Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET-B

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY/JUNE 2024

Semester : Semester VIII - 2020
Course Code : PET3012
Course Name : Fundamentals of Chemical Engineering
Program : B.Tech.

Date : June 03, 2024
Time :1:00 PM - 4:00 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ANY FIVE QUESTIONS **5QX2M=10M**

1. State Bernouli's principle.
(CO1) [Knowledge]

2. Write relationship between fluid velocity head and pressure head as per Bernoulli's Principle.
(CO2) [Knowledge]

3. Define the terms "molecularity" and "order of reaction".
(CO3) [Knowledge]

4. State Prandtl number and its significance in heat transfer.
(CO4) [Knowledge]

5. Abbreviate the full form CSTR and define.
(CO3) [Knowledge]

6. State Newton's Law of cooling.
(CO4) [Knowledge]

7. Illustrate collision theory.
(CO3) [Knowledge]

PART B

ANSWER ANY FIVE QUESTIONS **5QX10M=50M**

8. Explain the significance of understanding film theory in the context of mass transfer phenomena.
(CO1) [Comprehension]

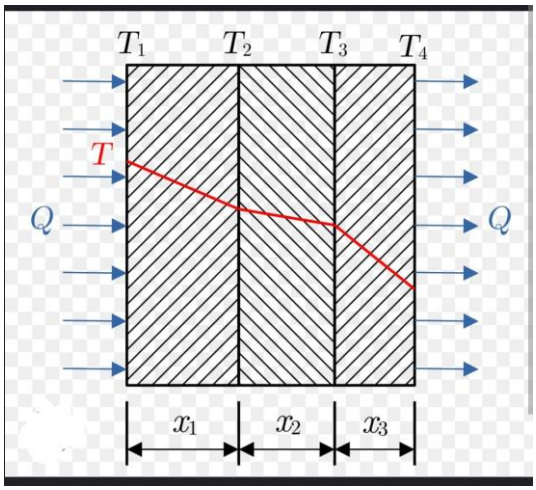
9. Water stands at a depth H in a large, open tank whose side walls are vertical. A hole is made in one of the walls at a depth h below the water surface. Compute the distance R from the foot of the wall does the emerging stream strike the floor.

(CO2) [Comprehension]

10. Based on 'differential mass balance' determine vapor average mole fraction.

(CO3) [Comprehension]

11. The following figure indicates a composite wall consisting of three layers of materials 1, 2, and 3 having thickness $x1$, $x2$, and $x3$ and thermal conductivity K1, K2, and K3 respectively. Based on the above figures and parameters determine the rate of heat flow (Q). Assume the heat conduction area of each layer "A" is constant.



(CO4) [Comprehension]

12. In a tube radius R m filled with the liquid dilute component, A is diffusing in the nonflowing liquid phase represented by

$$J_A = -D_{AB}\frac{\delta C_A}{\delta z}$$

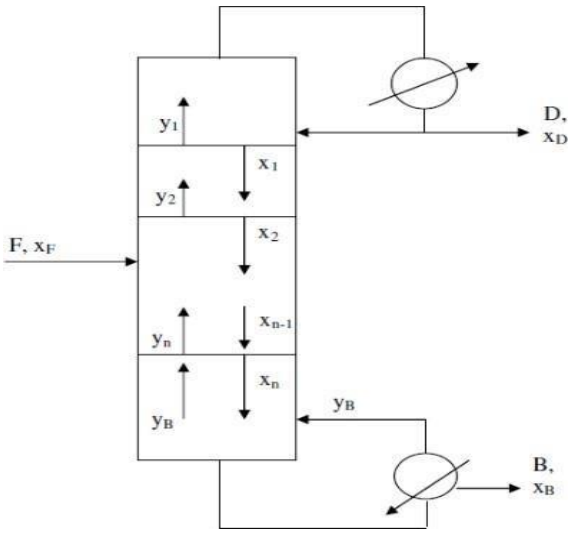
where z is the distance along the tube axis. Derive the differential equation for steady state for diffusion and reaction for this system.

(CO3) [Comprehension]

13. Describe the physical significance of the heat transfer coefficient. Mention the more important factors on which the heat transfer coefficient depends.

(CO4) [Comprehension]

14.



(CO3) [Comprehension

Based on the above figure estimate the minimum number of trays.

PART C

ANSWER ANY TWO QUESTIONS **2QX20M=40M**

15. A cylindrical water tower of diameter 3.0 m supplies water to a house. The level of water in the water tower is 35 m above the point where the water enters the house through a pipe that has an inside diameter 5.1 cm. The intake pipe delivers water at a maximum rate of 2.0×10−3m3·s−12.0×10−3m3·s−1. The pipe is connected to a narrower pipe leading to the second floor that has an inside diameter 2.5 cm . Determine the pressure and speed of the water in the narrower pipe at a point that is a height 5.0 m above the level where the pipe enters the house.

(CO2) [Application]

16. A constant density first-order reaction Gasoline→Ethane is carried out in a batch reactor. Data obtained are given table-

t(s)	30	60	90	120	150	180	600
xA	0.74	0.55	0.42	0.29	0.24	0.16	0.0025

If initial concentration of gasoline is 1 kmol/L, calculate the rate constant for the reaction. Also calculate time required for 50% conversion.

(CO3) [Application]

17. The wall of a cold storage consists of three layers- an outer layer of ordinary bricks,25cm thick, a middle layer of cork,10 cm thick and inner layer of cement,6 cm thick. The thermal conductivity of materials are- brick: 0.7, cork: 0.043 and cement: 0.72 W/m˚C. The temperature of the outer surface of wall is 30˚C and inner is -15˚C. Calculate (a) the steady-state rate of heat gain per unit area of the wall, (b) the temperature at the interfaces of the composite wall and (c) the percentage of the total heat transfer resistance offered by individual layers.

(CO4) [Application]