

Department of Civil and Environmental Engineering
The Hong Kong University of Science and Technology
Spring Semester, 2024-25

Course code	CIVL 2170
Title of course	Infrastructure Systems Engineering and Management
Class time & venue	Two 1.5-hour lectures with an additional hour tutorial per week. Class time and venue to be confirmed.
Instructors	Sisi JIAN (cesjian@ust.hk ; Room 3589) Yantao YU (ceyantao@ust.hk ; Room 3576)
Prerequisites	None
Credits	[3-1-0:3]
Description	This course will cover basic principles and techniques for analyzing engineering systems. It will entail an introduction to linear programs, network analysis, game theory, critical path method, benefit-cost and present value analyses of engineering projects.
Course objectives	At the end of this course, students will be able to: <ol style="list-style-type: none"> 1. Identify and formulate engineering optimization problems, 2. Solve engineering optimization problems with the quantitative technique of linear programs and network analysis, 3. Formulate multi-person decision making using game theory, 4. Conduct engineering economic feasibility study and analysis 5. Conduct project planning and scheduling of engineering systems, 6. Appreciate the breadth of engineering problems.
Topics	The following topics are covered in this course: <ul style="list-style-type: none"> • Introduction to systems engineering and management • Introduction to linear programs and their properties • Formulation and solving of linear programs • Formulation and solving of network problems • Formulating decision making using game theory • Project planning, work breakdown structure, and work sequencing • Critical path method (CPM) and PERT networks • Time value of money • Economic appraisal and analysis of engineering systems
Textbook(s) and/or other materials	ReVelle, C. S., Whitlatch, E. E., and Wright, J. R. (2003). <i>Civil and Environmental Systems Engineering</i> , Prentice Hall, New Jersey, USA. Halpin, D. W. (2012). <i>Construction Management</i> , 4th edition, John Wiley & Sons, Inc.
Computer usage	To be advised by the lecturers
Laboratory projects	No lab work required
Contribution to the professional component	40% mathematics and basic sciences 40% engineering topics 20% engineering management

Intended Learning Outcomes (ILOs) of this course	<p>On successful completion of this course, students are expected to be able to:</p> <ul style="list-style-type: none"> I. Formulate and solve engineering optimization problems using the techniques of linear programs and network analysis. II. Conduct engineering economic analysis and project planning and scheduling of engineering systems. III. Identify and formulate a range of engineering problems IV. Apply quantitative methods to solve engineering problems V. Appreciate a broad variety of engineering problems
Relationship to the program objectives	<p><i>PEO1: Provide students with professional skills in the design, construction and management of the civil infrastructure, as well as an awareness of environmental sustainability.</i> This course provides students with an exploration of various components of engineering optimization problems in infrastructure engineering and management, such as network analysis, project planning and scheduling, and cost-benefit and present-value analyses. (ILO I, II, V)</p> <p><i>PEO2: Train students with good communication skills so they can work effectively in large projects involving different parties and professions.</i> The course requires students to be involved in discussion on how to formulate and solve various engineering optimization problems during tutorials. (ILO I, II, III, IV, V)</p> <p><i>PEO3: Challenge students with research-type and open-ended design problems to stimulate self-learning and innovative problem solving skills.</i> The course requires students to find applicable reference materials on the subjects to supplement course lectures. (ILO I, II, IV)</p> <p><i>PEO4: 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.</i> Some emerging and challenging issues of infrastructure systems engineering and management in the real world will be introduced in some lectures. (ILO I, II)</p>
Relationship to program outcomes	<p><i>PO1: Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based.</i> Students have to apply knowledge in mathematics and science in this course. (ILO #I, II, III, IV)</p> <p><i>PO4: Acquire an ability to apply modern engineering and IT tools effectively and efficiently for engineering analysis, design and communication.</i> Students need to use computer software to address systems engineering optimization problems. (ILO #I, II)</p> <p><i>PO5: Develop an ability to identify and formulate civil and environmental engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations.</i> Students have to identify and formulate infrastructure project engineering and management problems, and propose feasible solutions through discussions in tutorials, take-home assignments, and exams. (ILO I, II, III, IV)</p> <p><i>PO7: Develop an appreciation of the breadth of civil and environmental engineering, and acquire basic knowledge in several disciplines to enable effective performance within a multidisciplinary work environment.</i> This course provides a wide range of subjects in Infrastructure Project Engineering and Management, which helps students appreciate the breadth of civil engineering and the complexity of a construction project. (ILO #I, II, V)</p> <p><i>PO10: Recognize the importance of seeking further specialization within civil and environmental engineering and the need for life-long learning.</i> This course provides a big picture of a construction project, which helps student relate various civil engineering disciplines and recognize the need for further understanding of them. (ILO V)</p>

Assessment of outcomes	<p>This course contributes to the assessment of program outcomes as follows:</p> <ol style="list-style-type: none"> 1. Homework assignments and in-class quizzes (30%) with related (real world) examples allow for reinforcement and assessment of students' understanding in Infrastructure Systems Engineering and Management. [PO 1, 4, 5, 7, 10] 2. A mid-term exam (35%) and a final exam (35%) allow for assessment of students' ability to apply their knowledge and technical skills to solve problems in Infrastructure Systems Engineering and Management. [PO 1, 5, 7]
Notes	<ul style="list-style-type: none"> • It is our collective responsibility to make each class a stimulating learning experience. I will start and end each class on time. At the same time, I expect you to show up for class on time. Please see http://www.ust.hk/vpao/conduct/good_learning_experience.pps for other proper classroom behaviors so that learning of everyone is fostered. • Take-home assignments should be submitted in class/through Canvas (be advised by the lecturers) on the due date. Any late submission will not be graded and will be given zero mark.
Prepared by	Sisi JIAN, Yantao YU
Date	22 January 2024