

Fall 2010  
Department of Civil and Environmental Engineering

## CEE 509 Transportation Systems Analysis

Engineering Science Credits: 2

Engineering Design Credits: 1

Required or Elective course: Elective

### Catalog Description:

This course focuses on the theory and application of transportation systems analysis (TSA) within the context of the metropolitan transportation planning and decision-making process currently in place in the U.S. An emphasis is placed on the use of TSA perspectives, principles, concepts, and methods in selected components of the process including the formulation of conceptual metropolitan transportation decision-making models; transportation data management; transportation demand estimating; urban activity analysis; transportation supply and performance analysis; transportation systems and project evaluation; and transportation investment programming and priority setting. A special effort is made to review the merits, challenges, and limitations of using TSA perspectives and concepts in the metropolitan transportation planning process and its various components.

Pre-requisites: CEE 310 or equivalent

Credit Hours: 3

### Textbook(s):

- G** Gomez-Ibanez, Jose, William B. Tye, and Clifford Winston (editors). *Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer*, Brookings Institution Press, 1999. ISBN 0-8157-3182-5 (Available in UMass library; Ebook available from the UMass library website)
- S** Sheffi, Yosef. *Urban Transportation Networks: Equilibrium Analysis with Mathematical Programming Methods*, Prentice-Hall, 1985, ISBN: 0-13-939729-9. (Available for download at [http://web.mit.edu/sheffi/www/selectedMedia/sheffi\\_urban\\_trans\\_networks.pdf](http://web.mit.edu/sheffi/www/selectedMedia/sheffi_urban_trans_networks.pdf))

Required Readings:

- M** Manheim, Marvin. *Fundamentals of Transportation Systems Analysis, Volume 1: Basic Concept*, The MIT Press, 1979, ISBN: 0-262-13129-3. (Available in UMass library; Prologue and Chapter 1 are available online at <http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=10223&mode=toc>)
- MM** Meyer, Michael D. and Eric J. Miller. *Urban Transportation Planning*, Second Edition, McGraw Hill, 2001. ISBN 0-07-242332-3 (Available in UMass library; Chapter 5.4 and part of Chapter 8 available through ereserve. <http://ereserves.library.umass.edu/eres/courseindex.aspx?&page=search>; Password required)
- DN** de Neufville, Richard. *Applied Systems Analysis: Engineering Planning and Technology Management*, McGraw-Hill, 1990, ISBN: 0-07-016372-3. (Available online at [http://ardent.mit.edu/real\\_options/ASA\\_Text/asa\\_Text\\_index.html](http://ardent.mit.edu/real_options/ASA_Text/asa_Text_index.html))

### **Optional Background Readings:**

#### **Microeconomics:**

Nicholson, Walter and Christopher Snyder, *Microeconomic Theory: Basic Principles and Extensions*, 10<sup>th</sup> Edition, South-Western College Publishing, 2007 (UMass library has 2<sup>nd</sup> edition, Dryden Press, 1978)

Parts I, II, and IV

#### **Probability and Statistics:**

Larsen, Richard and Morris Marx, *An Introduction to Mathematical Statistics and its Applications*, 4<sup>th</sup> Edition, Prentice Hall, 2005 (Mount Holyoke library has 2<sup>nd</sup> edition, Prentice Hall, 1986)

Chapters 1-6 and 11

DeGroot, Morris and Mark Schervish, *Probability and Statistics*, 3<sup>rd</sup> Edition, Addison Wesley, 2002 (Available in Amherst College library)

#### **Econometrics:**

Pindyck, Robert and Daniel Rubinfeld, *Econometric Models and Economic Forecasts*, 4<sup>th</sup> Edition, McGraw-Hill, 1998 (Available in Amherst College library)

Greene, William, *Econometric Analysis*, 6<sup>th</sup> Edition, Prentice Hall, 2007 (Smith College library has 5<sup>th</sup> edition, Prentice Hall, 2003)

Chapters 1, 2, and 6

### **Attendance policy:**

Students are expected to attend each class and **arrive on time**. Each student is responsible for the material covered and for all assignments made in class whether or not he or she attends the class. ***Attendance will be considered in assigning final grades.***

Students are responsible for taking exams at the scheduled times, to know the location that the exam will be given, and to make alternative arrangements in advance if a legitimate reason exists for not being able to take an exam. In considering whether to grant an excuse for an absence caused by illness or other extenuating non-academic reasons, faculty have the right to require formal, written documentation, within the limits of the health care provider's policy. (See Excuses for Health Reasons, under Administrative Policies & Procedures). **No make-up exams** will be given for un-excused absences.

State law requires that the University excuse any student who is unable to attend classes or participate in any examination or study because of religious observance. Students have the right to make up examinations or study that they miss because of religious observance without any adverse or prejudicial effects. Therefore, students have an obligation to inform their instructor, in advance, of the days on which they may be absent for religious reasons. Students should inform their instructor in writing of the days they will be absent as early in the semester as possible and always prior to the day(s) on which they will be absent for religious reasons.

### **Academic honesty policy:**

The student will be required to use published and unpublished literature in preparing class assignments and laboratory reports. Literature includes books, reports, papers, articles, speeches/oral presentations, interviews, and Internet Web Sites. **Plagiarism in any form will not be tolerated and will result in a grade of zero.** Plagiarism includes, but is not limited to, the following:

- Using thoughts or words of others and representing them as your own, including copying text from other sources without attribution. Direct quotation of other source material may be used if it is highlighted by quotation marks and/or italic font, and the source is acknowledged. Plagiarism also includes the description of concepts or ideas which you have taken from other sources, not copied word for word, but for which you do not attribute the source.
- Copying of papers prepared by other students, regardless of the source.
- Submitting a paper, and representing it as your own work, which was prepared by others.
- Downloading text and figures from an Internet Web Site which you do not attribute the source.

The student will be instructed on methods for proper referencing of cited literature using Transportation Research Board (TRB) format (see TRB Web Site).

**Assessment Methods (grading and instructor feedback):**

Assignments: 30% (Assignments have non-equal lengths and thus weights)  
Quizzes: 40% (in-class, open book/open notes)  
Term Project: 30%

**Course Performance Indicators (CPI's):**

1. I can apply the demand-service equilibrium principle to solve a passenger or freight transportation system problem.
2. I can identify the critical issues of the US transportation system.
3. I can apply the Logit model to predict travelers' mode choices.
4. I can understand the four-step travel demand forecasting models and interpret sensitivity analysis results from policy changes
5. I can solve a user equilibrium problem in a transportation network.
6. I can solve a system optimal problem in a transportation network.
7. I can use the benefit-cost ratio method to select a transportation project.
8. I can work with teammates and present a course project in both written and oral formats

**Program Outcomes from ABET Criterion 3– (a-k) addressed in the course:**

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (e) an ability to identify, formulate, and solve engineering problems
- (g) an ability to communicate effectively
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues

**Mapping of Course Performance Indicators to Program Outcomes:**

<b><u>CPI's</u></b>	<b><u>ABET (a-k) Mappings</u></b>
1	a,e
2	g,i,j
3	a,e
4	a,e
5	a,e
6	a,e
7	a,e
8	a,e,g,i,j

## Class Schedule

No.	Date		Topic	Reading	Assignment		Term Project
					Out	In	
Introductory Lectures							
1	Sep	7	Introduction to Transportation Systems	M0, 1 Handout			
2		9	Modeling Transportation Systems		1		
Demand Analysis							
3		14	Consumer Theory	G2			
4		16	Discrete Choice Analysis I	G2			
5		21	Discrete Choice Analysis II		2	1	
6		23	Travel Demand Modeling I	MM 5.4 Handout			Phase I Out
7		28	Travel Demand Modeling II				
8		30	Travel Demand Modeling III				
9	Oct	5	Urban Activity Systems	Handout			
Transportation Costs							
10		7	Transportation Costs I	G3			Phase I In
11		14	Transportation Costs II	G3	3	2	Phase II Out
Network Equilibrium Analysis							
12		19	Network Equilibrium	S1			
13		21	<b>Quiz 1</b>				Phase II(1) In
14		26	Constrained Optimization	DN3			
15		28	Shortest Path Algorithm	S5.3	4	3	
16	Nov	2	User Equilibrium I	S3			
17		4	User Equilibrium II	S3			
18		9*	System Optimum I	S3			
19		10	System Optimum II	S3			Phase III Out
20		16	Network Congestion Pricing I	G6			
21		18	Network Congestion Pricing II	G6			Phase II(2) In
System Evaluation							
22		23	Basics of Engineering Economy Benefit/Cost Analysis	DN10, 11, 12	5	4	
23		30	Transportation Project Evaluation	MM 8			
24	Dec	2	Term Project Presentation I				
25		7	Term Project Presentation II Course Review				
26		9	<b>Quiz 2</b>			5	

\* Date of this class will be changed based on the survey in the first class.

Term Project: Phase I – Projects and Teams; Phase II – Project Ranking (1) and Prospectus Report (2); Phase III – Final Project Report (due on Dec 18)

**Prepared by:** Song Gao

**Date:** 9/20/2010