

10991 : Fluid Flow Operations : 4 CH 01 / 4 CT 05

P. Pages : 3

Time : Three Hours

**AW - 3065**

Max. Marks : 80

- Notes :
1. Answer **Three** question From Section "A" and **Three** question from Section "B"
 2. Assume suitable data wherever necessary.
 3. Illustrate your answer necessary with the help of neat sketches.
 4. Use of slide rule logarithmic tables, Stem tables, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.

SECTION - A

1. a) What is Pascal's Law? Obtain an expression for it. 7
- b) What are the pressure measuring devices? Explain the working of U tube manometer with neat diagram. 7

OR

2. a) Define the term fluid and explain properties of the fluid. 8
 - b) A differential manometer is connected at the two points A & B of two pipes. Pipe A contains carbon tetrachloride having sp. gr. 1.594 under a pressure of 11.772 N/cm^2 and pipe B contains oil of 0.8 sp. gr. under a pressure of 11.772 N/cm^2 . The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as fluid filling U tube. 6
3. a) Define the terms. 6
 - i) Velocity potential function
 - ii) Stream function.
 - b) Define vortex flow and obtain an expression for equation of forced vortex flow. 7

OR

4. a) A stream function is given by $\Psi = 2x - 5y$. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. 5
- b) Discuss Laminar flow and Turbulent flow. 4
- c) Explain the following 4
 - i) Reynold's Number
 - ii) Euler's Number.

5. a) State the Bernoulli's theorem. Derive an expression for Bernoulli's equation and state the assumptions. 9
- b) Crude oil of density 840 kg/m^3 is pumped at a rate of 3 lit/sec through 600 m of steel pipe under a pressure drop of 500 kPa. Calculate the fanning factor if the pipe diameter is 52 mm. Use Hagen Poiseuille equation. 4

OR

6. a) An oil of sp.gr. 0.9 and viscosity 0.06 poise is flowing through a Pipe of diameter 200 mm at the rate of 60 Lit/sec find the head loss due to friction for a 500 m. Length of pipe. Find the power required to maintain this flow. 5
- b) Obtain an expression for loss of Head due to sudden Enlargement. 8

SECTION - B

7. a) Explain with neat sketch the construction and working of Venturi-meter. 8
- b) What is meant by pitot tube? Explain its working and application with neat sketch. 6

OR

8. a) What is rotameter? Give an expression for flow rate through rotameter. 7
- b) An orifice meter with orifice diameter 20 cm is used to measure the flow rate of water in a pipe of 40 cm diameter. The pressure gauges fitted upstream and down stream of the orifice meter indicate reading of $30 \times 10^4 \text{ N/m}^2$ & $20 \times 10^4 \text{ N/m}^2$. Coefficient of discharge for the meter is 0.60. Determine the discharge of water through pipe. 7
9. a) Describe the working of reciprocating pump and obtain an expression for the work done by pump with neat sketch. 8
- b) A centrifugal pump delivers water through a pipe of 30 cm. Diameter and 50 m. Long pipe. The flow rate of water is $0.3 \text{ m}^3/\text{s}$. The fractional losses in the suction head is 0.8 m. The fractional losses in the pipe fittings is 1.9 m. Determine work done per second by the pump. The efficiency of pump is 55%. 5

OR

10. a) A centrifugal pump delivers water. the speed of the pump is 1000 rpm The velocity of flow at outlet is 3 m/s. The outlet vane angle is 30° Net head of the Pump is 30 m, Power supplied to drive the Pump is 90 kW. The width of impeller at outlet 5 cm. The outlet diameter of impeller is 40 cm. Determine 7
- 1) Volumetric flow rate of water
 - 2) Work done by impeller per sec.
 - 3) Overall efficiency of the pump.
- b) Discuss the following 6
- i) Priming of a centrifugal pump.
 - ii) Cavitation.

11. a) Derive an expression for the minimum fluidization velocity for turbulent fluidized column. 7
- b) A fluid passes vertically upwards through a bed of catalyst consisting of spherical particles of diameter 0.3 mm & density 2600 kg/m^3 . The density of fluid is 900 kg/m^3 & viscosity of fluid is 9 mN-S/m^2 . The fractional voidage of fluidized bed at minimum fluidization is 0.50 & length of fluidized bed is 1.8 m. 6
Determine :
- 1) Min fluidization velocity
 - 2) Entrainment velocity.
 - 3) Pressure drop across fluidized column.

OR

12. a) A packed column of 0.5 m diameter & 4 m length packed with 30 mm ceramic Rasching rings is used in the gas absorption process carried out at atmospheric pressure at 293 K. The liquid and gas have the properties of water and air. The flow rate of liquid is $5 \text{ kg/m}^2 \cdot \text{S}$ and the flow rate of gas is $0.5 \text{ kg/m}^2 \cdot \text{S}$. 7
Determine the pressure drop across the packed column.
specific surface area of packing material is 650 m^{-1} .
Voidage of packed column 0.60
Viscosity of air = 0.018 mN-S/m^2 .
- b) Discuss the loading and flooding in the packed column with neat diagram. 6
