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Third Semester B.E. Degree Examination, Aug./Sept.2020
Unit Operations

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1   a. Explain the Rheological classifications of fluid with examples.   **(08 Marks)**
    b. Derive barometric equation by stating all assumptions.   **(12 Marks)**

OR

2   a. Water is flowing through a pipe of diameter 300mm and 200mm at the bottom end and upper end respectively. The intensity of pressure at the bottom end is 24.525N/cm^2 and at the upper end is 9.81 N/cm^2. Determine the difference in the datum head, if the rate of flow is 40 ℓps.   **(10 Marks)**
    b. With a neat sketch, explain Reynolds experiment. Also highlight the significance of Reynolds number.   **(10 Marks)**

Module-2

3   a. With a neat sketch, explain the working of centrifugal pump.   **(10 Marks)**
    b. Derive the discharge equation for venturimeter.   **(10 Marks)**

OR

4   a. Explain the construction and working of Rotary drum filtration.   **(10 Marks)**
    b. State and explain the different laws of crushing.   **(06 Marks)**
    c. Distinguish between constant rate and constant pressure filtration.   **(04 Marks)**

Module-3

5   a. Describe the different modes of heat transfer.   **(08 Marks)**
    b. An exterior wall of a house may be approximated by a 100mm layer of common brick (K_1 = 0.7 W/m.K) followed by Gypsum plaster (K_2 = 0.48 W/mK). What thickness of loosely packed Rock wool insulation (K_3 = 0.0635 W/m.K) should be added to the wall to reduce the heat loss by 25%?   **(12 Marks)**

OR

6   a. With a neat sketch, describe the construction and working of $1 - 2$ shell and tube heat exchanger.   **(10 Marks)**
    b. Write a note on the following :
        i) Fouling factor   ii) Drop wise condensation   iii) Film wise condensation
        iv) Heat transfer coefficient.   **(10 Marks)**

Module-4

7   a. What is Fick's law of diffusion? Derive an expression for steady state molecular diffusion in gases (counter current equimolar) condition.   **(10 Marks)**
    b. Explain the experimental method used for measurement of diffusivity.   **(10 Marks)**

OR

8 a. Derive an expression for the mass transfer of component A in to stagnant layer of component B. **(10 Marks)**

    b. In an $O_2 - N_2$ gas mixture at 101.325 Kpa and 298K, the concentration of O_2 at 2 phases 2mm apart are 10% and 20% (by volume) respectively. Calculate the rate of diffusion of O_2 for the cases i) when N_2 is non diffusing   ii) equimolar counter diffusion of 2 gases.
Data : $DAB = 1.81 \times 10^{-5}$ m^2/s. **(10 Marks)**

Module-5

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

    b. A mixture of Benzene and Toluene contains 60 mol % Benzene is to be separated to give a product of 95 mol % Benzene and residue containing 90 mol % Toluene. The feed enters the column at its bubble point. It is proposed to operation the column with a reflux ratio of R = 2.5. Find the number of theoretical plates and also the position of feed plate.
VLE data :

X	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Y	0	0.21	0.875	0.5	0.6	0.7	0.77	0.83	0.9	0.95	1

(10 Marks)

OR

10 a. With a neat sketch, explain the working of any one dryer. **(10 Marks)**

    b. Explain drying operation and draw a drying rate curve. **(06 Marks)**

    c. Define Liquid – liquid extraction and state briefly the application of extraction. **(04 Marks)**

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