FLUID MECHANICS LAB : EXPERIMENT NO : 4

AIM

- To determine Co-efficient of Discharge for an obstruction flow-meter (Venturi-meter / Orifice-meter)
- To find flow rate through a Rotameter.

EQUIPMENT

- Inlet supply tank with provision for varying flow rate
- Venturi-meter and orifice-meter fitted in horizontal pipe-line.
- U-tube differential manifold
- Collection tank with piezo-meter tube and scale.
- Stop watch

THEORY

Both venturi-meter and orifice-meter are devices used for measuring rates of flow of liquids flowing through them. The basic principle for both the devices is that when cross-sectional area of a section is reduced, pressure difference is created. This difference of pressure for a given set-up is related to flow-rates. If 'A_1 and A_2 are the areas of the two sections from where pressure tapping are taken, and 'h' is the difference in the pressure column of the manometer, then theoretical flow rate is given by

$$Q_{th} = \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{2gh}$$

Venturi-meter is basically a cylindrical section consisting of three distinct parts: a converging section with a cone angle of about 20°, a section of minimum area called throat and a diverging section with a cone angle of 5-7°.

Orifice-meter It basically consists of a circular hole, in a plate which is both thin and flat.

Rotameter has a float in a cylindrical pipe (which is graduated with a scale). The sharp edge of the float is pointing towards bottom from where fluid is entering. Depending upon the rate (Quantity) of fluid flow, the float will move up or down, thus directly indicating the quantity of fluid flowing through the pipe.

EXPERIMENTAL SET-UP

Water supply tank is connected to the inlet section (1) of the venturi-meter. There are two pressure tappings at the mouth and throat to the U tube mercury manometer (3). An outlet valve (4) is fitted at the delivery end of the venturi-meter . There is a collection tank (5) fitted with a piezo-meter tube (6) for measuring the actual flow rate.

PROCEDURE

- Record the inlet and throat diameters, as well as the dimensions of the collection tank.
- Open the valve and note the readings of the manometer to get 'h'
- Note the rise of water level in the collection tank with the help of stop-watch
- Repeat the experiment with different flow rates.
- Carry out the experiment similarly with the orifice-meter.
-

OBSERVATIONS

Table-1 Diameter of the pipe 2.5 cm Area A_1 = 4.9

Throat Diameter 1.5 cm Area A_2 = 1.76

Dimensions of the Collection tank L 50 cm

B 40 cm

Sl No	R cm	H (cm) $h_2 - h_1$	Water Level in collecting tank Initial h_1	Final h_2	Difference	Time of Flow (sec) t
V →		7.25 - 13.8 = 6.55	0	20	20	30 sec
O →		8.5 - 13.6 = 4.5	0	25	25	30 sec

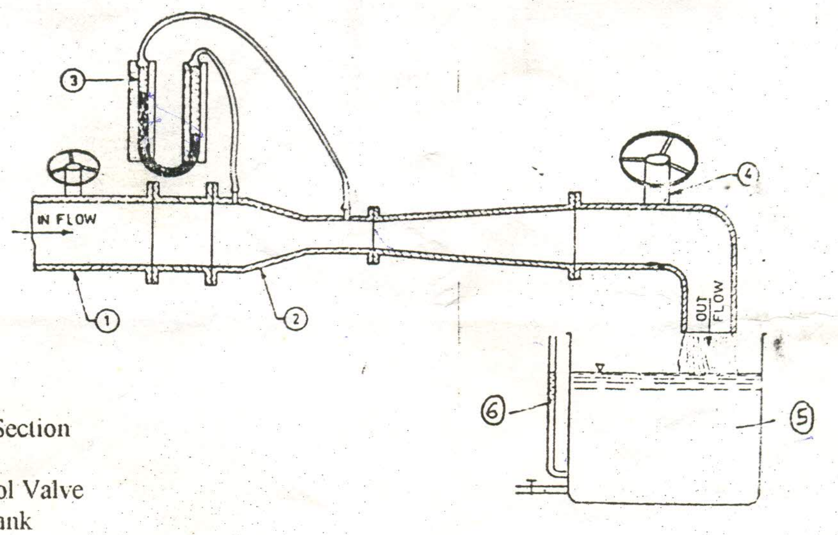
CALCULATIONS

Table –2

Sl No	h_e = 12.5 × R	Theoretical Flow rate Q_{th}	Actual Flow Rate Q_{A}	$C_d = Q_A / Q_{th}$
V →	15.62	19.8	20	1.01
O →	9.375	4.57	25	5.47

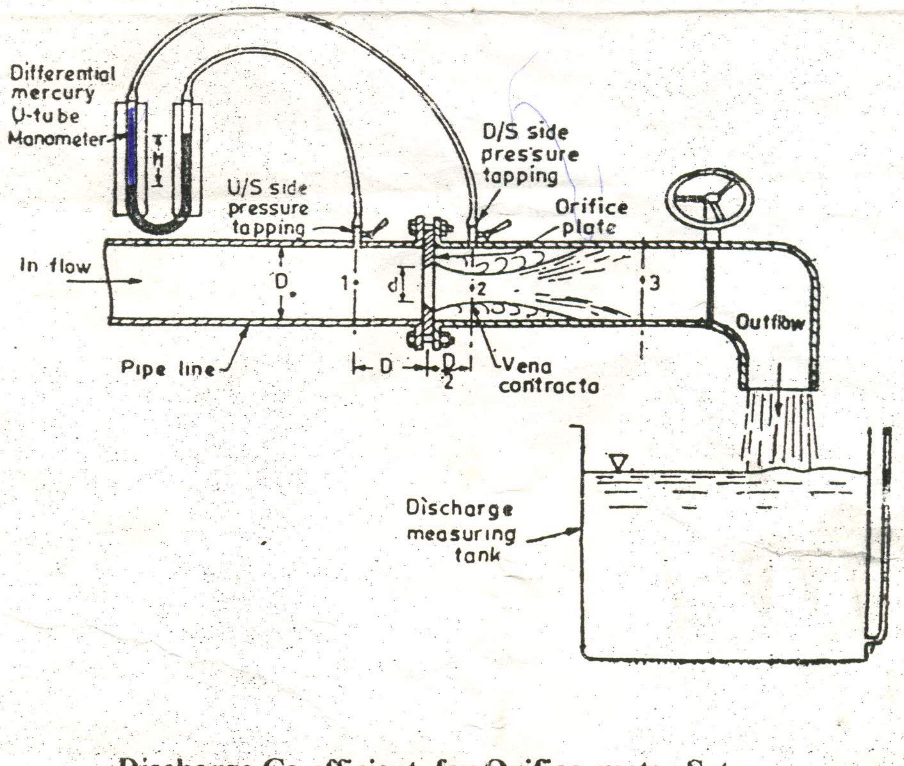
PRECAUTIONS

1. There should not be any bubble in the manometer.
2. Time period for measuring flow rate should be sufficiently large at-least 60 second.
3. Reading should be taken only when steady-state has reached.

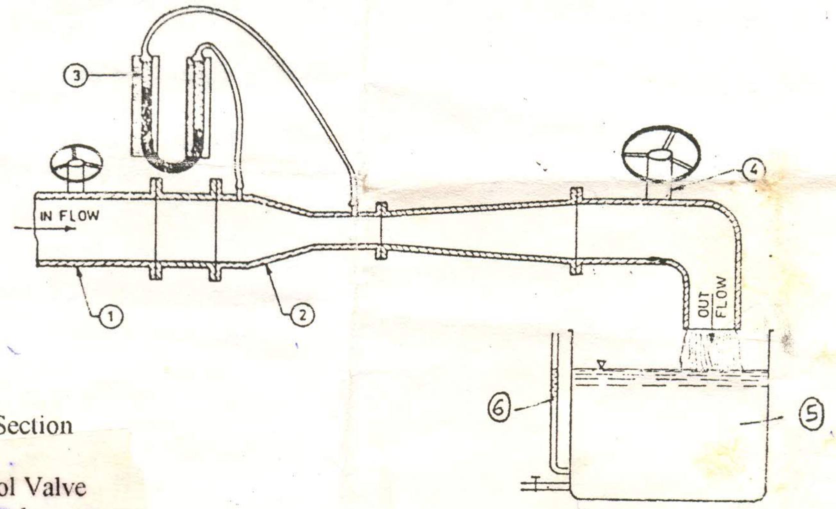


1. Inlet Section
2. Convergent Section
3. Manometer
4. Outlet Control Valve
5. Collection Tank
6. Piezo-meter tube

Discharge Co-efficient for Venturi-meter Set-up

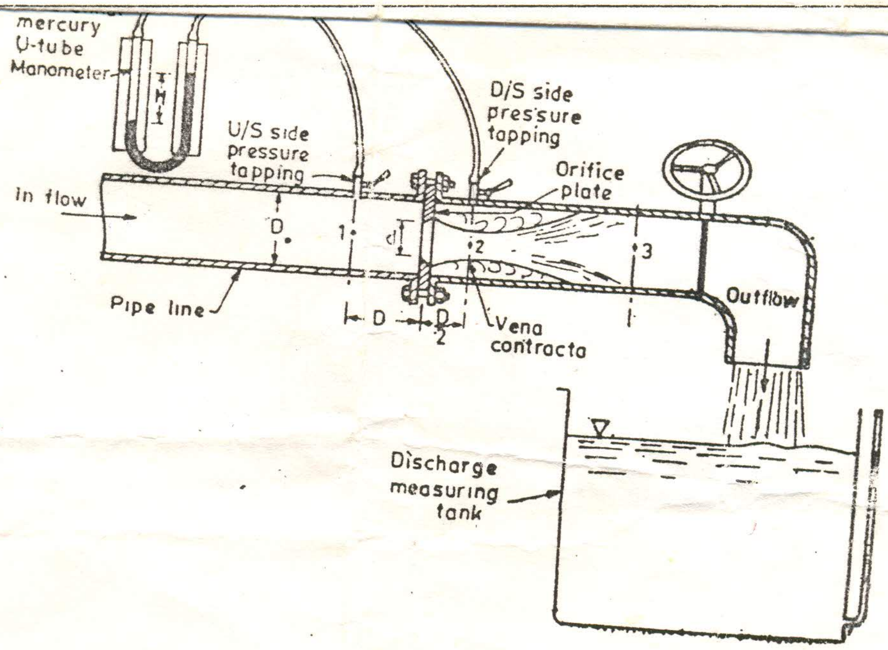


Discharge Co-efficient for Orifice-meter Set-up



1. Inlet Section
2. Convergent Section
3. Manometer
4. Outlet Control Valve
5. Collection Tank
6. Piezo-meter tube

Discharge Co-efficient for Venturi-meter Set-up



Discharge Co-efficient for Orifice-meter Set-up

FLUID MECHANICS LAB : EXPERIMENT NO : 5

AIM

- To determine Co-efficient of friction for pipes of different materials.

EQUIPMENT

- Inlet supply tank with overflow equipment
- Collection tank with provision for varying flow rate
- Different pipes with a provision to stop / allow flow of water.
- U-tube differential manifold
- Stop watch

THEORY Transportation of fluids through pipes is a very common .Distribution of gas & water for domestic distribution is an example. Experimental observations by Froude on long, straight and uniform diameter pipes on the flow of water has indicated that head loss due to friction h_f between two sections of the pipe varies

- In direct proportion with the velocity head $V^2 / 2g$
- Directly with the distance between the two sections (L)
- Inversely with the diameter of the pipe (d)

By introducing a co-efficient of proportionality 'f' called the friction factor, Darcy & Weisbach proposed the following equation for friction losses in pipes

$$h_f = f\left(\frac{L}{d}\right)\frac{V^2}{2g}$$

EXPERIMENTAL SET-UP

The set-up consists of four horizontal pipes of different material (numbered I to IV) and connected to inlet water (1) and outlet water-pipe (2). Tappings are taken for the mercury manometer (3) at two points from each of the pipes. A regulating valve (4) is fitted on each pipe to allow / stop flow of water through it. When the handle is in vertical position, the valve is closed. The flowing water discharges into a collecting tank (5) fitted with a piezo-metric tube and a graduated scale (6).

PROCEDURE

- Record the diameter 'd' of the pipe and the length 'L' between the two sections attached to the limbs of U-tube manometer.
- Open the supply valve to allow water to flow in that pipe only.
- Record the initial water level in the discharge measuring tank and start the stop watch and find the depth of water collected for a particular time by recording the final reading of the piezo-meter tube.
- Knowing the area of the measuring tank, flow discharge through the pipe can be obtained.
- Record the readings of the two limbs of the U-tube manometer, the difference of which gives the head-loss h_f.

- Calculate average velocity through the pipe using the relationship V= Q / A where 'A' is the cross-sectional area of the pipe. (For calculating the area of the pipe, consider internal diameter to be 0.9 times the external diameter).
- Calculate the Co-efficient of friction from the given formula.
- Repeat the experiment with a different flow rate
- Repeat the experiment for the other three pipes.
-

OBSERVATIONS

Table-1 External Diameter of the pipe 2.5 cm   I.D = 1.9 cm

Length of the pipe between two sections 90 cm

Dimensions of the Collection tank L ______ cm

B ______ cm

Sl No	h_f (cm)	Water Level Initial	Water Level Final	Time of Flow (sec)
Pipe I (i)				
(ii)				

Pipe IV (i)				
(ii)				

CALCULATIONS

Table –2

Sl No	Area of Pipe 'A'	Flow Rate 'Q'	Velocity V = Q /A	'f'
1				
2				
7				
8				

PRECAUTIONS

1. Make sure that only one regulating valve is open at a time.
2. There should not be any bubble in the manometer.
3. Time period for measuring flow rate should be sufficiently large at-least 60 second.

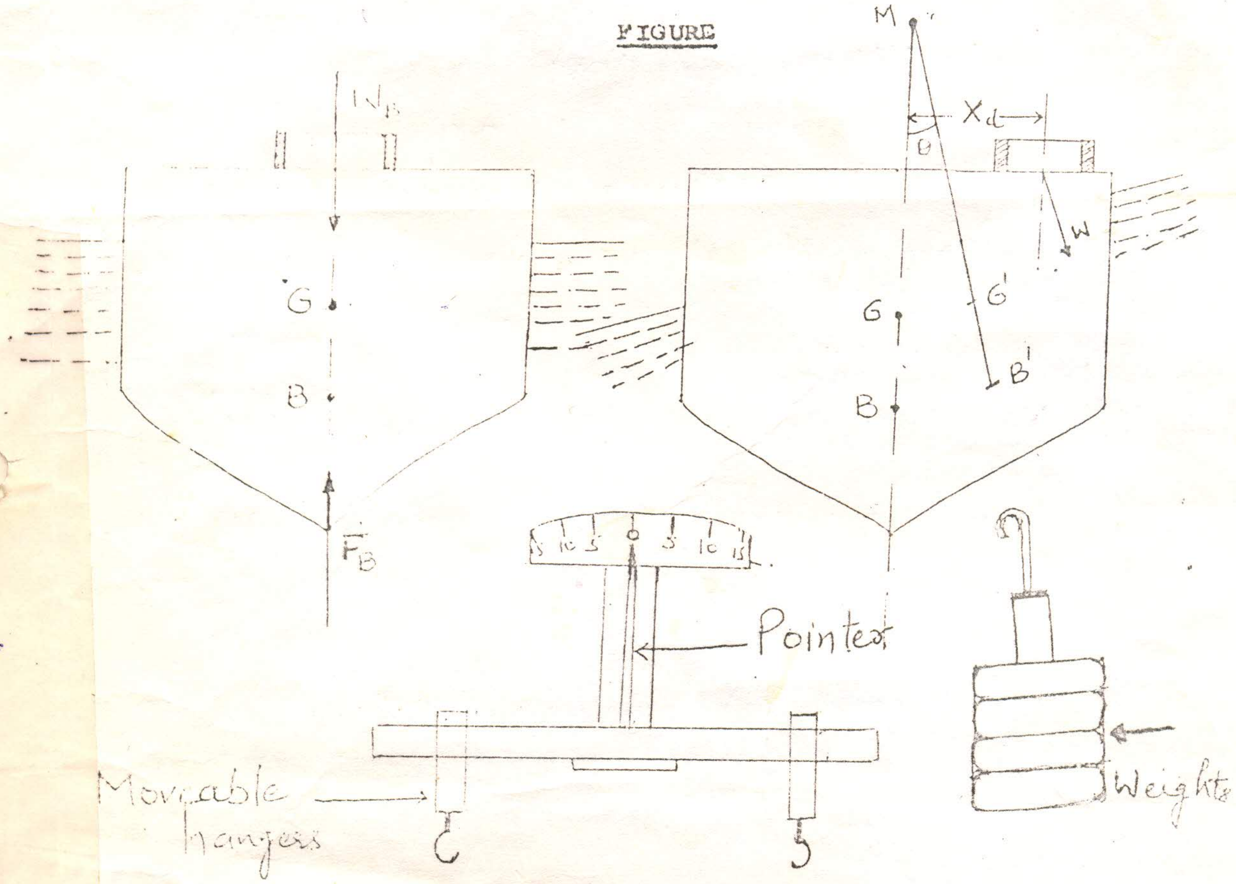
Co-efficient of friction for pipes of different materials.

EXPERIMENT No 9

AIM : To determine the metacentric height of a floating vessel under loaded and unloaded conditions.

EQUIPMENT : Flat bottom vessel, removable strips graduated arc with pointer, movable hangers, set of weights

FIGURE



THEORY : A body floating in a fluid is subjected to following system of forces :-

1) The downward force of gravity acting on each particle that goes to make up the weight of body W_B acting through centre of gravity G.

2) The upward buoyant force of fluid acting in various elements of submerged surface of floating body F_B acting through centre of buoyancy, B.

3) For a body to be in equalibrium on liquid surface, the two forces W_B and F_B must lie on same vertical line, i.e. these two forces must be collinear, equal and opposite. When the vessel has been tilted through angle θ, the centre of gravity of body G is remains unchanged in position but B i.e. centre of buoyancy will generally change its position. Thus W_B and F_B forms a couple. The line of action of F_B in new position cuts the axis of body at M. Which is called metacentre and distance GM is is called metacentric height. The metacentric height can be obtained by equating righting couple and applied moment.

$$GM = \frac{W_M \times x_d}{(W_B + W_M)\tan\theta} .$$

Where W_M = weight of unbalanced mass causing ~~movement~~ moment on body.

X_d = distance of unbalanced mass from the centre of cross-bar

W_B = weight of vessel.

EXPERIMENTAL SET UP :

A flat bottom vessel is allowed to float in a mild steel tank having a transparent side. Removeable steel strips are placed in the model for the purpose of changing the weight of the model. By means of pendulum (consisting of weight suspended to a long pointer) the angle of tilt can be measured on a graduated arc. For tilting the ship model, a cross-bar with two movable handles is fixed on the model. Pendulum and graduated arc are suitably fixed at centre of cross bar.

OBSERVATION AND CALCULATION :

~~AXXEXN~~

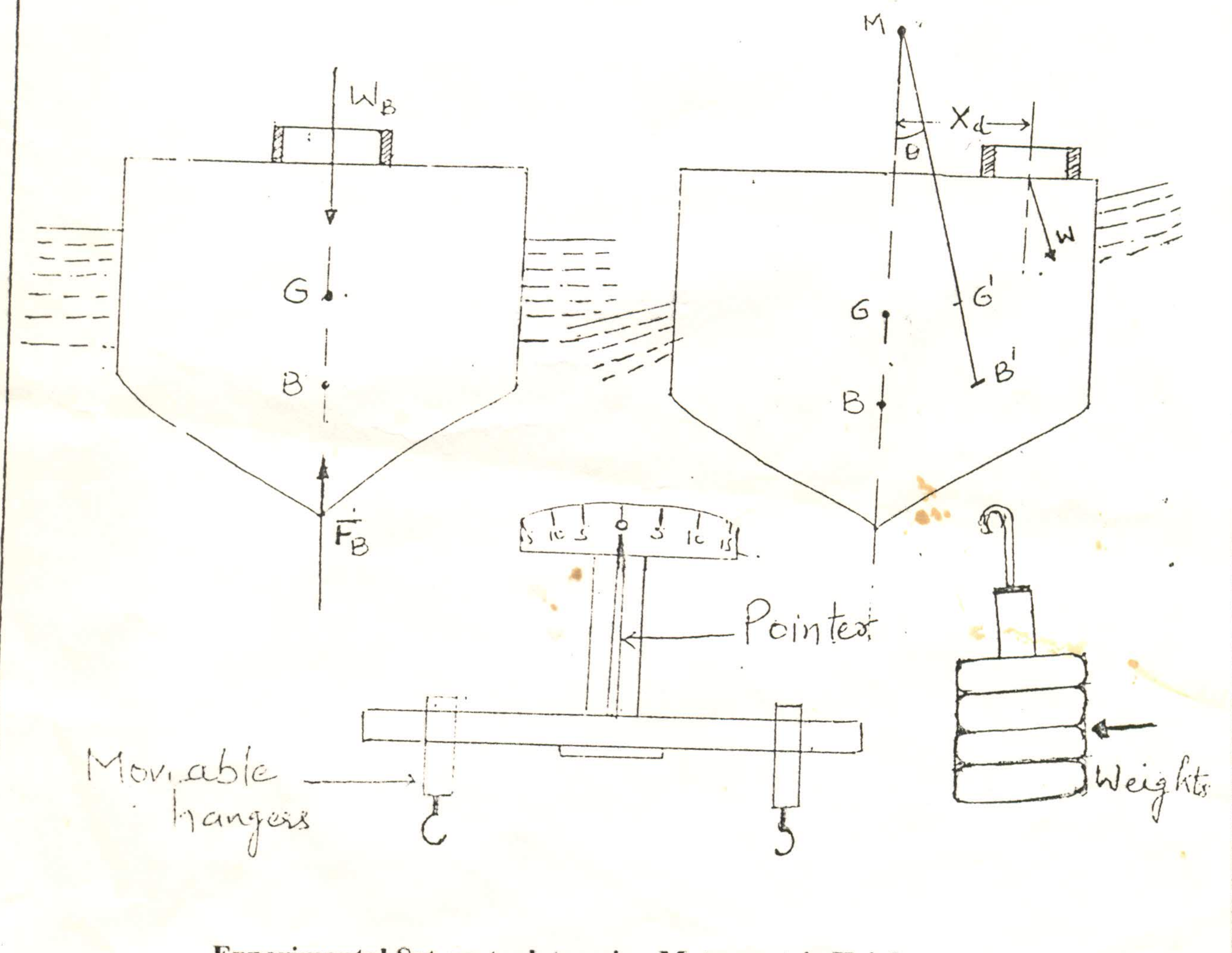
Area of tank (a) = ---45x45--------------- cm^2.

Water level (without vessel) = Y_1 = -----10------- cm.

Weight density of water (W) = 1 gm/cm^3.

OBSERVATION TABLE

Reading on tank with vessel Y_2 (cm).	Mass of vessel $W_B = (Y_2 - Y_1) \times A \times W$	Unbalanced mass (gms) = W_M	Angle heel (degree)	Distance of unbalanced mass (Xd) cms.	Metacentric height (cm) = GM = $\frac{W_M \times X_d}{(W_B + W_M)\tan\theta}$



Experimental Set-up to determine Meta-centric Height

FLUID MECHANICS LAB : EXPERIMENT NO : 5

AIM To find the value of velocity head with a Pitot Tube

EQUIPMENT

- A pitot tube
- A piezometer tube
- Small channel or pipe with arrangements of flow

THEORY

It is an instrument or device for measuring the velocity of flow at any point in a pipe or a channel. It is based on the principle that if the velocity of flow at ant point becomes zero, the pressure energy increases due to the conversion of the kinetic energy into pressure energy (as per Bernoulli's theorem). With reference to Fig-1, we can write

$$H + \frac{V^2}{2g} = H + h$$

or $$h = \frac{V^2}{2g}$$

or $$V = \sqrt{2gh}$$

In actual practice, $V = Cv\sqrt{2gh}$ where Cv is known as Pitot tube co-efficient, which takes into account the various losses. Its value varies from 0.95 – 0.98. However, for our experiment we shall take it to be 0.98. Height (h) of the manometric column has also to be corrected with regard to the liquid used .In that case, it becomes **h (Sm / Sf -1)** where

Sm is the Specific gravity of the liquid in amnemeter and
Sf is the specific gravity of the fluid flowing through the pipe.

EXPERIMENTAL SET-UP

It consists of a glass tube, bent at right angles. The lower end, which is bent at 90° is directed in the up-stream direction as shown in the Fig-1. The liquid rises up in the tube due to the conversion of kinetic energy into pressure energy. Fig-2 shows the arrangement of placement of manometer in the pipe for measuring the head to calculate the velocity.

PROCEDURE

Check that pitot tube is fitted in the channel so that its shorter limb points against the flow direction. Take four set of readings.

OBSERVATIONS
Record manometer head in the two limbs for each reading

CALCULATIONS
Show a sample calculation

Fig-1 Pitot Tube

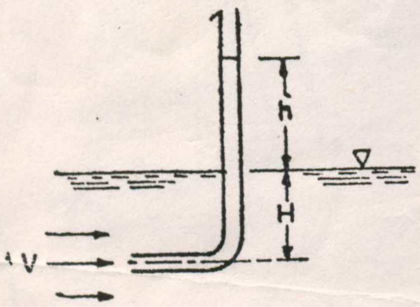
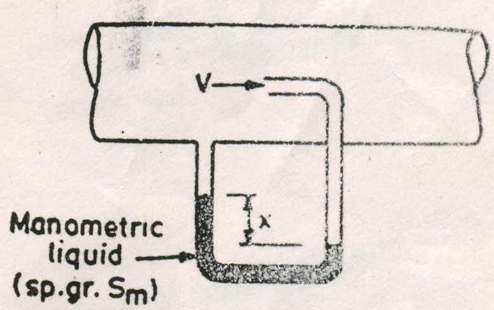


Fig-2 Pitot Tube with Manometer



Experimental Set-up : Velocity Measurement with Pitot Tube

FLUID MECHANICS LAB : EXPERIMENT NO : 6

AIM

- To study the flow transition from Laminar to Turbulent
- Ascertain Lower Critical Reynold's Number

EQUIPMENT

- As indicated in the Diagram

THEORY

Reynold's Number is the ratio of Inertia forces to Viscous forces. It is directly proportional to tube diameter, velocity of flow and inversely proportional to kinematic viscosity ($Re = VD / \nu$). Depending on Re, the flow can occur in two manners namely, laminar and turbulent The laminar flow moves in layers, one layer sliding over the adjacent layer as shown in the diagram placed opposite. On the other hand, with increase in velocity of flow and thus the Re, the inertial forces increase and there occurs rapid and continuous fluctuations in the flow. This type of flow is called turbulent flow and is shown in the diagram.

The term 'transition' refers to the change of flow from laminar to turbulent which occurs in some limited region of the flow.

For any flow, there exists a value of Reynold's number below which disturbances of any magnitude are dampened by viscous forces and the flow is always laminar. This is called lower Critical Reynold's number and its value for flow through circular tubes is less than 2000.

EXPERIMENTAL SET-UP

The apparatus consists of a glass tube with one end having bell mouthed entrance connected to a water tank. At the other end of the glass tube, provision (a cork) is there to vary the rate of flow. A capillary tube is introduced centrally in the bell mouth. A dye is fed into this tube from a small container placed at the top of the tank through a polythene tubing.

PROCEDURE

- Open the cork so that flow will start.

- Adjust the flow of dye through capillary tube so that a fine colour thread is observed indicating laminar flow.

- Increase the flow through glass tube and observe the color thread. If it is still straight, the flow is still in the laminar region. Keep increasing the flow till waviness starts.

- Note down the discharge at which color thread starts moving in wavy form which corresponds to 'higher critical Re'. The associated velocity is known as higher critical velocity.

- Increase the discharge still further. The filament starts breaking-up indicating greater turbulence. Further increase in the discharge will cause the flow to be turbulent which is apparent by the diffusion (mixing) of the dye in the flow.

- Start decreasing the discharge, the diffusion will initially continue. With further decrease in flow, a stage is reached when the dye filament become straight. This corresponds to 'Lower Critical Re' and ' Lower critical velocity'. If the experiment is repeated, it will be seen that higher critical Re varies for each run whereas lower critical re remains same.

OBSERVATIONS

Dimension of the tube :

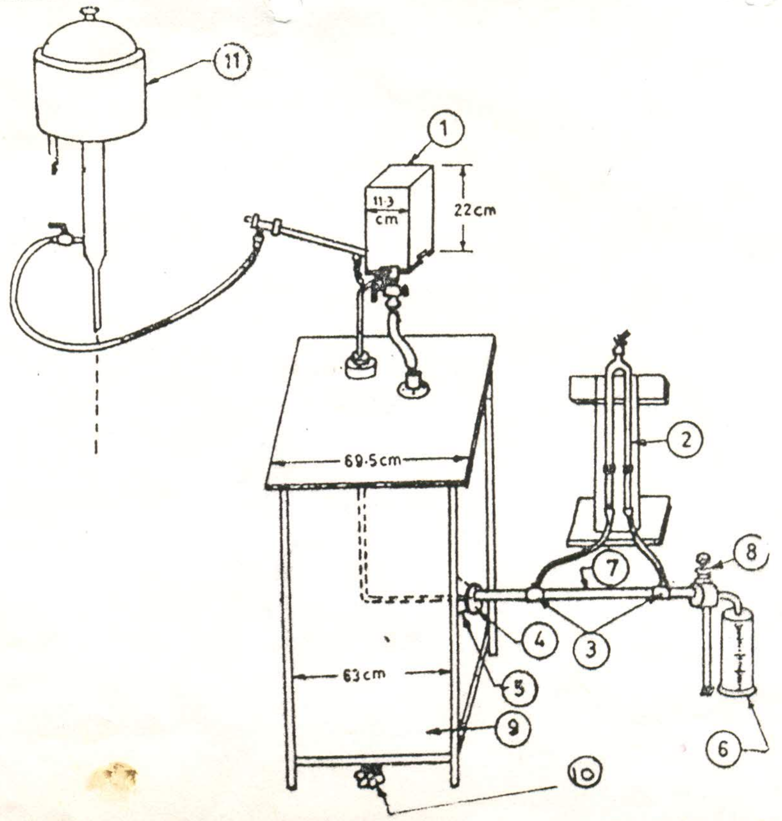
Run No	Discharge (cc / sec)	Re	Observation of Dye Pattern
1			
2			
3			

CALCULATIONS

$$Re = VD/\nu$$

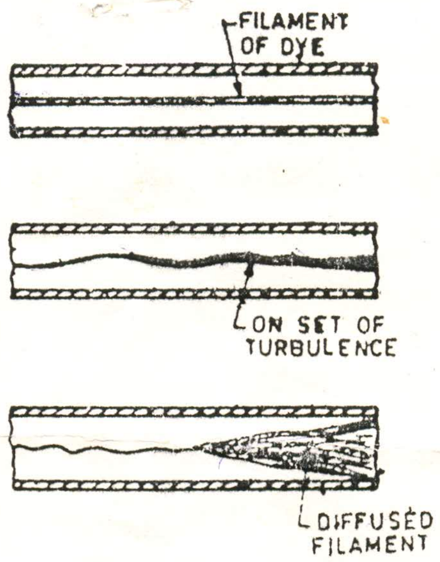
$$\nu = 10^{-6} \text{ m}^2 / \text{sec or } (10^{-2} \text{ cm}^2 / \text{sec}) \text{ for water, and}$$

$V = Q / A$ where A is the area through which flow is taking place.



1. Dye container
2. Piezometric Tubes
3. Pressure Tapping
4. Nozzle
5. Bell-mouthed Entrance
6. Graduated Cylinder
7. Flow Control valve
8. Water Collection tank
9. Outlet Valve
10. Filter
11. Filter water Container

Experimental Set-up : Laminar to Turbulent Flow



(*a*) Laminar Flow < 2000

(*b*) Transition 2000 to 4000

(*c*) Turbulent Flow > 4000

Experiment on Laminar & Turbulent Flows

FLUID MECHANICS LAB : EXPERIMENT NO : 2

AIM

- To study the flow through a variable area duct.
- Verify Bernoulli's energy equation and
- Plot a graph between pressure / total head along the length of the duct.

EQUIPMENT

- Inlet supply tank with overflow equipment
- Collection tank with provision for varying flow rate
- Perspex duct of varying cross-section
- Piezo-meter tubes installed along the length of the duct
- Stop watch

THEORY The law of conservation of energy states that for an in-compressible friction-less steady flow along a variable area duct, the total energy along stream-lines remains constant. This is called Bernoulli's Theorem. This energy, in case of water consists of total head of flowing fluid and comprises of pressure head, velocity head and elevation head . If P, V and Z refer to pressure, velocity and elevation (position) of water relative to some datum, then the energy equation between any number of sections say 1, 2 & 3 can be represented by the following as depicted in Fig-1

$$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2 = \frac{P_3}{w} + \frac{V_3^2}{2g} + Z_3$$

EXPERIMENTAL SET-UP

Refer Fig-2 . The set-up consists of conduit (1) of varying cross-section. It is made of perspex sheets which are joined together so as to form a convergent- divergent section. The size of the conduit at the entrance, in the middle and at the exit section is changing. All along the conduit, piezo-meter tubes (2) are fitted at regular intervals to measure pressure. The conduit is connected to an inlet tank (3) which has a cylindrical opening at the bottom. To regulate the flow into the tank and conduit, a valve (4) is provided. Varying flow rates can be obtained by controlling inlet and outlet valves (5) suitably and allowing a steady state to be reached. In this set-up, as the datum is same for all the 11 points, the value of 'Z factor' in Bernoulli's equation is same for all the points, hence need not to be taken into account. Flow of water is measured from the collecting tank (6), which has a graduated glass scale (7).

PROCEDURE

- Note down the width and depth of the conduit at all the 11 piezo-meter points. This is required for finding the area of cross-section at each point and hence the velocity at each point.
- Open the supply valve and adjust the flow so that water level in all the piezo-meter tubes remain at a constant level. It means that flow has become steady.
- Measure the discharge. For this, firstly note the length / breadth of the collecting tank and then measure the increase in height of the water column in the tank for a specified period measured with the help of stop-watch. (This can also be measured directly from the indicating tube which is calibrated in Liters).
- Vary the discharge & repeat the above steps for at least three more readings.

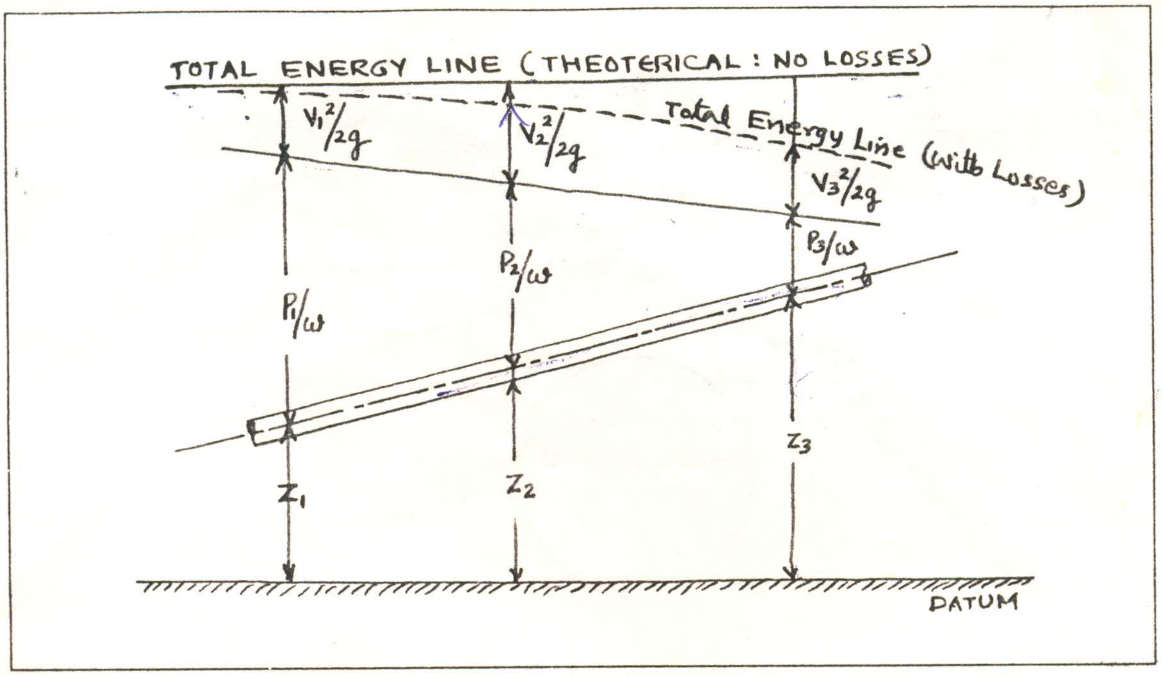
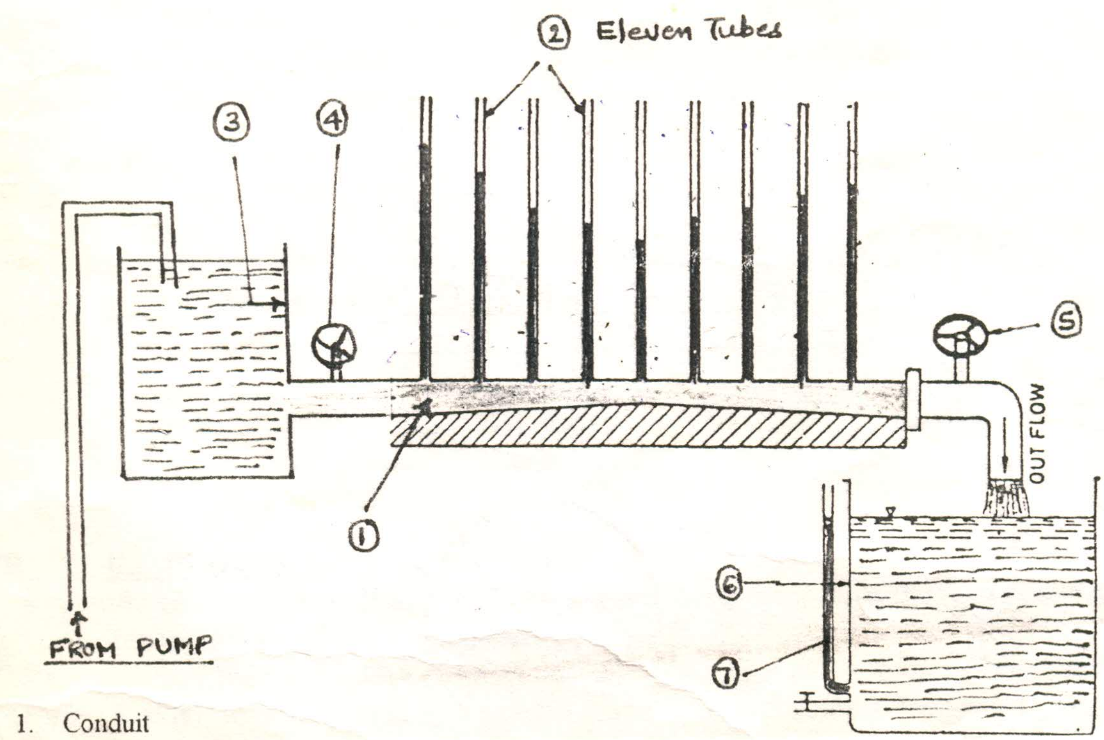


Fig –1 Principal of Bernoulli's Theorem



1. Conduit
2. Piezo-meter tubes
3. Inlet Tank
4. Control Valve
5. Control Valve
6. Collection tank
7. Graduated Glass Scale

Fig –2 Experimental set-up : Bernoulli's Theorem

ERVATIONS

able-1 Width of the Conduit 3·5 cm

Piezo Tube No	Distance from Reference Point	Height of the Section	Water level in Piezo-tubes (p) (i) (ii) (iii) (iv)
1			
2			

10			
11			

Table –2

Water Collection Tank Length ______ cm
Water Collection Tank Width ______ cm
Area of the Tank ______ Sq cm

Sl No	Water column Initial Height	Water column Final Height	Time Taken	Discharge (Q)
1				
2				
3				
4				

CALCULATIONS

Table –3

Sl No	Area of the Section (A)	Velocity 'V'= Q / A	Vel Head $V^2 / 2g$	Pressure Head p / w	$V^2 / 2g$ + p / w
1					
2					
3					
4					

GRAPH TO BE PLOTTED

- Hydraulic Gradient Line Plot p/w Vs distance of piezo tubes from the reference point (X-axis). Join the points by a smooth curve.
- Total Energy Line Plot ($V^2 / 2g$ +p / w) Vs distance of piezo tubes from the reference point (X-axis). Join the points by a smooth curve. This will show a downward trend towards the right indicating losses due to friction.

PRECAUTIONS

1. Apparatus should be in levelled condition.
2. Readings must be taken in steady / near-steady conditions
3. There should not be any bubble in either the piezo-meter tubes nor in the perspex duct.

FLUID MECHANICS LAB : EXPERIMENT NO 3

AIM *To determine Hydraulic Co-efficients (C_d, C_v, C_c) for Orifices*

EQUIPMENT

- Inlet supply tank with piezo-meter tube and scale and provision for fitting of different orifices in the vertical plane of the tank.
- Collection tank with piezo-meter tube and scale
- X-Y co-ordinates measuring scales mounted on the frame
- Orifices and spanner
- Stop watch

THEORY An orifice is a geometric opening in the side of a thin-walled tank or vessel. The opening serves to discharge the liquid in the tank. Stream of liquid issuing from the orifice opening is called 'jet'. In the process, the energy of the fluid in the tank is converted to kinetic energy as the jet issues out into the atmosphere. The jet cross-section initially contracts to a 'minimum' and then expands. The section at the contraction (with minimum area) is known as 'vena contracta'. The contraction and expansion of the jet results in loss of energy.

Co-efficient of Contraction (C_c): It is the ratio between the area of the jet at vena-contracta and the area of the orifice. Its value depends upon the shape and size of the orifice and water head causing the flow.

Co-efficient of Velocity (C_v): It is the ratio between the actual velocity and the theoretical velocity of the jet. The actual velocity (at vena-contracta) is less due to frictional resistance at the orifice edges. Its value also depends upon the shape and size of the orifice and water head causing the flow. Actual velocity is measured from the X-Y co-ordinates of the issuing jet and theoretical velocity is obtained from the head of water (h) in the supply tank. Consider a small particle of water at vena-contracta. Suppose it falls through a vertical distance 'y' and covers a horizontal distance 'x' in time 't' seconds,

We have $x = V.t$ and $y = \frac{1}{2} g t^2$

Eliminating 't' from the two equations, we get $V_a = \sqrt{gx^2 / 2y}$

Now, theoretical velocity is given by $V_{th} = \sqrt{2g.H}$

Thus $C_v = V_a / V_{th} = \sqrt{x^2 / 4yH}$

Co-efficient of Discharge (C_d): Since actual area of the jet is less than the area of the orifice, and the actual velocity is less than the theoretical velocity, therefore, actual discharge is less than the theoretical discharge. The ratio between the actual and the theoretical discharge is called co-efficient of discharge.

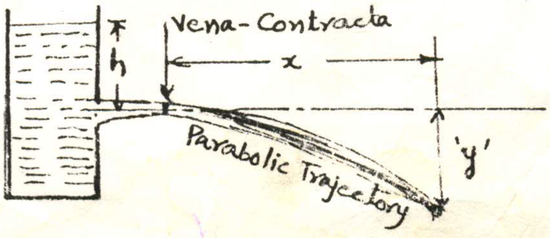
Actual discharge = Measured from the collecting tank

Theoretical discharge = $A.\sqrt{2gh}$ where A is the area of the orifice

Thus $C_d = C_v . C_c$

EXPERIMENTAL SET-UP

The set-up is shown in the Fig . It consists of an inlet tank mounted on a stand to which an orifice is fitted. The tank is connected to the adjustable water supply. There is a scale and piezo-meter tube attached to the tank to find out 'h'. A horizontal scale on which a hook is mounted, is attached to this inlet tank. Hook gauge can be moved vertically as well as horizontally and its movement can be read on vertical and horizontal scales respectively. The orifice discharges into the measuring tank.



PROCEDURE

- Fit a circular orifice and fit it on the mounting plate of the inlet tank
- Adjust the inflow of water to the inlet tank till a steady state condition is achieved i.e. head causing flow through as indicated by the piezo-meter tube is constant. Note water head 'h'
- Using the hook-gauge, measure x and y co-ordinates.
- Note the initial reading of water level in the measuring tank and simultaneously start the stop watch. After a sufficient interval of time (3-5 minutes), again note the reading of the water level and the time .
- Vary the head 'h' and repeat the above steps for one more reading.
- Change the orifice and repeat the experiment

OBSERVATIONS

Table-1 Water Collection Tank Length 50 cm
Water Collection Tank Width 40 cm
Area of the Tank 2000 Sq cm

Sl No	Discharge Tank Initial Vol	Discharge Tank Final Vol	Time (sec)	Head 'H'	'x'	'y'	Dia of Orifice
Circular							
(i)	0	30	50	19	22	8	8mm
(ii)	0	40	60	18	22	9	8mm
Converger							
(i)							
(ii)							

CALCULATIONS

Sl No	Area of Orifice 'A'	Discharge Actual Q_A	Discharge Theoretical Q_{th}	$C_d = \frac{Q_A}{Q_{th}}$	$C_v = \sqrt{\frac{x^2}{4yH}}$	$C_c = \frac{C_d}{C_v}$
1	200.96	30	3917.4136	0.0076581	0.7960	0.0096207

PRECAUTIONS

1. The position of vena-contracta should be found accurately and co-ordinates be measured from there.
2. The hook-gauge should always be moved in the same direction to avoid back-lash error.
3. For every reading, the time span for measuring discharge should be kept same, as far as possible.
4. Readings should be taken at steady state conditions.

FLUID MECHANICS LAB : EXPERIMENT NO : 8

ome

AIM

To determine the Discharge co-efficients for v notch and rectangular notches.

EQUIPMENT

- As indicated in the Diagram

THEORY

A notch is a geometrical opening in the side of a reservoir so that flow takes place in such a manner that liquid level is always **below** the upper edge of the opening. It may be considered as a largr orifice whose upper edge is eliminated so that it has a variable area depending upon the level of the free surface. A notch is used exclusively for measuring the discharge rates.

The V-notch is one of the most precise discharge measuring device suitable for a wide range of flow.. The relationship between discharge and the head of water over the notch can be developed by making the following assumptions :

- The free surface of the fluid remains horizontal so that plane of all the particles passing over the notch is horizontal.
- The effect of viscosity and surface tension is negligible.
- The velocity in the approach channel is negligible.
- Upstream of the notch, the flow is uniform.
- The pressure throughout the sheet of liquid which passes over the crest is atmospheric

Theoretical discharge for a V-notch $Q = 8/15\sqrt{2g} \times \tan \theta/2 \times H^{5/2}$ where θ is the angle of the notch

Theoretical discharge for a Rectangular-notch $Q = 2/3\sqrt{2g} \times W.H^{3/2}$ where W is the width of the notch

EXPERIMENTAL SET-UP

The apparatus consists of a tank on a raised platform. It is fitted with a V or rectangular notch with vertical perforated plates fitted in it to decrease turbulence and thereby the velocity of approach to the notch. There is a water inlet pipe with a controlling mechanism.. There is provision to measure the discharge ow water in a given period of time with a stop watch.

PROCEDURE

- Record the geometrical features of the notch.
- Allow the water into the tank till it just starts passing over the notch.
- Stop the supply of water and record the level of water with the gauge.

- Open the supply of water and increase it till the head over the sill of the notch becomes constant. Record this level. Difference of these two readings gives the 'head' of water.

- Measure the flow rate in a given period of time.

- Vary the flow rate with the regulating valve and repeat the experiment.

OBSERVATIONS

Width of rectangular Notch :
Angle of the V-notch :

Level of Crest H_1 H_2	Head 'H' = $H_1 - H_2$	Water level in collection Tank Initial Final	Time

CALCULATIONS

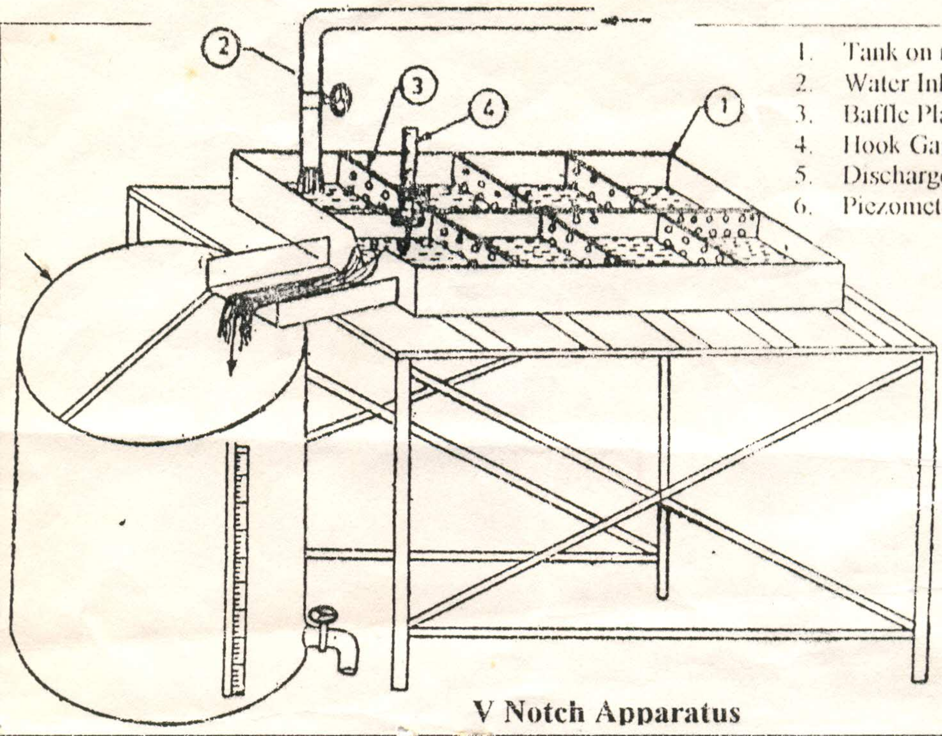
Actual Discharge Qa

Theoretical discharge Qth

Discharge Coefficient Cd = Qa / Qth

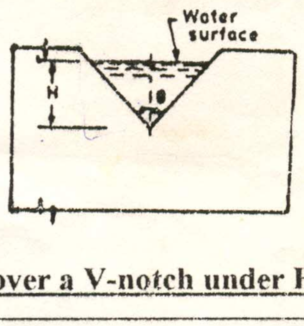
PRECAUTIONS

- Each reading should be taken when steady state condition is established and head remains constant.
- Flow rate for each reading should be recorded over the same time period which should be fairly large.
- Initial gauge reading should be taken when water becomes stand still.
- Final gauge reading should be taken after ensuring that there are no eddies or wakes on the water surface.



1. Tank on raised Platform
2. Water Inlet pipe & control valve
3. Baffle Plates
4. Hook Gauge with vernier Scale
5. Discharge Tank
6. Piezometer Tube

V Notch Apparatus



Flow over a V-notch under Head 'H'