Reactor Kinetics and Reactor Design

CHEN E4230, Spring 2014
Tuesdays and Thursdays 10:10am-11:25am
627 Mudd

Instructor:
Scott Banta sbanta@columbia.edu
820 Mudd (212) 854-7531
http://www.columbia.edu/~sb2373

Teaching Assistants:
TBD

Office Hours:
TBD

Prerequisites: CHEE 3010 Principles of Chemical Engineering Thermodynamics or equivalent.

Course Description: Reaction kinetics, applications to the design of batch and continuous reactors. Multiple reactions, non-isothermal reactors. Analysis and modeling of reactor behavior.

Course Objectives:

1. Understand chemical kinetic expressions and how to design experiments to determine them.
2. Develop problem-solving methodologies for continuous and batch reactor performance.
3. Develop computer skills for mathematical modeling, with an understanding that the modeling concepts can be broadly applied.
4. Improve design skills.

Textbook:
Fogler, H. *Elements of Chemical Reaction Engineering 4th Edition* Prentice Hall 2006
Text will be used extensively and is required. Your undergraduate Chemical Engineering Transport and Thermodynamics books will be useful references as well.

Lecture Notes:
Powerpoint slides have been created for all chapters. These will be posted on Courseworks in advance of the lectures. In class a high level overview will be given from the slides. It will be the student's responsibility to read the book and understand the detailed concepts in the slides outside of class.

Grading:

In Class Quizzes	30%
In Class Classwork	10%
Take Home Problem	10%
First Midterm Exam	15%
Second Midterm Exam	15%
Comprehensive Final exam	20%

Other Points:

- We will employ a modified Flipped Classroom with a Mastery Learning strategy
- Each week I will give a short overview lecture Thursday, with a high level overview of what I want you to learn
- I will assign book chapter, and give Powerpoint slides and Excel spreadsheets for you to go over before Tuesday
- On Tuesdays we will work on problems together in class. In class homework will be collected and graded.
- On Thursdays, before the new lecture, there will be a quiz on the prior material
- If you master the material, you can move on. If you do not demonstrate mastery of the material (i.e. do not pass the quiz) you cannot move on to the new quiz until you retake and pass the old quiz. You can retake quizzes until you demonstrate mastery.
- A recitation time/office hour will be scheduled for quiz retakes and for extra homework help
- Midterms and final exam will be open book and open notes.
- Matlab will be used for computation
- Courseworks system will be used for course maintenance and information dissemination.

Approximate weekly schedule

Week		Topic	Chapters
1	1/21	Introduction	
2	1/23, 1/28	Mole Balances/Conversion and Reactor Sizing	1&2
3	1/30, 2/4	Rate Laws and Stoichiometry	3
4	2/6, 2/11	Rate Laws and Stoichiometry/ Isothermal Reactor Design	4
5	2/13, 2/18	Isothermal Reactor Design	4
6	2/20, 2/25	Review, First Midterm	
7	2/27, 3/4	Collection and Analysis of Rate Data	5
8	3/6, 3/11	Multiple Reactions	6
9	3/13, 3/25	Multiple Reactions	6
10	3/27, 4/1	Review, Second Midterm	
11	4/3, 4/8	Steady State Heat Effects	8
12	4/10, 4/15	Unsteady State Nonisothermal Reactor Design	9
13	4/17, 4/22	Catalysis and Catalytic Reactors/ External Diffusion Effects	10 & 11
14	4/24, 4/29	Bioreactions, Misc Topics	
15	5/1	Exam Review	
16	TBA	Final Exam	