REG.NO.:

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

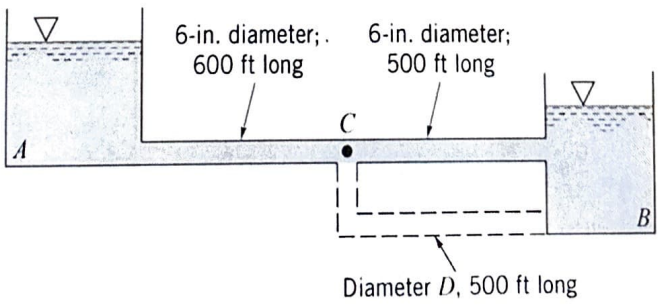
SLOT: D1+TD1

Programme Name & Branch	**: B.Tech (Chemical Engineering)**
Course Code and Course Name	**: BCHE205L, Momentum Transfer**
Faculty Name	**: D Chitra**
Class Number	**: VL2024250102660**
Date of Examination	**: 16-10-2024**
Exam Duration	**: 90 minutes**

Maximum Marks: 50

General instructions:

- Assume necessary and appropriate data if required.
- Use of Moody chart is permitted.

Q. No	Question	Marks
1.	The mass flow rate of air at 20°C (ρ=1.204 kg/m^3) through a 15 cm diameter duct is measured with a Venturi meter equipped with a water manometer. The Venturi neck has a diameter of 6 cm, and the manometer has a maximum differential height of 40 cm. Taking the discharge coefficient to be 0.98, determine the maximum mass flow rate of air this Venturi meter can measure. Also, calculate the average flow velocity in the duct.	10
2.	Air at standard conditions flows through a horizontal 1 ft by 1.5 ft rectangular wooden duct at a rate of Determine the head loss, pressure drop, and power supplied by the fan to overcome the flow resistance in 500 ft of the duct. $Q_1 = 5ft^3/min$	10
3.	The flow rate between tank A and tank B shown in Fig. 1 is to be increased by 30% (i.e., from Q to 1.30Q) by the addition of a second pipe (indicated by the dotted lines) running from node C to tank B. If the elevation of the free surface in tank A is 25 ft above that in tank B, determine the diameter, D, of this new pipe. Neglect minor losses and assume that the friction factor for each pipe is 0.02  Fig.1	10

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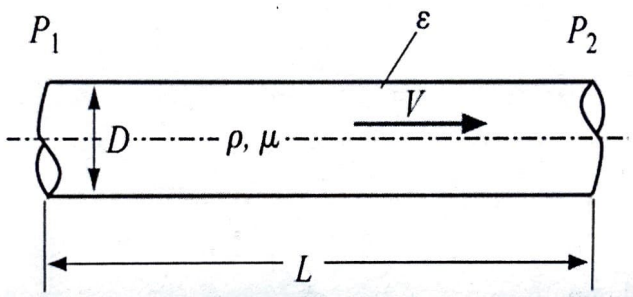
4.	An incompressible fluid of density r and viscosity m flows at average speed V through a long, horizontal section of round pipe length L, inner diameter D, and inner wall roughness height. The pipe is long enough that the flow is fully developed, meaning that the velocity profile does not change down the pipe. Pressure decreases (linearly) down the pipe in order to "push" the fluid through the pipe to overcome friction. Using the method of repeating variables, develop a nondimensional relationship between pressure drop $\Delta P = P_1 - P_2$ and the other parameters in the problem. Be sure to modify your π groups as necessary to achieve established nondimensional parameters, and name them. Refer Fig. 2	10
	 Fig. 2	
5.	River models are used to study many different types of flow situations. A certain small river has an average width and depth of 60 ft and 4 ft, respectively, and carries water at a flow rate of 700 ft^3/sec. A model is to be designed based on Froude number similarity so that the discharge scale is 1/250. At what depth and flow rate would the model operate?	10

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