ISYE 3133 ENGINEERING OPTIMIZATION

Required

Credit: 3-0-3

Prepared Prof. Sokol, Fall 2007

Prerequisite(s): ISYE 2027 and MATH 2602 and CS 2316, or MATH 3215-C or MATH 3225-C

Catalog Description:
Topics include mathematical modeling of engineering applications; network and graphical interpretations; linear, nonlinear, and integer programming; general solution strategies; and utilization of modeling languages and solvers for computer solution.

Text:
Winston, WL and Venkataramanan, M. *Introduction to Mathematical Programming*, 4th ed., Duxbury Press, 2002.

Objective
The objective of this course is to introduce students to the modeling of constrained decision-making problems and optimization. This includes techniques of mathematical modeling, optimization, and sensitivity analysis, as well as the use of commercial software tools.

Topical Outline
1. Mathematical modeling: understanding components of optimization models, identifying key constraints and objectives of a real-world problem, expressing objectives and constraints in algebraic form in terms of the decision variables.
2. Finding optimal solutions: optimality conditions; mathematical theory of linear, integer, and nonlinear programming; principle of branch-and-bound; implications of special structure for computational ease or difficulty.
3. Sensitivity analysis: duality and shadow prices; marginal analysis; using sensitivity information to measure the impact of uncertain data on outcomes and solutions.
4. Use of commercial software tools: introduction to at least one commonly-used commercial optimization and modeling software package; manipulating data input/output; understanding and analyzing output.
5. Advanced topics and/or deeper treatments of core topics may be covered as time allows.

Outcomes and their relationships to ISyE Program Outcomes

At the end of this course, students will be able to:

- Identify real-world objectives and constraints based on actual problem descriptions
- Create mathematical optimization models corresponding to problem descriptions
- Select and work through proper solution techniques based on the type of model
- Use optimization software to conduct analyses; interpret output
- Make sound recommendations based on solutions, analyses, and limitations of models

Course outcome \ Program Outcomes	**a. apply math**	**b. data**	**c. IE method**	**d. team**	**e. problem solving**	**f. prof/ and ethical responsibilities**	**g. communication**	**h. global, eco, envi and soc context**	**i. continue to improve**	**j. current issues**	**k. participate in an organization**
Identify… objectives and constraints…	H	H	H	M P	H				M		L
Create mathematical optimization models…	H	H	H	M P	H						
Select and work through… solution techniques…	H			M P	H						
Use optimization software…		M		M P	H					M	
Make sound recommendations…	H	H	H	M P	H		M P	L		L	L

- H, M and L denote high, moderate and low relationships.
- P: Team projects are sometimes conducted

Evaluation of the important outcomes

Four or more important outcomes will be evaluated from direct questions on the final exam:

1. Students are able to identify real-world objectives and constraints based on actual problem descriptions;
2. Students are able to create mathematical optimization models;
3. Students are able to work through proper solution techniques;
4. Students are able to make recommendations based on solutions, analyses, and limitations of models.