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Paper :- Fluid Mechanics I

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Q No 1.1)

(a) Define discharge? write its equation?

Ans :- Discharge :-

The amount of fluid passing a section of stream in unit time is called the discharge. if v is the velocity & A is the cross sectional area, the discharge Q is defined by $Q = AV$ which is known as volume flow rate. Discharge is also expressed as mass flow rate & weight flow rate.

Equation :-

$$Q = AV$$

Q = discharge rate

A = area

V = velocity is known as discharge equation.

Q2 (b) Define head & its types?

Ans:- HEAD:-

In a fluid statics (non-moving fluid systems) head generally refers to the height of static fluid. The deeper with in the fluid, the higher the pressure due to fluid head will be. The pressure Head in this case might refer to the pressure as a result of this static fluid.

The static system I just described can be modeled with the following

$P = \rho \times g \times h$

where P is the pressure due to the head of fluid, ρ is the density of fluid, g is the acceleration due to gravity & h is height of static fluid.

Types of heads:-

1) Potential Head:-

It is due to position above some suitable datum line. It is denoted by z.

2) Kinetic head :-

It is due to velocity of flowing liquid. Its value is given by $v^2/2g$ where v is the velocity of flow & g is the acceleration due to gravity

3) Pressure head :-

It is due to the pressure of liquid It value is given by p/w, where p is the pressure in N/m^2 & w is the weight density of the liquid in N/m^3.

Total head H = Potential head + kinetic head + Pressure head.

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Q No. (2)

(a) DATA:-

velocity $v = 20\ cm/sec = 0.2\ m/sec$

Pressure $= P = 30\ kpa = 30\ kg/m\text{-}sec^2$

Datum height $= h_a = 40\ cm = 0.4\ m$

Sol:-

As we known that

liquid pressure P is

$$P = \rho g h \rightarrow (1)$$

where $\rho = 1000\ kg/m^3$

so $(1) \Rightarrow h = \frac{P}{\rho g}$

$$h = \frac{30}{1000 \times 9.81}$$

$$= \frac{30}{9810}$$

$$h = 0.00305\ mm$$

$$\Rightarrow \boxed{h = 3.05\bar{}\ m}$$

Q2- Part (b)

DATA :-

Dia = 150 mm

= 0.15 m

Discharge Q = 0.5 m^3/sec

Velocity = ?

Sol:-

As we know that

$Q = AV \rightarrow (1)$

$Q = 0.5\ m^3/sec$

$A = \pi/4\ (0.15)^2$

$A = \frac{3.14 \times (0.1725)}{4}$

$\boxed{A = 0.1354}$

eq (1) $\Rightarrow V = Q/A$

$V = \frac{0.5}{0.1354}$

$\boxed{V = 3.6\ m/sec}$

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Q3 :-

GIVEN DATA :-

Specific gravity = 0.9

lenght = L = 40 m

Dia of Pipe = 200 mm = 0.2m

Viscosity = $\gamma = 6 \times 10^{-5}$ N.s/m^2

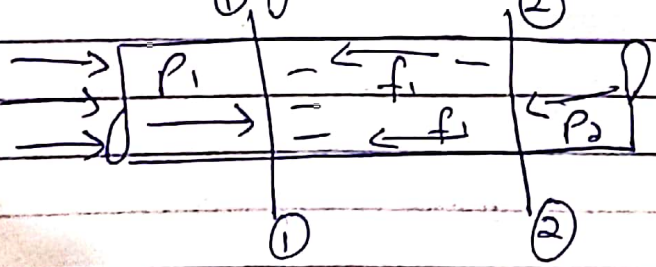
Discharge = Q = 0.06 m^3/s

Coefficient of friction = f = 0.0032

Head loss hf = ?

Sol :-

So Darcy - we is back equation



As By Darcy we is back equation

$$hf = \frac{4f l v^2}{2gd} \longrightarrow (1)$$

As $Q = AV$

$$\Rightarrow V = Q/A \quad \text{---} (a)$$

$$A = \frac{\pi}{4}(0.2)^2$$

$$A = 0.0314 \text{ m/sec}$$

(a) $\Rightarrow V = \frac{0.06}{0.0314}$

$$V = 1.91 \text{ m/sec}$$

(1) $\Rightarrow h_f = \frac{4(0.0032)(40)(1.91)}{2(9.81)(0.2)}$

$$\Rightarrow h_f = \frac{0.97792}{19.82}$$

Head loss

$$\boxed{h_f = 0.049 \text{m}}$$ Answers