank is equal to your student id no (7224) in mm. What is the net pressure force on a wall of water tank? Find the location of force application? If the water level drop to the half of the depth what will be the force and point of application of force?

From the above question it is clear that :

L = 1500 mm

Now we will convert "mm" into "m"

L = $^{1500}/_{1000}$ *= 1.5 m*

Width = w = $^{1500}/_{1000}$ *= 1.5 m*

Depth = d = 7224mm

Depth = d = $^{7224}/_{1000}$ *= 7.224*

1. *Net pressure D = 7.224m*
2. *D´ =* $^{7.224}/_{2}$ *= 3.612m*

   I. *Net pressure*

   D = 7.224

   F = $p_{avg} \times A$

   F = $(\delta g\, ^{h}/_{2}) \times (L \times D)$

   F = $(1000)(9.8)(^{7.224}/_{2}) \times 1.5 \times 7.224$

   F = 383568.39N

Or

F = 383.55KN

II. *Net pressure force*

D´ = 3.612

$F = \left((\delta g \, {}^{D'}/_{2} \,) \times (L \times D') \right)$

$F = (1000)(9.8)({}^{3.612}/_{2}) \times 1.5 \times 3.612$

F = 95892.09N

Or

F = 95.89KN
