AMPL12 CHEMICAL REACTION ENGINEERING

UNIT-1 INTRODUCTION TO REACTION ENGINEERING

1.1 Classification of reactions, definitions of reactions rate, variables affecting reaction rate, speed of chemical reactions.

UNIT-2 KINETICS OF HOMOGENOUS REACTIONS

2.1 Simple reactor types, the rate equation, concentration dependent term of rate equation.
2.2 Molecularity and order of reaction. Rate constant k, representation of an elementary and nonelementary reaction.
2.3 Kinetic models for nonelementary reactions.
2.4 Testing kinetic models.
2.5 Temperature dependant term of rate equations from Arrhenius theory and comparison with collision and transition state theory.
2.6 Activation energy and temperature dependency.
2.7 Predictability of reaction rate from theory.

UNIT-3 INTERPRETATION OF BATCH REACTOR DATA

3.1 Constant volume batch reactor, analysis of total pressure data, Integral and differential methods of analysis of data for constant volume and variable volume cases.
3.2 Temperature and reaction rate, search for a rate equation

UNIT-4 INTRODUCTION TO REACTOR DESIGN & IDEAL REACTORS FOR SINGLE REACTION

4.1 Mass and energy balances around a volume element.
4.2 Ideal batch reactor, steady-state mixed flow reactor, steady-state plug-flow reactor,
4.3 Holding and space time for flow reactors, space-time and space velocity.
4.4 Introduction to semi batch reactor.

UNIT-5 DESIGN OF REACTOR FOR SINGLE REACTIONS & DESIGN FOR PARALLEL REACTIONS:

5.1 Size comparison of single reactors, multiple reactor systems, recycle reactor and autocatalytic reactions.
5.2 Introduction to multiple reactions, qualitative and quantitative treatment of product distribution and of reactor size, the selectivity.

UNIT-6 POTPOURRI OF MULTIPLE REACTORS

6.1 Irreversible first order reactions in series.
6.2 Quantitative treatment, for plug flow or batch reactor and mixed flow reactor, their performance characteristics, kinetic studies and design.
6.3 First order followed by zero order reaction, zero order followed by first order reaction, successive irreversible reactions of different orders, reversible reactions, irreversible series-parallel reactions.

UNIT-7 TEMPERATURE AND PRESSURE EFFECTS:

7.1 Single Reactions: Calculations of heats of reaction and equilibrium constants from thermodynamics, equilibrium conversion, general graphical design procedure.

7.2 Optimum temperature progression, Energy balances equations in adiabatic and non-adiabatic case.

7.3 Exothermic reaction in mixed flow, Rules for choice of reactors and optimum operation of rectors.

7.4 Multiple Reactions: Product distribution and temperature.

Reference Books:

1. Chemical Reaction Engineering Author : Octave Levenspiel Publisher : Wiley-India Pvt. Ltd
2. Chemical Engineering Kinetics Author : J.M. Smith Publisher : McGraw-Hill
3. Elements of Chemical Reaction Engineering Author : H. Scott Fogler Publisher : Prentice Hall of India Pvt. Ltd