

## **CE 367 (#15445): HIGHWAY ENGINEERING Spring 2010**

Lecture: 12:30p – 2:00p Tu/Th, Location: 6.406 ECJ

Laboratory: Wed 5:00p-6:00p, Location: 3.402 ECJ

(Note : there are 3 weeks when the Wed lab will change to Fri. They are Feb 19, Feb 29 & Mar 5)

Related Course: Design Seminar Lecture (by Dr. Gilbert) Wed 3:00p-5:00p, in ECJ 1.202

### **I. Office Hours for Dr. Kara Kockelman**

Mondays 12:45 to 2:15 pm & Tuesdays 2:00 to 3:30 pm, 6.904 ECJ

Or, by appointment: 471-0210 (office phone number) & kcockelm@mail.utexas.edu

Note: Tyler Dube (tylerdube@gmail.com) will serve as lead course TA and lab instructor, with lab assistance from Taryn Ficke and several guest lecturers during the semester. Tyler will hold office hours on Mondays from 3:30p-5p in ECJ 3.402 (the Lab location), and be available weekly to assist students with lab projects, exam preparation and homework problems. Additional office hours will be hosted by graduate student Sergey Grebenschikov (grebensc@msu.edu) on Thursdays, from 4 to 6 pm in ECJ 6.706.

### **II. Prerequisites**

According to the College of Engineering Catalog, CE321, Transportation Systems, is a prerequisite for undergraduates intending to enroll in CE367; the consent of the instructor may waive this requirement.

### **III. Add/Drop Dates**

From the 1st through the 12th class day, an *undergraduate student* can drop a course via the web and receive a refund if eligible. From the 13th through the 20th class day, an automatic Q is assigned, no refund; approval from the Dean and departmental advisor is required. From the 21st class day through the mid-semester deadline, approval is required from the Dean, instructor of the course and departmental advisor.

*For graduate students:* From the 1st through the 4th class day, graduate students can drop a course via the web and receive a refund. During the 5th through 12th class day, graduate students must initiate drops in the department that offers the course and receive a refund. After the 12th class day, no refund is given. No class can be added after the 12th class day. From the 13th through the 20th class day, an automatic Q is assigned with approval from the Graduate Advisor and the Graduate Dean. From the 21st class day through the last class day, graduate students can drop a class with permission from the instructor, Graduate Advisor, and the Graduate Dean. Students with 20-hr/week GRA/TA appointment or a fellowship may not drop below 9 hours.

### **IV. Evaluation Plan**

The College of Engineering Course/Instructor Survey will be used as the basic evaluation tool. All students are encouraged to submit written comments during this survey.

### **V. Grading**

For purposes of grading, the performance of students enrolled in CE 367 or 391M will be assessed

using the following scoring system:

|                  |  |
|------------------|--|
| Homeworks        | 25% of score/grade                                 |
| Lab Projects     | 20% (10% for regular labs & 10% for final project) |
| In-Class Midterm | 22.5%  |
| Final Exam       | 32.5%  |

\* Generally, there are 9 or 10 regular homeworks in this course, one or two of which are essay assignments. The instructor reserves the right to consider Class Participation & Quizzes in the evaluation of a student's performance. These two items may contribute up to 8% of a student's grade, falling uniformly across categories. Lab participation will count toward the Design Project's grading. Exam dates are discussed below.

## VI. Homework Assignments

Homework problems will be assigned weekly and must be handed in at the *beginning* of the period in which they are due. After this time, they will be considered late and given *no credit*. However, *all assigned problems must be completed* (within 3 weeks of their due date and at least one week before the final exam) or a student's participation score will be adversely impacted. Please note all questions for the grader on your homework before re-submitting it, for added review.

## VII. Laboratory Sections & Design Project

The laboratory sections are intended for instruction and hands-on learning of computer-aided design (CAD) software. The roadway-design software used is that favored by the state DOT (TxDOT): GEOPAK. This software runs through MicroStation (a common CAD package). All lab assignments are provided via the Web at [http://www.cae.utexas.edu/prof/rioux/ce367\\_200901/GeometricDesignLab.htm](http://www.cae.utexas.edu/prof/rioux/ce367_200901/GeometricDesignLab.htm) (and these can be read while working on-line).

A number of courses in the Civil Engineering (CE) program curriculum have been designated as "design synthesis" courses. This is one of those courses, so your final project requires recognition of engineering standards of safety and quality, alongside various real-world constraints, including economic, environmental, social, political, ethical, and public health factors, constructability and sustainability.

The design project for this course involves the computer-aided geometric design and drafting of a highway interchange/ramp section. The design project is to be in teams of two and will constitute a significant component of the course. An oral presentation and a written report of the design project will be completed by each student team.

## VIII. Examinations

The in-class midterm is *tentatively* scheduled & the final exam is formally scheduled for the following dates:

|              |                           |
|--------------|---------------------------|
| Midterm*     | Thursday, March 4         |
| Final Exam** | Wednesday, May 12, 2-5 pm |

\* The instructor reserves the right to periodically administer, grade, and use in student evaluation "pop"/unannounced quizzes. Students should come to class prepared to contribute to each class's lecture and discussion by staying up-to-date with homeworks and reading.

\*\* If the majority of the students elect to make the final exam into a second in-class exam, given late in the semester, the instructor will seek to change this.

Make-up exams will *not* generally be given to any student. If a student is absent from a scheduled exam due to medical or other problems beyond her/his control and can plainly demonstrate this, the instructor can choose to give the student a completely different exam, additional assignments, and/or change the weighting of the student's various graded contributions.

## **IX. Text and Reader/Notes**

The Course Packet can be purchased for under \$35 at IT Printing at 512 West MLK, 512-476-6662. The Packet consists of selected pages from AASHTO's *A Policy on Geometric Design of Highways and Streets* (Fifth Edition, Copyright 2004, American Association of State Highway and Transportation Officials). This book is also called the "Green Book" and is held in the Engineering Library's reserves area, both electronically and in hard copy.

Lecture slides are available online (at

[www.ce.utexas.edu/prof/kockelman/public\\_html/ce367lecture1\\_5.pdf](http://www.ce.utexas.edu/prof/kockelman/public_html/ce367lecture1_5.pdf), [ce367lecture6\\_10.html](http://www.ce.utexas.edu/prof/kockelman/public_html/ce367lecture6_10.html), [ce367lecture11\\_15](http://www.ce.utexas.edu/prof/kockelman/public_html/ce367lecture11_15.pdf), [ce367lecture16\\_20](http://www.ce.utexas.edu/prof/kockelman/public_html/ce367lecture16_20.pdf), & [ce367lecture21+.pdf](http://www.ce.utexas.edu/prof/kockelman/public_html/ce367lecture21+.pdf)) for students to print (double-sided is best, and in color). Chapters from the latest *Highway Capacity Manual* (HCM) may also be needed later in the course, depending on student end-of-semester topic suggestions, so appropriate HCM readings may be assembled in the form of a course packet for students to purchase from a local copier. Since the course textbook does not cover all subjects in great depth and does not include example problems, students may wish to consult other texts for further reading. A highly recommended text for design is Garber and Hoel's *Traffic and Highway Engineering* (any edition). In addition, various design manuals from state departments of transportation may prove very helpful; for example, Texas' Design Manual can be found at <http://manuals.dot.state.tx.us/dynaweb/>. For more information on traffic operations, students may wish to consult the complete *Highway Capacity Manual* (by TRB), Garber and Hoel's textbook, C. F. Daganzo's *Fundamentals of Transportation & Traffic Operations* (1997) and/or A.D. May's *Traffic Flow Fundamentals* (1990). For more information on signage, islands, work zones, or other traffic-control-device situations, students should consult a recent *Manual on Uniform Traffic Control Devices*.

## **X. Other Information**

1 U.T. Austin provides upon request appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Office of the Dean of Students at 471-6259 (or 471-4241, TDD) as soon as possible to request an official letter outlining authorized accommodations. The College of Engineering also has its own Director of Students with Disabilities, who can be reached at 471-4321.

2 According to *The General Information Catalog* "a student who is absent from a class or examination for the observance of a religious holy day may complete the work missed within a reasonable time after the absence, if *proper notice* of the planned absence has been given". The deadline for proper notification of such an absence is the fifteenth day of the semester.

3 Students in CE367 are encouraged and authorized to work on homework assignments together and prepare for exams together. However, all written work handed in by a student is considered to be his/her own work, prepared without *unauthorized* assistance. To ensure your actions never compromise your and our class's integrity, please visit <http://www.utexas.edu/depts/dos/sjs/academicintegrity2.html>. Students who violate University rules on scholastic dishonesty (*e.g.*, anything which gives unfair academic advantage to a student) are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. An "F" grade will be the recommended penalty in most cases of scholastic dishonesty. One should refer to the Student Judicial Services website at <http://www.utexas.edu/depts/dos/sjs/> to access the official University policies and procedures on scholastic dishonesty as well as further elaboration on what constitutes scholastic dishonesty.

## **XI. Course Content & (Tentative) Outline of Topics and Dates of Presentation**

CE 367 covers various aspects of transportation relating to the design of roadways. The course *objectives* are that students are able to design safe and efficient roadways, are familiar with roadway-

design standards, and are comfortable with computer-aided highway design tools. Primary topics include driver behavior, vehicle response, roadway and interchange design, and roadway construction. A great variety of other topics apply as well. Given time constraints, students will be permitted to select final topics covered in class. A tentative scheduling of the course topics is shown below.

| <b>Lesson # &amp; TOPICS TO BE COVERED</b>                             | <b>Relevant Reading</b>              |
|--|--------------------------------------|
|  | <i>Green Book 5<sup>th</sup> ed.</i> |
| 1 Introduction & Overview of Course                                    | -                                    |
| 2 Highway Functions & Design Vehicles                                  | pp 1-46                              |
| 3 Driver & Traffic Characteristics                                     | 46-74                                |
| 4 Speed Criteria & Highway Flow  | 66-83                                |
| 5 Sight Distances: Stopping, Passing, & Decision                       | 109-128,224-229                      |
| 6 Horizontal Alignment: Circular Curves & Superelevation               | 131-167                              |
| 7a Slip, Roll & Banking  | 143-193                              |
| 7b Superelevation Development  | 143-193                              |
| 8 Compound Curves & Spirals  | 175-193                              |
| 9 Vertical Alignment   | 265-280                              |
| 10 Special Lanes   | 231-265                              |
| 11 Project Plans & Design Sequence                                     | 280-288                              |
| 12 Design Project Overview   |                                      |
| 13 Cross Sections: Lanes, Shoulders, Cross-Slopes, Pavements & Medians | 305-319, 337-339                     |
| 14 Cross Sections: Barriers & Clear Roadsides                          | 318-336                              |
| 15 <i>Review</i> for Midterm Exam                                      |                                      |
| <b>- Midterm Exam</b>  |                                      |
| <b>** SPRING BREAK **</b>  |                                      |
| 16 Intersections., Channelization, Left Turns, & Roundabouts           | 555-649                              |
| 17 Sight Distances at Intersections                                    | 650-741                              |
| 18 Interchange Types & Distinctions                                    | 743-807                              |
| 19 Exit & Entrance Ramp Design   | 823-867 & HCM Ch. 24                 |
| 20 Designing Away Death: Crash Exposure, Frequency, Severity           |                                      |
| <b><i>Students' Choice of Lecture Topics...</i></b>                    |                                      |
| 21 Freeway Level of Service (LOS) & Capacity Calculations              | 84-88 & HCM Ch. 13 &                 |
| 22 Two-lane Highway & Signalized Intersection LOS                      |                                      |
| 23 Weaving Segments LOS  |                                      |
| 24 Roadway Costs   |                                      |
| 25 Residential Street Design & Parking Lots                            |                                      |
| 26 Lighting: Open Roadways & Tunnels                                   | 348-356                              |
| 27 Drainage: Curbs, Channels, & Culverts                               | 319-329                              |
| 28 Highway Continuity, Uniformity, & Lane Balance                      | 807-823                              |
| 29 Earthwork Calculations  |                                      |
| 30 Designing for Pedestrians & Cyclists + ADA                          | 96-100, 357-367, 396-398             |
| 31 Assorted Topics (Work Zones, Motorcycles, Tunnels, Noise...)        |                                      |
| Last Class Review for Final Exam                                       |                                      |
| Lab Design Project Presentations                                       |                                      |
| May 12, 2-5 pm <b>Final Exam</b> (if given after semester)             |                                      |