

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII (NEW) EXAMINATION – WINTER 2020

Subject Code:2173514

Date:25/01/2021

Subject Name:Environmental Reaction Engineering

Time:10:30 AM TO 12:30 PM

Total Marks: 56

Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain Fick's first law of diffusion. Describe the contributions of liquid mixture to its overall total flux. **03**
 (b) Discuss the correlation between Effective diffusivity and tortuosity **04**
 (c) Correlate the time needed for complete conversion of a spherical particle considering that chemical reaction is rate governing step in shrinking core model. **07**
- Q.2** (a) Describe various properties of catalyst **03**
 (b) Write short note on Mass transfer boundary layer thickness **04**
 (c) Synthesize a rate law for the decomposition of Cumene to form benzene and propylene considering that surface reaction is rate limiting step. **07**
- Q.3** (a) Explain differences between ideal and non-ideal reactors **03**
 (b) Discuss the steps involved in a Catalytic reaction. **04**
 (c) Prove that for a first order reaction N-CSTRs connected in series will approximate to the behavior of PFR. **07**
- Q.4** (a) Define Thiele Modulus and Explain significance of this factor in catalytic reaction **03**
 (b) How E curve can be determined through pulse input experiments? **04**
 (c) The half-life period for a certain first order reaction is 2.5×10^3 sec. How long will it take for $1/4^{\text{th}}$ of reactant to be left behind? **07**
- Q.5** (a) Define holding time and space time for flow reactors. **03**
 (b) In an isothermal batch reactor 70% of reactant A is converted in 15 minutes. Find the space time and space velocity to effect this conversion in a plug flow reactor assuming first order kinetics. **04**
 (c) Discuss about reactions in series. **07**
- Q.6** (a) Discuss half-life method for analysis of rate data. **03**
 (b) Give brief on variable volume reactor **04**
 (c) Explain how different theories predict temperature dependency of reaction rate **07**
- Q.7** (a) Define order and molecularity of a reaction **03**
 (b) Derive the integrated form of rate expression for Irreversible unimolecular type Second order reactions. **04**
 (c) Differentiate between physical and chemical adsorption.
- Q.8** (a) How overall order of a reaction can be estimated from Integral method? **03**
 (b) If we are doubling the concentration of reactant, rate of reaction triples then Find out effect on the reaction order. **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 mol/l, 30 % of monomer reacts in 40 minutes. Find the reaction rate. **07**
