

ISYE 3133 ENGINEERING OPTIMIZATION

Required for BSIE

Credit: 2-3-3 in spring and fall, 3-0-3 in summer

Coordinators: Profs. Mohit Singh, Kati Moug, Spring 2026

Prerequisite(s): MATH 2603 or MATH 2602, ISYE 2027 and CS 2316.

References

Introduction to Mathematical Programming by W. Winston and M. Venkataramann, 4th edition, Chapters 1 – 9, and part of Chapters 10, 12, 13 and 14.

The book is out of print, but students can buy or rent a used copy. The same material is in Chapters 1-9 of Operations Research: Algorithms and Applications by Winston.

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.

Course description:

This course introduces optimization methods used to solve decision-making problems that arise in industrial engineering, operations research, and other fields of engineering, business and management.

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

The topical outline is shown in the table below. The table has 2 columns. The first column lists the topics to be covered. The second column lists the number of weeks these topics will be covered.

Topics	Weeks
Intro to Operations Research and Optimization	1
Formulating Models: examples, applications and computer modeling languages	6
Linear Optimization: models, simplex algorithm, sensitivity analysis, duality	3
Network Optimization: spanning trees, shortest path, max flow, assignment and transportation problems	2
Discrete Optimization: branch-and-bound, cutting planes	2
Total	14

Course Learning Outcomes

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

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

The Mapping from the Course Outcomes to ABET Student Learning Outcomes

The table below shows the relationship between course outcomes and ABET student learning outcomes. The table has 8 columns. The first column lists the course learning outcomes listed above. The next 7 columns list the abbreviated ABET Student Learning Outcomes. The entry of H in a row with specific course learning outcome and column with specific ABET Student Learning Outcomes indicate the importance of attain this outcome is high and will be assessed.

Course outcome \ Program Outcomes	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirn, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Formulate det math programs in practical systems	H						
2. Understand basic optimization techniques	H						
3. Interpret result	H					M	
4. Know the limitations of solution method		M					
5. Use software to solve problems	H						

Assessment of the important outcomes

Course outcomes 1, 2 based on direct questions on quizzes, mid-term and final exam, 3 and 5 will be assessed via large computer assignment.