Code No: A109212303 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
PROCESS ENGINEERING PRINCIPLES
Bio-Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What do you mean by basic quantities and derived units explain with examples?
   (b) Write the units of heat capacity, pressure units in SI and CGS system. [8+7]
2. Define what is a fluid and discuss the hydrostatic equilibrium for compressible and incompressible fluids. [15]
3. What is horse power of the pump? Explain the calculation of horse power with proper mathematical equations? [15]
4. An oil of density 917 kg/m^3 is being pumped in a pipe of diameter 15cm.The discharge is measured as 850L/min.The drop in the pressure in a stretch of 800m pipe line , both end of which are at the same elevation, is measured as 95kPa.Estimate the absolute viscosity of oil. [15]
5. (a) What is Mach number, Subsonic and supersonic?
   (b) Derive equation for Mach number of an ideal gas in terms of its acoustic velocity. [10+5]
6. (a) How does a U-tube manometer function? Derive an expression for (P_1 - P_2) in terms of measurable quantities.
   (b) What are the importance of check valves in process industries and explain its working? [7+8]
7. How long will it take for the spherical particles in the table below to settle, at their terminal velocities under free settling conditions through 2m of water at 20^{0}C? [15]

Substance	Specific gravity	Diameter(mm)
Galena	7.5	0.25
Coal	1.3	6

8. (a) What is momentum balance equation? Explain about the driving force for momeutum balance.
   (b) Why heat transfer take place from one point to the another point? Explain. [8+7]

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Code No: A109212303 **R09** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
PROCESS ENGINEERING PRINCIPLES
Bio-Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define a fluid & write Newton's law of Viscosity.
   (b) What are compressible and incompressible fluids? Describe them with examples. [7+8]
2. What are the different types of valves? Explain them in brief. [15]
3. (a) Convert 1.5×10^{-6} centipoise to kg s^{-1} cm^{-1}
   (b) Convert 0.122 horsepower(British) to British thermal units per minute(Btu min^{-1})
   (c) Convert 670 mm Hg ft^3 to metric horse power
   (d) Convert 345 Btu lb^{-1} to kcal g^{-1}. [15]
4. From the first principles derive Ergun's equation for the determination of pressure drop in a packed tower and briefly discuss the application. [15]
5. (a) Discuss in detail the construction and working of a centrifugal pump.
   (b) Explain the performance curve of a centrifugal pump. [7+8]
6. (a) Write Hagen-Poiseuille equation and explain the terms mentioned in it.
   (b) Derive a relation between average velocity and maximum velocity for laminar flow through pipes. [4+11]
7. Kerosene is flowing from tank 'A' to tank 'B' as shown in the figure 1 given below.

   Density of Kerosene is 0.816 gm/cm^3. Calculate the velocity of kerosene at point 'C' for the following conditions.

   (a) Tank 'A' and 'B' both at atmospheric pressures and no friction - l loss in the connecting pipeline ($\alpha = 1.0$) and no pump is used
   (b) Tank 'A' and tank 'B' at atmospheric pressures and frictional losses of 0.25 m kg f/kg and no pump is used ($\alpha = 1.0$)
   (c) Tank 'A' atmospheric pressure and tank 'B' 1.2 atmospheric pressure. Frictional losses of 0.25 m. kg. f/kg and no pump is used ($\alpha = 1.0$) [15]
8. Explain about the driving forces & resistanes involved in
   (a) Momentum transfer

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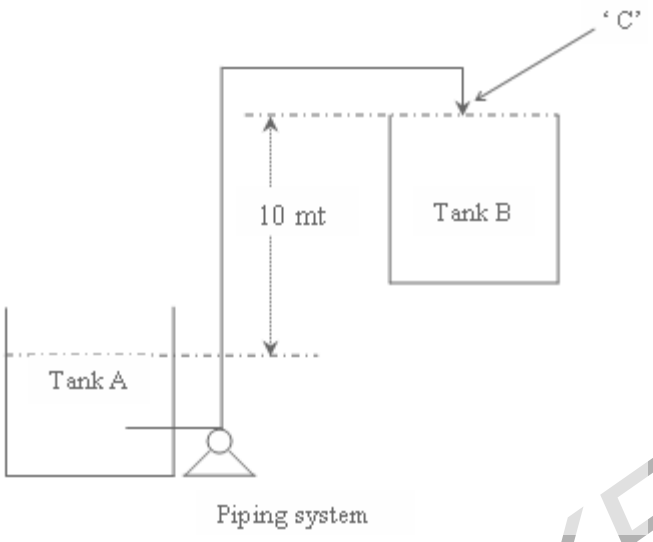

Figure 1:

(b) Mass transfer

(c) Heat transfer. [15]

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

Answer any FIVE Questions
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1. What is friction factor? Derive the relation between the skin friction and wall shear? [15]
2. What are time-dependent non-Newtonian fluids? Explain with a diagram and examples. [15]
3. (a) Plot a graph to explain the characteristics of centrifugal pump?
   (b) Briefly explain the situation under which peristatic pumps are used. [7+8]
4. A pump drawn a solution of a sp.gr.1.84 from a storage tank through 75 mm pipe. The velocity in the suction line is 0.914 m/sec. The pump discharges through pipe of 50 mm diameter to an over head tank. The end of the discharge pipe is 15.2 'm' above the level of the solution in the tank. Frictional losses in the engine piping system are 29.9 J/kg. What pressure must the pump develop and what is the power requirement of the pump if efficiency of the pump is 60%. [15]
5. Explain the significance of packed bed columns (reactors) in immobilized catalyst (enzyme) reactors. [15]
6. Discuss classification of the unit operations, explain in detail by taking an example. [15]
7. Calculate the kinetic energy of 250lb_m liquid flowing through a pipe at 35 ft s^{-1} express your answer in units of ft lb_f. [15]
8. Water at 68^0F is flowing through an orifice meter. The discharge at point 3 is directly proportional to the atmosphere. The actual pipe ID is 1 inch, and β is 0.6. The manometer contains an oil of specific gravity 1.10 and the reading for Δh is 1.50 in. Calculate the flow rate in m^3 per hour and the guage pressure at point 1 inch mm of water. [15]

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Code No: A109212303 **R09** **Set No. 3**

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

Answer any FIVE Questions
All Questions carry equal marks

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1. An orifice meter is used to measure the flow rate in pipes the flow rate is related to pressure drop by an equation of the form
   U = c $\sqrt{\Delta p/\rho}$ where
   U= fluid velocity, Δp= pressure drop, ρ = density of the flowing fluid, c= constant of proportionality, What are the units of "C"? [15]

2. 6 liters per min. of volume are flowing through a pipe of 1.2 cm I.D. pipe. If the density of volume is 0.87 gm/cm^3. calculate
   (a) Volumetric flow rate cm^3 / sec
   (b) Mass flow rate gm / sec
   (c) Average velocity cm / sec and
   (d) Mass velocity gm / sec cm^2. [4+4+4+3]

3. With a neat diagram explain the working of rotary pump and give the mathematical equation to calculate the efficiency of the pump? [15]

4. (a) Explain the construction of an Orifice meter with a neat sketch.
   (b) Explain the construction of an Venturi meter with a neat sketch. [7+8]

5. What is minimum fluidization velocity? Derive an expression for calculating minimum fluidization velocity. [15]

6. (a) Briefly explain Reynold's number and its importance.
   (b) Distinguish between laminar flow and turbulent flow. Write briefly on the following:
      i. Friction factor chart
      ii. Velocity distribution in laminar flow
      iii. Velocity distribution in turbulent flow. [15]

7. Write short notes on
   (a) Newton's law of Viscosity
   (b) Power law of fluids
   (c) Effect of temperature on viscosity. [5+5+5]

8. Explain about different Unit operations involved in mass transfer operations with examples. [15]

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