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

Autonomous Institute Affiliated to VTU

May 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 **Date: 12.05.2023**

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) State and derive the hydrostatic equilibrium principle. **10**

b) State and prove Pascal's law. **10**

OR

2 a) Explain with suitable examples, the behaviour of non-Newtonian fluids using shear stress versus velocity gradient plot. **08**

b) A simple manometer (U – tube) containing mercury is connected to a pipe in which an oil of specific gravity 0.94 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to the atmosphere. Find the vacuum pressure in the pipe, if the difference of mercury level in the two limbs is 25cm and height of the oil in the left limb from the center of the pipe is 10 cm below. **06**

c) What is a Boundary Layer? Explain the development of boundary layer for flow through a pipe in detail. **06**

UNIT - II

3 a) Derive the Bernoulli's equation by stating all the assumptions made. **10**

b) Starting from first principles, show that for laminar flow of a Newtonian fluid through circular pipe, pressure drop, $\Delta P = \frac{32\mu\bar{u}L}{\rho g D^2}$. **10**

OR

4 a) With the help of a neat sketch, derive the expression for average velocity of the flow of a Newtonian fluid through a pipe. **12**

b) With a neat sketch, explain the friction factor chart. **08**

UNIT - III

5 a) Derive the Area-velocity relationship for a compressible flow. **08**

b) Find the velocity of air flowing at the outlet of a nozzle fitted to a large vessel which contains air at a pressure of 294.3 N/cm^2 (abs). The pressure at the outlet of the nozzle is 206 N/cm^2 (abs). Take R=287 J/kg.K and k=1.4 for air. Assume temperature as 20°C. **06**

c) Define the terms: Stagnation pressure, stagnation density, stagnation temperature. **06**

UNIT - IV

6 a) Explain the construction and working of a centrifugal pump with the help of a neat diagram. **06**

b) Explain the following terms: (i) Net-positive suction head (ii) Pump efficiency (iii) Priming (iv) Cavitation. **08**

c) Derive the equation for determining the coefficient of discharge (C_o) of a fluid through an orifice meter. **06**

UNIT – V

7 a) What is meant by repeating variable? How are the repeating variables selected for dimensional analysis? **08**

b) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. **12**

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