

(Time: 3 Hours)

(Maximum Marks : 80)

Please check whether you have got the right question paper.

Note:

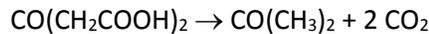
1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

Q.1 Answer the following **(Any four)**

- | | | |
|--|--|----|
| | a. Explain air lift reactors in detail. | 05 |
| | b. What is Arrhenius equation? Discuss the effect of temperature on rate of reaction. | 05 |
| | c. Explain zeroth order and first order reaction with example. Write the rate of reaction equation for the same. | 05 |
| | d. Derive the performance equation for PFR for first order reaction. | 05 |
| | e. Discuss the thermal behavior of stirred tank reactor. | 05 |

Q.2 a. Differentiate between CSTR, PFR and Batch reactors. Discuss the importance with respect to their application. 10

b. Decomposition of acetone decarboxylic acid is first order reaction:



Following is the data for the same;

Temp. (K)	273	293	313	333
k_1 (sec)⁻¹	2.46×10^5	47.5×10^5	576×10^5	5480×10^5

Find out the energy of activation for this reaction.

Q.3 a. A particular fermentation is to be carried out in a CSTR. The flow characteristics of the CSTR were evaluated by introducing a tracer in the form of pulse input. The time versus concentration of the tracer data are presented below. Find the average residence time and exit edge distribution E. 10

t (min)	0	10	20	30	40	50	60	70
Tracer conc. (g/l)	0	2	6	7	5	3	1	0

TURN OVER

- b. How do you interpret the batch reactor data to obtain the kinetics of a reaction? Explain integral method of analysis using first-order irreversible reaction as an example. 10
- Q.4 a. Derive an equation to find out the conversion in non-ideal reactor using Tank-in-series Model. 10
- b. On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order. 05
- c. Explain non ideal behavior of reactors. 05
- Q.5 a. Explain the effect of substrate and product inhibition on cell growth. 10
- b. Derive an expression for maximizing R in a series reaction for a mixed flow reactors. 10
- Q.6 a. The gas phase reaction $A + 2B \longrightarrow 2C$, which is first order in B is carried out isothermally in a plug flow reactor. The entering volumetric flow is $3 \text{ dm}^3/\text{min}$. and the feed is equimolar in A and B. The feed enters the reactor at 727°C and 10 atm. The rate constant at this temperature is $4 \text{ dm}^3/\text{mol. min}$. 10
- i) What is the volumetric flow rate when conversion is 30%?
- ii) What is the rate of the reaction at the entrance of the reactor?
- iii) What is the concentration of A at the entrance of the reactor?
- iv) What is the concentration of A at 50% conversion?
- b. Explain bubble column reactor and fluidized bed reactor in detail. 10
-