# THE UNIVERSITY OF ARIZONA®

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

## Spring 2026

### 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; 11<sup>th</sup> Edition; Published Date: 2021; Authors: F. Hillier and G. Lieberman; McGraw-Hill Education
>
> (*Or a newer version*) Introduction to Operations Research; 2024 Release; 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

Generative AI use is NOT allowed for this course. In this course any and all uses of generative artificial intelligence (AI)/large language model tools such as ChatGPT, Dall-e, Google Bard, Microsoft Bing, etc. will be considered a violation of the Code of Academic Integrity (https://deanofstudents.arizona.edu/policies/code-academic-integrity), specifically the prohibition against submitting work that is not your own. This applies to all assessments in the course, including homework assignments, exam and the participation questions.