S.E - III sem - Chem. 16:/12/15

Fluid Flow

(30) SE/III/CBGS/CHEM/FF

QP Code : **5265**

(3 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 :— 20
   (a) Explain Rheological characteristics of Newtonian and Non-Newtonian Fluids.
   (b) Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of2 m/s. Find the total head or total energy per unit weight of the water at a cross-section, which is 5 m above the datum line.
   (c) Find the loss of head when a pipe of diameter 250 mm is suddenly enlarged to a diameter of 450 mm. The rate of flow of water through the pipe is 300 lit/sec.
   (d) What is the significance of Mach No.? Also define Mach No.
   (e) Define and explain the concept of Stagnation Point.

2. (a) How are the manometers classified ? Explain it in brief. 10
   (b) An inverted V tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. When oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes. 10

3. (a) A 30 cm × 15 cm venturi-meter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturi-meter is 30 cm. The differential U-tube mercury manometer shows a gauge deflection of 25 cm. Calculate : 10
      (i) The discharge of oil, and
      (ii) The pressure difference between the entrance section and the throat section. Take coefficient of discharge as 0.98 and specific gravity of mercury as 13.6.
   (b) Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m. If the co-efficient of friction (4f) for each pipe is 0.32, caiculate the rate of flow for each pipe and also the diameter of a single pipe 100m long which would give the same discharge, if it were substituted for the original two pipes. 10

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4. (a) A gas is flowing through a horizontal pipe having area of cross section as 40 cm^2 where pressure is 40 N/cm^2 (gauge) and temperature 15°C. At another section the area of cross section is 20 cm^2 and pressure is 30 N/cm^2 (gauge). If the mass rate of flow of gas through the pipe is 0.5 Kg/Sec, find the velocity of gas at these sections assuming an isothermal change. Take R = 292 N-m/Kg-K and atmospheric pressure = 10 N/cm^2. 10

(b) Explain the power curves for baffled and unbaffled vessels in mixing and agitation. 10

5. (a) Oil of specific gravity 0.82 is pumped through a horizontal pipeline of 15 cm diameter, 3 km long at the rate of 900 lit/min. The pump has an efficiency of 60% and requires 10 hp to pump the oil. Determine the dynamic viscosity of the oil and verify whether the flow is laminar or turbulent. 10

(b) Derive an equation for flow measurement using venturi-meter, and list all assumption. 10

6. (a) List the various types of valves used in chemical industry and explain in detail. 5

(b) A centrifugal pump having an impeller diameter of 1 m is to be constructed so that it will supply a head rise of 200 m at a flowrate of 4.1 m^3/s of water whenoperating at a speed of 1200 RPM. To study the characteristics of this pump, a1/5 scale, geometrically similar model operated at the same speed is to be tested in the laboratory. Determine the required model discharge and head rise. Assume that both model and prototype operate with the same efficiency (and therefore the same specific speed). 10

(c) An oil of sp. Gr. 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 lit/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take υ = 0.29 stokes. 5

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