

## CBEMS 145 CHEMICAL ENGINEERING DESIGN

(Required for ChE: Elective for EnE)

<b>Catalog Data:</b>	<b>CBEMS 145 Chemical Engineering Design (Credit Units: 5)</b> Application of chemical engineering science techniques to design of chemical processes. Introduction to the systematic design of separations and the integration of energy requirement. Integration of process economics and optimization. Consideration of retrofit design, design of nontraditional chemical processes, Process safety. Prerequisites: CBEMS110, CBEMS120B, CBEMS130. (Design units: 5)
<b>Textbook:</b>	Peters, Max S. & Timmerhaus, Klaus D. <i>Plant Design and Economics for Chemical Engineers</i> , 5 <sup>th</sup> Edition, McGraw Hill Co., 2003.
<b>References:</b>	Perry, H. <i>Chemical Engineers Handbook</i> , McGraw-Hill, Textbooks for CBEMS40A, 40B, 110, 120AS, 120B and 130.
<b>Coordinator:</b>	Juan Hong
<b>Course Objectives:</b>	The objective of the design course is to teach the students the methodology with which they can synthesize and design chemical processes. We emphasize the use of modern computer tools commonly used in today's industry. We teach students how to perform design of individual equipment commonly used in chemical processes. We teach basic principles of plant design economics. We provide with the students the challenge to perform a complete plant design in a group. They learn to work as a team and to effectively communicate. At the end of the course students will produce a design document which includes material and heat balances, process flow diagrams, operating and capital costs and a cash flow analysis of the entire plant.
<b>Course Outcomes:</b>	Students will: Perform economic analysis, process synthesis, shortcut and computer-aided design methods Optimize a chemical process Account for risk and safety and environmental aspect of a design. Design a process using computer tools. Write a report.
<b>Prerequisites By Topic:</b>	Material and energy balances, thermodynamic analysis of chemical processes, isothermal and nonisothermal reactor design, heat and mass transfer processes, various separation processes.
<b>Lecture Topics:</b>	Process Synthesis, Degree of Freedom Analysis, Computational Sequencing for Modular Flowsheeting, Design Hierarchy, Heat Recovery Network and Energy Integration, Optimal Design, Heat Exchanger Design, Compressors & Turbines Design, Equipment Sizing and Costing, Economic Evaluation and Profitability, Safety and Professional Ethics
<b>Class Schedule:</b>	Meets for 5 hours of lecture and 1 hour of discussion each week for 10 weeks.

**Computer Usage:** Extensive use of the chemical process design and synthesis package programs: Provision Pro/II, Microsoft Excel, MathCad, and Microsoft Word.

**Laboratory Projects:** Modular Sequencing, Heat Exchanger Design, Ammonia Process Simulation, Sizing of Equipment & Capital & Operating Costs, and more

**Professional Component:** Contribute toward the Chemical Engineering Major design experience.

**Relationship to Program Outcomes:**

This course relates to Program Outcomes a, c, e, f, g, h, i, j, k, l, and m as

stated at:

<http://undergraduate.eng.uci.edu/degreeprograms/chemical/mission>

**Design Content Description:**

**Approach:** Design of unit operations and synthesis for the design of chemical processes. 5 hour Lectures per week. 3 hour Lab Discussion per week for Heat Exchanger Design, Ammonia Process Simulation, Sizing of Equipment & Capital & Operating Costs.

**Lectures:** 70%

**Laboratory Portion:** 30%

**Grading Criteria:**

Homework	10%
Quizzes	30% (unannounced)
Final	30%
Design Projects	<u>30%</u>
	100%

**Estimated ABET Category Content:**

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 0 credit unit or 0%

Engineering Design: 5 credit units or 100%

**Prepared by:** Juan Hong **Date:** June 2007

**CEP Approved:** Fall 2001