Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, July 2016

SUBJECT: CHEMICAL REACTION ENGINEERING 2 [CHE 306]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A.	A reactor is used to carry out the reaction A→R, $-r_A = 0.05C_A$, mol/(l.min). C(tracer): 35, 38, 40, 40, 39, 37, 36, 35 t, min: 0, 10, 20, 30, 40, 50, 60, 70 Calculate conversion assuming a). Plug flow (PFR) b). Mixed flow (CSTR)	**15**
1B.	Derive relationship between conversion and RTD data through Segregation model	**5**
2.	A catalyst particle consists of cylindrical pores and a single first order reaction occurs within the pores under isothermal conditions, without any change in volume. Develop expressions to find the concentration profile in the pore and also sketch the concentration profile inside the pore. What is the importance of effectiveness factor?	**20**
3A.	For an elementary liquid phase reaction A↔B. Make a plot of equilibrium conversion as a fraction of temperature. Determine the adiabatic equilibrium temperature when pure A is fed to the reactor at temperature of 300 K. Data: $\Delta H^o_{fa} = -40000$ cal/mol $\Delta H^o_{fb} = -60000$ cal/mol. $C_{pA} = C_{pB} = 50$ cal/ molK. k = 100000 at 298 K.	**15**
3B.	Write a note on Multiple Steady States.	**5**
4A.	Compare and contrast Physisorption and chemisorption	**08**
4B.	Find an interim rate expression for the following catalytic reaction when adsorption is rate controlling step. A → B. (Single site mechanism)	**12**
5A.	A batch of spherical solids (of single size) is treated by gas in a uniform environment. Solid is converted to a firm non flaking product according to shrinking core model (SCM). The conversion is 87.5% in reaction time of 1 hour and conversion is complete in 2 hours. Determine the rate controlling mechanism.	**8**

5B.	With a neat sketch relate time and conversion for a spherical particle when the controlling resistance is diffusion through the gas film.	**12**
6.	Reactant A decomposes in the presence of enzyme E. We also suspect that reactant B in some way influences this decomposition. To study this phenomenon various concentrations of A, B, and E flow into and out of a mixed flow reactor (V = 240 cm^3). (a) From the following data find a rate equation for the decomposition. (b) What can you say about the role of B in the decomposition? (c) Can you suggest a mechanism for this reaction?	**20**

C_{A0}, mol/m^3	C_A, mol/m^3	C_{B0}, mol/m^3	C_{E0}, mol/m^3	v, cm^3/min
200	50	0	12.5	80
900	300	0	5	24
1200	800	0	5	48
700	33.3	33.3	33.3	24
200	80	33.3	10	80
900	500	33.3	20	120