Code No: R09220802 **R09** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
MOMENTUM TRANSFER
Chemical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Write in detail about the separation of boundary layer on diverging channel. [15]

2. (a) Derive an equation for finding the pressure drop using a differential manometer.
   (b) Write short notes centrifugal decanter with necessary equations. [8+7]

3. (a) Explain briefly isentropic flow through convergent - divergent nozzles with neat sketch.
   (b) Explain briefly about critical pressure ratio.
   (c) Write the effect of cross section on Mach number for isentropic flow. [7+4+4]

4. (a) A tower having a diameter of 0.1524 m is being fluidized with water at 20.2^0C. The uniform spherical beads in the tower bed have a diameter of 4.42 mm and a density of 1603 kg/m^3 Estimate the minimum fluidizing velocity and compare with the experimental value of 0.02307 m/s.
   (b) Write different types of fluidization with their advantages. [7+8]

5. (a) For power law fluid the shear stress versus velocity gradient is as follows:

T	0	2	4	6
dv/dy	0	0.5	1.1	1.2

   Determine flow consistency index and flow behavior index.
   (b) Write short notes on effect on Temperature and pressure on gas viscosity.
   (c) Write short notes on flow in boundary layers. [6+4+5]

6. (a) Derive an expression for motion of particles from gravitational force.
   (b) Explain briefly how to estimate the surface mean diameter for mixture of particles. [9+6]

7. Natural gas having a viscosity of 11×10^{-6} kg/ms and a specific gravity relative to air of 0.6 is flowing through a schedule 40 15 cm pipe in which is installed a standard sharp edged orifice equipped with flange plates. The gas is at 37.78^0C and 137.8×10^3 N/m^2 abs at the upstream tap. The manometer reading is 1.15m of water at 15.6^0C. The ratio of specific heats for natural gas is 1.30. The diameter of the orifice is 5 cm. calculate the rate of flow of gas through the line based on a pressure of 99.216×10^3 N/m^2 and a temperature of 15.6^0C. [15]

8. It is desired to use 28.32 m^3/min of air (metered at a pressure of 101.3 kPa and 291.1K) in a process. This amount of air, which is at rest, enters the fan suction at a pressure of 741.7 mm Hg and a temperature of 366.3 K and is discharged at a pressure of 769.6 mm Hg and a velocity of 45.7 m/s. A centrifugal fan having a fan efficiency of 60% is to be used. Calculate the brake-kW power needed. [15]

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Code No: R09220802 **R09** **Set No. 4**

II B.Tech II Semester Examinations,April/May 2012
MOMENTUM TRANSFER
Chemical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the Bernoulli's equation for isothermal compressible flow.
   (b) Define mach number and critical pressure ratio. [9+6]

2. (a) Derive the equation for the calculation of terminal velocity when a particle is falling in stagnant fluid under the gravitational force.
   (b) Derive Kozney-Carman equation and write the assumptions involved. [6+9]

3. (a) Write short notes on Newtonian and Non- Newtonian fluids.
   (b) Differentiate between laminar and turbulent flow.
   (c) Write short notes on applications of Bernoulli's equation. [7+4+4]

4. (a) Describe about types of fluidization.
   (b) A tower having a diameter of 0.152 m is being fluidized with water at 25^0C. The uniform Spherical beads in the tower bed have a diameter of 4.42mm and a density of 1603 kg/m^3. Estimate the minimum fluidizing velocity assuming shape factor and void fraction of the bed are not available. [7+8]

5. One use of Hagen-Poiseuille equation is in determining the viscosity of a liquid by measuring the pressure drop and velocity of the liquid in a capillary of known dimensions. The liquid used has a density of 912 kg/m^3 and capillary has a diameter of 2.222 mm and a length of 0.1585 m. The measured flow rate was 5.33×10^{-3} m^3/s liquid and the pressure drop 131 mm of water (density 996 kg/m^3). Neglecting end effects, calculate the viscosity of the liquids. [15]

6. (a) Derive an expression for differential U-tube manometer for measurement of pressure drop.
   (b) What is inclined manometer and explain its use.
   (c) What are the criteria to be considered for selection of a manometric fluid? Give some examples. [6+5+4]

7. A venturimeter is to be installed in a schedule 40 100 mm line to measure the flow of water. The maximum flow rate is expected to be 73.8 m^3/hr at 15.6^0C. The 1.27m manometer, used to measure the differential pressure, is to be filled with mercury and water is to fill the leads above the mercury surfaces. The water temperature is to be 15.6^0C throughout. What throat diameter should be specified for the venture to the nearest 3 mm and what will be the power required to operate the meter at full load? Take $C_v = 0.98$. [15]

8. (a) Derive the expression for work of compression for isothermal compression.
   (b) Explain briefly centrifugal blower with neat sketch. [8+7]

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Code No: R09220802 **R09** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
MOMENTUM TRANSFER
Chemical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive Hagen - Poiseuille equation and mention the assumptions involved in the derivation.
   (b) What are the universal velocity distribution laws and state their limitations? [9+6]
2. (a) Explain the term fluidization. Briefly discuss the different types of fluidization. How do you calculate velocity at onset of fluidization?
   (b) Write short notes on pneumatic conveying. [6+9]
3. (a) Write Working characteristics of Rota meter.
   (b) Explain in detail about orifice meter. [8+7]
4. Write a brief note on the following:
   (a) Statistical nature of turbulent flow
   (b) Intensity and scale of turbulence
   (c) Laminar and turbulent flows in boundary layer. [5+5+5]
5. (a) Derive an expression for the force exerted on a submerged vertical plane surface in a static liquid and locate the position of center of pressure.
   (b) Explain briefly centrifugal decanter. [9+6]
6. What is friction parameter? Derive relation to friction parameter for adiabatic friction flow. [15]
7. (a) Particles of sphalerite (s.p.= 4.0) are settling under the force of gravity in carbon tetra chloride at 20^0C (s.p. = 1.594) .The diameter of the sphalerite particles is 0.004 in (0.10 mm). The volume fraction of sphalerite in CCl_4 is 0.20. What is the settling velocity of the sphalerite? The viscosity of CCl_4 at 200C is 1.03 cp.
   (b) Write the Newton's law for estimation of terminal velocity. [9+6]
8. A liquid is pumped from a reservoir to the top of the mountain through a pipe of ID of 0.1396 meter at an average velocity of 3.048 m/s the pipe discharges into the atmospheres at a level of 1219 meters above the level in the reservoir. The pipe line itself is 1524 m long if the efficiency of the pump is 70 per cent and if it costs 50 paisa/kW-hr. What is the hourly energy cost for pumping? Assuming entrance and exit losses negligible. [15]

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Code No: R09220802 **R09** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
MOMENTUM TRANSFER
Chemical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define and explain the terms 'cavitation' and 'NPSH'.
   (b) Describe the principle and construction of centrifugal pump. [8+7]

2. (a) Explain briefly the classification of fluids with suitable examples.
   (b) Define
      i. Path line
      ii. Streak line
      iii. Steam line
      iv. Stream tube. [7+8]

3. (a) Define
      i. Total pressure
      ii. Center of pressure.
   (b) Explain briefly continuous gravity decanters. [6+9]

4. Water at a temperature of 293^0K flows through a horizontal hydraulically smooth pipe with an internal diameter 155mm. A normal orifice plate having an orifice diameter 85mm is installed in the pipe. If the average velocity of flow of water is 1.25 m/s, determine the reading of the mercury differential manometer of the orifice plate. Assume suitable data. [15]

5. (a) Write short notes on continuous fluidization.
   (b) Derive an expression for minimum fluidization velocity. [7+8]

6. (a) Write short notes on drag reduction in turbulent flow.
   (b) Explain briefly about the friction factors for non-isothermal flow.
   (c) Explain the term hydraulically smooth. [5+6+4]

7. (a) At a a certain section of a duct in which air is flowing at a temperature of 32^0C and pressure of 79.95 KN/m^2 with a velocity of 365m/s. Assuming isentropic flow (reversible adiabatic) determine :
      i. The velocity and temperature at a section where the pressure is 122.63 kN/m^2.
      ii. The Mach number at both sections. Take R = 287 Nm/Kg^{0}K and k for air = 1.4.

(b) Write short notes on adiabatic frictional flow. [9+6]

8. A mixture of vapors pass through a packed bed of glass spheres having density 2.4 g/cc each of diameter 0.5 cm. The pressure drop due to the flow is 405 kgf/m^2 . The height of packed bed is 1.85 m. The density and viscosity of the vapor mixture are 3.8 10-3 g/cc and 0.015 cP, respectively.
Data:
Cross sectional area of the packed column tube = 0.09 m^2
Bed porosity = 0.4
Find the mass flow rate of the vapor mixture. Is the bed fluidized? [15]

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