

PhD Course

Intelligent Transportation Systems (ITS): Modeling and Analysis

block course: July 13-18, 2015; exact times to be announced

Von Melle-Park 5, room no.: 3136/42

Course Instructor: Professor Pitu Mirchandani, Arizona State University (Visiting Professor, Univ. Hamburg)

Course Value: 2 SWS or 4 LP

Course Overview:

This course will focus on the modeling and analysis of ITS-enabled transportation systems. Topics include:

- introduction to systems approach
- enhancement of transportation through ITS technologies
- transportation planning
- traffic operations, specifically real-time traffic control, and wide-area traffic management
- transit operations
- real-time traffic monitoring
- traveller information systems.

Course Contents: This course will focus on the modeling and analysis of ITS-enabled transportation systems. Topics include (1) enhancement of transportation through ITS technologies, (2) traffic operations, specifically real-time traffic control, and wide-area traffic management, (3) transit operations, specifically how they may be improved with potential ITS data (6) real-time traffic monitoring, (7) traveler information systems and (8) other emerging technologies, such as smart sensors, remote monitoring, and vehicle-infrastructure integrated systems.

Some background in linear algebra, optimization and statistics will be assumed. Individual (or two-person team, with permission) research projects will be required.

Student evaluation will be based on class participation and performance on projects.

Below is a tentative syllabus and schedule, these are subject to change based on student interests.

SYLLABUS (approx. lecture hours given in parenthesis)

- **Day 1:**
 - INTRODUCTION (1 hr): Summary of the course contents. Discuss what are “Intelligent Transportation Systems” and how they differ from non-ITS ones, focusing on the context of modeling and analysis of transportation systems. Framework on how we may look at a transportation system.
 - FUNDAMENTALS OF TRAFFIC FLOW THEORY (1.5 hrs) and NETWORK FLOWS (2 hrs) Review of classical network flow models; continuous flow versus discrete flow; vehicular traffic flow theory; simulation of traffic flow.
 - TRANSPORTATION PLANNING and the ROLE OF ITS DATA (1 hrs): Conventional 4-step approach; its improvement through ITS; network planning and role of traffic equilibrium; some case studies.
 - TRAFFIC OPERATIONS (2 hours): Review of traffic control; ITS and real-time traffic control; ramp-metering; dynamic traffic assignment, incident management,; evacuation management,
- **Day 2**
 - TRANSIT PLANNING AND OPERATIONS (2 hours): Transit systems and vehicle routing; real-time transit operational scheduling and dispatching.
 - TRAVELER INFORMATION SYSTEMS AND TRAFFIC MONITORING (2 hours): ITS data gathering systems; traveler information systems; location of sensors
 - **Individual meetings** for project discussion (3 hours)
- **Day 3**
 - EMERGING ITS TECHNOLOGIES (3 hours): Smart sensors; GPS-based systems; airborne remote monitoring; integrated in-vehicle roadside systems (Connected Vehicles and Automated Vehicles).
 - ADVANCED TRAFFIC OPERATIONS: ITS enhanced traffic control (2 hours)
 - **Individual meetings** for project discussion (2 hours)
- **Day 4**
 - TRANSIT PLANNING AND OPERATIONS (2 hours): Further discussions on Transit systems and vehicle routing; real-time transit operational scheduling and dispatching.
 - NEW RESEARCH IDEAS (2 hours): based on current research and student interests new research ideas will be discussed.
 - Discussions of student projects
- **Day 5**
 - CHALLENGES FOR TRAFFIC FLOW THEORY (2 hours): Some new problems and opportunities for new ITS enabled Active Traffic Management.
 - TRAFFIC SIMULATION MODELING (1.5 hours)
 - **Student presentations of ITS proposals** (3 hours)

How to register:

Please e-mail Julia Bachale: iwi@uni-hamburg.de until May 30, 2015 (Please remember that places are restricted and will be allocated in order of received registrations)