**The Hong Kong University of Science and Technology**

**UG Course Syllabus**

**[Course Title] Introduction to data analytics for smart transportation systems**

[Course Code] CIVL 4610

[No. of Credits] 3 Credits

Prerequisites: CIVL 1121 OR COMP 1023 OR COMP 1021 OR COMP 1022P OR COMP 2011 OR COMP 2012H

Corequisite: CIVL3610

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**Office Hours:** By email appointments

**Course Description**

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.

**Intended Learning Outcomes (ILOs)**

This course contributes to the following program learning outcomes:

ILO1. 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.

ILO4. 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.

ILO5. 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.

ILO8. 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

ILO9. 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.

ILO12. 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 and Grading**

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

**Assessments:**

| Assessment Task | Contribution to Overall Course grade (%) | Due date |
|---|---|---|
| Individual Assignment | 40% | Week 3, 5 |
| Group Project | 60% | Week 8, 10, 12, 13 |

**Mapping of Course ILOs to Assessment Tasks**

| Assessed Task | Mapped ILOs | Explanation |
|---|---|---|
| Individual Assignment | ILO1, ILO4, ILO5, ILO8, ILO12 | This task assesses students' ability to understand and apply travel time reliability and queuing theory concepts (ILO1), work with large open-source data in Python (ILO4), design a research question, methodology and data approach for a real problem (ILO5), evaluate the performance of urban transportation systems (ILO8), and utilize transport models to identify current issues, and propose transport policy implications (ILO12). |
| Group Project | ILO4, ILO5, ILO8, ILO9, ILO12 | This task assesses students' ability to work with large open-source data in Python (ILO4), design a research question, methodology and data approach for a real problem (ILO5), evaluate the performance of public transportation systems (ILO8), work in a team (ILO9), and utilize transport models to identify current issues, and |

| | | |
|---|---|---|
| | | propose transport policy implications (ILO12). |

**Final Grade Descriptors:**

| Grades | Short Description | Elaboration on subject grading description |
|---|---|---|
| A | Excellent Performance | Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals. |
| B | Good Performance | Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others. |
| C | Satisfactory Performance | Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals. |
| D | Marginal Pass | Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline. |
| F | Fail | Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline. |

**Course AI Policy**

The use of Generative AI is permitted and requested to assist students with brainstorming, drafting, and writing their reports.

**Communication and Feedback**

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have further questions about the mark should consult the instructor within five working days after the mark is received.

**Required Texts and Materials**

• 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.

**Academic Integrity**

Students are expected to adhere to the university’s academic integrity policy. Students are expected to uphold HKUST’s Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University’s definition of plagiarism and ways to avoid cheating and plagiarism.