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

II B.Tech II Semester Examinations,APRIL 2011
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) What is meant by hydrostatic pressure distribution? Derive the equation for the same.
   (b) Differentiate between unit operations and unit processes with suitable examples. [8+7]

2. Write short notes on:
   (a) Viscosity and Momentum flux.
   (b) Time dependent flow of fluids.
   (c) A pipe of 20cm and length 10m is used to transport oil of Sp.gr is 0.9 and viscosity 1.5 poise. The oil is pumped at a rate of 20 lit/sec. Find the average velocity and Reynolds Number. [4+4+7]

3. (a) Explain momentum equation for compressible fluids.
   (b) Obtain an expression for the sound wave in a compressible fluid in terms of change of pressure and change of density.
   (c) Derive the continuity equation for one dimensional compressible flow in differential form. [4+5+6]

4. (a) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 250m. The rate of flow of fluid through the pipe is 3.5 lit/sec. Find the pressure drop in the entire length and also the shear stress at the pipe wall.
   (b) Write short notes on universal velocity distributions. [10+6]

5. (a) Write about fluidization, Types and applications of fluidization.
   (b) Spherical particles of a catalyst are to be fluidized in a 1m.diameter cylindrical tower. The height of the static bed is 1.8m. During fluidization the solids occupy a height of 3m. What is the porosity of the fluidized bed? Porosity of static bed is 0.48. [7+8]

6. (a) A Venturi meter having a throat diameter of 38.9 mm is instilled in a line having an inside diameter of 102.3 mm. It meters water having a density of 999 kg/m^3. The measured pressure drop across the venture is 156.9 kPa. The venture coefficient C_v is 0.98. Calculate the gal/min and m^3/s flow rate.
   (b) Write short note on pitot tube. [9+6]

7. A packed bed of catalyst consisting of spherical particles of 150 μm diameter is subjected to fluidization by using oil of density 900 kg/m^3. If the density of the particles be 2500 kg/m^3, determine the mass flow rate of oil per unit area of bed to initiate fluidization. The dynamic viscosity of oil = 0.003 Pa.s. [15]

8. A three stage reciprocating compressor is to compress 180 std cubic ft/min of methane from 14 to 900 pounds/in^2 . abs. The inlet temperature is 80^0F. For the expected temperature range the average properties of methane are Cp = 9.3 Btu/Ib mol. ^{0}F $\gamma = 1.31$

   (a) What is the brake horse power if the mechanical efficiency is 80 percent?

   (b) What is the discharge temperature from the first stage?

   (c) If the temperature of the cooling water is to rise 20^0F? Assuming that jacket cooling is sufficient to absorb frictional heat. [15]

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

II B.Tech II Semester Examinations,APRIL 2011
MOMENTUM TRANSFER
Chemical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What is minimum fluidization velocity? Derive an expression for calculating minimum fluidization velocity. [15]
2. Write in detail about the separation of boundary layer on diverging channel. [15]
3. Discuss the function and application of different types of compressors, with details on compressor selection. [15]
4. Air at 5^0C is flowing through a pipe laid horizontal. The pipe diameter (ID) reduces from 85 mm to 40 mm. Air pressures at sections 1 and 2 are 3.5kg/cm^2 (gauge) and 3.5kg/cm^2 (gauge) respectively. Assuming the flow of air being isothermal all through, calculate the velocity of flow at sections 1 and 2. Take R = 29.27 kgf. m/kg ^{0}K. [15]
5. Explain how two immiscible liquids can be separated using a continuous gravity decanter. Derive the equation for the interface. Write down the equation for separation time. [15]
6. (a) Compare and contrast orifice and venture meters.
   (b) A venturi meter with a 12 in ID line carrying chlorine at 70^0 F. The Barometer is 29.5 in Hg, the upstream pressure 2 in Hg above atmospheric pressure and the head measured over the venture (upstream to throat) is 0.52 in Hg. Calculate the rate of flow in pounds per hour. Assume suitable data. [6+9]
7. Derive equation of motion for Newtonian fluid. [15]
8. (a) A spherical glass particle is allowed to settle freely in water at 293^0K from the rest. It attains its terminal velocity hence the value of the Reynolds number with respect to the particle is 0.1 Determine the diameter of the particle.
   (b) Write short notes on stagnation pressure. [8+7]

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

II B.Tech II Semester Examinations,APRIL 2011

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) Explain how the frictional losses in pipe fittings and valves can be accounted for design calculations.
   (b) How do you classify pumps? [9+6]
2. (a) Differentiate between isothermal and adiabatic frictional flow.
   (b) What are the assumptions made to derive the basic equations for compressible fluids?
   (c) Define Mach number. [6+5+4]
3. (a) Distinguish clearly between wall drag and form drag. What is drag coefficient?
   (b) Discuss the effect of Reynold's number on drag coefficients of different shapes. [7+8]
4. (a) Derive the Bernoulli's equation. State the assumption made. Write any one application.
   (b) Write short notes on turbulent flow. [11+4]
5. (a) A laminar flow is taking place in a pipe of diameter of 18cm. the maximum velocity is 1.5 m/s. Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 4cm from the wall of the pipe.
   (b) Write short notes importance of end effects. [11+4]
6. (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]
7. Dry air at 20^0C and 1 atm pressure flows through a pipe of ID 320mm. A Pitot-Prandtl tube is installed at the middle of the pipe. Its differential manometer with water shows a level difference of H = 5.8 mm. Calculate the mass flowrate of air. [15]
8. (a) How the interface radius will be effected by the changes in high density and low density liquid layers radius in centrifugal decanter.

(b) A continuous gravity decanter is to separate nitrobenzene (density is 1200 kg/m^3) from an aqueous wash liquid of 1000 kg/m^3 density. If the total depth of the separator is 90 cm and the interface is 30 cm from the vessel floor, what is the height of the heavy liquid overflow leg? [7+8]

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

II B.Tech II Semester Examinations,APRIL 2011
MOMENTUM TRANSFER
Chemical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain about the hindered settling and free settling. Discuss about the criterion for settling regime. [15]

2. (a) Write short note on Vena contracta.
   (b) How to account the form friction losses in the Bernoulli equation and explain. [7+8]

3. What are merits and demerits of fluidization? Define the term minimum fluidization velocity. Develop an expression for minimum fluidization. [15]

4. (a) Water flows through an orifice 25mm diameter in a 100mm pipe at the rate of 10 gallons per minute. What is the difference in level on a water manometer connected across the orifice? The discharge coefficient may be taken as 0.62 and viscosity of water is 1 cp.
   (b) Write short note on pressure recovery in Venturimeter. [9+6]

5. (a) Milk at 293 K having a density of 1030 kg/m^3 and viscosity of 2.12 cp is flowing at the rate of 0.605 kg/s in a glass pipe having a diameter of 63.5 mm.
      i. Calculate the Reynolds number. Is this turbulent flow?
      ii. Calculate the flow rate needed in m^3/s for a Reynolds number of 2100 and the velocity in m/s.
   (b) Write about Prandtl boundary layer considering a thin plate and flow is parallel to it [8+7]

6. (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]

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

8. Air flows from a reservoir through an isentropic nozzle into a long, straight pipe. The pressure and temperature in the reservoir are 20 atm and 1000^{0}R (555.6K), respectively, and the Mach number at the entrance of the pipe is 0.05.
   (a) What is the value of maximum conduit length?

(b) What are the pressure, Temperature, Density, Linear velocity, and mass velocity if the actual length is equal to maximum length? It is given that $\lambda = 1.4$ and $Ma_a = 0.05$.The density of air at 20 atm and 1000R is 0.795 lb/ft^3. [15]

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