CBEMS110 REACTION KINETICS AND REACTOR DESIGN

Catalog Data: **CBEMS110 Reaction Kinetics and Reactor Design (Credit Units: 4)**
F. Introduction to quantitative analysis of chemical reactions and chemical reactor design. Reactor operations including batch, continuous stirred tank, and tubular reactor. Homogeneous and heterogeneous reactions. Prerequisites: Mathematics 3D, Chemistry 1C, CBEMS40B. (Design units: 2)

Textbook: Fogler, H. Scott, *Elements of Chemical Reaction Engineering,* 3rd edition, Prentice Hall, 1999.

References:

Coordinator: Nancy A. Da Silva

Course Objectives: To design chemical processes, a chemical engineer must understand the principles of chemical reaction kinetics and chemical reactor design. This course is an introduction to the basic concepts in these areas. The course builds on concepts from chemistry, thermodynamics, mass and energy balances, and differential equations.

Course Outcomes: Students will be able to:
Reactor mole balances to batch and flow (CSTR, PFR) reactors.
Relate rates of reaction and apply rate laws in the design of chemical reactors.
Relate species' concentrations using reaction stoichiometry.
Design and analyze isothermal batch reactors and flow reactors.
Utilize conversion for the analysis and solution of reactor design equations.
Relate volume or pressure in gas-phase reactions to reaction conversion.
Analyze systems of multiple reactions.
Use mass and energy balances in the design of nonisothermal flow reactors.
Analyze surface reaction processes and design catalytic (heterogeneous) reactors.

Prerequisites By Topic: Chemical engineering thermodynamics, Mass and energy balances, Differential equations, Computer literacy and basic skills.

Lecture Topics: Rate Laws and theoretical foundations of chemical kinetics.
Analysis of kinetic data.
Analysis of complex reaction networks.
Design of ideal isothermal reactors. (CSTR and PFR)
Selectivity and optimization.
Temperature and energy effects. (Computer Project)
Nonideal reactors/residence time considerations.
Diffusion and Reactions in heterogeneous catalysis.
Heterogeneous Reactor Design.
Safety and Risk Aspect.

Class Schedule: Each class meets 4 hours per week for 10 weeks.

Computer Usage: Computer literacy and basic skills are required. MATLAB or Polymath is used to solve systems of algebraic and ordinary differential equations.

Laboratory Projects:

Professional Component: Contributes toward the Chemical Engineering Topics Courses and Major Design experience.

Relationship to Program Outcomes: This course relates to Program Outcomes 1, 3, 5, 10, 11, and 13 as stated at: http://www.eng.uci.edu/dept/objective_chemical

Design Content Description

Approach: Multiple lectures on reactor design. Homework and computer problems on reactor design.

Lectures: Lecture and homework - 100%

Laboratory Portion: 0%

Grading Criteria:

Homework:	20%
Quizzes:	10%
Midterm exam:	35%
Final exam:	35%
	100%

Exams and quizzes are closed book and notes. In general, exams and quizzes cannot be made up and no late homework sets will be accepted.

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 2 credit units or 50%
Engineering Design: 2 credit units or 50%

Prepared by: Nancy A. Da Silva **Date:** July 2005

CEP Approved: Fall 2001