

ECE 5400: Instrumentation, Signals, and Control in Transportation Applications

Course Description

Interdisciplinary course bringing together electrical engineering tools and transportation applications. Students gain valuable experience working in teams while learning traffic flow, surveillance and control.

Prior Course Number: 675

Transcript Abbreviation: Traf Inst & Theory

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Undergrad, Graduate

Student Ranks: Junior, Senior, Masters, Doctoral

Course Offerings: Autumn

Flex Scheduled Course: Never

Course Frequency: Even Years

Course Length: 14 Week

Credits: 3.0

Repeatable: No

Time Distribution: 3.0 hr Lec

Expected out-of-class hours per week: 6.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites: Prereq: 2020 and 2050, and Math 2415 (415); or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.

Exclusions: Not open to students with credit for 675, CivilEn 6750 (675), or 4750.

Cross-Listings: Cross-listed in CivilEn 5750.

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001

Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Provide students with a teamwork environment that is representative of the work strategies found in industry and research, but rarely in coursework
Address an interdisciplinary topic with a holistic approach that bridges Civil Engineering and Electrical Engineering (and to a lesser degree, other disciplines such as computer science and city planning)

Provide a comprehensive course traffic flow theory, traffic surveillance and traffic control. These studies will form the foundation for a research program on traffic surveillance, traffic flow theory, and traffic control
Introduce the students to managing and manipulating large quantities of raw data. This objective will include basic tasks such as working with analysis tools (e.g., Matlab)
Distill meaningful information from large quantities of sensor data. Applications will include traffic control, traffic flow theory, and driver behavior (e.g., car following models)

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Traffic flow theory- what are we monitoring and why?	8.0							
Existing traffic surveillance and control- hardware and software- how do we monitor and control traffic today and what are the shortcomings?	8.0							
Signals, shocks and disturbances- the waves that propagate through the traffic stream how do they travel and how do they affect traffic?	8.0							
New traffic surveillance technologies and traffic control methods	8.0							
Working with data analysis tools, e.g., Matlab	10.0							

Representative Assignments

Homework assignments will consist of interdisciplinary group projects, drawing on electrical engineering and transportation engineering skills.
Group assignments- Students will work in groups (usually teams of two) on (roughly) five successive group assignments to extract meaningful information from the data. Each group will submit a single report for the given assignment and each member will receive the same single grade. After each assignment the group members will be redistributed
Individual assignments- Individual assignments are meant to test the students' knowledge of basic concepts presented in lecture and readings. These assignments will usually be exercises where the student has to solve a problem set. Students will be graded on content and presentation.
Group project- Over the last third of the quarter students are expected to undertake a group project. The group projects will be more involved than the group assignments, students will propose a topic for the instructor to review (to provide feedback on the scope and guidance on the methodology), and then the students will conduct the research on the topic of their choice. The group project will include a hardcopy final report and an oral presentation.

Grades

Aspect	Percent
group assignments	30%
individual assignments	20%
group project	30%
exams and quizzes	20%

Representative Textbooks and Other Course Materials

Title	Author
<i>Traffic Flow Theory Monograph (free, on-line)</i>	published by the Transportation Research Board
<i>Fundamentals of Transportation and Traffic Operations</i>	C.F. Daganzo

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
***	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
***	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
**	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
**	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 and inclusive 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 conclusions
*	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
**	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 and inclusive 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 conclusions
	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Additional Notes or Comments

Updated title, abbreviation, description, prereqs, exclusions, goals and topics to match university format.

Added "or 292 or 294 (Spring 2011) " to prereqs 4/11/12

added contribution to new outcomes 6/18/2019 BLA

Prepared by: Betty Lise Anderson