Rubric *Title of course* *Instructor*	CIVL4610 Introduction to data analytics for smart transportation systems Sisi Jian
Course catalog description, prerequisites, and credit	This course covers the role of stochasticity in transport systems and the methods used to account for this within transport infrastructure assessment, with a particular focus on the application of data analysis methods. The course introduces how to analyze the performance of public transport systems and road network using classic queuing theory and travel time reliability concepts. The course will complement skills learnt in the other transport courses to provide a well-rounded knowledge of smart transport planning and management. The focus is on the application of transport models in real world settings using real data. Students have the opportunity to work with large open-source data in two experiential-learning projects. The course also develops skills for working with data and managing collaborative projects. *Prerequisite:* COMP1021/ COMP1022P/ COMP2011/ COM2012H *Corequisite:* CIVL3610 *Credit:* 3
Textbook(s) and/or other required material	Reference books: • Roess, Roger P., Elene S. Prassas, William R. McShane. Traffic Engineering. Third Edition, Upper Saddle River: Pearson Prentice Hall, 2004 (ISBN 0-13-142471-8) • Vukan Vuchic. Urban Transit Operations, Planning and Economics – John Wiley & Sons, 2005; • Daganzo, C. Fundamentals of Transportation and Traffic Operations, Pergamon-Elsevier,Oxford, U.K. (1997) • de Neufville, Richard. “Applied Systems Analysis - Engineering Planning and Technology Management”, McGraw Hill, 1990. • Hall, W. Randolph. “Queueing Methods - For Services and Manufacturing”, Prentice Hall, 1991. • Ravindran, A., Phillips, Don T. and Solberg, James J. "Operations Research - Principles and Practice", John Wiley and Sons, 1987.
Course objectives	This course will enable students to: 1. Comprehend and apply the theoretical knowledge to solve real-world transportation problems. 2. Learn how to use Python to clean, process, analyze and visualize transportation “big data”. 3. Develop the skills of research question formulation and project management.
Topics	This course will cover the following topics: 1. Advanced queuing theory 2. Discussion of common queuing models 3. Application of queuing models in public transport 4. Introduction to travel time reliability in road network 6. Data analysis approaches which feed into queuing models and road network performance models 7. Application of data mining techniques in smart transportation planning
Computer usage	Python
Laboratory projects	N.A.

Class/laboratory schedule	Lecture: 3 hours/week, Lab tutorial: 1 hour/week
Contribution to the professional component	100% engineering topics
Relationship to program objectives	This course contributes to the following program objectives: **POE2 Train students with good communication skills so they can work effectively in large projects involving different parties and professionals.** Students will work in a team in the group project and learn how to manage a project from proposing a research question to presenting the project results. **POE4 Expose students to real world engineering projects as well as cutting edge research to improve their understanding of the profession and technological advancements that can improve current practice.** Students will work on realistic transportation "big data" and identify real-world research questions they are interested to solve.
Relationship to program outcomes	This course contributes to the following program learning outcomes: **1. Obtain fundamental knowledge in mathematics and science** Students will learn the fundamental knowledge of queuing theory and reliability, as well as stochastic characteristics of transport systems. **4. Apply modern engineering tools** Students will learn how to work with large open-source data in Python, and learn how to use visualization tools and data mining techniques. **5. Formulate problems and propose feasible solutions** Students will learn how to design a research question, methodology and data approach for a real problem. Students will apply project design and data analysis methods to real problems with real data. **8. Obtain in-depth knowledge in at least one specialized area** Students will learn in-depth knowledge in queuing theory and performance evaluation of urban transportation systems **9. Communicate ideas effectively and able to work in teams** Students will work in teams in the second part of the course and work on a group project. Students will also present their work in a poster showcase in the last week. **12. Stay abreast of contemporary issues** This course focuses on the application of transport models in real world settings. Students will work on real data obtained from either government website or APIs, and utilize transport models to evaluate existing public transport and road network performance, identify current issues, and propose transport policy implications.
Assessment of outcomes	50% individual assignment (Outcomes 1,4,5,8,12) + 50% group project (Outcomes 4,5,8,9,12)
Prepared by	Sisi Jian
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