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Subject Fluid mechanics I

Semester 6th

Section B

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Q:. No: 01 01

Part: 01

Define discharge? write its equation

Discharge:

"The amount of fluid passing a section of a stream in unit time is called discharge.

If v is the mean velocity and A is the cross sectional area. the discharge Q is defined by $Q = AV$ which is known volume flow rate. Discharge is also expressed as mass flow rate and weight flow rate.

Volume flow rate, $Q = AV$

Mass flow rate. $M = \rho Q$

Weight flow rate, $W = \gamma Q$

Where

Q = discharge is in m^3/sec or ft^3/sec

A = Cross sectional area of flow in m^2 or ft^2

V = Mean velocity of fluid in kg/m^3 or $slug/ft^3$

γ = unit weight of fluid in N/m^3 or LB/ft^3

Q:No:01

Part b

Define Head and its types?

Ans: **Head:**

It is the sum of all energy head at a point in fluid or total energy per unit weight of fluid at a point.

Types of Head:

Kinetic head:

It is the kinetic energy per unit weight of fluid.

$$\frac{K.E}{W} = \frac{1}{2}\frac{mv^2}{mg} = \frac{v^2}{2g}$$ is kinetic head.

This is also known as velocity head

Its unit is meter.

Potential Head:

It is potential energy per unit weight of fluid.

$$\frac{PE}{W} = \frac{mgh}{mg} = h$$

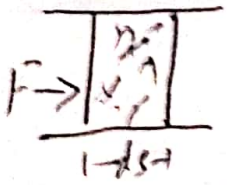
Pressure Head:

The vertical height of free surface above any point in a liquid at rest is pressure head or level of fluid due to pressure exerted by fluid

which is work = $F \cdot ds$

$$\frac{W}{W} \quad \frac{W}{W}$$

$$\therefore \frac{pA \cdot ds}{W} = \frac{p \times \text{volume}}{W}$$



Q:NO:02 05

Part: a

Given data:

Mean velocity = 20 cm/s

Pressure = 30 kPa

Height = 40cm

Required.

Head of water = ?

Sol:

$$H = Z_1 + \frac{V^2}{2g} + \frac{P}{\gamma}$$

$\because \gamma_w = 9.810 \text{ kN/m}^3$

$= 9810 \text{ N/m}^3$

$$= 0.4 + \frac{(0.2)^2}{2(9.8)} + \frac{30000}{9810}$$

$$H = 0.40203 + 3.058$$

$$\boxed{H = 3.4601 \text{ meter}} \rightarrow \text{Ans}$$

Q: No: 02

Part: b

Given Data

dia = 150 mm = 0.15 m

discharge, Q = 0.5 m^3/s

Required:

velocity = ?

Solution:

$$Q = AV$$

$$V = Q/A$$

$$V = \frac{0.5}{\frac{\pi}{4} d^2}$$

$$V = \frac{0.5}{\frac{\pi}{4} (0.15)^2}$$

$$V = 28.29 \text{ m/s} \rightarrow \text{Ans}$$

Question-3 07

Given data:

Specific gravity = 0.9

Length 410 m

dia = 200 mm = 0.2 m

Viscosity = 6×10^{-5} N.S/m²

$Q = 0.06 \, m^3/s$

$f = 0.0032$

Required:

Head loss = H_L = ?

Sol:

$$h_L = f \frac{L}{D} \frac{V^2}{2g}$$

Now we will find

$$Q = AV. \quad V = \frac{Q}{A}$$

$$V = \frac{0.06}{\frac{\pi}{4}(0.2)^2} \Rightarrow \boxed{V = 1.909 \, m/sec}$$

$$h_L = f \frac{L}{D} \frac{V^2}{2g}$$

$$h_L = 0.0032 \times \frac{40}{0.2m} \times \frac{(1.909)^2}{2 \times 9.8}$$

$$\boxed{h_L = 0.118m}$$