CEGE 3201: Transportation Engineering

Fall 2019

1 Instructors

Dr. Michael Levin
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Course meeting time: T/Th 1:00 PM–1:50 PM, Zoom 937 8531 1408

TA session: (a) Th 2:30 PM – 3:20 PM, Zoom 994 0569 1430
(b) Th 4:00 PM – 4:50 PM, Zoom 994 0569 14309

Office hours: 140 CEGE: M 10–12pm, W 4–5pm, F 3–4pm or by appointment
Course website: https://canvas.umn.edu/courses/193546

Teaching assistant: Te Xu
Email: xutetelove01@gmail.com
Office:
Office hours: 275 CEGE: W 11:15 AM – 12:15 PM or by appointment

2 Course description

This course is an introduction to solving transportation problems through analysis and design of transportation models. Topics include travel demand modeling, mode choice, network analysis principles, and transit operations; traffic flow principles, level of service, and signal control; and roadway geometric design. After completing this course, you will have a fundamental understanding of transportation system problems and concepts, as well as experience and tools to work with transportation data. This course also emphasizes using prerequisite mathematics, physics, and computer skills for engineering problem-solving.

3 Course format

Unlike other engineering courses you may have taken, this course will primarily follow a problem-based learning format. I will introduce transportation problems to you during the lecture. These problems will be solvable using the prerequisite skills (calculus, probability & statistics, kinematics, and programming), and much of the class time will be spent solving these problems. I will also be assigning you realistic transportation problems to solve. In the lecture, I will give you simplified versions so that you can develop concepts, but you will solve more realistic versions for assignments. **The purpose is for you to learn problem-solving skills, not just solution methods.** My goal is for you to develop the concepts

of the solution during class, be introduced to relevant computer tools in the lab session, then solve realistic transportation problems as homework. Every student is expected to participate in class discussions of problems and solutions. Active engagement with problems in-class has been shown to increase learning and retention[1].

3.1 Prerequisites

The prerequisites for this course are CEGE 3101, CEGE 3102, and Phys 1301. As the semester progresses, we will use geometry, calculus, probability and statistics, and kinematics. Some of the homeworks and lab assignments will require spreadsheet work or programming in Matlabs. This class will not make use of extensive technical knowledge from any of the prerequisite courses. For instance, you will encounter basic calculus-based kinematic motion equations, but not momentum or energy problems. Rather, the challenge is in learning which techniques apply to which problems. **Success in CEGE 3201 relies on understanding the underlying core concepts and not just the calculations involved.** If it has been a while since you took these courses, you may find it worthwhile to review the prerequisites before the semester gets too busy.

3.2 Course materials

The textbook for this course is *Principles of highway engineering and traffic analysis*, 7$^{\text{th}}$ edition, by Fred Mannering, Walter Kilareski, and Scott Washburn. Readings will be assigned at the end of each lecture to supplement material covered in class. The textbook also contains lookup tables for certain calculations, which we will reference in-class and on assignments. The cheapest new version I have seen is on the Wiley website. Older editions are probably usable, but you should find other ways to obtain the most recent versions of lookup tables and behavioral parameters for engineering problems.

Unfortunately, no recent textbook on transportation engineering covers all of the class material. Slides will be posted on the course website before each class. Slides contain links to solutions to in-class problems. At the end of each set of slides are reading assignments and suggested practice problems. For supplementary reading that covers certain topics in greater depth, I also recommend `https://en.wikibooks.org/wiki/Fundamentals_of_Transportation`, available online for free.

Assignments will be posted on Canvas and announced in class. Schedule changes will be announced on Canvas. By default, Canvas should email you when an announcement is posted. If you have that option disabled, you should check Canvas regularly for assignments and announcements.

[1] Deslauriers, L., McCarty, L., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences*.

4 Assessment

Grades will be determined entirely by performance on assignments.

Category	Weight
Homework assignments	90%

The +/− grading system will be used. At the end of the course, I may apply a curve if needed to ensure a proper grade distribution. Please feel free to contact me at any time during the semester to discuss your progress to date.

Homeworks will be challenging, and you should expect them to require significant time and effort. Do not wait until the night before to start! Understanding the engineering equations will not be sufficient to succeed on the homeworks; you must master the concepts to answer correctly. You are encouraged to work together on homeworks, but **you must write your solutions individually, in your own words**. You may use spreadsheets or other computer software on the homeworks. Email your spreadsheets and programs to me as part of the homework submission.

Late homeworks will be penalized by 30% (maximum score 70%), and will only be accepted up to one week late so that I can post solutions online. **Do not look at solutions from past semesters. I consider this academic dishonesty.** Some assignments will use similar solution methods as past problems, and reviewing past solutions will deny you the opportunity to discover the solution yourself.

Although attendance is not a component of the final grade, succeeding in this course requires full understanding of the concepts, and few students can achieve this without regular class attendance and participation. The class format (problem-based learning) is designed to force you to study and master the concepts during class.

5 Miscellania

The University of Minnesota provides, upon request, appropriate academic adjustments for qualified students with disabilities. For more information, contact the Disability Resource Center.

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including failing the course and/or dismissal from the University. Since dishonesty harms the individual as well as other students, policies on scholastic dishonesty will be strictly enforced.

Students may withdraw from a class within the first 2 weeks of class without penalty. Between 2 weeks and 10 weeks, students may 'W' drop a course without seeking approval. After 10 weeks, withdrawing requires an academic policy petition.

Additional official policy statements are available online.

6 Schedule

A tentative class schedule is shown below, but dates and topics may change.

Tuesday		Thursday	
1/18 Orientation	**1**	1/20 Trip generation	**2**
1/25 Mode choice	**3**	1/27 Shortest path	**4**
2/1 Trip distribution	**5**	2/3 Trip distribution	**6**
2/8 Traffic assignment	**7**	2/10 Traffic assignment	**8**
2/15 Traffic assignment	**9**	2/17 Public transit	**10**
2/22 Public transit	**11**	2/24 Driver behavior	**12**
3/1 Traffic flow theory	**13**	3/3 Traffic flow theory	**14**
3/8 *Spring break*		3/10 *Spring break*	
3/15 Traffic flow theory	**15**	3/17 Traffic flow theory	**16**
3/22 Queuing theory	**17**	3/24 Queueing theory	**18**
3/29 Capacity / Level of service	**19**	3/31 Traffic signals	**20**
4/5 Traffic signals	**21**	4/7 Traffic signals	**22**
4/12 Traffic signals	**23**	4/14 Vertical geometric design	**24**
4/19 Vertical geometric design	**25**	4/21 Vertical geometric design	**26**
4/26 Lateral geometric design	**27**	4/28 Lateral geometric design	**28**