ChEE 455/555
Environmentally Benign Design of Chemical Processes
Spring 2004
University of Arizona

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Office Hours: To Be Determined

Lecture: MWF 10 am - 10:50 am, ECON 304

Course Description:
This course will introduce you to the fundamental principles surrounding environmentally benign design of chemical processes. It will expose you to the social, economic, environmental and physical principles that must be balanced to create sustainable processes for manufacturing chemicals and products. Specifically, students will use green chemistry approaches combined with life cycle assessment techniques to evaluate, improve, and redesign chemical engineering processes.

Prerequisites:
Undergraduate seniors or second semester juniors who are concurrently in ChEE 326 and 305 are eligible.
Graduate students should be in the chemical, environmental, biomedical, or mechanical engineering graduate programs

Text: *Green Chemistry: Theory and Practice* by P. T. Anastas and J. C. Warner, Oxford University Press, New York (1998).
Additional materials will be available as a coursepack online at http://www.che.arizona.edu/Directory/Faculty/Blowers.htm

Course Objectives:
Upon completion of this course, students should:
1) Be able to discuss the implications of green design in the context of environmental and economic costs.
2) Be able to implement life cycle assessment on individual chemical engineering process flowsheets.
3) Be able to discuss the limitations, strengths, and uses of life cycle assessment methods applied to chemical engineering problems.
4) Be able to evaluate current chemical processes to identify environmental and economic impacts.
5) Be able to identify methods for improving the environmental and economic performances of chemical processes.
6) Be able to explain to other engineers the reasoning behind green chemistry and life cycle assessment methodologies.

7) Be able to read and critique published life cycle assessments for their individual strengths and weaknesses.
8) Be able to search for and use highly specific information in the published literature and to evaluate the relevance of the materials. Be able to effectively use library resources.

Other meta-objectives to be learned in this course:
1) Be able to communicate effectively in short written reports
2) Be able to present material orally to peers
3) Be able to perform literature searches for specific information that is needed
4) Be able to work effectively in teams to achieve multi-goal objectives

Course Grading Policies:
This course will be graded on a straight scale with the following grade thresholds:

Total percentage of points earned	Final Grade
85 -100 %	A
75 - 85 %	B
65 - 75 %	C
50 - 65 %	D
< 50%	F

The total grade will be made from the following break-down:

Homework/presentations:	30%
First group project:	15%
Second project:	15%
First exam:	20%
Final exam (group):	20%

Graduate Student Policy:

This course is open to both undergraduate and graduate students. Graduate students will be assigned one additional project to make this a graduate-level course for them. The graduate level project will be more in-depth and will involve a more sophisticated analysis than the undergraduate level projects. Clear guidelines for this project will be laid-out in a separate handout early in the semester.

Date	Day	Topic Covered	Reading Assigned	HW Assigned
1/14	W	Course philosophy		Hazards HW
1/16	F	LCA intro	Paper #1	
1/19	M	LCA intro		
1/21	W	Teamwork discussion		Assign student project
1/23	F	LCA details	Paper #2	Nitric Acid HW
1/26	M	MLK Day - No Class		
1/28	W	LCA details	Paper #3	
1/30	F	LCA details		¶
2/2	M	nitric acid plant	Paper #4	
2/4	W	information tech.	Paper #5	Car HW
2/6	F	Problems with LCA		¶
2/9	M	Problems with LCA		
2/11	W	Green chemistry intro		
2/13	F	Green chemistry intro		¶
2/16	M	Applications of green	Book	
2/18	W	chemistry		First short exam
2/20	F	Applications of green		Opinion paper ¶
2/23	M	chemistry		
2/25	W	Problems with green		
2/27	F	chemistry		¶
3/1	M	Student presentations		Solar HW
3/3	W	Student presentations		
3/5	F	Discuss presentations		
3/8	M	Integration of topics		
3/10	W	Integration of topics		
3/12	F	Integration of topics		
3/15	M	spring break		
3/17	W	spring break		
3/19	F	spring break		
3/22	M	discussion of solar HW		
3/24	W	economics	Paper #6	
3/26	F	economics		Semiconductor projects assigned
3/29	M	economics		
3/31	W	economics		
4/2	F	economics		Econ HW ¶
4/5	M	Unintended consequences	Paper #7	
4/7	W	Energy from biomass		
4/9	F	Health issues		¶
4/12	M	Engineering issues	Paper #8	
4/14	W			Decomissioning HW
4/16	F			¶
4/19	M			
4/21	W	Individual presentation		
4/23	F	Individual presentation	Paper #9	¶
4/26	M	Group presentations		
4/28	W	Group presentations		
4/30	F	integration of projects		
5/3	M	integration of projects		
5/5	W	last class - review		