CHEMICAL REACTION ENGINEERING I

ENCH 305

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 0

Course Objectives:
The objective of this course is to provide concepts of chemical reaction engineering, including mole balances, reaction kinetics, reactor types, and design principles for isothermal and non-isothermal systems. By the end of the course, students will be able to analyze, evaluate, and design chemical reactors such as batch, CSTR, tubular, and membrane reactors, using both analytical methods and numerical simulation tools.

1 Mole Balances (4 hours)

1.1 Rate of reaction
1.2 General mole balance equation
1.3 Batch and continuous flow reactors

2 Conversion and Reactor Sizing (5 hours)

2.1 Definition of conversion
2.2 Design equations for batch and flow reactors
2.3 Sizing continuous flow reactors
2.4 Reactors in series

3 Rate Laws and Stoichiometry (9 hours)

3.1 Reaction order and rate law
3.2 Reaction rates and reaction rate constant
3.3 Stoichiometry of batch and flow reactors
3.4 Reversible reactions and equilibrium conversions
3.5 Problem solving with Python

4 Isothermal Reactor Design (9 hours)

4.1 Design structure of batch and flow isothermal reactor
4.2 Pressure drop in reactors
4.3 Molar flow rate balance algorithm
4.4 Mole balances for batch and flow reactors
4.5 Membrane reactors
4.6 Semi-batch reactors
4.7 Design of reactor using computer software

5 Collection and Analysis of Rate Data (9 hours)

5.1 Algorithm for data analysis
5.2 Method of excess
5.3 Differential and integral method of analysis
5.4 Nonlinear regression
5.5 Rate data from differential reactors

6 Multiple Reactions (9 hours)

6.1 Yield and selectivity
6.2 Algorithm for multiple reactions
6.3 Types of reactions
6.4 Algorithm for solving multiple reactions in flow and membrane reactors

Tutorial (15 hours)

1. Conversion and reactor sizing for batch and flow reactors
2. Stoichiometry for batch and flow reactors
3. Isothermal reactor design for batch and flow reactors
4. Rate data analysis
5. Multiple reaction problems for flow and membrane reactors using computing tools

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1 and 2	9	12
3	9	12
4	9	12
5	9	12
6	9	12
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Fogler, H. S. (2016). Elements of chemical reaction engineering. Prentice Hall.
2. Levenspiel, O. (1999). Chemical reaction engineering (Latest Edition). John Wiley & Sons.