CBCS SCHEME

USN

21BT32

Third Semester B.E. Degree Examination, June/July 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. State and derive Bernoulli's equation. **(10 Marks)**

b. Derive the expression for Hydrostatic equilibrium. **(10 Marks)**

OR

2 a. Define fluid. Classify the Rheological behavior of fluids along with examples. **(10 Marks)**

b. A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. **(10 Marks)**

Module-2

3 a. Derive with a neat sketch an expression for discharge through orifice meter. **(10 Marks)**

b. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp.gr. 0.8. The discharge of oil through venturimeter is 60 litres/sec. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$. **(10 Marks)**

OR

4 a. Classify Manometers and derive equations for single column manometer. **(10 Marks)**

b. What are the guage pressures and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53×10^3 kg/m^3 if the atmospheric pressure is equivalent to 750 mm of mercury? The specific gravity of mercury is 13.6. **(10 Marks)**

Module-3

5 a. Derive an equation for force convection in pipe. Obtain $Q = U_i A_i \Delta T$? **(10 Marks)**

b. What is conduction? What are the different types of conduction? Derive the equation for steady state heat conduction through multilayer walls. **(10 Marks)**

OR

6 a. An ice box has walls constructed of a 10 mm layer of cork board contained between two wooden walls each of 20 mm thick. Find the rate of heat removed per unit area if the inner wall surface is kept at 263 K(-10°C), while the outer surface temperature is 303 K(30°C). Find out the zone in wall where the temperature is 293 K (20°C) . Data : Thermal conductivities of cork board and wood respectively are 0.041 and 0.105 W/mK. **(10 Marks)**

b. What is heat transfer co-efficient? Explain different types of flow patterns in heat exchangers. **(10 Marks)**

Module-4

7 a. What is mass transfer coefficient? Derive an equation for steady state diffusion of A through non diffusing B. **(10 Marks)**

b. Explain the theories related to the mechanism of mass transfer across a phase boundary at interface. **(10 Marks)**

OR

8 a. Ammonia gas (A) diffuses through nitrogen gas (B) under steady state conditions with Nitrogen non-diffusing. The partial pressure of A at locations 1 and 2 are 1.5×10^{4} Pa and 5×10^{3} Pa. The locations 1 and 2 are 0.15 m apart. The total pressure is 1.103×10^{5} Pa and temperature is 298 K. Calculate the flux of diffusion of ammonia. Also calculate the flux of diffusion for equimolar counter diffusion assuming that nitrogen is also diffusing. Take the value of diffusivity at prevailing conditions as 2.30×10^{-5} m^2/s [2.30×10^{-5}]. **(10 Marks)**

b. With a neat sketch explain the construction of 1 – 2 shell and tube heat exchanger. **(10 Marks)**

Module-5

9 a. Explain the process involved in separating two components by distillation. Discuss McCabe Thiele method. **(10 Marks)**

b. What is liquid-liquid extraction? Explain the qualities of solvent for extraction. **(10 Marks)**

OR

10 a. Explain equilibrium moisture curve and rate of drying curve. **(10 Marks)**

b. Write short notes on Tray Dryer. **(05 Marks)**

c. Write short notes on Flash Distillation. **(05 Marks)**

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