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

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH303IC24
Course Title:	Reaction Engineering
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 student will be able to –

1. interpret the process parameters for distillation and reaction systems (BL2)
2. analyse and interpret experimental data to obtain rate expressions (BL4)
3. select and design a suitable reactor for single and multiple homogeneous reactions (BL3)
4. comprehend the behaviour of various types of heterogeneous contacting patterns and reactions (BL2)

Total Teaching hours: 45

Syllabus:

		Teaching hours
Unit I	**Thermodynamics** Introduction to Phase Equilibrium, fundamentals and calculations vapour-liquid equilibrium, applications of thermodynamics in process industries, heat of reaction basics, calculation of equilibrium constant, effect of temperature, pressure and composition of reaction equilibrium constants.	**15**
Unit II	**Kinetics of Homogeneous Reactions and Reactor fundamentals** Introduction to chemical kinetics, classification of reactions, variables affecting reaction rate, testing kinetic models, Arrhenius theory. 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.	**12**
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. plug flow reactors in series, mixed flow reactors in series.	**10**
Unit IV	**Introduction to Heterogeneous Reactions and Catalysis** Introduction to heterogeneous reactions and contacting patterns for two phase systems. Concept of residence time distribution, compartment model and dispersion model. Overview of physicochemical properties of catalyst, catalyst characterisation, deactivation and regeneration,	**08**

catalytic reactors.

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	2
2	Determine activation energy and frequency Factor	2
3	Validation of pseudo first order reaction	2
4	Study of effect of multiple CSTR in series	2
5	Study effect of concentration in PFR	2
6	Study of effect of recycle ratio in PFR	2
7	Reaction kinetic studies in a plug flow reactor	2
8	RTD studies in continuous stirred tank reactor	2
9	RTD studies in plug flow reactor	2
10	Catalyst preparation by wet impregnation method	2
11	Combustion characteristics of coal particles	2