

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2173509/2173514

Date:16/05/2019

Subject Name:Environmental Reaction Engineering

Time:02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	(a) Define: 1) space time, 2) space velocity, 3) Recycle ratio	03
	(b) Discuss size comparison of mixed flow reactor and plug flow reactor for n^{th} order reaction.	04
	(c) Derive the process design equation for mixed flow reactor.	07
Q.2	(a) Discuss advantages and disadvantages of batch reactor.	03
	(b) Justify that CSTRs connected in parallel behave as one single CSTR of the same total volume.	04
	(c) Explain size comparison of MFR and PFR in detail.	07
	OR	
Q.3	(c) Derive the process design equation for PFR.	07
	(a) Explain instantaneous fractional yield and overall fractional yield.	03
	(b) For following parallel reactions $A \longrightarrow R$ $A \longrightarrow S$ If R is the desired product and the order of reaction is same for both the reactions then how can one get more production of R?	04
	(c) Prove that N number of same sized mixed flow reactors in series can be approximated as a plug flow reactor.	07
	OR	
Q.3	(a) Prove that N number of same sized mixed flow reactors in series can be approximated as a plug flow reactor.	03
	(b) For reactions in series $A \longrightarrow R \longrightarrow S$ If the desired product is S then explain which method should be used?	
	(c) What are the reasons for exit age distribution? What are the techniques to evaluate the RTD?	07
Q.4	(a) Define mean residence time and variance with equation.	03
	(b) Explain pulse input experiment for RTD studies.	04
	(c) The data given below represent a continuous response to a pulse input into a closed vessel which is to be used as a chemical reactor. Calculate the mean residence time of fluid in the vessel and tabulate and construct the E curve.	07

t, min	C _{pulse} , g/l
0	0
5	3
10	5
15	5
20	4
25	2
30	1
35	0

OR

- Q.4**
- (a) Differentiate between physical and chemical adsorption. **03**
- (b) Explain relationship between E and F curve. **04**
- (c) A sample of tracer hytane was injected as a pulse into a vessel (to be used as a reactor) and the effluent concentration is measured as a function of time. The following data are obtained: **07**

t, min	C (g/m ³)
0	0
1	1
2	5
3	8
4	10
5	8
6	6
7	4
8	3
9	2.2
10	1.5
12	0.6
14	0

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

- Q.5**
- (a) Define: i) heterogeneous reaction, ii) catalyst, iii) Catalyst activity **03**
- (b) Differentiate between packed bed reactor and fluidized bed reactor. **04**
- (c) Write the sequence of steps according to shrinking core model for gas-solid non-catalytic reactions. Draw a schematic figure to show these steps when reaction $A(g) + bB(s) \rightarrow \text{products}$ takes place on a solid spherical particle of unchanging size. **07**

OR

- Q.5**
- (a) Differentiate constant volume and variable volume batch reactor. **03**
- (b) Explain types of catalyst deactivation. **04**
- (c) Qualitative discussion about product distribution in reactions in parallel for two reactant. **07**
