ENS 511
Engineering Optimization

Course Syllabus
Spring 2023-2024

Instructor
İhsan Sadati E-mail: msadati@sabanciuniv.edu
Office Location: FMAN/SBS G024
Office Hours: Tuesdays 11:00-12:30

Course Schedule
Lectures: Tuesdays 9:40 am - 10:30 am (FENS-L029), Wednesdays 11:40 am - 1:30 pm (FENS-L029)

Course Content
This course will cover optimization methods for solving engineering problems. The methods will include linear and nonlinear programming, integer programming, dynamic programming, network models, and an introduction to metaheuristic algorithms.

Recommend or Required Reading

Textbook
Introduction to Operations Research 11th Edition by Frederick Hillier and Gerald Lieberman. (Publisher: *McGraw-Hill)*

Reading
- Operations Research: An Introduction, Global Edition, 10th Edition by Hamdy A. Taha (Publisher: *Pearson*)
- Optimization in Operations Research: Pearson New International Edition by Ronald L. Rardin (Publisher: *Pearson*)
- Engineering with Excel, 5th Edition by Ronald W Larsen (Publisher: *Pearson*)
- Algorithm Design: Pearson New International Edition, 1st Edition by Jon Kleinberg & Eva Tardos (Publisher: *Pearson*)

Objectives
This course will expose students to operations research modeling and essential tools for optimization. It is designed for engineering students who do not have an industrial engineering background but would like to learn about modeling and optimization concepts. This course will be beneficial for those likely to use these methods in their research and projects.

Learning Outcomes

At the end of the course, the student is expected to have the ability to construct mathematical models of real-life problems and to use appropriate methods/software to solve the constructed models.

Grading

Quizzes	15%
Assignments	15%
Midterm Exam	25%
Final Exam	45%
Total	100%

- The instructor might make adjustments to this grading scheme if necessary.

Assignments

- We will have **Three Group Assignments** during the semester.
- Maximum number of collaborating students is **2**
- Assignments are due at the beginning of the class meeting to which they are assigned.
- Late deliveries will not be accepted.
- The length of each assignment should not exceed four single-sided A4 sheets.
- Students are encouraged to collaborate in assignment preparation, provided that
    - each student writes his/her assignment (i.e., no copying others' work)
    - each student mentions with whom he/she collaborated.
    - The maximum number of collaborating students is 2.

Quizzes

- We will have **Four** Quizzes during the semester.
- Quizzes might be on the written assignment or the previous or current lectures' discussions.
- Some quizzes will be announced beforehand, some will not.

Exams

- One Midterm Exam and one Final Exam.

Make-up Exam Policy

- There will be a single make-up exam that will be conducted after the midterm exam
- Coverage will be announced.
- The student needs to inform the instructor and document the reason for missing the regular exam.
- The make-up exam cannot be taken to replace an already-taken exam.

Tentative Course Outline

The chapters refer to the Introduction to Operations Research 11th Edition textbook by Frederick Hillier and Gerald Lieberman.

Week	Chapters	Title
1	1 & 2	Introduction, Overview of How Operations Research and Analytics Professionals Analyze Problems
2	3	Introduction to Linear Programming
3	4	Solving Linear Programming Problems: The Simplex Method
4	5	The Theory of the Simplex Method
5	6	Duality Theory
6	8	Other Algorithms for Linear Programming
7	**Midterm Exam**	**-**
8	9	The Transportation and Assignment Problems
9	10	Network Optimization Models
10	10	
11	11	Dynamic Programming
12	12	Integer Programming
13	13	Nonlinear Programming
14	14	heuristics, Metaheuristics Applications of optimization in machine learning (including linear and nonlinear regression)