Exam Date & Time: 21-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

DEPARTMENT OF CHEMICAL ENGINEERING

CHEMICAL REACTION ENGINEERING [CHE 2223]

Marks: 50 **Duration: 180 mins.**

Descriptive

Answer all the questions. Section Duration: 180 mins

Answer ALL Questions.
Any missing data may be suitably assumed.

1A) Compare the different theories of temperature dependency of a rate equation to obtain the most suitable one. (4)

1B) The pyrolysis of ethane proceeds with an activation energy of about 300 KJ/mol. How much faster is the decomposition at 650 ^{o}C than at 500 ^{o}C. (3)

1C) Develop performance equation for an Ideal PFR (3)

2A) Aqueous A reacts to form R (A $\rightarrow$ R) and in the first minute in a batch reactor its concentration drops from C_{Ao} = 2.03 mol/liter to C_{Af} = 1.97 mol/liter. Find the rate equation for the reaction if the kinetics are second order with respect to A. (5)

2B) Discuss Integral method of analysis, by developing an equation for a bimolecular 2nd order reaction, A + B $\rightarrow$ Prod. (3)

2C) Differentiate τ and t_m. (2)

3A) The following liquid-phase reaction is carried out in a CSTR and achieves 50% conversion (4)

$A \rightarrow B, (-rA) = k C_A^2$

(i) What will be the conversion if this reactor is replaced by another reactor which is six times as large? All other conditions remain the same

(ii) What will be the conversion if the original CSTR is replaced by a PFR of equal

volume? All other conditions remain the same. State all the assumptions that have been taken into account.

3B) Discuss the graphical procedure to determine conversion, for MFR's connected in series. (3)

3C) Classify Instantaneous (ψ) and Overall fractional yields (ϕ). How is it different from Selectivity? (3)

4A) At present conversion is 2/3 for our elementary second-order liquid reaction

$2A \rightarrow 2B$ when operating in an isothermal plug flow reactor with a recycle ratio of unity. What will be the conversion if the recycle stream is shut off? (4)

4B) Analyze series type reactions and assess them qualitatively. (3)

4C) Describe any three distribution functions employed for RTD. (3)

5A) Derive and provide insights for the Michaelis-Menten equation. (4)

5B) What is RTD and how does it help assess non-ideality. (3)

5C) Explain in detail the Differential method of analysis of kinetic data. (3)

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