CEE 350-106 TRANSPORTATION ENGINEERING

(3 credits)

Lectures Thursdays, 6:00 PM – 8:50 PM
Faculty Memorial Hall Room 409 (FMH 409)

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Office Hours: Thursdays 2-4pm
or by appointment

Prerequisite CE 200, CE 200A. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

Required Textbook

Principles of Highway Engineering and Traffic Analysis, 7th Edition - F.L. Mannering and S.S. Washburn. John Wiley & Sons, Inc., ISBN 978-1-119-49396-9

Course Description *(from NJIT's course catalog)*

This course will discuss the principles and practices of transportation engineering and urban transportation planning. The major topics of this course cover 1) highway geometric design, 2) capacity analysis of highways and intersections, and 3) travel demand forecasting. The course will have a group project investigating real world example problems related to traffic impact analysis studies for transportation facilities.

Course Objectives (General)
By the end of this course, the student will be able to:

1. Understand the principles and practices of transportation engineering and urban transportation planning.
2. Understand the interactions between transportation planning and land use planning, economics, social planning and master plans.
3. Gain the facility of utilizing state-of-the-art techniques and models in the field.
4. Have the capability to identify and solve transportation problems within the context of data availability and limitations of analysis tools.

POLICIES & PROCEDURES

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

Communication:

The preferred mode of communication between the students and the instructor outside of class is e-mail. Nevertheless, students can contact the instructor by phone with course-related questions,

or schedule virtual consultations via WebEx. The instructor can be contacted through Canvas as well.

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.

Lectures/Class:

- The attendance will be taken at each lecture/class.
- Each student may be excused to miss up to two classes with prior permission/VALID reason.
- Each subsequent class absence will be reported to the Dean of Students and may affect student's standing and grade.
- Five (5) or more missed classes may result in an F grade.

Withdrawals:

To ensure consistency and fairness in application of the NJIT policy on withdrawals, student requests for withdrawals after the deadline will not be permitted unless extenuating circumstances (e.g., major family emergency or substantial medical difficulty) are documented. The course Professor and the Dean of Students are the principal points of contact for students considering withdrawals.

Handouts:

All handouts will be printed and distributed to students in class. They will also be posted in Canvas in electronic format.

Lecture Notes and Materials:

- The lecture notes will be posted in Canvas prior to each lecture. Other course materials may be posted in Canvas after the class (e.g., in-class exercises and homework solutions).
- Some lectures (equivalent to Modules in Canvas) will include recorded videos of homework solutions and in-class examples. The students are expected to review those videos to solidify the concepts and calculations presented in class, and as part of the preparation for exams.

Homework:

Homework assignments will be assigned to reinforce course learning objectives. The assignments will be targeted to provide practice for methods that may be included in course exams. There will be approximately eight-to-nine homework assignments during the semester. The homework assignments will be posted in Canvas. Collaborating, sharing, and/or copying of exam/homework is **NOT** allowed. Credit will not be given to individuals who either initiate, allow, or participate in such behaviors. The NJIT honor code will be upheld at all times and any violation will be brought to the immediate attention of the Dean of Students

Homework Format:

Homework assignments will be provided electronically in Canvas as PDF documents. The submission of the homework assignments will also be through Canvas. Students must submit their homework assignments in a single PDF document. It can be a scanned copy of the hand-written assignment, or an electronic document converted to PDF format.

Late Homework:

The assignments must be turned in by the due date specified by the instructor. No late homework will be accepted.

Homework Solutions:

The homework solutions will be provided as recorded videos posted in Canvas. Students are expected to review all homework solution videos.

Exams:

Unless otherwise noted, the exams will be conducted in-person. There will be three exams throughout the semester. Exam #1 and Exam #2 will be conducted during the regular class hours, as indicated in the class schedule. The date and location of the final exam (Exam #3) will be announced as part of the University-wide final examination schedule. The students will be provided the exam problems at the beginning of the examination period and will have a specified amount of time to complete the exam and submit the solutions to the instructor/proctor: e.g., 80 minutes for Exams #1 and #2, and 120 minutes for the Exam #3 (Final Exam). Each student must submit the calculation sheets used to derive the solutions for the exam problems. The students can utilize the formula sheet during the exams, as approved by the instructor. If exams must be conducted virtually (e.g., due to changes in the University pandemic policies, inclement weather, or other emergency), the instructor will provide timely and detailed information and instruction on the examination process.

Collaborating, sharing, and/or copying of exam/homework is **NOT** allowed. Credit will not be given to individuals who either initiate, allow, or participate in such behaviors. The NJIT honor code will be upheld at all times and any violation will be brought to the immediate attention of the Dean of Students.

Group Project:

The class will be divided into multiple groups, each consisting of 3-4 students. Each group will be assigned an intersection in the vicinity of NJIT campus to conduct a Level of Service analysis, determine deficiencies in intersection operations, identify and evaluate potential solutions. The proposed solutions will be evaluated using Highway Capacity Software (HCS) and a microscopic traffic simulation software VISSIM. The software is available on the workstations at the CEE Computer Lab (Colton Hall, Room 318) and may be provided by the instructor for personal use on student's computers for the duration of the course. Each group must submit the list of group members by the end of the 4th week of the semester, and the presentation of the group project will be held in the 15th week of the semester. The format of the presentation is free, but the presentation must include the following sections:

1. Goal and objectives of the project.
2. Spatial and temporal scopes of the project.
3. Project site description (e.g., intersection geometry, traffic condition, signal phase sequence, etc.).
4. Summary of the traffic flow data – current conditions (e.g., approach traffic demand, green time, yellow time, saturation flow rate, etc.).
5. Description of the identified problems and proposed solutions (improvements).
6. Summary of the Level of Service analysis using HCS (current conditions vs. improvements).
7. Summary of the traffic simulation analysis using VISSIM (current conditions vs. improvements).
8. Conclusions and Recommendations.

Calculation of Course Grade: A weighted average grade will be calculated as follows:

Homework	15%
Exam #1:	20%
Exam #2:	20%
Exam #3:	20%
Group Project:	25%

The minimum requirements for final letter grades are as follows:

A = 90-100%, B+ = 85-89%, B = 80-84%, C+ = 75-79%, C = 70-74%, D = 60-69%, F < 60%

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: 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)

Other Class Polices:

Cell Phones and mobile devices (e.g., Laptop, iPad/Tablet PC, iPod, etc.): Cell phones shall be turned off or silenced prior to coming to class. Texting and the use of mobile devices during the class shall not be allowed.

Course Schedule:

Week	Date	Topic/Assignment
1	01/23	- Course Overview - Introduction to Transportation Engineering (Chapter 1) - Fundamentals of Traffic Flow (Chapter 5.1 ~ 5.3)
2	01/30	- Fundamentals of Traffic Flow (Chapter 5.1 ~ 5.3) - Greenshields Model of Traffic Flow (Chapter 5.3) - **Assignment #1**
3	02/06	- Introduction to Queuing Theory and Models (Chapter 5.5 ~ 5.6) - Queuing Models of Traffic Flow (Chapter 5.6) - **Assignment #2**
4	02/13	- Highway Capacity and Level of Service Analysis Part 1: Basic Freeway Segment (Chapter 6.1 ~ 6.4) - Highway Capacity and Level of Service Analysis Part 2: Multi-Lane Highway (Chapter 6.5)

		- **Assignment #3**
5	02/20	- **Exam #1** - Highway Capacity and Level of Service Analysis Part 3: Two-Lane Highway (Chapter 6.6 ~ 6.7) - Lab: Highway Capacity Software – Freeway Analysis (CEE Computer Lab, Colton Hall 3rd Floor Room 318) - **Assignment #4**
6	02/27	- Traffic Control and Analysis of Signalized Intersections Part 1 (Chapter 7.1~ 7.3) - Traffic Control and Analysis of Signalized Intersections Part 2 (Chapter 7.4~ 7.5)
7	03/06	- Lab: Highway Capacity Software – Intersection Analysis (CEE Computer Lab, Colton Hall 3rd Floor Room 318) - **Assignment #5**
8	03/13	- Lab: Traffic Simulation using VIISSIM software (CEE Computer Lab, Colton Hall 3rd Floor Room 318)
9	03/20	Spring Recess – No class!
10	03/27	- **Exam #2** - Road Vehicle Performance: Braking Forces, Stopping Distance (Chapter 2)
11	04/03	- Geometric Design of Highways: Introduction (Chapter 3.1 – 3.2) - Vertical Curves – Fundamentals (Chapter 3.3) - **Assignment #6**
12	04/10	- Vertical Curve Design and Stopping Sight Distance, Part 1 (Crest and Sag Vertical Curves) (Chapter 3.3) - Vertical Curve Design and Stopping Sight Distance, Part 2 (Passing Sight Distance and Sag Curves with Overpass) (Chapter 3.3) - **Assignment #7**
13	04/17	- Horizontal Curves – Fundamentals (Chapter 3.4) - Horizontal Curve Design – Design Speed and stopping Sight Distance Considerations (Chapter 3.4) - **Assignment #8**
14	04/24	- Horizontal Curve Design – Design Speed and Stopping Sight Distance Considerations (Chapter 3.4) - Geometric Design of Highways: Combined Vertical and Horizontal Alignment (Chapter 3.5) - **Assignment #9**
15	04/31	- Group Project Presentations
16	TBD	- **Exam #3 (Final Exam)**

Course Objectives Matrix - CE 350 Transportation Engineering:

Strategies and Actions	Course Student Learning Outcomes	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Methods/Metrics
Course Objective 1: Understand the principles and practices of transportation engineering and urban transportation planning.				
Discuss public transportation facilities.	Demonstrate the principles and practices of transportation engineering and urban transportation planning	2, 7	1, 2	Discussions and homework.
Use analytical tools to design transportation facilities.		2, 7	1	Homework, hands-on laboratory exercises, group project, exams.
Implement design of transportation facilities.		2	1, 2	Graded group project.
Course Objective 2: Understand the interactions between transportation planning and land use planning, economics, social planning and master plans.				
Link transportation to land use, economics, social planning, and master plans.	Recognize the interactions between transportation planning and land use planning, economics, social planning and master plans.	2, 4	2, 3	Homework and exams.
Develop interactions between each of the above factors.		2, 4	2, 3	Homework and exams.
Give examples of growth due to improvement in transportation.		2	2, 3	Discussions, exams, and homework.
Course Objective 3: Gain the facility of utilizing the state-of-the-art techniques and models in the field.				
Introduce need for forecasting models.	Employ state-of-the-art techniques and models in the field.	1, 2, 7	1, 2	Homework and exams.
Discuss application of models.		1, 2, 7	1, 2	Homework and exams.
Assign large scale problems.		1, 2, 7	1, 2	Graded group project.
Course Objective 4: Have the capability to identify and solve transportation problems within the context of data availability and limitations of analysis tools.				
Discuss how to obtain data necessary for transportation studies.	Identify and solve transportation problems within the context of data availability and limitations of analysis tools.	7	1, 2	Homework, graded group project.
Match up analysis tools, data sets and problems to solve.		2, 7	1, 2	Homework, laboratory exercises, group project.
Introduce problems to be solved using analysis tools.		2, 7	1, 2	Homework, group project, exams.

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 scholarship 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:

- **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.
- **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.
- **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:

- an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
- 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
- an ability to communicate effectively with a range of audiences
- 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
- 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
- an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusion
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated 1/6/2025