Enrolment Number: _____

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech MID Semester Exam
6th SEMESTER

SUBJECT: Chemical Reaction Engineering -II (203103353) **BRANCH: Chemical Engineering**

[Date: 29.1.2024] **[Time: 02.30 P.M. to 04.00 P.M.]** **[Total Marks: 40]**

Q.1 **(A) Multiple Choice Questions:** **05**

1) If M is the total amount of tracer injected and v is the volumetric flow rate of the effluent, then what is the Relationship between cumulative and exit age distribution?

a) E= C /(M.v) b) E= C /(M/v) c) E= M /(c/v) d) E = MC/(v)

2) The area under the curve of exit age distribution integrated between time, t = 0 and t = ∞ is ____.

a) Zero b) Unity c) Two d) Infinite

3) If the entire volume of PFR is 10 m3 and dead volume is 2 m^3, then active volume of PFR is _____.
a) 10 b) 20 c) 8 d) 12

4) The Exit age distribution of fluid leaving a vessel is used....
a) To study the reaction mechanism
b) To study the extent of Ideal flow in the vessel
c) To study the extent of Non-ideal flow in the vessel
d) To know the activation energy

5. Which of the following represents heterogeneous catalytic reaction?
a) Ammonia synthesis
b) Burning of coal
c) Reduction of iron ore
d) Roasting of ores

(B) Define: Early mixing and Late mixing, Mean Residence time, Tracer. **05**

Q.2 **Attempt any four (Short Questions):** **12**

(1) Explain Residence time Distribution function for Non-Ideal system.

(2) Provide ways in which the mean residence time can be calculated.

(3) List out the examples of Heterogeneous reaction-based catalytic and Non-Catalytic chemical reaction.

(4) Write down about Contacting Patterns (Schemes) For Two-Phase system.

(5) Explain in Brief Micro fluid and Macro fluid based on State of Aggregation.

Q.3 **Attempt any two:** **08**

(1) What are different non ideal patterns? Define E, F and C curves and derive relation between them.

(2) Short note: RTD Measurement with Pulse input

(3) Explain Limiting Step (Rate controlling) for heterogeneous reaction.

Q.4 **(A)** Short note on Dispersion Model for non-Ideal system. **05**

(B) Gaseous reactant A diffuses through a gas film and reacts on the surface of a solid according to a reversible first-order rate, **05**

$$-r_A'' = k''(C_{As} - C_{Ae}) \qquad \text{mol/m}^2\text{.sec}$$

Where CAe, is the concentration of A in equilibrium with the solid surface. Develop an expression for the rate of reaction of A accounting for both the mass transfer and reaction steps.

OR

(B) A slug of dye is placed in the feed stream to a continuous stirred reaction vessel operating at steady state. The dye concentration in the effluent or outlet stream was monitored as a function of time to generate the data in the table below. Time is measured relative to that at which the dye was injected. **05**

Given data:

Time (sec)	0	120	360	360	480	600	720	840	960	1080
Tracer concentration (g/m3)	0	6.5	12.5	12.5	10	5	2.5	1	0	0

Plot the 'C' & 'E' curves and determine the mean residence time of the fluid by Numerical method.