

Spring Semester, 2023-24

Course Code	CIVL4640
Course Title	Introduction to Smart City Economics
Class Time & Venue	Two 1.5-hour lectures per week TBD
Instructor	Sen Li (cesli@ust.hk)
Course Credits	3
Class Quota	50
Prerequisites	None
Course Description	This course will cover economic principles and tools for analyzing the emerging challenging problems in the context of Civil Engineering with a focus on smart city development. The course discusses various economic problems arising in modern power and transport systems through the lens of electric vehicles, renewable energy, mobility-on-demand services, etc. The course will complement the existing course in microeconomics by focusing on engineering applications and offering extensive practical examples within the smart city context. Through lectures and exercises, students will learn state-of-the-art models and tools to identify, formulate, and address challenging problems in smart city development.
Course Objectives	At the end of this course, students will be able to: 1. Identify economic phenomena in Civil engineering; 2. Analyze emerging problems in modern power systems based on economic tools and principles; 3. Formulate economic models for emerging mobility-on-demand services; 4. Quantify the impact of regulation policies on the transportation systems; 5. Recognize the importance and challenge in developing sustainable smart city and familiarize with tools relevant to smart city development.
Topics	➤ Introduction to economic fundamentals in Civil Engineering ➤ Economic principles in modern two-settlement electricity markets ➤ Introduction to ancillary service markets ➤ Economic model of emerging mobility services ➤ Regulations on emerging mobility services
Intended Learning Outcomes (ILOs) of this course	On successful completion of this course, students are expected to be able to: 1. Formulate and solve electricity market problems based on economic models and equilibrium analysis. 2. Formulate and solve economic problems in mobility-on-demand service based on economic models and optimization tools

	3. Identify the potential for improvement in transport and energy systems and design strategies to realize the potential. 4. Appreciate a broad impact of civil engineering on smart city development and environmental sustainability.
Textbook / Reference material	Kirschen, Daniel S., and Goran Strbac. <i>Fundamentals of power system economics</i>. John Wiley & Sons, 2018. Stoft, Steven. <i>Power system economics</i>. Journal of Energy Literature 8: 94-99, 2002.
Assessment of outcomes	This course contributes to the assessment of program outcomes as follows: 1. Homework assignments (40%) with real world examples on economic problems of modern transport and energy systems to assess students' capability to design and analyze smart urban infrastructures. [PO 1,2,5,6,7] 2. Final exam (50%) allows for assessment of students' ability to apply learned knowledge to address real-world smart city design problems regarding urban sustainability. [PO 5,6,11, 12] 3. Participation (10%) allows for assessment of students' motivation to study, the ability to effectively express opinions, and the sense of professional responsibilities. [PO 11, 12]
Date	13 Jan 2024

Class Schedule

Week	Lecture Topic
1	Role of economics in Smart City Development
2	Math camp: optimization and game-theoretic models
3	Basic concepts on microeconomics
4	Theory of firms: monopolistic and duopolistic markets
5	Overview of power market
6	Balancing operations in smart grids
7	Renewable integration and demand response
8	Power networks and optimal power flow
9	Transportation network companies
10	Economic model of emerging mobility-on-demand services
11	Regulation on mobility-on-demand services to improve social welfare
12	Selfish-routing on transport networks
13	Price of anarchy and regulatory intervention