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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E.   Semester: III
Branch: Chemical Engineering   Duration: 3 hrs.
Course Code: 19CH3DCFME   Max Marks: 100
Course: Fluid Mechanics   Date: 19.09.2023

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 prove the Pascal's law. **10**

    b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15c m below. **10**

OR

2. a) Briefly explain the following:
       (i) Potential flow
       (ii) Ideal fluid and laminar flow
       (iii) No slip condition **06**

    b) Explain the concept of boundary layer separation and wake formation with a neat diagram. **08**

    c) A differential manometer is connected at the two points A and B as shown in figure below. At B, air pressure is 7.848 N/cm^2 (abs.). Find the absolute pressure at A. **06**
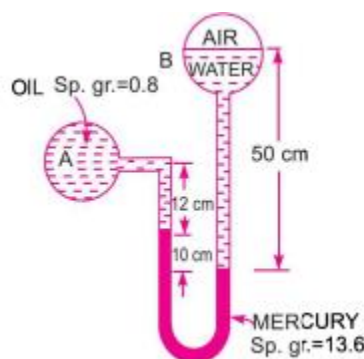
UNIT - II

3. a) Derive Bernoulli's equation without friction on the basis of Newton's second law of motion. **12**

    b) Explain the construction and working of a venturimeter with a neat sketch. **08**

OR

4. a) Derive Darcy's equation for loss of head due to friction in pipes. **10**

   b) A 150 mm diameter pipe reduces in diameter abruptly to 100 mm diameter. If the pipe carries water at 30 litres/sec, calculate the pressure loss across the contraction. Co efficient of contraction is 0.6. **10**

UNIT - III

5. a) A compressible fluid flowing in a pipe and develop the mechanical energy balance for the adiabatic process. **14**

   b) Calculate the Mach number at a point on a jet-propelled aircraft, which is flying at 400 m/s at sea level where air temperature is 20°C. Consider k and R values to be 1.4 and 287 J/kg K, respectively. **06**

UNIT - IV

6. a) What is cavitation? Can you suggest how to avoid the cavitation in the pumps? **10**

   b) What do you understand by the terms pump efficiency and pump priming? Write the characteristics curves of the centrifugal pump with the help of sketches. **10**

UNIT - V

7. a) Why Buckingham's π-theorem is superior to Rayleigh's method? State Buckingham's π-theorem. **08**

   b) Establish the dimensionless relationship if the power input, P, to a centrifugal pump is a function of the volumetric flowrate, Q, impeller diameter, D, rotational rate, ω, the density, ρ, and the viscosity, μ, of the fluid: **12**

$$P = f(Q, D, \omega, \rho, \mu)$$

   Use the Buckingham's π-theorem and consider ω, ρ, and D as the repeating variables.

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