CHE-976 Advanced Chemical Kinetics & Its Applications

Credit Hours: 3
Pre-requisites: Nil
Course Objectives:

- Imparting basic to advance knowledge of kinetics to the students.
- Examples from the industry for incorporation of principle of Kinetics learned during the course.
- Up gradation of existing processes through research work based on the knowledge learned.

Course Contents:

Introduction to Chemical Kinetics:
Rate of Reaction, Rate constant, Order and Molecularity, Various order of reaction, The effect of temperature on reaction rates.

Kinetics and Thermodynamics:
Thermodynamics and chemical reactions.

Unimolecular Reactions:
Lindemann theory, Hinshelwood theory, RRKM Theory.

Kinetics aspects of Mass Spectrometry:
Quasi Equilibrium theory, Mass Spectrometry Basics, Kinetic studies employing Mass spectrometry.

Thermal Analytical Techniques and Kinetic studies:
Basic principles of thermal analytical techniques, Arrhenius equation, Determination of Arrhenius parameters.

Kinetics of Polymerization:
Types of polymerizations, Kinetics of free radial polymerization, Co-polymerization

Investigation of Mechanism by Kinetic Methods:
The reaction of acetone with Iodine, Nitration of aromatics hydrocarbons, The thermal decomposition of Dinitrogen Pentoxide.

The Kinetic isotope effect:
The kinetic isotope effect, The reverse kinetic isotope effect.

Fast Reactions:
Introduction, Flow techniques, Relaxation method, Shock tubes, ESR spectroscopic techniques, NMR spectroscopic techniques
Analysis of Experimental Results

Course Outcomes:

- Understanding the heart of Chemistry and Chemical Engineering principles.
- Determination of Arrhenius parameters.
- Design of chemical reactors.

Recommended Reading (including Textbooks and Reference books)

- Elementary reaction kinetics, Latham, Joseph Lionel
- Chemical Kinetics and reaction dynamics, Santosh K. Upadhyay
- Modern methods in Kinetics, C.H. Bamford and C.F.H Tipper-Editors
- Chemical Engineering Kinetics, Smith, J.M.
- Introduction to chemical engineering kinetics and reactor design, 2nd edition, Wiley.