FMHM.

3rd Sem Mech, CL

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PROBABLE SHORT QUESTIONS

MODULE - 01

(1) Q. Differentiate between Newtonian and Non-Newtonian fluid. 2011

M. Newtonian fluid :- A real fluid in which the shear stress is directly proportional to the rate of shown strain is known as Newtonian fluid.

Non-Newtonian fluid :- A real fluid in which the shear stress is not proportional to the rate of shear strain is known as non-Newtonian fluid.

(2) Q. A plate of 0.0254 mm distant from a fixed plate moves at 61 cm/sec and requires a force of 0.2 kg(f)/m^2 to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. 2011

M.

Given: $dy = 0.0254$ mm

$= 0.025 \times 10^{-3}$ m

Velocity of upper plate,

$u = 61$ cm/s $= 0.61$ m/s

force on upper plate,

$F = 0.2$ kg(f)/m^2 $= 2$ N/m^2

$\because$ Shear stress, $i = \mu \frac{du}{dy}$

$du = u - 0 = 0.6$ m/s

$i = F = 2 N/m^2$

$\therefore \mu = \frac{2 \times 0.254 \times 10^{-3}}{0.61} = 8.34 \times 10^{-5} \frac{Ns}{m^2}$

$= 8.34 \times 10^{-4}$ poise. (Ans)

(3) Q. What is metacentric height of a body? Why is it an important consideration for a body? 2011

Ans. Meta centre :- It is defined as the point about which a body starts oscillating when the body is tilled by a small angle.

Metacentric height :- The distance between the metacentre of a floating body and the centre of gravity of the stability of a floating body is determined from the position of meta-centre (M)

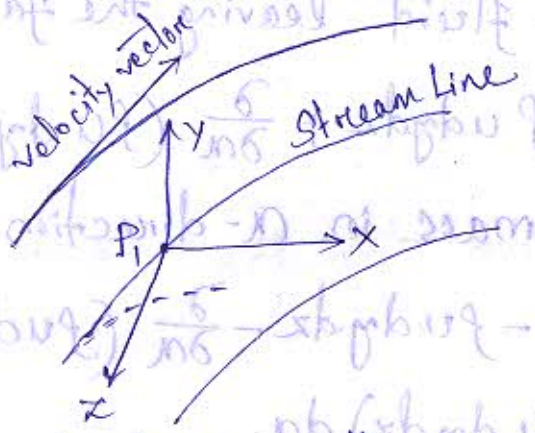
a] Stable Equilibrium :- If the metacentre M is above the centre of gravity G, the floating body will be in stable equilibrium.

b] Unstable Equilibrium :- If the metacentre M is below centre of gravity G, the floating body will be in unstable equilibrium.

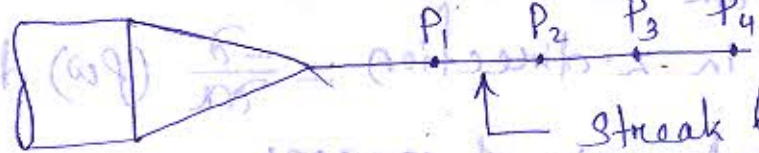
c] Neutral Equilibrium :- If the point M is at the centre of gravity of the body, the floating body will be in neutral equilibrium.

(4) Q. Distinguish between stream line and streak line. 2011, 2010

Ans A streamline is an imaginary line drawn through the flow field in a manner such that the velocity vector of the fluid at each and every point on the stream line is tangent to the stream line at that instant.



A streak line is the instantaneous picture of the position of ~~the~~ all the fluid particles that have passed through a fixed point in the flow field.



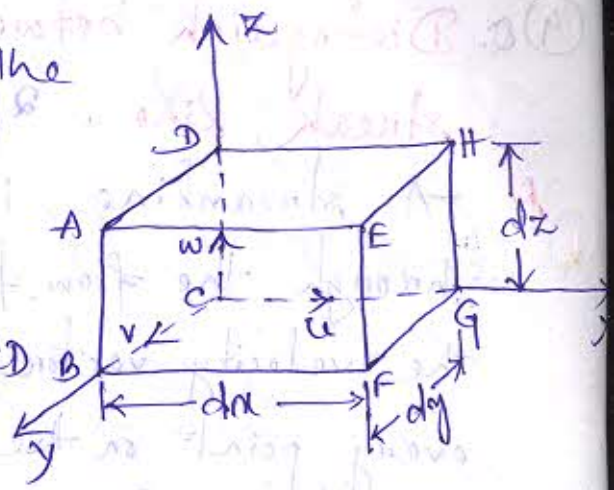
(5) Q. Write the expression for equation of continuity in differential form. 2011

Ans Consider a fluid element of length dx, dy and dz in the direction x, y & z and corresponding velocity components u, v and w.

Mass of fluid entering the face ABCD per second

= ρ × velocity in x-direction × Area of ABCD

= ρ × u × (dy × dz)



Then mass of fluid leaving the face EFGH per second $= \rho u\,dy\,dz + \frac{\partial}{\partial x}(\rho u\,dy\,dz)\,dx$

∴ Gain of mass in x-direction

$= \rho u\,dy\,dz - \rho u\,dy\,dz - \frac{\partial}{\partial x}(\rho u\,dy\,dz)\,dx$

$= -\frac{\partial}{\partial x}(\rho u\,dy\,dz)\,dx$

$= -\frac{\partial}{\partial x}(\rho u)\,dx\,dy\,dz$ {∵ dy dz is constant}

Similarly the net gain of mass in y-direction

$= \frac{-\partial}{\partial x}(\rho v)\,dx\,dy\,dz$

and in z-direction $= \frac{-\partial}{\partial x}(\rho w)\,dx\,dy\,dz$

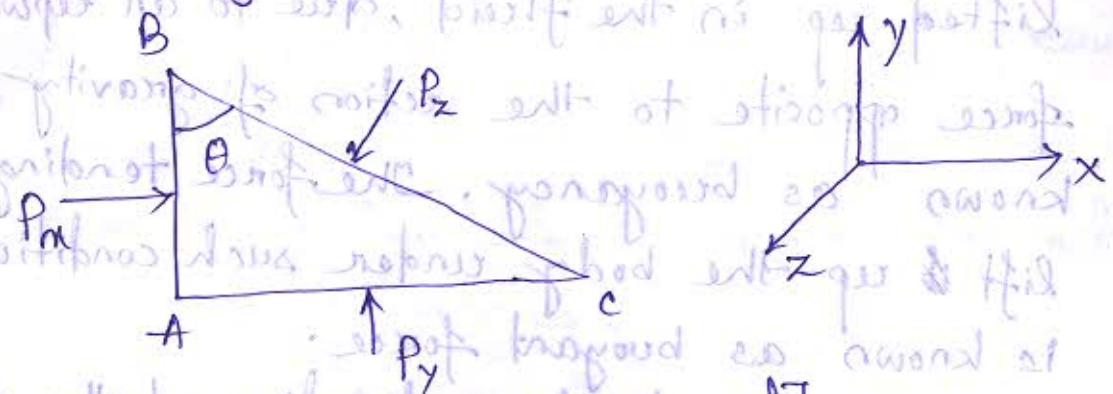
∴ Net gain of masses

$= -\left[\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial y}(\rho v) + \frac{\partial}{\partial z}(\rho w)\right] dx\,dy\,dz$

(6) Q. Define Pascal's Law. 2010

A. This law states the intensity of pressure at a point in a static fluid is the same in all directions.

According to Pascal's Law P_x, P_y, P_z



[Pressure of on Fluid Element]

⑦ Q. How viscosity varies with respect to temperature for gas and liquids? 2010

Ans. The relation between viscosity and temperature for liquid and gases are:

for liquid, $\mu = \mu_0 \left(\frac{1}{1 + \alpha t + \beta t^2} \right)$

where, μ = Viscosity of liquid at t°c, in poise

μ_0 = Viscosity of liquid at 0°c, in poise

α, β = are constant for the liquid.

for gases, $\mu = \mu_0 + \alpha t - \beta t^2$

for liquid, the viscosity decreases when temperature increases.

for gases, the viscosity increases when temperature increases.

⑧ Q: Define the term buoyancy and center of buoyancy → 2010

Ans. When a body is immersed in a fluid either wholly or partially it is subjected to an upward force which tends to lift it up.

This tendency for an immersed body to be lifted up in the fluid, due to an upward force opposite to the action of gravity, is known as buoyancy. The force tending to lift up the body under such conditions is known as buoyant force.

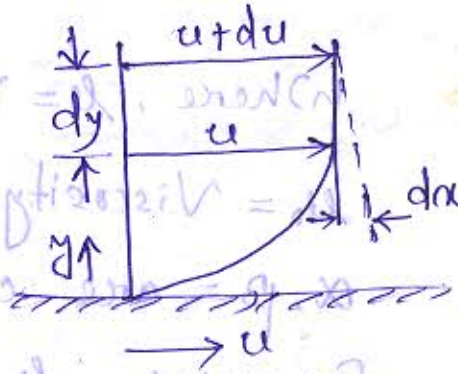
The point of application of the force of buoyancy on the body is known as centre of buoyancy.

→ 2009, 2010

(9) Q. Define and explain Newton's Law of viscosity.

Ans. It states that the shear stress (τ) on a fluid element layer is directly proportional to the rate of shear strain.

i.e. $\tau = \mu \frac{du}{dy}$



where μ = constant of proportionality is called the co-efficient of viscosity.

(10) Q. What do you understand by 'Total pressure' and 'centre of pressure'? 2009

Ans. Total Pressure: It is defined as the force exerted by a static fluid on a surface either plane or curved when the fluid comes in contact with the surface. This force always acts normal to the surface.

Centre of Pressure : It is defined as the point of application of the total pressure on the surface.

Example - Water tank, Sluice gate, Channel.

(11) Q. What are the conditions of equilibrium of a floating body and a submerged body?

Ans. It states that when a body is immersed in fluid either wholly or partially, it is buoyed or lifted up by a force which is equal to the weight of the fluid displaced by the body.

Case - I

$$W_s > F_B$$

$$\rho_s g V > \rho_{Liquid} V g$$

$$\rho_s > \rho$$

Then body will sink or fall from where it is immersed.

Case - II

$$W_s < F_B$$

$$\rho_s < \rho$$

Then body will rise from where it is immersed