Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. END SEMESTER EXAMINATIONS 2019

SUBJECT: CHEMICAL REACTION ENGINEERING 2 [CHE 3202]

REVISED CREDIT SYSTEM (27/04/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

✤ Missing data may be suitable assumed.

1A.	Obtain an equation for conversion by using Bypassing and Dead space as the two parameters.	06
1B.	 a) For a CSTR of volume 6 m³ operating with a steady-state (liq) feed rate of 0.4 m³min⁻¹.What fraction of the exit stream. (i) is of age less than 10 min? (ii) has been in the tank longer than 30 min? b) For a CSTR operating as in (a), suppose a small pulse of a tracer material is added to the feed at a particular time (t = 0). How long (min) does it take for 80% of the tracer material to leave the tank? 	04
2A.	 A first-order liquid-phase endothermic reaction A→products takes place in a CSTR. The feed concentration of A is 1.25 mol/L, the feed rate is 20 L/s, and the reactor volume is 20,000 L. The enthalpy of reaction is +50,000 J/mol, the specific heat of the reacting system is 3 J/g-K, and its density is 900 g/L. a) If the feed temperature is 300 K, at what temperature must a heating coil (with UA=10,000 J/s-K) in the tank be maintained to keep the temperature of the CSTR the same as the feed temperature? What conversion is obtained? At 300 K, the rate constant k_A=0.004 s⁻¹. b) If there were no heating coil in the tank, what should the feed temperature be to achieve the same result? Clearly mention the assumptions made wherever required. 	08
2B.	Compare and contrast Physisorption and chemisorption.	02
3A.	With a neat sketch derive the relation between time and conversion for small shrinking particle (flaking) when gas film is the rate controlling step.	06
3B.	Derive an expression for the effectiveness factor (for η only) of a 1 st order irreversible reaction, A \rightarrow product, where diffusion is taking place in a cylindrical pore.	04

4A.	To determine the rate controlling mechanism of a particular gas-solid system, two engineers A and B were employed. Both of them were provided with oven of same type and same gas supply. They were allowed to do the trial for 1 hour. 'A' conducted the experiment at 100°C and after 1 hour, he observed that the 6 mm particles were 69.8% converted and 4 mm particles were 90% converted. 'B' conducted the experiment at 150°C and after an hour, he observed that 8 mm particles were 57% converted and 4 mm particles were 86.75% converted. From these data, find the rate controlling mechanism.	06
4B.	Write a note on slurry reactors kinetics.	04
5A.	Find an interim rate expression for the following catalytic reaction when surface reaction is controlling. $A + B \rightarrow C + D$.	06
5B.	Explain in brief with plots the eight different cases based on two-film theory in fluid-fluid contact systems.	04