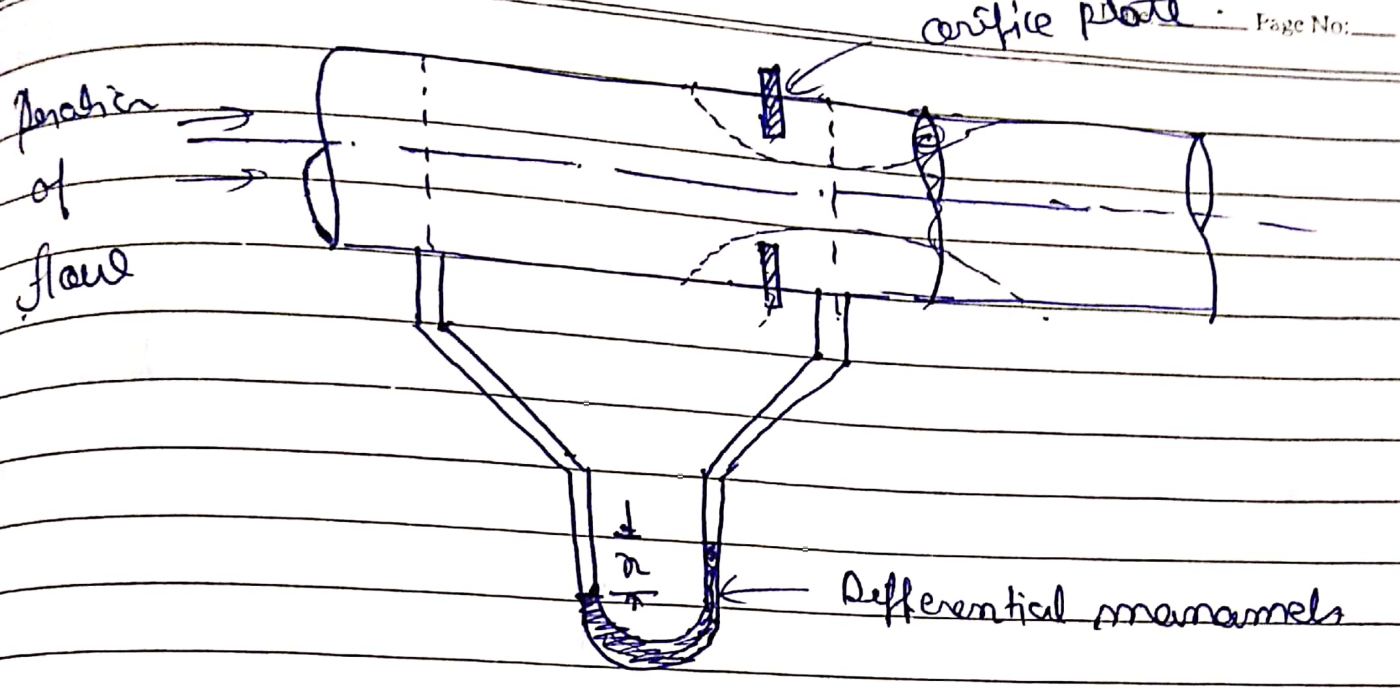
Date:______ Page No:____

ORIFICE METER

it is device used for measuring the rate of flow of a fluid through a pipe.

- It is a cheaper device as compared to venturi meter.
- It works on the same principle as that of ventrimeter.
- it consist of circular plate which has a circular sharp edge hole called orifice, which is concentric with the pipe
- orifice dia is kept generally 0.5 times the dia of the pipe. though it may vary from 0.4 to 0.8 times the pipe dia
- A differential manometer is connected at section (1) and section (2)



Let. P_1 = Pressure at section 1-1
V_1 = velocity at section 1-1
a_1 = area of pipe at section 1-1

P_2, V_2, a_2 are corresponding d value at section (2)

Apply bernoulli's equation at section 1-1 and 2-2

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2$$

$$\left(\frac{P_1}{\rho g} + z_1\right) - \left(\frac{P_2}{\rho g} + z_2\right) = \frac{V_2^2}{2g} - \frac{V_1^2}{2g}$$

$$\left(\frac{P_1}{\rho g} + z_1\right) - \left(\frac{P_2}{\rho g} + z_2\right) = h = \text{Differential head}$$

$$h = \frac{V_2^2}{2g} - \frac{V_1^2}{2g}$$

$$V_2 = \sqrt{2gh + V_1^2}$$

Now Section (2) is at the Vena Contracta and a_2 represent the area at the area of Vena Contracta

if a_0 is the area of orifice

$$C_c = \frac{a_2}{a_0}$$

where C_c = Coefficient of Contraction

$$a_1 V_1 = C_c = \frac{a_2}{a_0}$$

$$a_2 = a_0 C_c$$

by Continuity eq^n

$$a_1 V_1 = a_2 V_2$$

$$V_1 = \frac{a_2}{a_1} V_2 = \frac{a_0 C_c V_2}{a_1}$$

$$V_2 = \sqrt{2gh + \frac{a_0^2 C_c^2 V_2^2}{a_1^2}}$$

Date:______ Page No:____

$$V_2^2 = 2gh + \left(\frac{a_0}{a_1}\right)^2 c_c^2 V_2^2$$

$$V_2^2\left[1-\left(\frac{a_0}{a_1}\right)^2 c_c^2\right] = 2gh$$

$$V_2 = \frac{\sqrt{2gh}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 c_c^2}}$$

then discharge

$$Q = V_2 \times a_2$$

$$= V_2 \times a_0 c_c$$

$$= \frac{a_0 c_c \sqrt{2gh}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 c_c^2}}$$

$$c_d = c_c \frac{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 c_c^2}}$$

$$c_c = c_d \frac{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 c_c^2}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2}}$$

$$Q = a_0 \times C_d \frac{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 C_c^2}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2}} \times \frac{\sqrt{2gh}}{\sqrt{1-\left(\frac{a_0}{a_1}\right)^2 C_c^2}}$$

$$Q = \frac{C_d \, a_0 a_1 \sqrt{2gh}}{\sqrt{a_1^2 - a_0^2}}$$