ISYE 3133 ENGINEERING OPTIMIZATION

Required
Credit:
3-0-3
Prepared:
Prof. Dey, Fall 2013

Prerequisite(s): MATH 2602, ISYE 2027, CS 2316 or CS 1322 or equivalent.

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

Topics	Weeks
Intro to OR and Optimization (quiz), text	1
Linear program models: objective functions, constraints, decision variables, absolute values, optimization software (HW), text	2
Standard IP models, text	3
Advanced IP, TSP, text	1
Linear program solution using simplex method, tableau, notes,	3
Duality, (certificates), sensitivity	3
Relaxation, branch and bound	1
Total	14

Outcomes and their relationships to ISyE Program Outcomes

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

- Formulate deterministic mathematical programs in various practical systems
- Understand basic optimization techniques
- Be able to interpret the results of a model and present the insights (sensitivity, duality)
- Know the limitations of different solution methodology
- Use software to solve problems

Course outcome \ Program Outcomes	a. apply math	b. Design, conduct experiment, analyze interpret data	c. Design system	d. team	e. problem solving	f. prof/ and ethical responsibilities	g. communication	h. global, eco, envi and soc context	i. Life-long learning	j. Contemporary issues	k. use tools for eng. practice
Formulate math programs	High	High			High						
Understand optimization techniques	High										High
Interpret results		High			High						High
Know limitations of method					High					Med	High
Use software		High			High			Low		Low	

- 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

ISyE ABET Student Outcomes a - k

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) an ability to function on multidisciplinary teams

e) An ability to identify, formulate, and solve engineering problems
f) An understanding of professional and ethical responsibility
g) An ability to communicate effectively
h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) A recognition of the need for, and an ability to engage in life-long learning
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.