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(03 Hours)

[Total Marks: 80]

N. B.: (1) Question No. 1 is **Compulsory**.

(2) Attempt any **Three** questions out of remaining **five** questions.

(3) Figures to the **right** indicate **full** marks.

(4) Make **suitable** assumptions wherever **necessary**.

1. Answer the following sub questions (Any **FIVE**) [20]

(a) Differentiate between 'U' tube manometer and inclined tube manometer.

(b) Discuss the effect of roughness parameter on Friction Factor

(c) Differentiate between Venturimeter and Orifice meter

(d) What is the significance of Mach No.? Also define Mach No.

(e) Differentiate between Centrifugal and Reciprocating Pump.

(f) Prove that Pressure in Compressible fluids is given by $P_b / P_a = \exp [-g (Z_b - Z_a) / RT]$.
Assume that fluid is in static condition

2. (a) Prove that the velocity of sound wave in a compressible fluid is given by- [10]

$$l = \sqrt{k/\rho}$$

Where k = Bulk modulus of fluid and ρ = Density of fluid

(b) A venturimeter is to be installed in a 100 mm line to measure the flow of water. The maximum flow rate is expected to be 73.8 m³/hr. The 1.27 m manometer used to measure the differential pressure is to be filled with mercury and water is to fill the leads about the mercury surfaces. What throat diameter should be specified for the venture and what will be the power required to operate the meter at full load? $C_d=0.98$ [10]

[TURN OVER

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3. (a) For the laminar flow of the fluid through a circular pipe, derive an expression for the average Velocity, maximum velocity and also show the velocity profile. [10]
- (b) In a vertical pipe conveying water, pressure gauges are inserted at A and B where the diameters are 15 cm and 7.5 cm, respectively. The point B is 2.4 m below A and when the rate of flow down the pipe is $0.02 \text{ m}^3/\text{sec}$, the pressure at B is 0.12 Kg/cm^2 greater than at A. Assuming that the losses in the pipe between A and B can be expressed as $KV_A^2/2g$ where V_A is the velocity at A. Find the value of K. [10]
4. (a) A supersonic plane flies at 1900 Km/hr in air having a pressure of 28.5 KPa(abs) and density of 0.439 kg/m^3 . Calculate the temperature, Pressure, Density of air at stagnation point on the nose of plane for adiabatic. Take $R=287 \text{ Nm/Kg K}$ and $K = 1.4$ [10]
- (b) Derive an expression for Bernoulli's Theorem from Eulers equation of motion. [10]
5. (a) 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 N/cm^2 and 11.772 N/cm^2 respectively. Find the loss of head due to contraction if $C_c = 0.62$. Also determine the rate of flow of water. [10]
- (b) The diameter of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 cm . [10]
6. (a) Draw and Discuss the Characteristics curves for a centrifugal pump for head, capacity, power and efficiency. [10]
- (b) List out different types of valves used in industries along with their function and explain any two them in detail with diagram. [10]
