UNIVERSITY OF ENGINEERING AND TECHNOLOGY

TAXILA

FLUID MECHANICS LAB

Experiment No 5

SUBMITTED BY

Name: Zeeshan Mahmood

Reg. No: 20-ME-157

Section: A_2

SUBMITTED TO
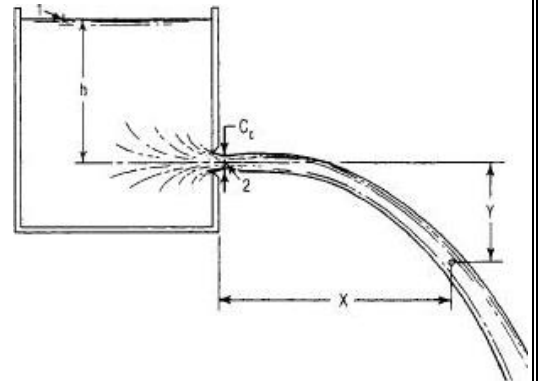
Engr. Abdul Rehman

EXPERIMENT NO. 5

TITLE:

To determine hydraulic coefficients in flow through orifices.

APPARATUS:

- ➤ Perspex tank with an orifice in side wall
- ➤ Steel Rule
- ➤ Stop watch
- ➤ Water collecting Perspex tank

THEORY:

When flow takes place through an orifice from the supply tank, the water jet leaving the orifice

gets contracted at the downstream of the orifice and the point where it gets the maximum

contraction is called as vena-contracta. Following are three hydraulic coefficients of orifice:

1. Coefficient of Contraction (Cc)
2. Coefficient of Velocity (Cv)
3. Coefficient of discharge (Cd)

1. Coefficient of Contraction (Cc)

It is the ratio of area of water jet at

vena-contracta to the area of the orifice.

$$C_c = \frac{a_c}{a}$$

Where,

ac = Area of jet at vena-contracta

a = Area of the orifice

2. Coefficient of Velocity (Cv)

It is the ratio of velocity of water jet at vena-contracta to the theoretical velocity.

$$C_v = \sqrt{\frac{x^2}{4yh}}$$

Where,

x = Horizontal ordinate

y = Vertical ordinate

h = Head

3. Coefficient of discharge (Cd)

It is the ratio of actual discharge to the theoretical discharge.

$$C_d = \frac{Q}{a.\sqrt{2gh}}$$

Where,

Q = Actual discharge

a = Area of the orifice

g = acceleration due to gravity

The relation between the coefficient of contraction, coefficient of velocity and coefficient of discharge can be expressed as :

Coefficient of discharge = coefficient of contraction X coefficient of velocity

$$C_d = C_c \cdot C_v$$

PROCEDURE:

➢ Open one inlet and maintain the head constant at supply tank over the orifice. The water is supplied by basic hydraulic bench
➢ Allow water to flow through orifice.
➢ Maintain constant water level during practical
➢ Note the time taken for collecting to a height 'h' in the measuring tank.
➢ Note X and Y coordinates using scale at the center of vena contracta point
➢ Repeat the experiment by changing X-coordinates.

OBSERVATIONS:

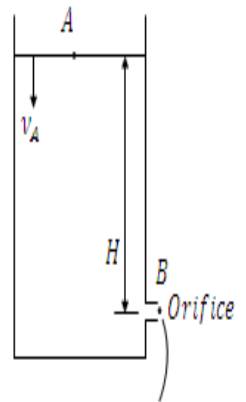| Sr No.	H	X	Y	$V_{th}=\sqrt{2gH}$	$Q_{th}=a x V_{th}$	Q_{ac}	$C_v=x/\sqrt{4yH}$	$C_d=Q_{act}/Q_{th}$	$C_c=C_d/C_v$
1	26	36.4	12	226.6	71.83	87.05	1.005	1.211	1.211
2	26	41.4	16	226.6	71.83	87.05	1.011	1.211	1.211
3	26	45.4	20	226.6	71.83	87.05	0.99	1.211	1.211

CALCULATIONS:

H is constant: $v_A = 0$

$$TH_A = TH_B + h_{L_{A-B}}$$

$$0 + 0 + H = \frac{v^2_B}{2g} + 0 + 0$$

$$v_g = \sqrt{2gH}$$

$$Q_{th} = A\sqrt{2gH}$$

$$Q_{act} = \frac{volume}{time} = C_d A\sqrt{2gH}$$

Measurement of Jet Trajectory

$$v = v_0 + at$$

$$v = v_0^2 + 2ax$$

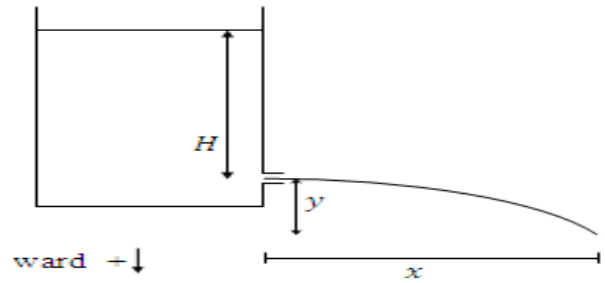$$x = v_0 t + \frac{1}{2}at^2$$

In x-direction

$$y = v_{0y}t + \frac{1}{2}gt^2$$

Assuming positive in downward direction

$$y = \frac{1}{2}gt^2$$

$$y = \frac{1}{2}g\left(\frac{x}{v}\right)^2$$

$$v = \sqrt{\frac{1}{2}g\frac{x^2}{y}}$$

H

y

ward +↓

x

$$v_{act} = \sqrt{\frac{gx^2}{2y}} = \frac{x}{\sqrt{\frac{2y}{g}}}$$

Result:

Coefficient of contraction of orifice, Cc = **1.211**

Coefficient of velocity of orifice Cv = **1.005**

Coefficient of discharge of orifice, Cd = **1.211**

Experiment Title: To determine hydraulic coefficients in flow through orifices.

Course title: Fluid Mechanics Lab   **Total Marks:** _____

Practical No. 5   **Date of experiment performed:** 26-11-2021

Course teacher/Lab Instructor: Engr. Abdul Rehman   **Date of marking:** _____

Student Name: Zeeshan Mahmood

Registration no. 20-ME-157

Knowledge components	Domain	Taxonomy level	Contribution	Max. marks	Obtained marks
1. Student has conducted the experiment by practicing the hands-on skills. 2. Student has achieved required accuracy in performance.	Psychomotor	Precision (P3)	60%	15	
3. Student has contributed or responded affectively in form of group or team.	Affective	Respond (A2)	20%	5	
4. Student has knowledge regarding the experiment and successfully applied the input values for required calculations.	Cognitive	Apply (C3)	20%	5	
			Total	25	

Signed by Course teacher/ Lab Instructor