

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VII (NEW) EXAMINATION – WINTER 2024****Subject Code:3173518****Date:30-11-2024****Subject Name: Basics of Reaction Engineering and Thermodynamics****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: 1) Space time, 2) Fugacity 3) Chemical Potential **03**
 (b) Give the difference between physical and chemical adsorption. **04**
 (c) Prove that N number of same sized mixed flow reactors in series can be approximated as a plug flow reactor. **07**
- Q.2** (a) Explain the concept of Entropy. **03**
 (b) Give the statement of Zeroth and First law of Thermodynamics. **04**
 (c) Derive the process design equation for mixed flow reactor. **07**
- OR**
- (c) Derive the process design equation for PFR reactor. **07**
- Q.3** (a) Write down the applications of CSTR. **03**
 (b) Give the details of differential analysis method. **04**
 (c) A polymerization reaction occurs at constant temperature in a homogeneous phase. For initial monomer concentrations of 0.3, 0.5 and 0.9 mole/l, 30% of monomer reacts in 40 minutes. Find the reaction rate. **07**
- OR**
- Q.3** (a) How to select reactor based on the yield of desired product. **03**
 (b) Give the comparison between reversible and irreversible process. **04**
 (c) What are the effect of pressure and temperature on fugacity. **07**
- Q.4** (a) What is the difference between order and molecularity of a reaction? **03**
 (b) Differentiate constant volume and variable volume batch reactor. **04**
 (c) An aqueous feed of A and B (400 liter/min, 100 mmol A/liter, 200 mmol B/liter) is to be converted to product in a plug flow reactor. The kinetics of the reaction is represented by $A + B \rightarrow R$, $-r_A = 200 C_A C_B$ mol/(liter)(min). Find the volume of reactor needed for 99.9% conversion of A to product. Draw a schematic diagram. **07**
- OR**
- Q.4** (a) What is catalyst deactivation? **03**
 (b) Explain types of catalyst deactivation. **04**
 (c) Give the details of third law of thermodynamics. **07**
- Q.5** (a) Explain the Arrhenius equation. **03**
 (b) Explain the concept of instantaneous and overall yield. **04**
 (c) Explain in detail about network of thermodynamic equations. **07**
- OR**
- Q.5** (a) Explain in brief about different types of Thermodynamics diagrams. **03**
 (b) What do you mean by Ideal and non-ideal Solutions? **04**
 (c) Describe the graphical method to determine the best arrangement for given conversion of unequal sized MFRs connected in a series. **07**
