TTE 4004 - TRANSPORTATION ENGINEERING

Course Description: This course provides an introduction to highway engineering and traffic analysis. Topics covered include an introduction to the significance of highway transportation to the social and economic underpinnings of society, road vehicle performance, geometric design of highways, traffic flow an queuing theory, highway capacity and level of service analysis, traffic control and analysis at signalized intersections, and travel demand and traffic forecasting.

Course Objective: The objective of this course is for students to gain a solid understanding of the principles of highway engineering and traffic analysis. This course will present a large number of practical problems, and in sufficient depth, such that the student will be capable of solving real highway-related problems.

Instructor: Dr. Scott Washburn  
Department of Civil and Coastal Engineering  
512-E Weil Hall  
Office Hours: Tues, Wed: 10:00 – 11:30 AM  
Email: swash@ce.ufl.edu

Meeting Location and Times: Mechanical & Aerospace Engineering Building (MAEB), Room 211; M, W, F; 7th Period (1:55 – 2:45)

Course Website: http://transportation.ce.ufl.edu/courses/tte4004

Course Requirements:

1. Six problem-oriented assignments. The objective of these assignments is to assist in the learning of course material, so discussion of assignments among students is encouraged.

2. Six in-class design problems. These are comprehensive problems covering the major topics of each chapter. These will be worked on in class, with the assistance of the instructor. They are to be completed in groups (2-3).

3. Six quizzes. These quizzes will be closed-book, consisting of 4-6 qualitative questions addressing major concepts of the chapter, and one quantitative question similar to a homework problem and/or a component of the in-class design problem.

4. One final exam. This exam will be open-book and open-notes. The exam will consist of 3-5 comprehensive quantitative problems that relate to any of the material covered during the semester.


Class Attendance: Students are expected to attend all class meetings. There is no specific penalty for missing a class; however, students are responsible for the content of each lecture, which may or may not be contained in the textbook. Furthermore, make-up quizzes or exams will not be given except in the case of a documented personal or family illness/emergency. In-class design problems are expected to be
worked on during the scheduled class time; thus, you must be present during these class sessions to receive credit for these assignments.

**Class Demeanor and Etiquette:** This should follow the rules of common sense. Students are encouraged to participate in class discussion and to initiate such discussion whenever they feel that they or the class could benefit from a dialog with the instructor. Other actions that disturb the class are strongly discouraged. Use of a laptop for note-taking is acceptable, but not for engaging in chat room discussions, E-mail, or surfing the web. *Cell phones and pagers must be turned off before the class begins* (if you need it for potential emergency notification, please see me before class to discuss).

**Grading:** Grades will be given at the end of the semester based only on the work completed during the semester. Only homework assignments and design problems received by the due date (5:00 PM) will be eligible to receive full credit. Homework assignments will be accepted until the beginning of the next lecture period (1:55 PM), but will only be eligible to receive up to 90% of the original maximum. No credit will be given for assignments turned in after that period. If you choose to collaborate with a classmate on the homework, that is fine, and even encouraged. However, every student is responsible for turning in an individual assignment. The main goal of the homework is for you to learn the concepts of the course, so that you can prove it on the quizzes and exams. So remember that it will be in your best interest to understand all of the assigned problems, even if collaborating with another individual.

**Grade Distribution:**

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<tbody>
<tr>
<td>Problem assignments</td>
<td>20%</td>
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<tr>
<td>In-class design problems</td>
<td>20%</td>
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<tr>
<td>Quizzes</td>
<td>30% (lowest quiz score dropped)</td>
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<td>Final Exam</td>
<td>30%</td>
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<td>Extra Credit Field Trip</td>
<td>2.5%</td>
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**Final Grading Scale:**

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<tr>
<th>Percentage of Available Points</th>
<th>Final Grade</th>
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<tr>
<td>92+ %</td>
<td>A</td>
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<tr>
<td>86-92 %</td>
<td>B+</td>
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<tr>
<td>80-86 %</td>
<td>B</td>
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<tr>
<td>74-80 %</td>
<td>C+</td>
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<td>70-74 %</td>
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<td>66-70 %</td>
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<td>62-66 %</td>
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**University Policies**

**Honesty Policy:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others. The full text of the University’s policy may be found on the UF web site at [http://www.dso.ufl.edu/judicial/procedures/honestybrochure.php](http://www.dso.ufl.edu/judicial/procedures/honestybrochure.php)
Accommodations for students with disabilities: Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- SHCC Mental Health, Student Health Care Center, 392-1171, Personal Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Software Use: All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.
Subject Areas and Learning Objectives

Introduction

- Transportation and Society
- Role of civil engineering in the planning, design, construction, operation and maintenance of highways and associated transportation facilities and services.

Learning Objective: This portion of the class provides some general background information on transportation. This information is intended to give the student a basic knowledge of some of the fundamental issues in transportation. The primary objective is to get students to start thinking about transportation critically and not accept, at face value, the ideologic view of transportation that is often portrayed in the popular press and espoused in political jargon.

Road Vehicle Design and Performance

- Resistance
- Acceleration
- Deceleration
- Braking Theory

Learning Objective: The objective of this portion of the course is to give students a basic understanding of the factors influencing road vehicle performance. This includes familiarity with terms such as power, torque, and gearing as they apply to actual road vehicles and the elements of braking including brake-force proportioning and braking efficiency. After completing this section, the student is not expected to be able to design a vehicle but is expected to have a basic understanding of the performance characteristics and design compromises that are associated with modern road vehicles.

Geometric Design

- Sight Distance Requirements
- Vehicle Cornering
- Horizontal and Vertical Alignments

Learning Objective: The geometric design of highways is the key element in safety and critical in accident litigation. The objective of this chapter is to familiarize students with the elements involved in geometric design and the safety concerns that motivate vertical curve length and horizontal curve design. After completing this section, the student is expected to have a basic understanding of curve design and stationing and have all of the tools to begin a basic design of a highway section, and the background necessary to readily begin learning a variety of computer software packages that assist in the details of highway geometric design.
Traffic Flow and Queuing Theory

- Traffic Stream Parameters and Relationships
- Models of Traffic Flow
- Queuing Theory and Traffic Flow Analysis
- Applied Queuing Models (D/D/1, M/D/1, M/M/1, M/M/N)

Learning Objective: Traffic flow models and queuing theory have broad impacts in transportation engineering and they build upon student’s basic math and probability knowledge. The objective of this section is to give the student a basic understanding of traffic flow and queuing theory and familiarity with the deterministic and probabilistic assumptions made for vehicle arrivals and departures. After completing this section, the student is expected to have the tools to understand basic traffic flow and queuing principles and have the underlying basis for understanding complex queuing systems.

Highway Capacity and Level of Service Analysis

- Level of Service Concept
- Basic Freeway Segments
- Multilane Highways
- Two-lane Highways

Learning Objective: Capacity and level of service analysis serves as a basis for determining highway construction needs and other transportation resource allocations. This section provides students with the knowledge needed to conduct capacity and level of service analyses, familiarity with the terminology used in such analyses, and the background needed to use the Highway Capacity Manual (HCM) capacity and level of service analysis methods.

Traffic Control and Analysis at Signalized Intersections

- Basic Signal Control
  - D/D/1 Queuing
  - Probabilistic Arrivals
  - Traffic Signal Timing

Learning Objective: The objective of this section is to give students a familiarity with the elements of signal control, signal timing, signal timing theory, and terminology. This material is designed to serve as a foundation for a more detailed study of the complexities of traffic signal theory and operation.

Travel Demand and Traffic Forecasting:

- Trip Generation
  - Mode and Destination Choice Models
  - Highway Route Choice Models

Learning Objective: The objective of this chapter is to introduce students to the modern theories underlying traveler trip decisions, and the determination of the modes and routes chosen by travelers. The material in this chapter will also provide students with an important understanding of the current state of traffic forecasting, and some critical insight into the deficiencies of forecasting methods currently used in practice.