CH226	CHEMICAL REACTION ENGINEERING-I	L	T	P	C	Int	Ext
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Semester IV [Second Year]

COURSE OBJECTIVES:

1. To provide knowledge on different types of reactions, reaction rate, collection and analysis of reaction rate data to derive rate expressions
2. To provide knowledge on different kinetic models to analyze the batch reactor data
3. To provide knowledge of different types of reactors (Batch, semi batch, CSTR, PFR) and to derive the design equations of ideal reactors from mole balance
4. To provide a foundation on deriving rate expressions for series, parallel, reversible reactions and the knowledge about product distribution in multiple reactions, recycle reactors and auto catalytic reactions
5. To provide the knowledge on thermal characteristics of various reactions

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Analyze kinetic data and determine the rate expressions (reaction order and specific reaction rate) for a reaction
2. Derive and solve design equations for batch, semi batch and steady state flow reactors
3. Solve appropriate rate expressions for series, parallel and reversible reactions. Understand the performance characteristics and the advantages and disadvantages of major reactor types
4. Analyze multiple reactions to determine selectivity and yield

UNIT I [CO:1] **(12)**

Overview of Chemical Reaction Engineering:

Thermodynamics, chemical kinetics, classification of reactions, variables affecting the rate of reaction, definition of reaction rate.

Kinetics of homogeneous reactions: Concentration dependent term of rate equation, temperature dependent term for rate equation, searching for a mechanism, predictability of reaction rate from theory.

UNIT II [CO:2] **(12)**

Interpretation of Batch Reactor Data:

Constant volume batch reactor- Analysis of Rate Data:, integral and differential Methods Method of Half-Lives, Method of Initial Rates, Method of Fractional life. Analysis of total pressure data.

Variable volume batch reactor, fractional volume change, temperature and reaction rate, and search for a rate equation. Reactions of shifting order, design of batch reactor

UNIT III [CO:3] **(12)**

Introduction to Reactor design:

Design of Isothermal Flow reactors-general discussion, symbols and relationship between CA and XA,space time and space velocity, steady state mixed flow reactor, steady state plug flow reactor, holding time and space time for flow systems.

Size comparison of single reactors, multiple reactor systems Autocatalytic reactions and Recycle Reactors.

UNIT IV [CO:4] **(12)**

Design for Single Reactions:

Size comparison of single reactors, multiple reactor systems, recycle reactor, autocatalytic reactions.

Design for multiple reactions:

Reactions in parallel, reactions in series, contacting patterns, product distribution

LEARNING RESOURCES:

TEXT BOOK:

Chemical Reaction Engineering, Octave Levenspiel, 3rd edition, Wiley Eastern

REFERENCE BOOK(s):

1. Elements of chemical reaction engineering, H.S.Fogler, 2nd edition, PHI
2. Chemical Engineering Kinetics, J.M.Smith, 3rd edition, McGraw Hill
3. Chemical Reaction Engineering, Octave Levenspiel, 2nd edition, Wiley Eastern