

Course Syllabus

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C E 397: Infrastructure Systems Optimization

Maseeh Department of Civil, Architectural and Environmental Engineering

Cockrell School of Engineering

Number of Credit Hours: 3

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Course Information

- Term: Fall, 2025
- Course Number & Section: C E 397
- Course Name: Infrastructure Systems Optimization
- Credit Hours: 3
- Class Meeting Days: Monday and Wednesday
- Class Meeting Time: 12:30 PM – 2:00 PM

- 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: Tuesday: 11:00 AM – 12:00 PM, Wednesday: 10 AM - 11 AM. Or by e-mail
- Email: zguo@utexas.edu
- Phone: NA

Zoom Sessions

- Prof. Guo's Office Hour (Please let me know in advance if you plan to join.)

<https://utexas.zoom.us/j/98925868410>

- Class meetings will be recorded. Recordings will be available only to students registered for this class as courtesy. This is intended to supplement the synchronous classroom experience and to accommodate those who cannot attend the scheduled class meeting due to emergencies. Students are expected to follow appropriate university policies and maintain the security of passwords used to access class meetings and recorded lectures.

Enrollment Requirements

Course Prerequisites:

Basic programming skills; Students will be required to write their own computer programs.

Course Co-requisites: NA

Course Description

The objective of this course is to introduce concepts, principles, modeling techniques, and practice of infrastructure management. The focus is on multi-stage optimization techniques facing increasing system uncertainties and complexity, and their application to management decision-making for civil infrastructure systems.

Course Materials and Resources

Required Materials/Resources

- Lecture notes will be made available electronically via Canvas.

Other Reference/Resources

- Uddin W., Haas R. and Hudson W.R., Infrastructure Management, McGraw-Hill, 2013
- Hillier F. and Lieberman G., Introduction to Operations Research, Edition, McGraw-Hill
- R. Bellman and R. Kalaba, Dynamic Programming and Modern Control Theory, Academic Press, 1965.
- Alexander Shapiro, Darinka Dentcheva, Andrzej Ruszczyński, Lectures on Stochastic Programming: Modeling and Theory, Second Edition (ISBN-13: 978-1611973426, ISBN-10: 1611973422)

Software for the Course:

- Python, Matlab, or R (for Homework #2)
- Python/Pyomo, Matlab, or Excel (for Homework #3,#4)
- Install Anaconda (include Python and some useful tools): [How to Install Anaconda with Jupyter Notebook](https://docs.anaconda.com/anaconda/install/)  [\(https://docs.anaconda.com/anaconda/install/\)](https://docs.anaconda.com/anaconda/install/)
- Install Pyomo: <https://pyomo.readthedocs.io/en/stable/installation.html>  [\(https://pyomo.readthedocs.io/en/stable/installation.html\)](https://pyomo.readthedocs.io/en/stable/installation.html)

Student Learning Outcomes

- Master the basic multi-stage operations research approach for management of infrastructure systems
- Develop an operations research foundation for future coursework in engineering

Course Activities

- Four problem-oriented homework assignments. The objective of these assignments is to assist in the learning of course material, so discussion of assignments among students is encouraged. But each student is required to submit his/her own written answers/codes before class in the due date.
- In-class mid-term exam
- One final project, including writing of a term paper and in-class presentation. The objective of the

term paper is to investigate a topic of interest in the area of infrastructure systems by using the methodologies discussed in this course. Students may work in group or individually.

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.

Assessment and Grading Procedures

Assignment	Percentage of Grade
Participation	10%
Homework	40%
Midterm	20%
Term Paper	15%
Presentation	15%
Total	100%

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

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*

(*This schedule is subject to modification by Prof. Guo at any point in the semester due to unexpected conflict/delay. Please check regularly. Thank you.)

<i>Week</i>	<i>Date</i>	<i>Lecture Topic</i>	<i>Submission Due</i>
1	25-Aug	Course Overview	
1	27-Aug	Introduction to infrastructure management	
2	1-Sep	NO CLASS - Labor Day holiday	
2	3-Sep	Dynamic Programming	
3	8-Sep	Dynamic Programming Examples	
3	10-Sep	Markov Chain and Markov Decision Processes	
4	15-Sep	Facility Level Decision (Finite Horizon)	HW1
4	17-Sep		
5	22-Sep	State Augmentation	
5	24-Sep		
6	29-Sep	Facility Level Decision (Infinite Horizon)	HW2
6	1-Oct	Examples on Solution Approaches	
7	6-Oct		
7	8-Oct	System Level Decision Problems (Infinite Horizon)	
8	13-Oct		
8	15-Oct	System Level Decision Problems (Finite Horizon)	HW3
9	20-Oct	Mid-term Review	
9	22-Oct	Mid-term Exam	
10	27-Oct	NO CLASS - Conference Travel (Final Project Introduction)	
10	29-Oct	NO CLASS - Conference Travel (Final Project Teaming)	HW4
11	3-Nov	Guest Lecture - TxDOT Pavement Management Systems, Dr. Hui Wu	
11	5-Nov	Reinforcement Learning	
12	10-Nov	Final Project Idea Pitch	Topics
12	12-Nov	Reinforcement Learning Examples	
13	17-Nov	Mathematical Modeling	Literature Review
13	19-Nov	Project Q&A - Office Hour	
14	24-Nov	NO CLASS - Fall break / Thanksgiving	
14	26-Nov	NO CLASS - Fall break / Thanksgiving	
15	1-Dec	Course_Summary_Project Q&A	Results
15	3-Dec	Presentation and Discussion	
16	8-Dec	Presentation and Discussion	Term Paper
Final Exam		NA	

Policy Statement

- Disability & Access, Accommodations: <https://disability.utexas.edu/> ➞
(<https://disability.utexas.edu/>)
- General Information Catalog: <http://catalog.utexas.edu/general-information/> ➞
(<http://catalog.utexas.edu/general-information/>)
- Academic Dishonesty: <https://catalog.utexas.edu/general-information/appendices/appendix->

[c/student-conduct-and-academic-integrity/](https://catalog.utexas.edu/general-information/appendices/appendix-c/student-conduct-and-academic-integrity/)  [\(https://catalog.utexas.edu/general-information/appendices/appendix-c/student-conduct-and-academic-integrity/\)](https://catalog.utexas.edu/general-information/appendices/appendix-c/student-conduct-and-academic-integrity/)

- Religious Holy Days/Attendance: <http://catalog.utexas.edu/general-information/academic-policies-and-procedures/attendance/>  [\(http://catalog.utexas.edu/general-information/academic-policies-and-procedures/attendance/\)](http://catalog.utexas.edu/general-information/academic-policies-and-procedures/attendance/)
- Security & Emergency Management: <https://preparedness.utexas.edu/safety/emergency-terms>  [\(https://preparedness.utexas.edu/safety/emergency-terms\)](https://preparedness.utexas.edu/safety/emergency-terms)
- Restricting information (for students):
<https://registrar.utexas.edu/students/records/restrictmyinfo> 
[\(https://registrar.utexas.edu/students/records/restrictmyinfo\)](https://registrar.utexas.edu/students/records/restrictmyinfo)

Course Summary:

Date	Details	Due
Fri Sep 19, 2025	 HW1 (https://utexas.instructure.com/courses/1429675/assignments/7254856)	due by 11:59pm
Tue Sep 30, 2025	 HW2 (https://utexas.instructure.com/courses/1429675/assignments/7355887)	due by 11:59pm
Wed Oct 15, 2025	 Midterm Survey (https://utexas.instructure.com/courses/1429675/assignments/7254859)	due by 11:59pm
Wed Oct 22, 2025	 Midterm (https://utexas.instructure.com/courses/1429675/assignments/7377335)	due by 11:59pm
Fri Oct 24, 2025	 HW3 (https://utexas.instructure.com/courses/1429675/assignments/7254857)	due by 11:59pm
Mon Nov 10, 2025	 Topic (https://utexas.instructure.com/courses/1429675/assignments/7254863)	due by 11:59pm
Mon Nov 17, 2025	 Literature Review (https://utexas.instructure.com/courses/1429675/assignments/7254858)	due by 11:59pm
Sun Nov 30, 2025	 HW4 (OPTIONAL with 5 pts extra credit)	due by 11:59pm

<https://utexas.instructure.com/courses/1429675/assignments/7390654>

Mon Dec 1, 2025



[Results](#)

<https://utexas.instructure.com/courses/1429675/assignments/7254862>

due by 11:59pm

Wed Dec 3, 2025



[Presentation and Slides](#)

<https://utexas.instructure.com/courses/1429675/assignments/7254861>

due by 11:59pm

Mon Dec 8, 2025



[Final Term Paper](#)

<https://utexas.instructure.com/courses/1429675/assignments/7254855>

due by 11:59pm



[Participation](#)

<https://utexas.instructure.com/courses/1429675/assignments/7254860>