Utkalmani Gopabandhu Institute Of Engineering, Rourkela

LESSON PLAN

Academic Year 2025-26

Department of Chemical Engineering

LESSON PLAN

SUBJECT CODE : TH-2

NAME : CHEMICAL REACTION ENGINEERING

BRANCH : CHEMICAL ENGINEERING

SEMESTER :Diploma-VI

CREDIT POINTS : 4

NUMBER OF MODULES : 5

CLASSES REQUIRED : 60

PRE-REQUISITE :Basic integration and differentiations, basic idea on types of chemical reactions, basic idea on catalyst

MODULE-I

CHEMICAL KINETICS 1.1 Classification of chemical reaction. 1.2 Rate of reaction, rate constant. 1.3 Elementary and non-elementary reaction. 1.4 Molecularity and order of reaction. 1.5 Arrhenius equation. 1.6 Concept of activation energy. 1.7 Half-life reaction. 1.8 Solve problems to determinerate,order of reaction and activation energy.

Objectives:

To study the classification of chemical reaction and associated properties like rate of reaction,molecularity,order etc and to understand the mathematical expression of Arrhenius equition also on the dependent variables of Arrhenius equition.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
1	Introduction to Chemical Reaction engineering	T1, R1, R2
2	Classification of chemical reaction	T1, R2
3	Rate of reaction, rate constant	T1, R2
4	Elementary and non-elementary reaction.	T1, R1, R2
5	Molecularity and order of reaction	R1, R2
6	Concept of activation energy	R1,R2
7	Arrhenius equation.	R1,R2
8	Numericals on Arrhenius equition.	T1, R1, R2
9	Numericals on Arrhenius equition	
10	Numericals on rate of reaction	
11	Half-life reaction	
12	Numericals on half-life period	
13	Numericals to determine the order of reaction	
14	Doubt clear class	
15	Quiz test	

MODULE-II

INTERPETATION OF BATCH REACTOR DATA

2.1 Derivation of integrated rate equation for irreversible unimolecular type, first-order reaction, irreversible bimolecular type second order reaction.
2.2 Methods of interpretation of Batch reactor data.
2.3 Derivation of equation for constant volume batch reactor.
2.4 Solve numerical based on topics 2.1 to2.3

Objectives:

To understand the derivation process of different order rate equition for constant and as well as for variable volume batch reactor and also mathods of interpretation of batch reactor data.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
16	Mathods of interpretation of batch reactor data	T1, R1, R2
17	Mathods of interpretation of batch reactor data	T1, R2
18	Mathods of interpretation of batch reactor data	T1, R2

19	Derivation of irreversible unimolecular first order reaction equition	T2, R1, R2
20	Derivation of irreversible unimolecular first order reaction equition	R1, R2
21	Numericals based on first order equition	R1,R2
22	Numericals based on first order equition	R1,R2
23	Numericals based on first order equition	T2, R1, R2
24	Numericals based on first order equition	T2, R1, R2
25	Derivation of irreversible bimolecular type second order reaction.	R1, R2
26	Derivation of irreversible bimolecular type second order reaction	T1, R1, R2
27	Derivation of irreversible bimolecular type second order reaction	T2, R1
28	Numericals based on second order equition	
29	Numericals based on second order equition	
30	Numericals based on second order equition	
31	Derivation of equation for constant volume batch reactor	
32	Autocatalytic reaction,Variable volume batch reactor, Reversible reaction	
33	Doubt clear class	
34	Doubt clear class	
35	Quiz test	

MODULE-III

CATALYSIS

CATALYSIS 3.1. Define and classify catalysis with example. 3.2. Characteristics of catalytic reaction. 3.3. Promoter, Inhibitors, Accelerators, carriers and their actions. 3.4. Catalytic poisoning. 3.5. Autocatalysis, negative catalysis, enzyme catalysis. 3.6. Deactivation of catalysis, Activation energy and catalysis. 3.7 Discuss theories of catalysis 3.8 Preparation of catalyst

Objectives:

To study the different classification of catalyst,catalyst poisoning,theories of catalyst and its effect on activation energy and rate of reaction.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
36	Define and classify catalysis with example	T1, R1, R2
37	Characteristics of catalytic reaction	T1, R2
38	Promoter, Inhibitors, Accelerators, carriers and their actions.	T2, R2
39	Promoter, Inhibitors, Accelerators, carriers and their actions.	T1, R1, R2
40	Catalytic poisoning.	R1, R2
41	Autocatalysis, negative catalysis	R1,R2

42	enzyme catalysis.	R1,R2
43	Deactivation of catalysis, Activation energy and catalysis.	T2, R1, R2
44	Discuss theories of catalysis	T1, R1, R2
45	Discuss theories of catalysis	R1, R2

MODULE-IV

REACTORS 4.1 Construction and operation of Batch reactors, semi batch reactor, continuous reactor, Tank Reactors, Tubular Reactor,CSTR, Fixed Bed Reactor, Fluidized bed Reactor, Spray column reactor, Packed column Reactor, Reactor with catalyst. 4.2 Basic design equations for batch, CSTR, TFR. 4.3 Space velocity, space-time, and residence time. 4.4 Choice of a reactor and material of construction of reactor. 4.5 Optimum Reactor Design

Objectives

To study the construction and operation of different types of reactors and to derive the basic design equition for Batch,CSTR,TFR. To study the choice of reactors and material of construction with optimum design condition.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
46	Construction and operation of Batch reactors	T1, R1, T2
47	semi batch reactor, continuous reactor,	T1,T2, R2
48	Tank Reactors, Tubular Reactor, Fixed Bed Reactor	T1,T2, R2
49	Fluidized bed Reactor, Spray column reactor	T2, R1, R2
50	Packed column Reactor, Reactor with catalyst	T1,T2,R1, R2
51	Basic design equations for batch, CSTR, TFR.	T1,T2,R1,R2
52	Basic design equations for batch, CSTR, TFR.	T1,T2,R1,R2
53	Numericals on Batch,CSTR,PFR	T1, R1, R2
54	Space velocity, space-time, and residence time	T2, R1, R2
55	Choice of a reactor and material of construction c reactor.	R1, R2,T1,T2

MODULE-V

CHEMICAL EQUILIBRIUM

5.1 Reversible reaction with example. 5.2 Chemical equilibrium, characteristic of chemical equilibrium. 5.3 Law of Mass action, equilibrium constant 5.4 Le Chatelier's Principle. 5.5 Condition for maximum yield in industrial processes

Objectives:

To study the basic concept of chemical equilibrium and its characteristics, Le chatelier's principle and to understand the condition for maximum yield in industrial process.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)
56	Reversible reaction with example	T1, R1, R2
57	Chemical equilibrium, characteristic of chemical equilibrium.	T2, R2,T2
58	Law of Mass action, equilibrium constant	T1, R2,T2

59	Le Chatelier's Principle.	T2, R1, R2
60	Condition for maximum yield in industrial processes	R1, R2

Course Delivery Plan

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
MODULE	1	1	1	1,2	2	2	2	2	3	3	3,4	4	4	4,5	5

BOOKS FOR REFERENCE:
TEXT BOOKS

T1: Chemical Reaction Engineering by Octive Levenspiel, Wiley Publications
T2: Chemical Reaction Engineering Volume-1 by K A Gavane Nirali Publication
REFERENCE

R1: Chemical Reaction Engineering by S C Roy, Dhanpat Rai publications
R2: Theories & Problems in Chemical Reaction Engineering by Y K Mohanty Khanna publications

	Prepared by	Approved by
Signature		
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