SUMMER-2024	
Exam Seat No.:	
Academic Year: 2023-2024	Semester: III
Class: SY	Program: B.Tech
Branch Code: CHE	Pattern: 2022
Name of Course: Process Calculation	Course Code: CHE222005
Max. Marks:60	Duration: 2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper
and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

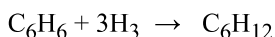**Question No. 1 Attempt following Question**

1a)	98 gm. of sulphuric acid are dissolved in water to prepare one liter of solution. Find Normality and molarity	(6)	CO1

Question No. 2 Attempt following Question

2a)	Explain Material Balance for Mixing operation with net Block Diagram.	(6)	CO2

Question No. 3 Attempt following Question

3a)	Gaseous benzene ($C6H6$) reacts with hydrogen as per the following reaction.	(8)	CO3

$$C_6H_6 + 3H_3 \rightarrow C_6H_{12}$$

30 % excess hydrogen is used above that required by the reaction. Conversion is 50 % and yield is 90 %. Calculate the requirement of benzene and hydrogen gas for 100 moles of Cyclohexne.

OR

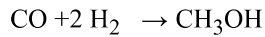|			
3b)	Explain Limiting reactant and Excess of reactant with example.Write note on Conversion of the reaction.	(8)	CO3

3c)	The feed containing 60 mole % of A, 30 mole % of B and 10 % inserts enters a reactor, 80 % of A reacts according to following reaction.	(8)	CO3

$$2A + B \rightarrow C$$

Find composition of product stream on mole basis.

OR

3d) Write note on Selectivity and Yield of the reaction. Write Stoichiometric Coefficient and   (8)   CO3
     Stoichiometric ratio for the reaction.

   $CO + 2 H_2 \rightarrow CH_3OH$

Question No. 4 Attempt following Question

4a) Calculate the standard heat of formation of n-propanol liquid using following data   (8)   CO4

   $\Delta H_{f(CO_2)}$ = -93.98Kcal/mol.

   $\Delta H_{f(H_2O)}$ = -68.27 Kcal/mol.

   $\Delta H_{C(C_3 H_7OH)}$ = -484.40 Kcal/mol.

OR

4b) Calculate the heat formation of liquid ethyl acetate using following data.   (8)   CO4

   $\Delta H_{f(CO_2)}$ = -93.98Kcal/mol.

   $\Delta H_{f(H_2O)}$ = -68.26 Kcal/mol.

   $\Delta H_{C(C_4 H_8O_2)}$ = -532.82 Kcal/mol.

4c) Chlorinated diphenyl is heated from 303 K to 503 K in an indirectly fired heater at a   (8)   CO4

   rate of 3500 kg/h. Calculate the heat to be supplied to the fluid in the heater. The heat capacity of
   the fluid in this temperature range is given by the equation.

   $C_P = 0.751 + 1.465 \times 10^{-3}T$, kJ/kg^{-1}.K.

OR

4d) A mixture of isomeric Diphenyl and Dichloro Tetrachloroethane is used as a thermic   (8)   CO4

   fluid in a liquid phase heating system. The thermic fluid enters an indirect fired heater at a
   temperature of 450 K and leaves the heater at a temperature of 550 K. Calculate the supply of heat
   to the heater per kg of the liquid heated. The heat capacity of the fluid is given by the equation: C_P
   = $1.435 + 2.19 \times 10^{-3}T$, kJ/(kg^{-1}.K).

Question No. 5 Attempt following Question

5a) Describe the humidity chart with detailed parameters and neat sketch.   (8)   CO5
OR
5b) Write a short note on: (8)   CO5

   (a) Relative humidity (b) Difference between Dry bulb and Wet bulb temperature and (c)
   Applications of Humidity Chart.

5c) Calculate the net calorific value (NCV) at 298K of a sample of fuel oil having C/H ratio 9.33 (by   (8)   CO5
   weight) & containing sulphur to the extent of 1.3% by weight.

   Data- The GCV of the fuel oil at 298K(25^{0}C) = 41785 KJ/Kg

OR

5d)   Explain Net Calorific value (NCV) and Gross calorific value (GCV).Write note on solid and liquid   (8)   CO5
fuels give at least two examples on each.

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