NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Chemical Engineering
Third Year/Semester V

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH301CC24
Course Title:	Chemical Reaction Engineering-I
Course Type:	Core
Year of introduction:	2024-25

L	T	Practical component			
		LPW	PW	W	S
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. classify various reaction types and their mechanism (BL2)
2. analyse and interpret experimental data from batch reactors to obtain rate expressions (BL4)
3. choose and design suitable reactor for single and multiple homogeneous reactions (BL3)
4. estimate the heat of reaction and study effect of temperature and pressure on rate of reaction (BL5)

	Contents	Teaching hours (Total 45)
Unit I	**Kinetics of Homogeneous Reactions** Introduction to chemical kinetics, classification of reactions, variables affecting reaction rate, concentration dependent term of rate equation, temperature dependent term of rate equations, testing kinetic models, Arrhenius theory, collision theory, comparison of theories.	**09**
Unit II	**Interpretation of Batch Reactor Data** Integral, differential and half-life methods of analysis of data for constant volume and variable volume cases, searching a rate equation and mechanism to fit experimental data.	**14**
Unit III	**Reactor Design for Single and Multiple Reactions** Mass and energy balances for steady state and unsteady state reactors, batch reactor, plug flow reactor, mixed flow reactor and their comparison. multiple reactor system, plug flow reactors in series, mixed flow reactors in series, reactors of different types in series, recycle reactors and auto catalytic reactions, series, parallel and complex reactions, contacting patterns and product distribution.	**16**
Unit IV	**Temperature and Pressure Effects on rate of reaction** Heat of reaction, effect of temperature and pressure on heat of	**06**

reaction, chemical equilibrium and constants, optimum temperature progression.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on the above content of course.

Suggested Readings/References:

1. Levenspiel O., Chemical Reaction Engineering, Wiley Publications.
2. Fogler H S., Elements of Chemical Reaction Engineering, Prentice Hall Publications.
3. Smith J. M., Chemical Engineering Kinetics, McGraw-Hill Publications.

L= Lecture, T=Tutorial, P= Practical, C=Credit

List of Experiments:

Sr. No.	Practical	No. of Hours
1	Study effect of concentration in batch reactor	02
2	Determine activation energy and frequency factor	02
3	Validation of pseudo first order reaction	02
4	Study effect of concentration in continuous stirred tank reactor	02
5	Study effect of multiple continuous stirred tank reactor in series	02
6	Study effect of concentration in plug flow reactor	02
7	Study effect of PFR-CSTR in series	02
8	Study effect of CSTR- PFR in series	02
9	Study effect of recycle ratio in plug flow reactor	02
10	Reaction kinetic studies in continuous stirred tank reactor	02