U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 22CH3PCFME / 19CH3DCFME **Max Marks: 100**
Course: Fluid Mechanics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Derive the expression for pressure drop measured by an inverted U Tube differential manometer with a neat sketch. **10**

b) A plate 0.025 mm distant from a fixed plate moves at 60 cm/s and requires a force of 2 N/m^2 to maintain its speed. Determine fluid viscosity between the plates. **05**

c) If the atm. pressure at sea level is 101430 N/m^2, determine the pressure at a height of 2500 m assuming that the pressure variation follows. (i) Hydrostatic law, and (ii) Isothermal law. The density of air is given as 1.208 kg/m^3. **05**

OR

2 a) List the properties of the fluids considered for fluid flow phenomena. **04**

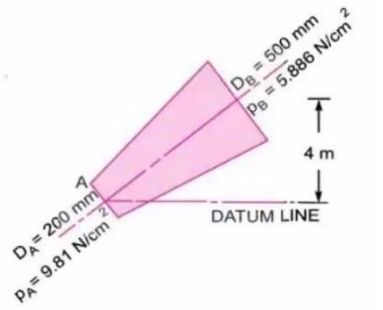
b) Explain Reynolds stress and Eddy viscosity. **10**

c) Estimate the transition length at the entrance to a 15-mm tube through which 100 percent glycerol at 60 ^0C is flowing at a velocity of 0.3 m/s. The density of glycerol is 1,240 kg/m^3 and viscosity is 98 cP. **06**

UNIT - II

3 a) Derive the equation of continuity for an incompressible fluid. **10**

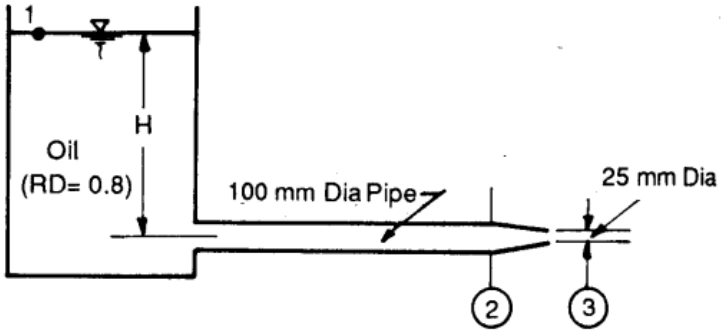
b) A pipeline carrying oil of specific gravity 0.87 changes in diameter from 200 mm diameter at point A to 500 mm diameter at point B, which is 4 m above the level of a higher level. If the pressure at A & B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 liter/s. Determine the loss of head & the direction of flow. **10**



OR

4 a) What are the limitations of Bernoulli's equation? Explain how the pump work is estimated using the Bernoulli's equation. **10**

b) Figure below shows a nozzle at the end of a pipe discharging oil from a tank to atmosphere. Estimate the discharge from the nozzle when the head H in the tank is 4.0 m. The loss in the pipe can be taken as 20 $\frac{V^2}{2g}$ where V = velocity in the pipe. The loss of energy in the nozzle can be assumed to be zero. Also determine the pressure at H base of the nozzle. **10**



UNIT - III

5 a) Derive the expression of velocity, pressure and temperature for the flow of a compressible fluid through a nozzle. **10**

b) Define Mach number and explain its significance. **04**

c) Find the sonic velocity for the following fluids: (i) Crude oil of specific gravity 0.8 and bulk modulus 1.5x 10^9 N/m^2 (ii) Mercury having a bulk modulus of 27x10^9 N/m^2 **06**

UNIT - IV

6 a) Define a pump and illustrate the classification of pumps. **06**

b) Explain the characteristics curves of a centrifugal pump. **08**

c) Explain the causes of priming and cavitation in pumps. **06**

UNIT – V

7 a) Using Buckingham-π theorem of dimensional analysis, show the torque due to friction developed over a disc rotating in a fluid is expressed as $T = D^5N^2\rho\ \Phi[\frac{\mu}{D^2N\ \rho}]$ Where, D is diameter of disc, N is speed, μ is the viscosity and ρ is the density of fluid **10**

b) Explain the significance of any five dimensionless numbers used to solve fluid flow problems. **10**

******