Reg. No.



Manipal Institute of Technology, Manipal

(A Constituent Institute of MAHE)

V SEMESTER B.TECH (CHEMICAL ENGINEERING) MAKE UP EXAMINATIONS, Dec 2017

SUBJECT: CHEMICAL REACTION ENGINEERING 1 [CHE 3102] REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

Answer **ALL** the questions and any missing data may be suitably assumed.

| 1A. | Obtain an equation to analyze the total pressure data obtained from a constant volume batch reactor. | | | | | | 06 |
|-----|--|--|--|--|--|--|----|
| 1B. | The pyrolysis of ethane proceeds with an activation energy of about 300 KJ/mol. How much faster is the decomposition at 650 $^{\circ}$ C than at 500 $^{\circ}$ C. | | | | | | 04 |
| 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. | | | | | | 06 |
| 2B. | Explain in detail the Differential method of analysis of kinetic data. | | | | | | 04 |
| 3A. | A PFR operating isothermally at 773 K is used to conduct the following reaction: $A \rightarrow B + C$. If a feed of pure A enters at 5 atm and at a flow rate of 0.193 ft ³ /s, what length of pipe with a cross-sectional area of 0.0388 ft ² is necessary for the reaction to achieve a conversion of 90 %? Data: $k = 7.8 * 10^9 \exp[-19,200/T] \text{ s}^{-1}$. | | | | | | 06 |
| 3B. | Derive the performance equation for an ideal MFR. | | | | | | 04 |
| 4A. | A + 2B → R; r_R = k₁ C_A C_B² and A + B → S; r_s = k₂ C_A C_B, with k₂ = 2k₁. Find a) What are the fractional yield expressions ψ(R/A) and ψ(R/B) for the system. b) How should the MFR be operated so as to maximize the production of R from a single feed consisting of C_{AO} = C_{BO} = 1. | | | | | | 06 |
| 4B. | Quantitatively evaluate the behavior of N-equal sized MFR's connected in series. | | | | | | 04 |
| 5A. | $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | | | | | 06 |
| 5B. | Explain – Instantaneous (Ψ) and over all fractional yields (ϕ). | | | | | | 04 |