

Year & Sem: E2S1	Course Code:CH2102	Course Name: Chemical Reaction Engineering I	No. of Credits: 4	L 2	T&PS 2	P 0
UNIT I: Overview of chemical reaction engineering- classification of reactions, variables affecting the rate of reaction definition of reaction rate. Kinetics of homogenous reactions- concentration dependent term of rate equation, Temperature dependent term of rate equation, searching for a mechanism, predictability of reaction rate from theory. Interpretation of batch reactor data- constant volume batch reactor:- Analysis of total pressure data obtained in a constant-volume system, the conversion, Integral method of analysis of data– general procedure, irreversible unimolecular type first order reactions, irreversible bimolecular type second order reactions, irreversible trimolecular type third order reactions, empirical reactions of nth order, zero-order reactions, overall order of irreversible reactions from the half-life, fractional life method, irreversible reactions in parallel, homogenous catalyzed reactions, autocatalytic reactions, irreversible reactions in series. UNIT II: Constant volume batch reactor– first order reversible reactions, second order reversible reactions, reversible reactions in general, reactions of shifting order, Differential method of analysis of data. Varying volume batch reactor–differential method of analysis, integral method of analysis, zero order, first order, second order, nth order reactions, temperature and reaction rate, the search for a rate equation. UNIT III: Introduction to reactor design- general discussion, symbols and relationship between C_A and X_A. Ideal reactors for a single reaction- Ideal batch reactor, Steady-state mixed flow reactor, Steady-state plug reactors. Design for single reactions- Size comparison of single reactors, Multiple- reactor systems, Recycle reactor, Autocatalytic reactions. UNIT IV: Design for parallel reactions- introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size. Multiple reactions-Irreversible first order reactions in series, quantitative discussion about product distribution, quantitative treatment, plug flow or batch reactor, quantitative treatment, mixed flow reactor, first-order followed by zero-order reaction, zero order followed by first order reaction. UNIT V: Temperature and Pressure effects- single reactions- heats of reaction from thermodynamics, heats of reaction and temperature, equilibrium constants from thermodynamics, equilibrium conversion, general graphical design procedure, optimum temperature progression, heat effects, adiabatic operations, non adiabatic operations, comments and extensions. Exothermic reactions in mixed flow reactors-A special problem, multiple reactions. References/Text Books: 1. Chemical Reaction Engineering, 3rd ed., O. Levenspiel, John Wiley & Sons, 1999. 2. Elements of Chemical Reaction Engineering, 2nd ed., H.S. Fogler, PHI Learning Pvt. Ltd., New Delhi, 2010. 3. Chemical Engineering Kinetics, 3rd ed., J.M. Smith, McGraw-Hill, New York, 1981. Lecture Plan: Unit-I & -II syllabus for MID-I, Unit-III & -IV syllabus for MID-II and Unit-V & -VI syllabus for MID-III examinations.						