

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE7011 - Advanced Transportation Network Analysis

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: The course will introduce students to advanced concepts in transportation network analysis including recent advances in dynamic traffic assignment and stochastic network models.

Course Content: Static Traffic Assignment: Equilibrium modeling of transportation networks; Network representation, Wardrop's criteria, mathematical formulation, variational inequality formulation, properties, efficient algorithms and solution techniques, implementation. Generalized Equilibrium Assignment models: User Equilibrium (UE) with variable demand; UE with link interactions and multiuser class, multi-criteria traffic assignment. Transportation network design problem: connectivity and capacity design, applications, bi-level formulation and solution procedure. Dynamic Traffic Assignment: Differences between static and dynamic traffic assignment; Dynamic User Equilibrium and System Optimal Models; Traffic Flow Models for DTA; Alternative formulations (VI, LP, complementarity), Analytical and simulation models, Solution Procedure and modules: time-dependent shortest path algorithm, network loading; OD estimation, Applications of DTA Stochastic Network Analysis and Modeling: Background, definitions and sources of stochasticity, quantification of stochasticity on transport networks, stochastic routing models, stochastic traffic assignment models, Routing and assignment with recourse.

Text Books: NIL

Reference Books:

- Transportation Network Analysis, Bell, Michael G.H.; Iida, Yasunori, John Wiley & Sons, 1997.
- M. Patriksson, The Traffic Assignment Problem: Models and Methods, Topics in Transportation, VSP BV, Utrecht, The Netherlands, 1994.
- Urban Transportation Networks: Equilibrium Analysis with Mathematical Programming Methods, Yusef Sheffi. NJ: Prentice-Hall, 1985.
- Transportation Planning: State of the Art (Applied Optimization), Michael Patriksson (Editor), Martine Labbe (Editor), Springer; 1 edition, 2002.
- Transportation and Network Analysis: Current Trends: Miscellanea in honor of Michael Florian (Applied Optimization), Michel Gendreau (Editor), P. Marcotte (Editor), Springer; 1 edition, 2002.
- Modeling Dynamic Transportation Networks: An Intelligent Transportation System Oriented Approach, Bin Ran, David Boyce, Springer; 2nd rev. ed. Edition, 1996.
- Equilibrium and Advanced Transportation Modelling, P. Marcotte (Editor), Sang Nguyen (Editor), Springer, 1998.
- Network Economics: A Variational Inequality Approach, A. Nagurney, Springer, 1998. • DTA Primer: An introduction to general concept and modeling approaches of Dynamic Traffic Assignment (DTA). Yi-Chang Chiu et al., 2010.

Prerequisite: NIL