VIT
Vellore Institute of Technology

REG.NO.: 24BCM002

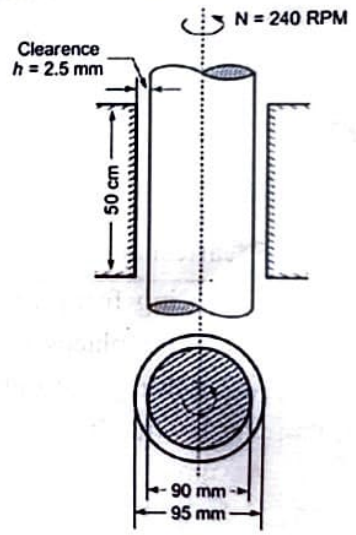
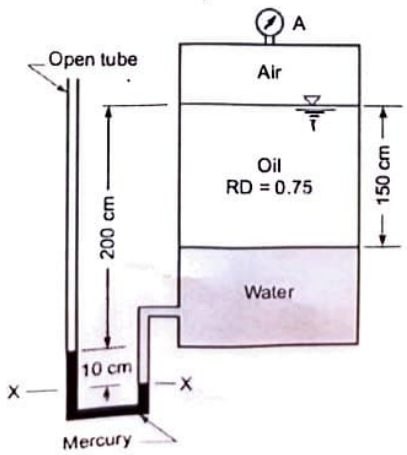
SLOT: C1+TC1

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

Programme Name & Branch	**: B.Tech Chemical Engineering**
Course Code	**: BCHE205L**
Course Name	**: Momentum Transfer**
Faculty Name(s)	**: Dr. Dharmendra Kumar Bal/Dr. Babu Ponnusami**
Class Number(s)	**: VL2025260501167/VL2025260501165**
Date of Examination	**: 29/01/2026**
Exam Duration	**: 90 minutes**

Maximum Marks: 50

General instruction(s): Answer all questions

Q. No	Question	Marks
1.	A cylindrical shaft of 90 mm diameter rotates about a vertical axis inside a fixed cylindrical tube of length 50 cm and 95 mm internal diameter as shown in figure 1. If the space between the tube and the shaft is filled by a lubricant of dynamic viscosity 2.0 poise, determine the power required to overcome viscous resistance when the shaft is rotated at a speed of 240 rpm.  Figure.1	10
2.	(a)The tank is closed at the top and contains air at a pressure P_A as shown in figure 2. Calculate the value of P_A for the manometer reading shown. [5M]  Figure.2 (b) If the surface tension at the soap-air interface is 0.088N/m, calculate the internal pressure in a soap bubble of 3 cm diameter.[5M]	10

3. A 2.0 m long conical diffuser of 20 cm diameter at the upstream end and 80 cm diameter at the downstream end as shown in figure 3. At a certain instant, the discharge through the diffuser is observed to be 200 L/s of water and is found to increase uniformly at a rate of 50 L/s. Estimate the local, convective and total acceleration at a section 1.5 m from the upstream end. 10

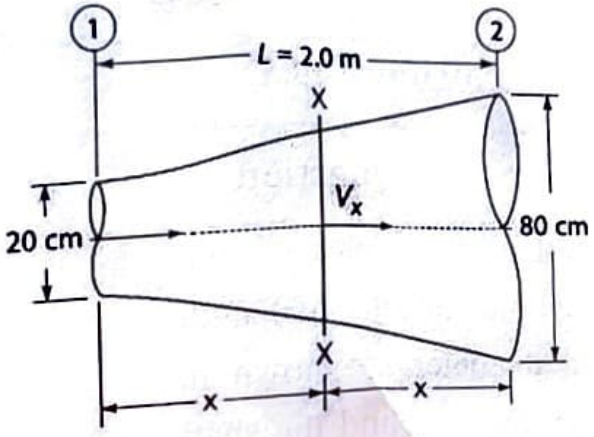
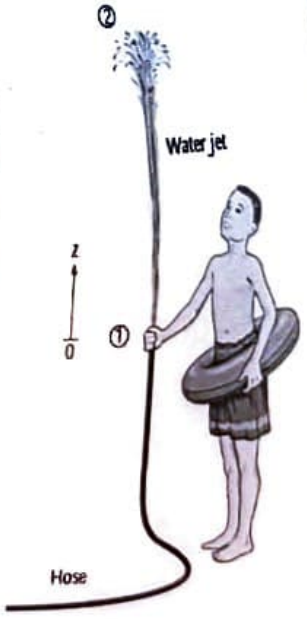


Figure.3

4. Derive the continuity equation for the fluid flow through a control volume in three dimensional Cartesian coordinate system. 10

5. (a) Water is flowing from a hose attached to a water main at 400 kPa gauge. A child places his thumb to cover most of the hose outlet, causing a thin jet of high-speed water to emerge. If the hose is held upward, what is the maximum height that the jet could achieve? Assume the flow exiting into the air is steady, incompressible, and irrotational and the velocity inside the hose is relatively low. Take density of water 1000 kg/m^3.[5M]



(b) A Pipe line carrying oil (sp.gr.0.8) changes in diameter from 300 mm at position 1 to 600 mm diameter at position 2 which is 5 meters at a higher level. If the pressures at positions 1 and 2 are 100 kN/m^2 and 60 kN/m^2 respectively and the discharge is 300 liters/sec, determine: Loss of head and direction of flow. [5M]

Formulas:

$$\tau = -\mu \frac{du}{dy}$$

$$P_B = P_A + \rho g h$$

$$\frac{P}{\rho g} + \frac{V^2}{2g} + Z = Constant$$