

CBE 400
INTRODUCTION TO PRODUCT AND PROCESS DESIGN
FALL 2008

MWF 10-11 a.m., Rm. 313 Towne

M 5:00-6:30 p.m., Rm. 337 Towne – Sept. 15, 22, 29; Oct. 6, 20, 22 (Weds.); Nov. 3, 24; Dec. 1

No classes – Sept. 22, Oct. 1, 13 (Fall Break), Nov. 17 (AIChE Meeting), 28 (Thanksgiving)

Office hours – Scheduled before homework assignments are due, Humphrey Lounge or M70

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Text: Seider, W.D., J.D. Seader, and D.R. Lewin, *Product and Process Design Principles: Synthesis, Analysis, and Evaluation*, Wiley, 2004.

Lewin, D. R., et al., *Using Process Simulators in Chemical Engineering: A Multimedia Guide for the Core Curriculum*, attached to the front cover of each textbook.

Outline: The Design Process
Molecular Structure Design
Process Creation - Preliminary Process Synthesis
Process Simulation - ASPEN PLUS, BATCH PLUS
Heuristics for Process Synthesis
Synthesis of Separation Trains
Second Law Analysis - Thermodynamic Efficiency, Lost Work Analysis
Synthesis of Heat Exchanger Networks
Detailed Equipment Design
Configured Consumer Product Design
Capital Cost Estimation
Profitability Analysis
Selection of Design Projects for CBE 459

Exams: 1 hour, October 3
1 hour, November 14
2 hours, Final Exam, December 12, 12:00 – 2:00 p.m.

Homework: Average for all homework = 1 exam grade
All assignments must be submitted

Web Sites: For the latest information concerning CBE 400, access the Product and Process Design Web Page (www.seas.upenn.edu/~seider/design.html). Also, see www.courseweb.upenn.edu to obtain the latest homework assignments and course announcements.

Goals:

After completing this course, students will:

1. have been introduced to the strategy of product and process design involving commodity and specialty chemicals, including pharmaceuticals and configured consumer products.
2. have been introduced to methods of selecting chemicals having desired properties using molecular structure design.
3. be able to carry out process synthesis using heuristics and process simulation methods.
4. have carried out several process simulations using ASPEN PLUS and BATCH PLUS.
5. have learned to synthesize distillation trains for nearly-ideal mixtures, and have been introduced to the synthesis of distillation trains for azeotropic mixtures.
6. be able to carry out second-law analysis; that is, calculate the lost work and thermodynamic efficiency for a chemical process.
7. be able to carry out heat integration of process flowsheets.
8. be able to size and estimate the costs for distillation complexes, heat exchangers, pumps, compressors, expanders, and other kinds of equipment, using many cost equations.
9. be able to carry out profitability analyses using approximate and rigorous methods, and using a profitability analysis spreadsheet by Holger Nickisch (on the CD-ROM accompanying the textbook).
10. have been introduced to some of the steps in designing industrial and configured consumer products.
11. have been assigned a CBE 459 product/process design project, and through solution of many homework exercises, be prepared to carry out the design effectively.