CBE 400
INTRODUCTION TO PRODUCT AND PROCESS DESIGN
FALL 2011

MWF 9-10 a.m., Rm. 311 Towne
M 5:00-6:30 p.m., Rm. 311 Towne – Sept. 19, 26; Oct. 3, 24; Nov. 7, 14, 28; Dec. 5
No classes – Sept. 30, Oct. 10 (Fall Break), 25 (Thanksgiving Break)
Office hours – Scheduled before homework assignments are due, Rooms 336 or M70

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

Exams:  1 hour, Wednesday, October 19
        1 hour, Monday, November 21
        2 hours, Final Exam, Thursday, December 15, 9:00 – 11:00 a.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.
Course Learning Objectives:

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.

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.