155: 518 **Process Systems Engineering: Modeling and Optimization of Process Design and Operations** FALL 2012

Web page: Sakai webpage
Lectures: Mon 5:00pm-8:00 pm C-115

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Office hours: By email arrangement

Course Description: The purpose of this course is to provide fundamental instruction on the mathematical programming techniques used in the solution of process design, synthesis and operations problems. This course will review techniques in optimization and mathematical modeling to study synthesis analysis, evaluation and optimization of process alternatives, process operations involving planning and scheduling, uncertainty considerations on process design and operations.

Teaching Assistant: there will be no teaching assistant for this course.

Course Objectives:
1. Educate students to structure and solve complex problems, and integrate material from diverse range of engineering disciplines - a systems approach to problem solving.
2. Learn basics of optimization techniques.
3. Learn optimization modeling of synthesis and operations problems.

Texts:
- *Systematic Methods of Chemical Process Design (Strongly recommended)***.**
  By L.T. Biegler, I.E. Grossmann, A.W. Westerberg.
  Published by Prentice Hall, 1997.
- *Engineering Optimization : Methods and Applications*
  By G.V. Reklaitis, A. Ravindran, K.M.Ragsdell.
  Published by John Wiley & Sons, 1983.
- *Nonlinear and Mixed Integer Optimization: Fundamentals and Applications*
  By C.A. Floudas. Published by Oxford University Press, 1995.
- *Model Building in Mathematical Programming*
  By H.P. Williams. Published by John Wiley & Sons, 1990.
- *Mathematical programming: theory and algorithms*
  By M. Minoux Published by John Wiley & Sons, 1986
- *Integer and combinatorial optimization*
  By G.L. Nemhauser. Published by Elsevier, 1988.
- *Selected papers from the literature*

Class Participation:
To improve class participation, students with most presence in the class will get up to 10 points extra in their final grade. Class participation includes quizzes every week.

Assessment:
Homeworks, quizzes: 20%; 1st Exam: 25%; 2nd Exam: 25%; Project: 30%

Topics covered:

Week	Date	Topic	Book Chapter/Reading Assignment
1	Sep. 10	Course Organization-Introduction Review of basic concepts of optimization, Optimality Conditions	Floudas Chapter 2
2	Sep. 17	Building linear models / linear programming	Notes
3	Sep. 24	Kuhn-Tucker optimality conditions, Nonlinear programming algorithms	Floudas, Chapter 3
4	Oct. 1	Modeling of discrete and continuous decisions, Propositional logic and modeling of disjunctions, Mixed integer linear programming	Floudas, Chapter 5
4	Oct. 8	Mixed Integer Nonlinear Programming	Floudas Chapter 6
5	Oct. 15	Global Optimization /Stochastic optimization	Notes
6	Oct. 22	Use of different computer software for modeling and optimization	Notes
7	**Oct. 29**	**No Class AIChE Conference**	
8	Nov. 5	General Concept of Simulation for Process Design, Process Flowsheet Optimization	Grossmann, Biegler, Westerberg Chapters 8,9
9	Nov. 12	Exam 1 (Fundamentals in Optimization)	Notes Open
10	Nov. 19	General Concept of Simulation for Process Design, Process Flowsheet Optimization	Grossmann, Biegler, Westerberg Chapters 8,9
11	Nov. 26	Modeling uncertainty / Process feasibility	Notes
12	Dec. 3	Surrogate Based Optimization – Pharmaceutical Engineering	Notes/Slides
13	**Dec. 10**	**Exam 2**	
	Dec 13	**Project Presentations**	