OBSERVATIONS AND CALCULATIONS

Table 1. Results of flow through Venturimeter

S.No.	Manometric reading in cm of mercury		Equivalent head in meters of water (h)	Time for H rise sec	Discharge (Q) m^3 / s		Coefficient of discharge, C_d
	h_1	h_2			Q_{act}	Q_{th}	

Diameter of inlet of venturimeter, d_1 =
Diameter of throat of venturimeter, d_2 =
Dimensions of collecting tank =

Table 2. Results of flow through Orificemeter

S.No.	Manometric reading in cm of mercury		Equivalent head in meters of water (h)	Time for H rise sec	Discharge (Q) m^3 / s		Coefficient of discharge, C_d
	h_1	h_2			Q_{act}	Q_{th}	

Diameter of pipe, d_1 =
Diameter of orificemeter, d_2 =
Dimensions of collecting tank =

Experiment No: Roll No:
Date :

4. ESTIMATE THE RATE OF FLOW FOR A PIPE LINE SUPPLYING WATER TO HOUSTON REFINERY, TEXAS (using Venturimeter / Orificemeter)

AIM

To determine the coefficient of discharge of given Venturimeter / Orificemeter

BASIC CONCEPT

Flow rate measurement is a fundamental necessity in almost all flow situation of engineering importance. For confined flows the main devices used are a class of meters called obstruction meters. The basic principle in all these obstruction meters is that the flow undergoes a change in its cross-sectional area as it passes along the channel. It results in creation of difference of pressure across the channel which is uniquely related to the flow rate and geometry of the obstruction together with the fluid properties. Venturimeter consists of a converging section, a cylindrical throat and a divergent cone. A differential mercury manometer is connected between the inlet section and the throat of venturimeter to measure the pressure difference between these two sections.

The following expressions are used to compute the discharge through a venturimeter.

Theoretical discharge, $Q_{th} = \dfrac{a_1 a_2 \sqrt{2gh}}{\sqrt{(a_1^{\,2} - a_2^{\,2})}}$

a_1 = Cross- sectional area of inlet

a_2 = Cross- sectional area of throat

g = acceleration due to gravity

h = Pressure head in terms of flowing liquid $= \dfrac{(h_1 - h_2)}{100}\left(\dfrac{s_m}{s_l} - 1\right)$

h_1 = Manometric level in one limb of manometer.

h_2 = Manometric level in another limb of manometer.

S_m= Specific gravity of manometric liquid (for Mercury = 13.6)

S_1 = Specific gravity of the flowing liquid (for Water = 1.0)

Actual discharge, Q_a = AH / t

A = Internal plan area of collecting tank.

H = Rise of water level in the tank

t = Time taken for rise of " H" cm in the collecting tank.

Coefficient of discharge of the venturimeter, $C_d = Q_a / Q_t$

MODEL CALCULATIONS

APPARATUS

1. Pipe fitted with Venturimeter / Orificemeter
2. Differential U – tube mercury manometer
3. Collecting tank fitted with piezometer and gate valve
4. Stop watch
5. Meter scale

PROCEDURE

1. The diameter of the inlet section, throat and internal plan dimensions of the collecting tank are measured.
2. The control valve in the pipe line is opened for maximum discharge.
3. The pressure difference between the inlet section and throat of the venturimeter is measured
4. The outlet valve of the collecting tank is closed and time taken for a rise of "H" cm in the collecting tank is noted down
5. The above procedure is repeated for different discharges by controlling the gate valve.

GRAPH

The following graph is drawn by taking Q_{act} on y – axis and $\sqrt{h}$ on x-axis

Q_{act} vs $\sqrt{h}$

RESULT

The coefficient of discharge of Venturimeter / Orificemeter (C_d) =
(from experiment)

The coefficient of discharge of Venturimeter / Orificemeter (C_d) =
(from Q_a vs $\sqrt{h}$ graph)

INFERENCE