Q.P. Code :18635

(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:

$CO(CH_2COOH)_2 \rightarrow CO(CH_3)_2 + 2\ CO_2$

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 dm^3/ min. and the feed is equimolar in A and B. The feed enters the reactor at 727^oC and 10 atm. The rate constant at this temperature is 4 dm^3/ mol. min. 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?	10
	b.	Explain bubble column reactor and fluidized bed reactor in detail.	10
