





10MEB406/10AUB406

- 4 a. State and prove Bernoulli's equation for a fluid flow. Mention assumption made in derivation. (10 Marks)
- b. The water is flowing through a taper pipe of length 100 m diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end, if the pressure at the higher level is  $19.62 \text{ N/cm}^2$ . (10 Marks)

**PART - B**

- 5 a. What is venturimeter? Derive an expression for the discharge through a venturimeter. (08 Marks)
- b. Differentiate between Pitot tube and Orifice meter with neat sketches. (04 Marks)
- c. The frictional torque  $T$  of a disc of diameter  $D$  rotating a speed  $N$  in a fluid of viscosity  $\mu$  and density  $\rho$  in a turbulent flow is given by  $T = D^5 N^2 \rho \phi \left[ \frac{\mu}{D^2 N \rho} \right]$ . Prove this by the Buckingham method of dimensions. (08 Marks)
- 6 a. Derive an expression for the head loss due to:  
(i) Sudden expansion (05 Marks)  
(ii) Sudden contraction (05 Marks)
- b. Define hydraulic gradient line and total energy line. (02 Marks)
- c. A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipe is given as  $13.734 \text{ N/cm}^2$  and  $11.772 \text{ N/cm}^2$  respectively. Find the loss of head due to contraction if  $C_d = 0.62$ . Also determine the rate of flow of water. (08 Marks)
- 7 a. Sketch the velocity and shear stress distribution across the section of the pipe for viscous flow through it. (04 Marks)
- b. Derive Hagen - Poiseuille equation with usual notations. (08 Marks)
- c. A fluid of viscosity  $0.7 \text{ Ns/m}^2$  and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as  $196.2 \text{ N/m}^2$ . Find  
(i) The pressure gradient (ii) The average velocity (iii) Reynold number of the flow (08 Marks)
- 8 a. Define the terms: (i) Boundary layer (ii) Boundary layer thickness (iii) Drag (iv) Lift. (08 Marks)
- b. Define Mach number. What is the significance of mach number in compressible fluid flows? (04 Marks)
- c. A flat plate  $1.5\text{m} \times 1.5\text{m}$  moves at  $50 \text{ km/hr}$  in stationary air of density  $1.15 \text{ kg/m}^3$ . If the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine : (i) The lift force (ii) The drag force (iii) The resultant force (iv) The power required to keep the plate in motion. (04 Marks)
- d. A projectile travels in air of pressure  $10.1043 \text{ N/cm}^2$  at  $10^\circ\text{C}$  at a speed of  $1500 \text{ km/hr}$ . Find the Mach number and the Mach angle. Take  $K = 1.4$  and  $R = 287 \text{ J/kgK}$ . (04 Marks)

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