VIT
Vellore Institute of Technology

SLOT: D1+TD1

REG.NO.: 24B[redacted]

SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -II
FALL SEMESTER 2025-2026

Programme Name & Branch	: B.Tech- Automotive, Mechanical, Manufacturing Engineering
Course Code	: BMEE204L
Course Name	: Fluid Mechanics and Machines
Faculty Name(s)	: **Anuj Kumar, Aruna Kumar Behura, Gundabattini Edison, Mohamed Ibrahim M, Sreeja Sadasivan**
Class Number(s)	: **VL2025260102051, VL2025260102049, VL2025260102050, VL2025260102048, VL2025260102047**
Date of Examination	:**08 October 2025, 2:00PM-3:30 PM**
Exam Duration	: **90 minutes** **Maximum Marks: 50**

General instruction(s): "The use of Moody chart" is permitted

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes Statements:
  - CO. 3: Formulate suitable governing equations to solve fluid flow problems
  - CO. 4: Analyse the viscous flow through pipes and determine various losses
  - CO. 5: Perform dimensional analysis of various flow problems

Q. No	Question	M	CO	BL
1.	A student in a university hostel notices that the water pressure in the showers seems to have dropped. To investigate, a clever engineering student decides to measure the flow rate from the main water supply pipe feeding the bathrooms. To determine the flow rate, the student measured the time it took to fill a 50-liter bucket. This took 3 minutes and 40 seconds. The student has access to a simple venturimeter with a throat diameter of 2.5 cm, which is attached to the water supply pipe (diameter =5cm). Using a homemade differential manometer with a fluid that is four times as dense as water, what should be the expected height difference (x) on the manometer? Assume a coefficient of discharge (Cd) of 0.96 for the venturimeter.	10	CO3	BL3
2.	Determine the magnitude and direction of the anchoring force needed to hold the horizontal elbow and nozzle combination shown in **Fig.1** in place. The gage pressure at section (1) is 100 kPa. At section (2), the water exits to the atmosphere.	10	CO3	BL3
3.	A fluid of (μ=8 poise and ν= 8 stokes) is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at wall is given as 196.2 N/m^2. Find pressure gradient, (ii) the	10	CO4	BL3

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	average velocity (iii) Reynolds Number (iv) calculate power required per km of pipe line to overcome the viscous resistance.			
4.	Suppose you are designing an HVAC system for a commercial building. The design requires a 7-meter-long, rectangular duct (15 cm x 20 cm) made of commercial steel (ε=0.045 mm) to supply fresh air to a specific room. The air needs to be delivered at an average velocity of 7 m/s at standard atmospheric pressure and a temperature. Determine the minimum power the fan needs to overcome the friction losses within this duct section. (Assume density of air as 1.145 kg/m^3 and viscosity as 1.895 $\times 10^{-5}$ kg/m.s)	10	CO4	BL3
5.	A liquid of density ρ and viscosity μ flows by gravity through a hole of diameter d in the bottom of a tank of diameter D **(Ref Fig.2)**. At the start of the experiment, the liquid surface is at height h above the bottom of the tank, as sketched. The liquid exits the tank as a jet with average velocity V straight down as also sketched. Using dimensional analysis, generate a dimensionless relationship for V as a function of the other parameters in the problem. Identify any established non-dimensional parameters that appear in your result.	10	CO5	BL3

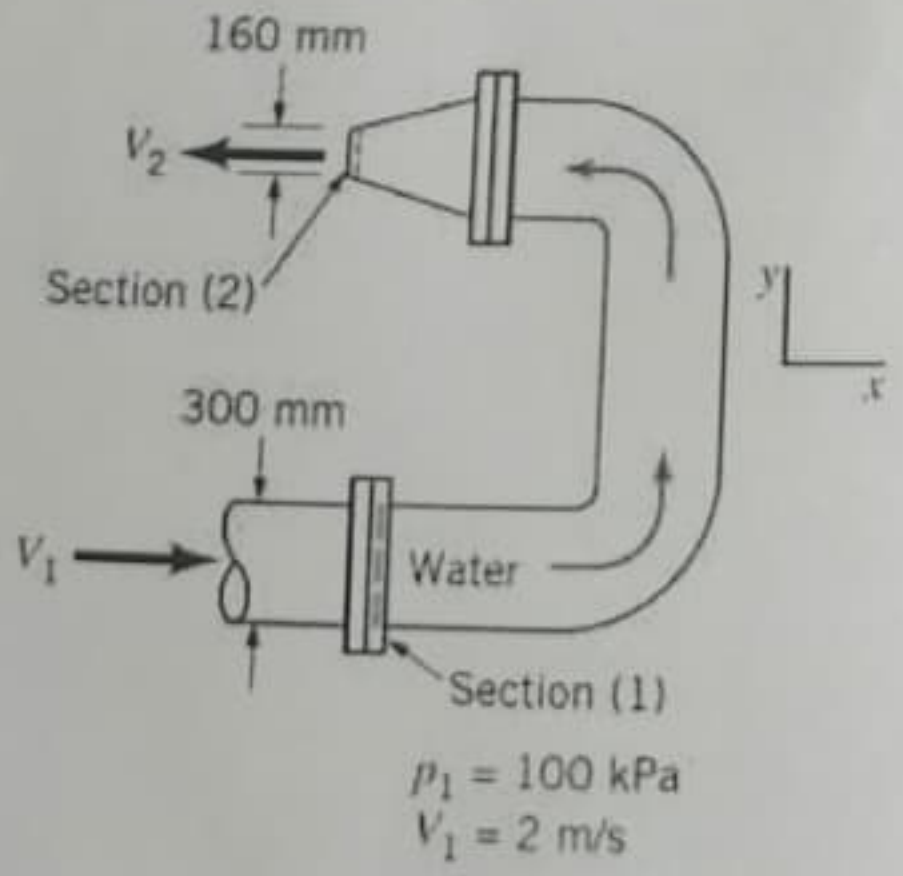

Fig.1 Schematic of elbow and nozzle arrangement (For question 2)

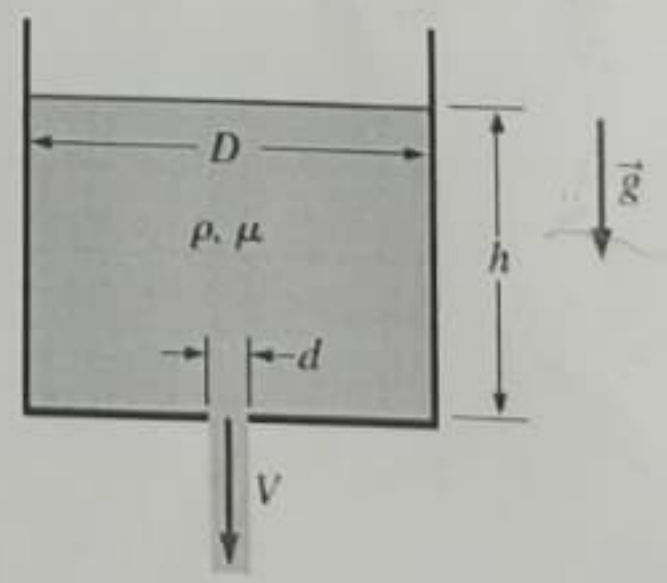

Fig.2 Schematic representation of given flow condition (For question 5)

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