KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

POLITEKNIK MALAYSIA
KUCHING SARAWAK

DEPT. OF MECHANICAL ENGINEERING		
DJJ20273 / FLUID MECHANICS		
LECTURER NAME		
TYPE OF ASSESSMENT		
TOPIC		
DURATION		
DATE OF ASSESSMENT		
STUDENT'S INFORMATION	NAME	REGISTRATION NO.
TOTAL MARKS	CLO3	/MARKS

Nota :

i. *Bagi kursus seperti MPU22042 Bahasa Kebangsaan A dan lain-lain kursus yang diajar dalam Bahasa Melayu maka penggunaan bahasa pada muka hadapan lembaran kerja dan arahan/kandungan pada lembaran kerja adalah menggunakan Bahasa Melayu sepenuhnya.*

POLITEKNIK MALAYSIA
KUCHING SARAWAK

DJJ20273 – FLUID MECHANICS

ASSESSMENT NO. 3 FLOW RATE MEASUREMENT

CLO NO.	CLO STATEMENT	PLO NO.	DK DP NA
CLO3	Organize appropriate experiments in groups according to the Standard Operating Procedures.	P4, PLO5	DK6: ENGINEERING PRACTICE DP1: DEPTH OF KNOWLEDGE DP2: RANGE OF CONFLICTING REQUIREMENT DP3: DEPTH OF ANALYSIS REQUIRED

A. OBJECTIVES

To calculate the flow in a pipeline with orifice plate and venture tube.

B. LEARNING OUTCOME

At the end of the lab session students should be able:

i. To determine the Actual Flow Rate (Q_{actual}) and the Theoretical Flow Rate (Q_{exp}) for different pressure measurement equipment.

ii. To determine the coefficient of Discharge (Cd) for different pressure measurement equipment.

C. TOPIC SUMMARY/ THEORY

Flow measurement is the quantification of bulk fluid movement. It can be measured in a variety of methods. Venture and Orifice meters are the most used flow-sensing elements in industries. The venturi tube has a converging conical inlet, a cylindrical throat, and a diverging recovery cone. It has no projections into the fluid, no sharp corners, and no sudden changes in contour.

Orifice plate is frequently used for measuring the flow rate of gases through pipelines but can also be used to choke the flow and so limit the throughput. The orifice consists of a thin plate that is usually fitted into a flanged joint in the pipeline. It has a sharp-edged opening that is concentric with the pipe.

D. MATERIAL / TOOLS

i. Fluid Friction Apparatus (D1131)

ii. Calculator

E. GENERAL INSTRUCTION / SAFETY PROCEDURE

i. Wear suitable attire when in the lab.

ii. Wear safety goggles while handling the liquids.

iii. Always clean droplets or excessive liquid at the working area during and after experiments.

iv. Always obey the Lecturer/Lab Assistant instructions.

F. WORK INSTRUCTION / PROCEDURE

i. Perform the startup procedure.

ii. Select orifice plate to study.

iii. Connect tapping pressure in between the orifice plate to differential pressure transmitter and to manometer.

iv. Fully open MBV-110 and MBV-111.

v. Ensure other ball valves are fully closed.

vi. Start P-101 and slowly open MGV-101 until the level starts to show up in the tube manometer.

vii. Allow the flow to be stabilized and record the read on the digital indicator.

viii. Record the differential pressure between P1 and P2 and the height difference in tube manometer. Repeat steps 1-8 for venturi tube.

G. RESULT

Items	ΔP	ΔH	Q_{exp}	A_2	v	D	d	β	Cd	Q_{calc}	ΔQ
Unit	(kPa)	(m)	(L/min)	(m^2)	(m/s)	(mm)	(mm)			(L/min)	(L/min)
Orifice Plate	1.8	0.179	6.6			28	10		0.6		
Venturi tube	0.1276	0.02	6.2			25.4	15		0.94		

The formula for calculation:

$$Q_1 = C_d A_2 \sqrt{\frac{2\rho g \Delta H}{\rho(1-\beta^4)}}$$

Where:

Q_1 = Inlet flowrate, m^3/s
C_d = Discharge coefficient, (0.6)
P_1 = Inlet pressure, N/m^2
P_2 =Orifice plate pressure, N/m^2
H = Difference in height, m
A_2 = Area of nozzle/throat, m^2
A_o = Area of orifice/venturi, m^2
ρ = Density of water, kg/m^3
β = Inner and outer diameter ratio
d = Orifice/venturi diameter, m
D = Pipe diameter

H. DISCUSSION

Justify the differences in Q_{exp} and Q_{calc}.

Explain the factors that affected the differences in Q_{exp} and Q_{calc}.

I. REFERENCES

Douglas,J.F, J.M Gasiorek & J.A Swaffield (1996). Fluids Mechanics – (3rd Edition). Longman:

Singapore Prasuhn, Alan L (1980). Fundamentals of Fluid Mechanics. Prentice-Hall: London

Bagu, C & Mudin, H (2020). Fluid Mechanics Laboratory Experiments and Demonstrations – (Polytechnic Edition). MSR Enterprise.

Dr. Pruthviraj U. (2024). Virtual Labs. Fluid Mechanics Lab. https://fm-nitk.vlabs.ac.in/

PREPARED BY: *(Course Lecturer)* *……* *( )* ***Date:***	***CHECKED BY:*** *(Course Coordinator/ Head of Programme)* *……* *( )* ***Date:***	***APPROVED BY:*** *(Head of Programme/ Head of Department)* *……* *( )* ***Date:***