***1. Department, number, and title of course***

Department of Civil Engineering, CENG 5363, Transportation Network Analysis

***2. Graduate Course***

***3. Course (catalog) description***

Introduction to planning and optimization techniques for the analysis of transportation networks. Principles of precise algorithms for finding transport network equilibrium flows and applications that relate to these flows. Topics include routing algorithms, user equilibrium traffic assignments, system optimal, stochastic user equilibrium, traffic paradox, origin-destination matrix estimation, and transportation network design.

***4. Prerequisite(s)***

CENG 4351 Traffic Engineering: Operations and Control, CENG 5353 Operations Research and Advanced Mathematics, and CENG 5354 Urban Transportation Planning.

***5. Textbook(s) and/or other required material***

*Transportation Network Analysis*, 1st Edition, by M.G.H. Bell and Y. Iida, Published by John Wiley & Sons, ISBN 0-47-196493-X, 1997.

***6. Course Objectives***

- Develop an organized analytical approach to analyzing and solving transportation network problems.
- Formulate mathematical models describing transportation network flow, stochastic conditions that arise, and network design.
- Apply optimization techniques specialized for such transportation models.
- Analyze the models and solutions to make decisions to improve the performance of the transportation network system.

***7. Topics Covered***

- Introduction to transportation planning, traffic behavior and equilibrium in the planning process, data collection issues, and current issues in traffic system modeling.
- Modeling transportation networks: representation and formulations, network flow modeling, and model properties.
- Routing and network algorithms: network notation and shortest path properties, representing and finding paths, complexity and proofs of correctness.
- Network costs: traffic behavior and mathematical representation.
- Deterministic user equilibrium: existence and uniqueness, solution algorithms, sensitivity, most likely path flow, demand elasticity.
- Stochastic user equilibrium: user path choice, existence and uniqueness.
- Network based demand estimation: most likely trip table, generalized least squares, bi-level programming.
- Network design: bi-level programming, sensitivity analysis.
- Dynamics/uncertainty

***8. Class/laboratory schedule, i.e., number of sessions each week and duration of each session***

LESSONS: 45 @ 50 min (3.0 Att/wk) LABS: None

***9. Contribution of course to meeting the professional component***

3.0 Credit Hours (ES=2.5, ED=0.5)

This is a graduate level transportation engineering course that focuses on transportation network analysis including models, solution algorithms, and implementation techniques used in transportation systems. The course incorporates government and industry standard manuals for engineering planning and analysis. It provides the principles of transportation network analysis and modeling techniques needed in transportation industry planning, operations, management, design, and analysis.

***10. Relationship of course to program outcomes***

The course director's assessment of how this course contributes to the civil engineering program outcomes is listed below. The following scale is used:

1=No Contribution; 2=Small Contribution; 3=Average Contribution; 4=Large Contribution; 5=Very Large Contribution

| CIVIL ENGINEERING PROGRAM OUTCOMES | Course Director Assessment |
|---|---|
| **Program Outcomes**<br>Students who qualify for graduation with a civil engineering masters will demonstrate: | |
| Have specialized knowledge in an area of civil engineering beyond that normally expected at the undergraduate level. | 4 |
| Are adequately prepared for advanced professional practice. | 4 |
| Completing a thesis or design project address a civil engineering problem using sound engineering principles and techniques. | 3 |
| Solve an engineering problem of importance to the State, the Nation, or the Global community. | 2 |
| Demonstrate the ability for independent life-long learning. | 4 |
| Have effective oral, written, and graphical communication skills. | 1 |

***11. Person(s) who prepared this description and date of preparation***

Dr. Wei (David) Fan, E.I.T., Assistant Professor, 6 June 2008.