CBCS SCHEME

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21BT32

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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 in brief Reynold's experiment with a neat sketch. **(10 Marks)**

b. Water with a density of 998 kg/m^3 is flowing through a pipe at a steady mass flow rate through a uniform diameters pipe. The entrance pressure of the fluid is 68-9 kN/m^2 in the pipe, which connects to a pump which supplies 155.4J/kg of fluid flowing in the pipe. The exit pipe from the pump is the same diameter as the inlet pipe. The Exit section of the pipe is 3.05m higher than the entrance and the exit pressure is 137.8kN/m^2. The Reynolds number in pipe is above 4000 in the system. Calculate frictional heat loss in pipe system. **(10 Marks)**

OR

2 a. With a neat sketch derive Bernoulli's equation for incompressible fluid. Add a note on correction factors for fluid fraction. **(12 Marks)**

b. Write short notes on :
i) Equation of continuity
ii) Laminar and turbulent flow. **(08 Marks)**

Module-2

3 a. With a neat sketch, derive an expression for coefficient of discharge of orifice meters. **(14 Marks)**

b. Define and explain the laws of crushing. **(06 Marks)**

OR

4 a. Water is flowing at a rate of 500cm^3/s through an orifice of 25mm diameters installed in a 75mm diameter pipe. What will be the difference in the level on mercury manometers connected across the meters? The coefficient of orifice meters is 0.65. **(10 Marks)**

b. Explain the construction, principle and working of centrifugal pumps. **(10 Marks)**

Module-3

5 a. Derive an expression for heat transfer through a thick walled hollow cylinder of inside radius r_1 and outside radius r_2 and of length L, with a thermal conductivity K. **(10 Marks)**

b. Derive an expression for logarithmic mean temperature difference for a heat exchanger. **(10 Marks)**

OR

6 a. Derive an expression for critical radius of insulation for a circular pipe. **(10 Marks)**

b. Write a brief note on shell and tube heat exchanger. **(10 Marks)**

Module-4

7 a. Obtain an expression for steady state equimolar counter diffusion of two ideal gases A and B. **(10 Marks)**

b. What is diffusivity? Show that $N_A = J_A + X_A (N_A + N_B)$. **(10 Marks)**

OR

8 a. In an oxygen nitrogen gas mixture at 101.3KPa and 298 K, the concentrations of oxygen at two phases are 2mm apart are 10 and 20% by volume respectively. Calculate the flux of diffusion of oxygen for the cases where i) nitrogen is non diffusing ii) there is equimolar counter diffusion of two gases.
Diffusion of O_2 in N_2 is $1.81 \times 10^{-5} m^2/s$. **(10 Marks)**

b. Show that for equimolar counter diffusion $D_{AB} = D_{BA}$. **(10 Marks)**

Module-5

9 a. Define distribution coefficient and add a note on ternary system with triangular diagram. **(10 Marks)**

b. Discuss in detail about the methods of distillation. **(10 Marks)**

OR

10 a. Explain in detail the construction and working of rotary dryer. **(10 Marks)**

b. Explain in detail the principle and working of any two stages type extractors. **(10 Marks)**

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