

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VII EXAMINATION-SUMMER 2023****Subject Code: 2170501****Date: 27/06/2023****Subject Name: Chemical Reaction Engineering - II****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1*	(a) Define RTD and state its importance in reactor performance of Plug Flow Reactor	03
	(b) State the reasons for the existence of Non-Ideal flow in the process vessel	04
	(c) Derive the expression for Dispersion Model in Plug Flow and state its application	07
Q.2	(a) Define linear and Non-linear processes	03
	(b) Discuss the interrelationship of E,F and C curves and state application of E curve	04
	(c) Discuss the Contacting patterns for two phase systems	07
	OR	
	(c) Discuss the rate steps involved in Heterogeneous system	07
Q.3	(a) Define the Enhancement factor in fluid-fluid reaction and state its application	03
	(b) What you understand by Hatta Modulus and state its importance in fluid-fluid reaction and its application in increasing overall rate of reaction	04
	(c) Explain kinetic regimes for straight mass transfer and Chemical reaction in Fluid-fluid reaction	07
	OR	
Q.3	(a) State the three important reasons for carrying out fluid-fluid reactions	03
	(b) Give examples for fluid-fluid reactions	04
	(c) Derive the expression for the tower height in design involving fluid-fluid reaction with straight mass transfer without chemical reaction	07
Q.4	(a) State the assumptions made in SCM (Shrinking Core Model)	03
	(b) Discuss slurry reaction kinetics with diagram showing concentration profile	04
	(c) Explain progressive conversion model for spherical particles in case of fluid-particle reactions	07

OR

- Q.4** (a) List the examples of Fluid-Particle reaction **03**
- (b) Derive the equation for fluid particle reaction considering Gas Film Diffusion as rate controlling step. **04**
- (c) Discuss the parameters for determination of rate controlling steps in fluid-particle reaction **07**
- Q.5** (a) Define the role of Catalyst Promoters and Inhibitors **03**
- (b) Discuss any three important physical properties of Catalyst **04**
- (c) The catalytic reaction $A \rightarrow 4R$ is run at 3.2 atm and 117°C in a plug flow reactor which contains 0.01kg of catalyst and uses a feed consisting of the partially converted product of 20 liters/hr of pure unreacted A. The results are as follows:

Run	1	2	3	4
CA _{in} , mol/ltr	0.100	0.080	0.060	0.040
CA _{out} , Mol/ltr	0.084	0.070	0.055	0.038

Find a rate equation to represent this reaction

OR

- Q.5** (a) Define Catalyst Poisoning and Catalyst fouling **03**
- (b) Discuss Monolayer and Multilayer adsorption process and state its importance in measurement of surface area of Catalyst **04**
- (c) Calculate the time needed to burn to completion particles of graphite ($R_0 = 5$ mm, $\rho_B = 2.2$ gm/cm³, $k'' = 20$ cm/sec) in an 8% oxygen stream. For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. Reaction temperature = 900°C and 1 atm **07**
