BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.TECH. **SEMESTER: V**
BRANCH: CHEM/P&P **SESSION: MO/2022**

SUBJECT: CL302 CHEMICAL REACTION ENGG. - I

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	The aqueous phase reaction A → 2R proceeds as follows:	[5]	3	3

time, sec	780	2080	3540	7200
X_A, %	11.2	25.7	36.7	55.2

Calculate the rate constant and order of the reaction by using integral method. Also calculate the time required for 50% conversion. Assume initial concentration is 0.05 mol/liter.

Q2 (a) In a liquid-phase chemical reaction, the concentration of the limiting reactant varies with time as follows: [2] 1 3

Concentration (mol/L)	100	67	45	32	24	20	18	17	16
Time, min	0	2	4	6	8	10	12	14	16

Calculate the rate of the reaction at 4 minute.

Q2 (b) For a reaction A→P whose rate constant is expressed in unit of kmol/m^3.s. Calculate the rate constant if 80% conversion is obtained in 1 hr. Also calculate time required for 90% conversion and conversion after 30 min of reaction started. [3] 1 3

Q3 (a) Calculate the fractional volume change for the following reactions [3] 2 2
2A + 20% Inerts → 3P + Q+ Inerts
A + 2B → 2P + 3Q

Q3 (b) Show the examples of (i) unimolecular, (ii) bimolecular reactions [2] 1 2

Q4 The following gas phase elementary reaction 2A →3P + 2Q is carried out in a constant pressure batch reactor. The rate constant is 0.06 m^3 $kmol^{-1}.s^{-1}$ and initial concentration is 0.09 kmol/m^3. Calculate the time required for 80% conversion [5] 3 3

Q5 The following table is the experimental data for the given reaction A→R. [5] 5 4

X_A	0	0.1	0.2	0.4	0.6	0.7	0.8
$-r_A$ $(mol/m^3.s)$	0.45	0.37	0.30	0.195	0.113	0.079	0.05

If the initial molar flow rate is 0.4 mol/s then compare the volume of e CSTR and PFR required to reach final conversion 80%.

:::::: 26/09/2022 ::::::M