

UCH501 CHEMICAL REACTION ENGINEERING-1

L	T	P	Cr
3	1	2	4.5

Introduction: Overview of chemical reaction engineering, Classification of reactions, Variables affecting rate, Definition of reaction rate, single and multiple reactions, Elementary and non-elementary reactions, Molecularity and order of reaction, Reaction pathways, Effects of temperature, pressure, Heat and mass transfer on rate, Arrhenius law, Activation energy, Reversible and irreversible reactions, Reaction equilibrium.

Kinetics: Constant volume and variable volume batch, CSTR and PFR reactor data, Analysis of total pressure data obtained from a constant-volume batch reactor, Integral and differential methods of analysis of data, Autocatalytic reactions, Reversible reactions, and Bio-chemical reactions.

Homogeneous Single Reactions: Performance equations for ideal batch, Plug flow, Back-mix flow and semi batch reactors for isothermal condition, Size comparison of single reactors, Multiple-reactor systems, Recycle reactor, Autocatalytic reactions, Optimum recycle operations.

Multiple Reactions: Parallel reactions of different orders, Yield and selectivity, Product distribution and design for single and multiple-reactors, Series reactions: first-order reactions and zero-order reactions, Mixed series parallel complex reactions, Choice of reactors for simple and complex reactions.

Temperature Effects for Single and Multiple Reactions: Thermal stability of reactors and optimal temperature progression for first order reversible reactions, Adiabatic and heat regulated reactions, Design of non-isothermal reactors, Effect of temperature on product distribution for series and parallel reactions.

Laboratory work: Experiments on batch reactors, Semi-batch reactors, Continuous stirred tank reactors, Tubular reactors, RTD, Fluid-solid reactions.

Text Books:

1. Fogler, H.S., Elements of Chemical Reaction Engineering, Prentice Hall of India (2003).
2. Levenspiel, O., Chemical Reaction Engineering, John Wiley & Sons (1998).

Reference Books:

1. Smith, J.M., Chemical Engineering Kinetics, McGraw Hill, New York (1990).
2. Denbigh, K.G., and Turner, J.C.R., Chemical Reactor Theory - An Introduction, Cambridge University Press, UK (1984).