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Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Unit Operations

Time: 3 hrs.   Max. Marks: 100

Note: *Answer FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define fluid. Explain classification of fluids and types and types of Non-Newtonion fluids.
                                                                                  (10 Marks)
    b. Derive Barometric equation.   **(10 Marks)**

OR

2 a. Crude oil of density 840kg/m³ is pumped at a rate of 3 lts/s through a 6000m length pipe, under a pressure drop of 550KPa, calculate the friction factor if the pipe diameter is 52mm.Use the Hagen Poiseuille equation.   **(08 Marks)**
    b. Explain Reynolds experiment with different types of flow.   **(08 Marks)**
    c. Define sedimentation. Explain the theory of settling.   **(04 Marks)**

Module-2

3 a. Derive a flow equation for Venturimeter with neat sketch.   **(10 Marks)**
    b. Suphuric acid is to be pumped for 800m long through a 50mm id pipe at a rate of 3kg/s and then raised vertically 15m by the pump. If the pump is electrically driven and has an efficiency of 50%, what power will be required? Density of acid = 1650 kg/m³, Viscosity of acid = 8.6 m Pa.s   **(10 Marks)**

OR

4 a. A dolomite mixture having the following screen analysis is screened though a standard 100 mesh screen. Calculate the effectiveness of the screen and the mass ratios of overflow and underflow to feed.

Mesh	Feed	Oversize	Undersize
35	7.07	13.67	0.0
48	16.6	32.09	0.0
65	14.02	27.12	0.0
100	11.82	20.70	2.32
150	9.07	4.35	14.32
200	7.62	2.07	13.34
-200	33.80	0.0	70.02

                                                                                  (08 Marks)
    b. Explain the working of Ball mill.   **(08 Marks)**
    c. What is filtration? Explain the types of filtration.   **(04 Marks)**

Module-3

5 a. Derive on equation steady state heat conductor through multilayer walls. **(10 Marks)**
    b. A 50mm diameter pipe of circular cross – section and with wall 3mm thick in covered with two concentric layer of lagging, the inner layer having thickness of 25mm and thermal conductivity of 0.08w/mK, and the outerlayer having thickness of 40mm and thermal conductivity of 0.04 w/mK. Estimate the rate of heat loss per meter length of pipe if the temperature inside the pipe is 550K and outside temperature is 330K. Thermal conductivity of pipe is 45W/m K.   **(10 Marks)**

OR

6 a. Explain co-current and counter current flow with temperature profile. **(04 Marks)**
   b. Cold fluid is flowing through the heat exchanger at a rate of 15m³/h. It enters the heat exchanger at 303K and leaves at 328k. The hot thermic fluid enters the heat exchanger at the rate of $21\frac{m^3}{n}$ at a temperature of 388K. Find out the area of transfer required and the overall heat transfer coefficient be 3490 w/m²K.

   Data :

   Density of cold fluid   = 1000kg/m³
   Density of thermic fluid   = 950 kg/m³
   Specific heat of cold fluid   = 4.187 kJ/kg K
   Specific heat of thermic fluid = 2.93 kJ/kg K

   (06 Marks)
   c. Explain the construction and working of shell and Tube heat exchange. **(10 Marks)**

Module-4

7 a. Define Fick's law of diffusion and different types of diffusion. **(10 Marks)**
   b. Derive an equation for steady state diffusion of A through non-diffusing B. **(10 Marks)**

OR

8 a. In an oxygen – nitrogen gas mixture at 101.3KPa and 298K, the concentrations of oxygen at two phases 2mm apart are 10 and 20% by volume respectively. Calculate the flux of diffusion of oxygen for the cases where :
   i) The nitrogen is non-diffusing
   ii) There is equimolar diffusion of the two gases Diffusivity of O_2 in N_2 is 1.81×10^{-5} m²/s. **(08 Marks)**
   b. Write a note on :
   i) Mass Transfer co-efficiency
   ii) Interphase mass transfer
   iii) Diffusivity measurement. **(12 Marks)**

Module-5

9 a. What is liquid – liquid extraction? Explain the qualities of solvent for extraction. **(10 Marks)**
   b. Explain the McCabe Thiele method for binary distillation. **(10 Marks)**

OR

10 a. Explain equilibrium moisture curve and rate of drying curve. **(10 Marks)**
   b. Find out the rate of drying and moisture content from the following data.

Weight of wet saw dust	Weight of saw dust after drying	Time (h)
250g	230g	0.5
250g	215g	0.75

   Dimension of tray   = 10cm × 10cm
   Weight of dry saw dust on tray = 150 g **(10 Marks)**

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