

S.E. III Sem. Chem
Fluid Flow
SE (Chem) - III - CBGS
FF

9/6/14

(30)

(1)

QP Code : NP-18767

(3 Hours)

[Total Marks]

- N. B. : (1) Question No. 1 is compulsory.
(2) Attempt any three questions from remaining five questions.
(3) Assume suitable data wherever necessary.

1. (a) Define Newtonian and Non-Newtonian fluids with suitable examples. 4
(b) What are the frictional losses in flow through a pipe. Explain with neat sketch. 4
(c) Explain cavitation and priming for pump. 4
(d) Differentiate between Compressible and Incompressible fluids. 4
(e) Explain different types of agitators. 4
2. (a) Water is flowing between two parallel plates at a distance of 1 cm apart. The maximum velocity of water is 0.6 m/s and the viscosity of water is 1 NS/m². Determine :- 8
(i) Average velocity of water.
(ii) Loss of pressure per unit length of plate.
(iii) Shear stress at the pipe wall.
(iv) Volumetric flow rate of water.
(b) Oil of viscosity 0.098 kg/m.sec and specific gravity 0.9 flows through a horizontal pipe of 2.5 cm diameter. If the pressure drop per meter length of pipe is 0.12 kg f/cm². Determine :- 10
(i) The rate of flow.
(ii) Reynold No.
(iii) The power required per 50 m length of the pipe to maintain the flow.
(c) Draw the characteristic curves for a centrifugal pump for head, capacity power and efficiency. 2
3. (a) A gas flowing through a horizontal pipe at a temperature of 4°C. The diameter of the pipe is 8 cm and at a section 1-1 in this pipe, the pressure is 3 kg f/cm² (gauge). The diameter of the pipe changes from 8 cm to 4 cm at the section 2-2 where the pressure is 2.0 kg f/m² (gauge). Find the velocities of the gas at these sections assuming as isothermal process. 10
Take :- $R = 29.27 \text{ kg f-m/kg } ^\circ\text{K}$ and
Atmospheric pressure = 1.03 kg f/cm².
(b) Draw a neat sketch of universal velocity distribution law for turbulent flow of Newtonian fluid in smooth pipe with concerned equations. 5
(c) Derive an expression for velocity of sound for an adiabatic process. 5

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4. (a) The diameters 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 m. 10
- (b) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. 10
5. (a) An orifice meter consisting of 10 cm diameter orifice in a 25 cm diameter pipe has a coefficient of 0.65. The pipe delivers oil of 0.8 specific gravity. The pressure difference on the two sides of the orifice plate is measured by mercury oil differential manometers. If the differential gauge reads 80 cm of mercury. Calculate the rate of flow in litre/sec. 10
- (b) List the various types of valves used in chemical industry along with their functions. 10
6. (a) Give the typical proportions of tank and impeller dimensions of a standard stirred tank. 5
- (b) For a turbine agitator installed in a vertical tank, speed is 1.5 rps. Diameter of tank is 1.8 m and diameter of turbine is 0.61 m and the density of the liquid is 1498 kg/m^3 , and viscosity is 120 N.s/m^2 . If the power no. $NP = 65/N \text{ Re}$. Calculate the power required for agitation. 5
- (c) Two reservoirs with a difference in water surface elevation of 10 m are connected by a pipeline ABC which consists of two pipes AB and BC joined in series. Pipe AB is of 10 cm in diameter, 20 m long and has a value of $f = 0.02$. Pipe BC is of 16 cm diameter, 25 m long and has $f = 0.018$. The junctions with the reservoirs and between the pipes are abrupt. 10
- (i) Calculate the discharge.
- (ii) What difference in reservoir elevation is necessary to have a discharge of 15-lit/sec (Include all minor losses).

Con. 13529-14.