The Hong Kong University of Science and Technology

UG Course Syllabus

Transportation System Operations

CIVL 4620

3 Credits

Pre-requisites: CIVL3610

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Course Description

This course intends to provide students with an introductory understanding of fundamental theories and concepts for transportation management, including transportation economics, land use and transportation interaction, and queuing theory. This course also intends to equip students with engineering methods for traffic operations, including intersection signal control and public transportation operations and management

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Evaluate the principals involved in the design of transportation systems components, including transportation supply and demand, traffic control, and transit systems.
2. Utilize mathematical or quantitative methods to model components of the transportation system.
3. Apply key traffic and transportation engineering principles to the design and management of components of the transportation system, including transportation infrastructure appraisal, traffic control, and transit system.

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 (%)
Mid-Term	30%
Quiz	20%
Final examination	50%

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Mid-Term, Quiz and Final examination	ILO1, ILO2, ILO3.	Students will develop an ability to design and management components of the transportation system and develop an ability to work with real traffic control project examples (ILO 3); Students will develop an ability to work on challenging design homework, which will require a good understating of the principles (ILO 1, 2 and 3)

Grading Rubrics

Best 8 out of 11 or 12 quizzes (distributed during tutorial) will be counted.

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

Not applicable.

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 feedback including marks should consult the instructor within five working days after the feedback is received.

Resubmission Policy

Not applicable.

Reference Reading Materials

1. *Transportation Engineering: An Introduction.* C. Jotin Khisty. Prentice Hall Inc. 1990
2. *Transportation Engineering and Planning* (Second Edition). C.S. Papacostas & P.D. Prevedouros. Prentice Hall., 1993.
3. *Principles of Highway Engineering and Traffic Analysis*. F.L. Mannering and W.P. Kilareski. John Wiley & Sons, 1990.
4. *Traffic Flow Fundamentals*. Adolf D. May. Prentice Hall Inc., 1990.
5. *Traffic Engineering*. W.R. McShane and R.P. Roess, Prentice Hall, Inc. 1990.
6. *Modeling Transport*. J. de D. Ortuzar and L. G. Willumsen. John Wiley & Sons. 1990.
7. *Urban Public Transportations: Systems and Technology*. V. R. Vuchic. Prentice Hall, 1981.
8. *Managerial Economics and Strategy*. Jeffrey M. Perloff, James A. Brander. Pearson, 2017.

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.

Course Outline:

1. TRANSPORTATION ECONOMICS
    - 1.1. Demand and Elasticity
    - 1.2. Supply and Costs
    - 1.3. Demand and Supply Equilibrium
    - 1.4. Market Structure, Market Power and Monopoly
    - 1.5. Cartels and Cournot Oligopoly
    - 1.6. Externalities and Congestion Pricing

2. QUEUING THEORY AND TRAFFIC FLOW ANALYSIS
    - 2.1. Probabilistic Models Of Traffic Flow
    - 2.2. Dimensions Of Queuing Models
    - 2.3. D/D/1 Queuing Regime
    - 2.4. M/D/1 Queuing Regime
    - 2.5. M/M/1 Queuing Regime
    - 2.6. Traffic Analysis At Highway Bottlenecks

3. INTERSECTION CONTROL AND DESIGN
    - 3.1. Inter-green Period and Dilemma Zone
    - 3.2. Saturation Flow and Lost Time
    - 3.3. Approach Capacity and Degree of Saturation
    - 3.4. Determination of Lane Groups
    - 3.5. Cycle Length and Green Allocation
    - 3.6. Signal Coordination
    - 3.7. Delay Analysis at Signalized Intersections

4. TRANSIT OPERATIONS AND MANAGEMENT
    - 4.1. Definitions of Quantitative Performance Attributes
    - 4.2. Transit Line Capacity
    - 4.3. Way Capacity
    - 4.4. Vehicle Control and Operating Safety Regimes
    - 4.5. Transit Station Operations

5. THE LAND-USE TRANSPORTATION SYSTEM
    - 5.1. Accessibility
    - 5.2. Location Theory
    - 5.3. Land-Use and Transportation
    - 5.4. Land-Use Forecasting and Planning