CBCS SCHEME

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18BT33

Third Semester B.E. Degree Examination, July/August 2021
Unit Operations

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Define fluid. Give the Rheological classifications with examples. **(10 Marks)**
b. Derive the barometric equation. **(10 Marks)**

2 a. With a neat sketch, explain Reynolds experiment and its significance. **(10 Marks)**
b. Water is flowing through a pipe having diameter 20cm and 10cm respectively. The rate of flow through the pipe is 35LPS. The section 1 is 6m above the datum and section 2 is 4m above the datum. If the pressure at the section 1 is 39.24 N/cm^2. Find the intensity of pressure at section 2. **(10 Marks)**

3 a. Derive the discharge equation for orifice meter. **(10 Marks)**
b. With a neat sketch, explain the principle and working of reciprocating pump. **(10 Marks)**

4 a. Define the following:
i) Rittenger's law
ii) Bond's law
iii) Kick law **(06 Marks)**
b. With a neat sketch, explain the working of Rotary Drum filtration. **(10 Marks)**
c. Calculate the operating speed of a ball mill from the following data:
i) Diameter of ball mill = 500mm
ii) Diameter of ball = 40mm. **(04 Marks)**

5 a. Derive an expression for steady state heat conduction through a composite wall. **(10 Marks)**
b. An exterior wall of a house may be approximated by a 100mm layer of common brick $(K_1 = 0.7W/mK)$ followed by 40mm layer of gypsum plaster $(K_2 = 0.48W/mK)$. What thickness of loosely packed rock wool insulation $(K_3 = 0.0635W/mK)$ should be added to reduce the heat loss by 25%. **(10 Marks)**

6 a. With a neat sketch, explain the construction of 1-2 shell and tube heat exchanger. **(10 Marks)**
b. Write a note on the following:
i) Modes of heat transfer
ii) Film wise and drop wise condensation
iii) Fouling factor
iv) Fourier's law. **(10 Marks)**

7 a. Define Fick's law of diffusion. Derive an expression for steady state molecular diffusion in gases (equimolar counter current) condition. (10 Marks)

b. Ammonia gas is diffusing at a constant rate through a stagnant layer of air of 1mm thickness. Conditions are fixed so that the gas contains 50% by volume of ammonia at one boundary of the stagnant layer. The ammonia diffusing to the other boundary is quickly absorbed and the concentration is negligible at that place. The temperature is 295K and pressure is 1atm. Under these conditions the diffusion coefficient of NH_3 in air is $D_{AB} = 0.18\ cm^2/s$. Calculate the rate of diffusion of NH_3 through the layer. (10 Marks)

8 a. With a neat sketch, explain the experimental determination of diffusivity. (10 Marks)

b. Briefly explain mass transfer coefficient and their correlations. (10 Marks)

9 a. With a neat sketch, explain working of simple distillation. (10 Marks)

b. A liquid mixture has a relative volatility (α) of 2.5. Compute the Vapor Liquid Equilibrium data (VLE) for the liquid mixture. The above mentioned liquid mixture is to be fed to the distillation column for separation. Feed is a liquid entering at its bubble point with 50 mol % More Volatile Component (MVC). The product contains 95 mol% MVC and the residue containing 10 mol% MVC. Reflux ratio R = 2.5. Calculate the number theoretical plates required and also the position of feed plate using McCabe Thiele's method. (10 Marks)

10 a. With a neat sketch, explain any one extraction operation method. (10 Marks)

b. Briefly explain drying rate curve. (05 Marks)

c. Write a note on the selection of solvent for extraction operation. (05 Marks)

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