



Syllabus

SIE 440/540: Survey of Optimization Methods
Department of Systems & Industrial Engineering
University of Arizona

Spring 2025

Course Description

(3 units) Survey of methods including network flows, integer programming, nonlinear programming and dynamic programming. Models development and solution algorithms are covered.

Course Prerequisites

SIE 340 - Deterministic Operations Research, or equivalent. Knowledge of linear programming.

Time and Location: TuTh 12:30PM-1:45PM, ENGR 301

Instructor: Dr. Neng Fan

Office: ENGR 312

Office Hours: TuTh 11:00AM-12:00PM or by appointment

Email: nfan@arizona.edu

Course Format and Teaching Methods

Lecture only; individual project; in-class discussion; web-delivered content.

Course Objectives and Expected Learning Outcomes

Students are able to develop a working knowledge of different types of optimization methods in these directions: learning solution approaches for linear/integer/dynamic/nonlinear programming and some network optimization problems; developing an appropriate optimization model from a verbal description of a problem; choosing an appropriate solution technique; extracting relevant information from the model and solutions.

Course Communications

Course website: <https://d2l.arizona.edu> All class materials, including lecture notes, homework assignments, project instructions, supplemental readings, grades, announcements, etc., will be distributed through D2L. Also, if needed, the instructor will contact you through official UA email address and please check D2L and your email at least once per day.

Required Texts and Materials

Textbook (required):

Introduction to Operations Research; 11th Edition; Published Date: 2021; Authors: F. Hillier and G. Lieberman; McGraw-Hill Education

References:

- Title: Operations Research: Applications and Algorithms; Author: W.L. Winston; 4th Edition; Published Date: 2004; Publisher: Duxbury Press or
- Title: Introduction to Mathematical Programming; Authors: W. L. Winston and M. Venkataramanan; 4th Edition; Published Date: 2002; Publisher: Thomson Learning.

- Some papers distributed in class

Course Topics

- LP: Review of Linear Programming: modeling, simplex method, big M and two-phase methods, duality, dual simplex method, sensitivity
- NO: Network Optimization: transportation problem, transportation simplex method, terminology, shortest path problem, minimum spanning tree problem, maximum flow problem, minimum cost flow problem, network simplex method
- IP: Integer Programming: modeling with integer variables and binary variables, branch-and-bound algorithm, cutting plane algorithm
- NLP: Nonlinear Programming: review of differential calculus, types of nonlinear programming, convexity of functions, one-variable and unconstrained optimization, convex programming
- DP: Dynamic Programming: examples, solution procedure

Assessments, Grading Scale and Policies

Assessment Categories	Percentage of final grade	
	SIE 440	SIE 540
Homework Assignments (5 sets)	30%	20%
Midterm Exam	30%	25%
Final Exam	40%	35%
Course Project	Not required	20%
Total	100%	100%

- Homework Assignments: There are 5 sets of homework assignments. Late homework will not be accepted, unless with permission of instructor.
- Midterm and Final Exams: The two exams will be closed book and closed notes. Some formulations and tables will be given in the exam. Before each exam, there will be a review session and more details will be given during this session.
- SIE 540 Course Project: Only students take SIE 540 are required to complete this individual project. More details will be given in class.

Dispute of Grade Policy: For questions on grades, you have to email teaching assistant or the instructor within one week of grades posted. Students registered this course for honors credits should email the instructor to set up an appointment to discuss the additional requirements.

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see:

<http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

University Policies

All university policies related to the syllabus are available at:

<https://academicaffairs.arizona.edu/syllabus-policies>

Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

Student Resources

University of Arizona's Basic Needs Resources page: <https://caps.arizona.edu/basic-needs>

UA Academic policies and procedures: <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information: <https://deanofstudents.arizona.edu/support/student-assistance>