ChE 140B

Chemical Reaction Engineering

http://www.chemengr.ucsb.edu/~ceweb/courses/che140b/index.html

Enrollment code: 05173

Meeting Time: Tuesdays, Thursdays 9:30–10:45 a.m.
Engineering 2, Room 1519

Instructor: Professor Brad Chmelka
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Office Hours: Mondays 1:30–3:30 p.m.
Engineering 2, Room 3201

Text: “Elements of Chemical Reaction Engineering”

Grading:

Homework Assignments: 25%
Mid-term Examination: 30%
Final Examination (Tues., Dec. 6, 8-11 a.m.): 45%

100%
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Course Content

Objective: To provide and extend a basic understanding of chemical reaction engineering principles, with emphases on heterogeneous reaction processes and associated reactor designs.

The course will cover:

(1) Chemical Reaction Kinetics
   • Thermodynamic considerations
   • Reaction rate expressions: temperature, composition dependences
   • Catalytic reaction mechanisms

(2) Heterogeneous Catalysis and Reactions at Surfaces
   • Chemical and physical adsorption/desorption
   • Surface reactions and catalysis
   • Mass transport effects
   • Non-isothermal effects

(3) Design of ChemicalReactors
   • Non-isothermal conditions and reactors, safety
   • Non-ideal flow behaviors and considerations

(4) Chemical Reaction Engineering Applications
   • Petroleum refining, chemical processing, pharmaceutical manufacture, biochemical processes, environmental engineering, etc.
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Instructor: Professor Brad Chmelka

Suggested References

Primary Text:

1. H.S. Fogler
   Elements of Chemical Reaction Engineering

Supplemental texts (available in main library or from Professor Chmelka)

2. L.D. Schmidt
   The Engineering of Chemical Reactions
   Oxford, 2005

3. R.I. Masel
   Chemical Kinetics and Catalysis
   Wiley-Interscience, 2001

4. I. Chorkendorff, J.W. Niemantsverdriet
   Concepts of Modern Catalysis and Kinetics
   Wiley-VCH, 2003

5. J.M. Thomas, W.J. Thomas
   Principles and Practice of Heterogeneous Catalysis
   VCH, 2005

6. C.H. Bartholomew, R.J. Farrauto
   Fundamentals of Industrial Catalytic Processes
7. H.F. Rase  
   *Handbook of Commercial Catalysts: Heterogeneous Catalysts*  
   CRC Press, 2000

8. H.H. Lee  
   *Heterogeneous Reactor Design*  
   Butterworth, 1985

9. C.G. Hill  
   *Chemical Engineering Kinetics and Reactor Design*  
   Wiley, 1977

10. J.M. Smith  
    *Chemical Engineering Kinetics*  

11. J.J. Carberry  
    *Chemical and Catalytic Reaction Engineering*  
    McGraw-Hill, 1976

12. J.B. Butt  
    *Reaction Kinetics and Reactor Design*  
    Prentice-Hall, 1980

13. R. Hughes  
    *Deactivation of Catalysts*  
    Academic Press, 1984

14. O. Levenspiel  
    *Chemical Reaction Engineering*  
    Wiley, 1972

15. R.B. Bird, W.E. Stewart, and E.N. Lightfoot  
    *Transport Phenomena*  
    Wiley, 1960
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Problem-Solving Strategies & Requirements

1. Draw a picture of the problem or system in question (e.g., a schematic diagram, flow chart, graph, etc.)

2. If the problem is complicated, first break it into smaller portions.

3. Consider carefully what you're being asked. Identify key concepts/ideas.

4. Identify the knowns & unknowns → Assign them ‘variable’ labels and translate them into mathematical relationships.

5. State clearly all assumptions. These often help simplify the problem, but need to be made critically and be justifiable.

6. Be systematic and thorough. Include written descriptions of your reasoning and page/text references to supporting information.

7. Work in algebraic form, substituting numbers (always with units) only at end. Do the dependences make physical sense? Are the units correct? Be careful.

8. Review your work for correctness.

9. Indicate numerical answers clearly by underlining or boxing final values.

10. Express written explanatory answers in complete sentences.

11. IMPORTANT: All submitted work must have a neat, professional appearance. This is essential for clear communication and reflects directly on the credibility of your results.
   - The pages should be stapled in the upper lefthand corner, with lines made using rulers or straight edges, neat organization, legible writing, and without extensive cross-outs or messy erasures. (Scrap paper or pages torn from notebooks are not acceptable.)
   - Below standard work will be subject to a 50% reduction in points before grading.
   - E-mail correspondence must be professional in content and format.