Course Syllabus

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C E 367R: Optimization Techniques for Transportation Engineering

Maseeh Department of Civil, Architectural and Environmental Engineering

Cockrell School of Engineering

Number of Credit Hours: 3

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Course Information

- Term: Spring, 2026
- Course Number & Section: C E 367R
- Course Name: Optimization Techniques for Transportation Engineering
- Credit Hours: 3

- Class Meeting Time: T/Th 11:00AM - 12:15PM
- Class Location: ECJ 1.322
- Course Modality: Face-to-face

Instructor Information

- Instructor: Dr. Zhaomiao Guo
- Office Location: ECJ 6.104 or Zoom
- Office Hours: T: 2 PM - 3 PM; Th: 12:45 PM – 2:00 PM or by e-mail
- Email: **zguo@utexas.edu (mailto:zguo@utexas.edu)**

Zoom Sessions

- CE 367R - Lectures: **https://utexas.zoom.us/j/82807457005 (https://utexas.zoom.us/j/82807457005)**

(Access only with prior announcement or approval for an emergency.)

- Prof. Guo's Office Hour: **https://utexas.zoom.us/j/98925868410 (https://utexas.zoom.us/j/98925868410)**

Enrollment Requirements

- Course Prerequisites:
  - CE 311K (Introduction to Computer Methods) with a grade of C (2.0) or better
- Course Co-requisites:
  - NA
- Basic Programming Skills:
  - Students will be required to write their computer programs in Python.

Course Description

This course will expose you to the basic concepts of formulating and solving optimization problems, particularly in transportation engineering. Transit and roadway network design, vehicle routing and logistics, and resource allocation, and machine learning rely heavily on optimization theories and methods. By the end of this course, you will have the basic knowledge to address these questions and many others that arise in civil engineering. You will be able to formulate a variety of engineering problems as optimization models and have the practical knowledge needed to solve them.

Furthermore, you will have a conceptual understanding of optimization models, which allows you to understand and critically evaluate optimization model results.

Course Materials and Resources

Required Materials/Resources

- There is no textbook for this course. Lecture slides will be posted for references.

Other Reference/Resources

- Entry level: Hillier, F. S., & Lieberman, G. J. (2024). *Introduction to operations research*. McGraw-Hill.
- Intermediate: Vanderbei, R. J. (2020). *Linear programming: Foundations and extensions* (5th ed.). Springer.
- Advanced: Bertsimas, D., & Tsitsiklis, J. N. (1997). *Introduction to linear optimization*. Belmont, MA: Athena Scientific.
- Advanced: Boyd, S., & Vandenberghe, L. (2004). *Convex optimization*. Cambridge University Press.

(Most of these texts are available online.)

Software for the Course:

- Install Anaconda (include Python, Jupyter Lab, and some useful tools): **How to Install Anaconda with Jupyter Notebook (https://docs.anaconda.com/anaconda/install)**
- Install Pyomo (include GLPK and IPOPT solvers): **How to install PYOMO with solvers using CONDA (https://pyomo.readthedocs.io/en/6.8.0/installation.html)**
- Students may be able to finish most of the work on other Python IDEs (e.g., Google Colab, VS Code, PyCharm). However, limited support will be provided, and autograding functionalities may not work.

Student Learning Outcomes

- This course will give you an introduction to the theory and applications of optimization methods. Upon completion of this course, you will have an understanding of:

- the applications of optimization to (transportation) engineering problem
- mathematical modeling of linear optimization problems
- solution methods for linear optimization problems

This course is designed to achieve the ABET Student Outcomes marked with a "X" in the first column.

	Student Outcomes
X	1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
	3. An ability to communicate effectively with a range of audiences
	4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
X	5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
	6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
X	7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Course Activities

- Homework:
  - Homework assignments will be posted to Canvas with the due date and time indicated.
  - Programming portions of your assignments should be completed using Python/PYOMO using the notebook template provided for auto-grading.
  - The objective of these assignments is to assist in the learning of materials, so discussion of assignments among students is encouraged.
  - Each student is required to upload his/her own answers (scanned or typed) as a single pdf file and related coding files to Canvas before the deadline.
- In-class pop quizzes
  - In-class knowledge check.
- Two midterm exams:
  - Exams are closed books and closed notes.
  - A letter-size cheat sheet (double-sided) is allowed.
- One final group project:
  - Each group should have 3-5 students.
  - Each group will present its project in class.
  - Each group will submit one final report with each team member's contributions specified.
- Participation will be evaluated based on factors such as attendance, in-class participation, and Q&A contributions on Canvas.

Make-up Exams and Assignments

Per university policy, you are allowed to submit make-up work (or an equivalent, alternate assignment) for university-sponsored events, religious observances, or legal obligations (such as jury duty). If this participation conflicts with your course assignments, I will offer a reasonable opportunity for you to complete missed assignments and/or exams. The make-up assignment and grading scale will be equivalent to the missed assignment and its grading scale. But such requests are strongly discouraged and will be accommodated only when prior permission from the instructor has been sought adequately in advance and/or sufficient evidence has been provided.

Communication

All communication will be done either in class, Canvas, or by UT emails. Students MUST check their UT emails regularly. All announcements will be posted on Canvas. Students must make it a habit to log on to Canvas and check for any announcements.

Assessment and Grading Procedures

Assignment	Percentage of Grade
Participation	5%
Homework	15%
In-class Quizzes	15%
Mid-term Exam	40%
Group Final Project	25%
Total	100%

I will adopt plus/minus grading system. All grades for the assignments and exams will be posted on webcourses.

Letter Grade	Points
A	93 – 100 points
A-	90 – 92 points
B+	87 – 89 points
B	83 – 86 points
B-	80 – 82 points
C+	77 – 79 points

C	73 – 76 points
C-	70 – 72 points
D+	67 – 69 points
D	63 – 66 points
D-	60 – 62 points
F	59 and below

Course Schedule*

Please note that each module will span multiple classes, please refer to the module overview page for specific class times and assignment due dates.

Week	Date	Lecture Topic	Submission Due
1	13-Jan	Course Overview (Zoom Session due to Conference Travel)	
1	15-Jan	Introduction to Optimization	
2	20-Jan	Python/PYOMO Primer	
2	22-Jan		
3	27-Jan	Linear Programming	HW0
3	29-Jan		
4	3-Feb	Geometry of Linear Programming	
4	5-Feb		
5	10-Feb	Simplex Method	
5	12-Feb		HW1
6	17-Feb	Midterm Review	
6	19-Feb		
7	24-Feb	Midterm Exam	
7	26-Feb	Network Basic and Network Modeling	HW2
8	3-Mar		
8	5-Mar	Shortest Path Problem	
9	10-Mar		
9	12-Mar	Maximum Flow Problem	
10	17-Mar	Spring Break	
10	19-Mar	Spring Break	HW3
11	24-Mar		
11	26-Mar	Minimum Cost Flow Problem	
12	31-Mar		
12	2-Apr	Midterm Exam	
13	7-Apr	Final Group Projects (Q&A)	
13	9-Apr	Facility Location Problems (Optional)	HW4
14	14-Apr		
14	16-Apr		
15	21-Apr	In-Class Presentation	
15	23-Apr	Course Summary, Q&A	
16	28-Apr	Study days - No Class	Slides
Final Project		Tuesday, April 29 11:59pm	Final Reports

(* Subject to change. Please check regularly.)

Policy Statements

Academic Integrity statement.

Sharing of Course Materials is Prohibited: No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments),

in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

Class Recordings.

Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

University Health Services.

Important safety information and University health services resources can be found here: **https://www.healthyhorns.utexas.edu/index.html (https://www.healthyhorns.utexas.edu/index.html)** & **https://protect.utexas.edu/ (https://protect.utexas.edu/)**

Disability statement.

The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Student Affairs, Disability & Access, 512-471-6259 (email: access@austin.utexas.edu) or **https://disability.utexas.edu/ (https://disability.utexas.edu/)**

Course Instructor Survey/Evaluation.

An evaluation of the course and instructor will be conducted at the end of the semester using the approved UT Course/Instructor evaluation forms.

Undergraduate student Drop policy.

From the 1st through the 12th class day (4th class day in the summer sessions), an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 13th (5th class day in the summer sessions) through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor.

Emergency Preparedness Plan

Emergency Preparedness means being ready. It takes an effort by all of us to create and sustain an effective emergency preparedness system. You are your own best first responder. Please use **https://preparedness.utexas.edu/welcome-emergency-preparedness (https://preparedness.utexas.edu/welcome-emergency-preparedness)** as a resource to better understand emergency preparedness at the university, and how you can become part of and contribute to the preparedness community. To monitor emergency communications for specific instructions, go to**https://utexas.edu/emergency (https://utexas.edu/emergency)** . To report an issue (none emergency) call 512-471-4441. In case of emergency, call 911.

Course Summary:

Date	Details	Due
Fri Jan 16, 2026	**Pre-class Survey (https://utexas.instructure.com/courses/1438727/assignments/7451836)**	due by 11:59pm
Tue Feb 3, 2026	**HW0: Introduction - Coding (https://utexas.instructure.com/courses/1438727/assignments/7451826)**	due by 11:59pm
	HW0: Introduction - Handwritten (https://utexas.instructure.com/courses/1438727/assignments/7541998)	due by 11:59pm
Thu Feb 5, 2026	**Quiz: Python Programming (https://utexas.instructure.com/courses/1438727/assignments/7451820)**	due by 12:15pm
Sun Feb 15, 2026	**HW1: Linear Programming and Geometry - Coding (https://utexas.instructure.com/courses/1438727/assignments/7451827)**	due by 11:59pm
	HW1: Linear Programming and Geometry - Handwritten (https://utexas.instructure.com/courses/1438727/assignments/7451828)	due by 11:59pm
Thu Feb 19, 2026	**Quiz: Network Modeling (https://utexas.instructure.com/courses/1438727/assignments/7560372)**	due by 12:15pm
	Quiz: Simplex Method (https://utexas.instructure.com/courses/1438727/assignments/7451821)	due by 12:15pm

Sun Feb 22, 2026	HW2: Simplex Method: Production Planning - Handwritten (https://utexas.instructure.com/courses/1438727/assignments/7451830)	due by 11:59pm
Tue Feb 24, 2026	Midterm 1 (https://utexas.instructure.com/courses/1438727/assignments/7451835)	due by 12:30pm
Sun Mar 1, 2026	HW2: Simplex Method: Production Planning - Coding (https://utexas.instructure.com/courses/1438727/assignments/7451829)	due by 11:59pm
Fri Mar 13, 2026	Midterm Survey (https://utexas.instructure.com/courses/1438727/assignments/7451822)	due by 11:59pm
Thu Mar 19, 2026	HW3: Shortest Path Problems: Construction Project Management - Coding (https://utexas.instructure.com/courses/1438727/assignments/7451831)	due by 11:59pm
	HW3: Shortest Path Problems: Construction Project Management - Handwritten (https://utexas.instructure.com/courses/1438727/assignments/7451832)	due by 11:59pm
Thu Apr 2, 2026	Midterm 2 (https://utexas.instructure.com/courses/1438727/assignments/7582848)	due by 11:59pm
Thu Apr 9, 2026	Quiz: Model Inputs (https://utexas.instructure.com/courses/1438727/assignments/7451823)	due by 12:30pm
Fri Apr 10, 2026	HW4: Max Flow and Min-cost Flow Problems: Evacuation - Coding (https://utexas.instructure.com/courses/1438727/assignments/7451833)	due by 11:59pm
	HW4: Max Flow and Min-cost Flow Problems: Evacuation - Handwritten	due by 11:59pm

	(https://utexas.instructure.com/courses/1438727/assignments/7451834)	
Thu Apr 23, 2026	Final Project - Presentation (https://utexas.instructure.com/courses/1438727/assignments/7451824)	due by 11:59pm
Wed Apr 29, 2026	Course Evaluations Spring 2026 (https://utexas.instructure.com/calendar?event_id=4697705&include_contexts=course_1438727)	11:59pm
	Final Project - Report (https://utexas.instructure.com/courses/1438727/assignments/7451825)	due by 11:59pm
	Attendance and Participation (https://utexas.instructure.com/courses/1438727/assignments/7605018)	