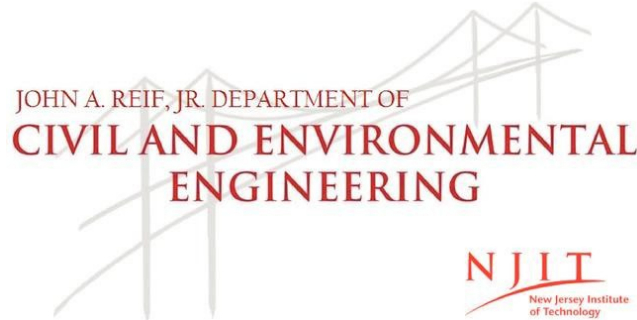


Interdisciplinary Program in Transportation/Civil Engineering



TRAN 650 – 851-853 URBAN SYSTEMS ENGINEERING

Fall 2025

- INSTRUCTOR:** **Lazar Spasovic**
Professor, Civil and Environmental
- OFFICE:** Tiernan Hall (TIER) 272 (within the Transportation Suite, 2nd floor)
Phone: (973) 642-7214 Cell: (551) 208-8560
E-mail: spasovic@njit.edu
- OFFICE HOURS:** Mondays 4:30 - 5:30 p.m.
 Wednesdays 4:30 - 5:30 p.m., and by appointment.
 Via e-mail with a maximum response time of 48 hrs.
- LECTURES:** Distance Learning material posted on Wednesdays

COURSE DESCRIPTION

The course introduces the basic quantitative methods that underline modern urban systems engineering and management science analysis. The basic theory of these methods will be described along with a strong emphasis on the practical applications of these methods. This latter objective is accomplished through the use of various optimization software packages and case studies. In particular, the concept of mathematical programming, stochastic processes, queuing theory, and modern decision analysis will be presented and applied to a variety of problems arising in transportation, civil engineering, and engineering management.

REQUIRED BACKGROUND

Undergraduate Courses in Probability and Statistics, Mathematical Analysis for Technology, and Personal Computers (as per the Graduate Catalog).

REQUIRED TEXT

Introduction to Operations Research, by Frederick Hillier (2024 edition.)

HOMEWORK ASSIGNMENTS

There will be six homework assignments following the lectures. They are shown in the course page within NJIT Canvas. The homework assignments must be performed independently by each student. Students will submit the homework solutions via NJIT Canvas. The due date for each homework assignment will be one week after the homework has been posted in NJIT Canvas. The actual submission due date and time will be indicated in the assignment.

CASE STUDIES

Four case studies will be assigned. The class will be divided into groups of 2-3 students each and each group will solve the case studies independently as a team. The students are encouraged to form their own groups. Case study solutions will be due two weeks after the assigned date. Each group will submit a single case study solution report. The cover page will list the names of all students in the group. The solution report can be submitted either in a report format (MS Word or PDF), or a presentation format (PowerPoint or PDF slides). The submission will be via NJIT Canvas.

CLASS PARTICIPATION

Students are encouraged to participate in online discussions using the forums in NJIT Canvas. The instructor will create forums for each weekly module. The students should post questions related to lectures or assignments in the forums. The instructor may invite the class to discuss a particular question or problem and students are encouraged to take part in the discussion.

EXAMS

There will be a midterm and a final exam. Each exam will be assigned through Canvas, and it will be an open-book exam. Students will work independently during the exam. Students will have a certain allotted time to solve the problems and submit their solutions. The submission will be through Canvas.

GRADING:	Case Studies	15%
	Homework	15%
	Midterm Exam	30%
	Final Exam	30%
	Class Participation	10%

Academic Integrity: It is expected that NJIT's University Code on Academic Integrity will be followed in all matters related to this course. Refer to NJIT's Dean of Students website to become familiar with the Code on Academic Integrity and how to avoid Code violations.

<https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly and consistently.

AI statement: The use of artificial intelligence (AI) is permitted in this course only when explicitly stated in assignments. If students use AI for any course-related work, they must cite it according to the guidelines provided on the [NJIT Library AI Citation page](#). If you have any questions about AI use in this course, please contact the course instructor before submitting any assignments. In cases where AI use is not allowed, students are expected to complete work without AI assistance to develop their skills in this subject area.

Students with Documented Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at: (<http://www.njit.edu/counseling/services/disabilities.php>)

TENTATIVE SCHEDULE OF CLASSES

WEEK	TOPIC	ASSIGNED READING
1	Introduction Linear Programming	Chapters 1-3
2	Graphical Method for LP/Review of Linear Algebra/Simplex Method	HW #1 Assigned
3	Simplex Method/Revised Simplex Method; Transportation Application: Highway Ramp Metering	Chapter 4 HW #2 Assigned
4	Duality Theory/Sensitivity Analysis	Chapters 5-6 Case Study #1 Assigned
5	Network Models Conrail Empty Rail Car Repositioning, a TRF Paper	Chapters 9-10
6	Network Simplex/Transportation Applications	Chapter 9 HW #3 Assigned Case Study #1 Due
7	Integer Programming Traveling Salesman Problem	Chapter 12 Case Study #2 Assigned

8	Midterm Exam	
9	Nonlinear Programming	Chapter 13 HW #4 Assigned Case Study #2 Due
10	Review of Basic Probability Theory	Chapter 24 Case Study #3 Assigned
11	Stochastic Processes Queuing Theory and Application Toll Plaza Operation	Chapter 17 and 26 HW #5 Assigned
12	Statistics, Forecasting, Regression Analysis	Chapter 20 (Section 9) Case Study #4 Assigned Case Study #3 Due
13	Decision Analysis	Chapters 16 HW #6 Assigned
14	Transportation/Civil/Management Applications	Case Study #4 Due
15	Final Exam	

Note: The dates shown in the NJIT Canvas course page supersede those dates shown in the Tentative Schedule of Classes

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarships among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. **Professional Growth:** Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as academia, business, and law through further education.

3. **Service:** Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Student Outcomes

Our **Student Outcomes** are what students are expected to know and be able to do by the time of their graduation:

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
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative 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 conclusion
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated 8/2025