School of medical and Allied Sciences

Course Code : BPHT3004 **Course Name: Pharmaceutical Engineering**

TOPIC:FLUID FLOW

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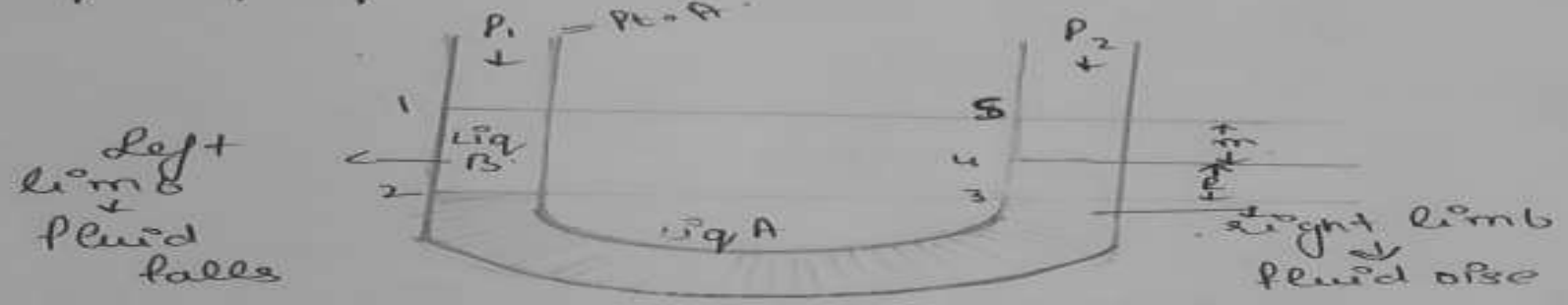
Manometer

- It is an instrument used for measuring the pressure acting on column of fluid .
- it consist of U – shaped tube in which different pressures acting in 2 arms of tube causes the liquid to reach diff height in 2 arms .
- the fluid which flows inside it is k/a manometric fluid

* It basically consist of a glass U-shaped filled with liq A & liq B.



we have to find pressure at pt. A = P_1

now before finding it we will assume.

[pressure at pt. A > pressure in atm.]

As the fluid flowing b/w pt 2 & 3 are at same heigh & have equal density.

∴ $P_2 = P_3$

now, we will find P_2 = through pressure at Pt-1

P_3 = " " at Pt 5.

which help us to find pressure at Pt. A for P_1.

now we know acc. to Pascal

$$[P = \rho g h]$$

$$[\text{Height} = m + R]$$

now $$[P_2 = P_1 + \rho g (m + R)]$$

$$[P_3 = P_5 + \rho g m R]$$

$P_5 = 0$ (as pressure exerting by the rising fluid in right limb cancels out atm. pressure applied at pt. 5, $\therefore P_5 = 0$).

$$[P_3 = \rho m g R]$$

$P_2 = P_3$

$\therefore$ $P_1 + \rho g (m + R) = (P_5)^{0} + \rho m g R$

$P_1 = \rho g m R - \rho g (m + R)$.

$$[P_1 = \rho m g R - \rho g (m + R)]$$

So with this eqn we can find pressure at pt. A.

PIEZOMETER

- It is the simplest form of manometer . It measures gauge pressure only
  - It consist of a vertical tube i.e. open at one end and attached to a container at other end. They are the devices used for measuring the difference of pressures between two points in a pipe or in two different pipes.
  - It consists of a U-tube , containing a heavy liquid , Whose two ends are connected to the points whose difference of pressure is to be measured
  - It is suitable for measurement of small press. difference
  - It is 2 of types : u- tube DM
    : Inverted u-tube DM

APPLICATION OF MANOMETER

- Used in the maintenance of heating, ventilation, and air conditioning (HVAC) systems, low pressure pneumatic or gas systems.
- Construction of bridges, installing swimming pools and other engineering applications.
- Climate forecasting.
- Clinical applications like measuring blood pressure and in physiotherapy.
- Piezometers are used to measure the pressure in pipes where the liquid is in motion.

Inclined TUBE MANOMETER

It is a slant manometer

Inclination is done to improve the sensitivity

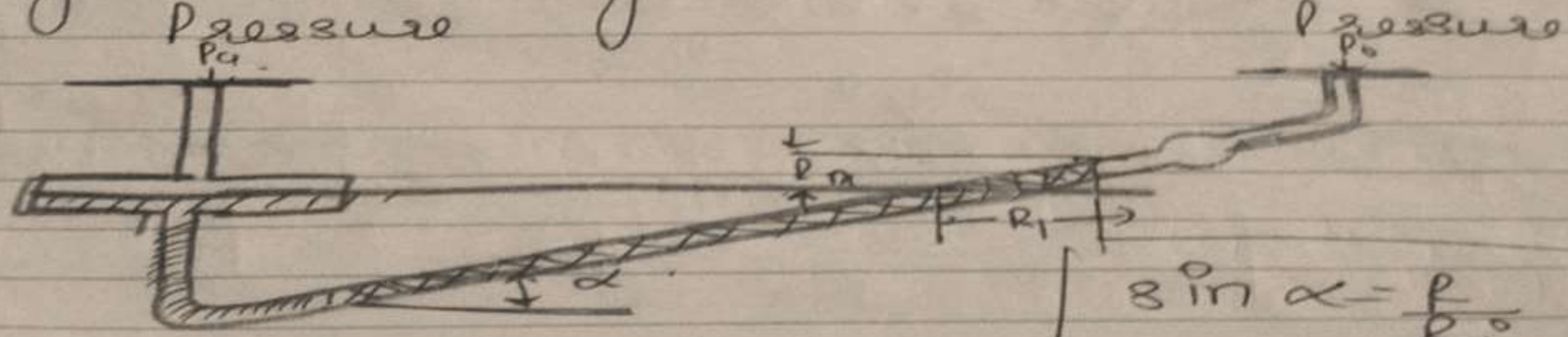
This manometer is used to measure very small pressure difference with increased accuracy

For ex- in air and gas installation , in this application the manometer is arranged with the indicating tube inclined

The angle of measuring arm is about 10degree

$$P_1 - P_2 = g R (\rho_A - \rho_B) \sin\alpha$$

* To measure small press. diff. need to magnify R_m some way.



$$\sin\alpha = \frac{R}{R_i}$$

$$R = R_i \sin\alpha$$

$$P_a - P_b = g R_1 (\rho_a - \rho_b) \sin\alpha$$

Principle of Pitot tube

- According to Bernoulli's therom

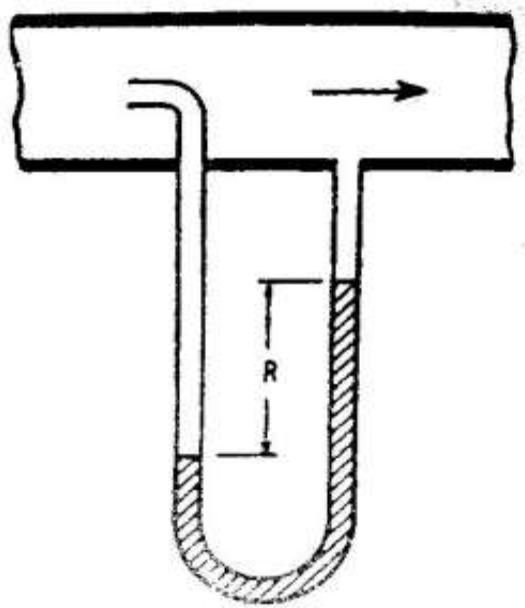
Total energy at any point =

Pressure energy + Potential energy + K. E

$U_o = C_o \sqrt{2g\Delta H}$ .....ΔH= Difference in pressure head

$\Delta H = U^2 / 2g$ .....U= Velocity at point of incertion

Pitot tube



References

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2: R. A., KIM, J. & BROW NE, L. W. B. 1991 Some characteristics of small-scale turbulence in a turbulent duct flow. J. Fluid Mech. 233, 369–388

3:https://studylib.net/doc/8164236/ppt---manometer