**Seat No: _____** **Enrollment No: _____**

# PARUL UNIVERSITY

## FACULTY OF ENGINEERING & TECHNOLOGY

**B.Tech. Summer 2018- 19 Examination**

**Semester: 7** **Date: 10/05//2019**
**Subject Code: 03103401** **Time: 10:30am to 01:00pm**
**Subject Name: Chemical Reaction Engineering-II** **Total Marks: 60**

**Instructions:**
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1 Objective Type Questions.** **(15)**

1. Define: Mean time
2. What is Residence Time Distribution?
3. Define :Catalyst
4. Define : Non Ideal Flow
5. List out the Design Rectors for Fluid-Fluid Reaction.
6. Define : Fractional Conversion
7. Case: H: (Infinitely Slow reaction) A+B➔ Product what is actual Rate of reaction
   a) -RA = k fl Ca Cb b) -RA = k fl Ca c) -RA = k Ca Cb d) -RA = k
8. Rate of equation based on the unit Interfacial surface of solid is_____.
9. Define: Macro fluid
10. What is the effect of reaction when Hatta no (MH) Large.
    a) Fact Reaction b) Slow Reaction c) No change in Reaction d) All
11. What is Porous catalyst?
12. Define: Conversion and Selectivity.
13. Give five important steps for SCM for spherical particles.
14. List out Characteristics of Tracer in heterogeneous reaction.
15. For the Heterogeneous Catalytic reaction
    a) Activation Energy is High b) Activation Energy is low c) Cannot predict d) None

**Q.2 Answer the following questions. (Attempt Any three)** **(15)**

**A)** Explain the step input method and impulse input method for determining C, E, and F curves in non-ideal chemical reactors.

**B)** The following data were obtained from a Pulse Input to a vessel:

| **t (min)** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **C ($g/m^3$)** | 0 | 1 | 5 | 8 | 10 | 8 | 6 | 4 | 2.8 | 2.3 | 1.1 | 0.6 | 0 |

Plot the 'C' & 'E' curves and determine the fraction of material leaving the vessel that has spent between 3 to 6 min in the vessel.

**C)** For Fluid-Fluid reactions, Enlist the eight cases for mass transfer and reaction with neat sketch

**D)** Short note: Limiting Step in Heterogeneous reaction.

**Q.3** **(A)** Derive the rate equation for Instantaneous reaction with low concentration (CB) of Gas- liquid Reaction in fluid – fluid reaction. **(07)**

**(B)** Derive the expression for fractional conversion for the reaction between Particle and fluid when particles of solid are changing in size and Diffusion through Ash layer controls. Derive the performance equation. **(08)**

**OR**

**(B)** Derive the expression for fractional conversion for the reaction between solid and fluid when particles of solid are changing in size and Diffusion through Gas film controls. Derive the performance equation. **(08)**

**Q.4** **(A)** Short note: Micro fluid and Macro fluid in detail. **(07)**

**OR**

**(A)** State and explain the steps in heterogeneous catalytic reaction with schematic diagram

**(B)** Spherical particles of zinc blend of size R = 1 mm are roasted in an 8% oxygen stream at 900°C and 1 atm the reaction that proceeds according to Shrinking- core model (SCM) is as follows: $2ZnS + 2O2 \rightarrow 2 ZnO + 2SO2$. **(08)**

Calculate the time needed for complete conversion of a particle and the relative resistance of ash layer diffusion during this operation.

**Data*:*** Density of solid, $\rho B = 4.13$ gm/cm3, reaction rate constant= k" = 2 cm/sec, for gases in the ZnO layer, D**e** = 0.08 cm2/sec, molecular weight of Zn = 65.38 g/mol and S = 32 g/mol.