

**The University of Utah**  
**Department of Civil and Environmental Engineering**

**CVEEN 7545 Traffic Operation Analysis**  
**Syllabus for Fall 2019**

**Class:** CVEEN 7545 Traffic Operation Analysis

**Time:** Monday 3:00 p.m. – 5:20 p.m.

**Location:** Layton Auditorium (MCE 1001)

**Description:** Two-thirds of urban vehicle-miles of travel in the U.S. are on signal-controlled roadways. Traffic control systems are designed and installed to achieve two primary goals – safety and efficiency – by providing orderly movement in all directions. However, present traffic control systems are by no means a perfect solution for delay or crash problems on urban roads. A poorly designed traffic control system can have a negative impact on traffic operations by lengthening vehicle delay, increasing the rate of vehicle crashes, and introducing disruptions to traffic progression. On a national average, poor signal timing causes up to fifteen percent excess vehicle delay, sixteen percent excess vehicle stops, seven percent excess travel time, and nine percent excess fuel consumption. A previous study reported that there are roughly 300,000 traffic signals in the U.S. and about 75 percent of them could be improved easily and inexpensively. This indicates that huge benefits are potentially obtainable through traffic control system optimizations. In recent years, traffic detectors have been intensively deployed in major highway systems across the country. These sensors generate tremendous traffic data that are extremely valuable for traffic management, forecast, and control. How to manage the data efficiently and produce the most useful information out of them have been crucial challenges faced by traffic professionals. Therefore, this course introduces important concepts and principles of traffic system design, geometric characteristics, and operation of streets and highways, including planning aspects, traffic design and control, and highway safety. Simulation modeling and application of these concepts and principles to actual situations will be emphasized to evaluate traffic system performance.

**Objectives:** The objective of this class is to introduce traffic system design concepts, control components, management strategies, and tools for evaluating their effectiveness. With the instructions, assignments, and projects in this course, students are expected to learn traffic system control devices, working principles, and popular algorithms. Additionally, the VISSIM traffic simulation package will be introduced in great detail so that students can use it for evaluating the performances of traffic operation plans. Major topics of this course include:

- (1) traffic control system components;
- (2) timing plan design;
- (3) traffic flow characteristics;
- (4) driver behavior models;
- (5) advanced control algorithms; and

(6) traffic control system modeling and simulation.  
 Knowledge on the above subjects and traffic simulation skills are considered indispensable for modern traffic engineering practice.

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**Grading Policy:** Assignments: 20%  
 Projects: 40%  
 Midterm Exam 1: 20%  
 Midterm Exam 2: 20%

Grading	Score Range	Grade
	93-100	A
	90-92	A-
	87-89	B+
	83-86	B
	80-82	B-
	77-79	C+
	70-76	C
	60-69	D
	<60	E

**Course Schedule (Tentative) – Fall 2019**

Week	Day	Date	Topics	Readings	Note
1	M	Aug. 19	Introduction and Course Overview Simulation Theory Fundamentals I	Readers 1, 2 &3	HW#1 out
2	M	Aug. 26	Simulation Theory Fundamentals II and Traffic Simulation Models	Reader 4	
3	M	Sept. 2	Labor Day (no class)		HW#1 due; HW#2 out
4	M	Sept. 9	Traffic Control Introduction (MUTCD), Traffic Controller and Standards	Readers 5&6	
5	M	Sept. 16	Pre-timed Traffic Signal Control, Pre-timed Signal using Synchro and VISSIM	Readers 7&8	HW#2 due, P#1 out
6	M	Sept. 23	Traffic Detectors and Applications	Readers 9,10&11	
7	M	Sept. 30	Midterm I		
8	M	Oct. 7	Fall Break (no class)		
9	M	Oct. 14	Actuated Signal Control	Reader 12	P#1 due, P#2 out
10	M	Oct. 21	Intersection Control Performance Analysis, Signal Control Coordination	Reader 13	

11	M	Oct. 28	Traffic Flow Characteristics and Driver Behavior Models		
12	M	Nov. 4	Roundabout Modeling, Roadway Capacity Analysis		HW#3 out
13	M	Nov. 11	Freeway Simulation Modeling and Calibration		P#2 due, P#3 out
14	M	Nov. 18	Midterm II		HW#3 due
15	M	Nov. 25	Vehicle Actuated Programming (VAP)		
16	M	Dec. 2	Final Project Presentation		P#3 due

**Note:** The syllabus is not a binding legal contract. The instructor may modify it when the student is given reasonable notice of the modification.

# CVEEN 7545 Course Expectations and Policy

## Expectations for Course Work

The work in this course consists of assigned reading, homework and project. All of them are designed to help you achieving the course learning objectives and should be completed on time. Four individual assignments, three projects (both reports, electronic files, and presentations), two midterms, will be employed to evaluate your learning through the course.

**Assigned Reading.** Most lectures have assigned readings (please see the course schedule for details) that you need to finish *before* attending the classes. Though these assigned readings will not be directly evaluated, it will be greatly beneficial to complete reading them on time because they provide important information for you to better understand the class contents.

### Homework

Homework assignments are individual efforts as described in *CVEEN Homework Assignments: Process of Solution and Formatting Requirements* (effective 9/1/2004):

*The completed homework assignments that you turn in for credit must be substantially your own work. It is permissible to discuss the basic concepts and how to solve the problem in a general sense with others prior to working on the assignment. Once you have started a problem, you may ask questions of other students, but the questions should be limited to specific aspects of a problem that you do not understand. It is not acceptable to work on the assignments with another person or in a group where the assignments are worked entirely together. You may get as much help from the Teaching Assistant and Professor for the class as they can legitimately give you during their regularly scheduled office hours or via e-mail (if the Teaching Assistant or Professor is willing to communicate via e-mail). It is not permissible to use either solution manuals or solutions from past classes for homework assignments that are turned in for credit. All assignments must have the following signed pledge at the front of the assignment:*

*On my honor as a student of the University of Utah, I have neither given nor received unauthorized aid on this assignment.*

*If the pledge is missing or is not signed, the assignment will not be graded.*

### **Homework and project reports are due on the due date at the beginning of class.**

Homework deliverables must follow the Departmental formatting and style requirements given in *CVEEN Homework Assignments: Process of Solution and Formatting Requirements*.

The course schedule shows approximate dates for homework assignments and projects. Exact assignment and due dates will be identified during the semester by the instructor and announced during the regularly scheduled classroom meetings.

### Exams

The two midterm exams will be held during multiple, regularly scheduled classroom meetings. Conflict exam requests must be made at least two weeks prior to the exam date and will be decided on a case-by-case basis. The course content included on the exams as well as the exam format will be announced by the instructor during regularly scheduled class periods prior to the exam date. Every class is different in terms of the pace of material coverage. The midterm exam dates on the course schedule are tentative and may be adjusted with ample notification.

### **College of Engineering Guideline**

The College of Engineering Semester Guidelines contain important dates regarding adding, dropping and withdrawing from classes as well as the College Policy regarding repeating courses. Please refer to the details here: <https://www.coe.utah.edu/semester-guidelines>

### **Safety Statement**

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit [safeu.utah.edu](http://safeu.utah.edu).

### **Accessibility**

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. ([www.hr.utah.edu/oeo/ada/guide/faculty/](http://www.hr.utah.edu/oeo/ada/guide/faculty/))

### **Professional Responsibilities**

Students should read the “Student Code” (Policy 6-400: Code of Student Rights and Responsibilities) carefully and know they are responsible for the content. The Policy is located at the following link:

<http://www.regulations.utah.edu/academics/6-400.html>

All students are expected to maintain professional behavior in the classroom setting.<sup>1</sup> Students have specific rights in the classroom, detailed in Section II of the Student Code. The Student Code also specifies academic misconduct, including, but not limited to, cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. The process for resolving any violations of the Student Code, including academic sanctions, is also described.

<sup>1</sup> Discussion threads, e-mails, and chat rooms are all considered to be equivalent to classrooms, and student behavior within those environments shall conform to the Code.

## **Course Policy**

**Late Homework Turn-ins.** You are required to turn in your homework on time. Late homework can be accepted within four days after the due date but will be discounted at 20% per day it is late. For example, if an assignment is due on May 10, and you turn it in on May 12, it would amount to a deduction of 40% for this two-day late assignment. If you turn in on May 15 or after, it will not be accepted and no credit will be given to this assignment of more than four days late.