

The Hong Kong University of Science and Technology

UG Course Syllabus

Course Title: Energy System Modeling for Buildings and Cities

Course Code: CIVL4310

No. of Credits: 3

Pre-/co-requisites: (MATH 1014 OR MATH 1024) AND (PHYS 1112 OR PHYS 1312)

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Course Description

The energy system plays a vital role in smart, low-carbon buildings and cities. Modeling the energy system is a fundamental step for predicting loads, designing energy-efficient solutions, and optimizing performance. This becomes even more crucial in the face of climate change and the pursuit of sustainable development.

This course offers both theoretical knowledge and practical experience in energy system modeling for buildings and cities. The lectures will delve into the underlying principles, mathematical laws, and practical examples that are needed to model the energy systems for cities and buildings. From a theoretical standpoint, the course will explore the fundamentals of heat transfer and building thermal dynamics. In terms of practical applications, the course will introduce building energy systems, especially Heating, Ventilation, and Air Conditioning (HVAC) System. Additionally, the course will introduce energy systems at different scales, focusing on the building-scale energy system (HVAC) as well as the city-scale energy system (district heating and cooling system). This course has four modules as shown below: review of thermal fundamentals, math of dynamic systems modeling, major components of HVAC system, and energy system modeling at different scales.

Intended Learning Outcomes (ILOs)

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

1. Learn the thermal foundations and math foundations to analyse building energy system
2. Learn the basics and major components of building and urban energy system
3. Understand the gray-, and white-box model for energy simulation at room, building and urban scale
4. Master the skills to propose, analyze and evaluate building energy saving strategies

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:

The average of the two best performing exams

- Exam I: scheduled in early October
- Exam II: scheduled in early November
- Exam III: scheduled at the end of the semester

Format: half-open book.

- You are allowed to bring at most 2 A4 sheets with you for each exam.

Assessment Task	Contribution to Overall Course grade (%)	Comments
Exams	100%	The average of the two best performing exams

Mapping of Course ILOs to Assessment Tasks

[add to/delete table as appropriate]

Assessed Task	Mapped ILOs	Explanation
Exam I	ILO1, ILO3	Cover lectures 1 to 6.
Exam II	ILO1, ILO2	Cover lectures 7-15
Exam III	ILO2, ILO4	Cover lectures 16-25

Grading Rubrics

The grading is based on your exam score. To be specific, the score is the average of the two best performing exams.

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	[Example: 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	[Example: 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	[Example: 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	[Example: 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	[Example: 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

AI is allowed on this course.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, e.g., strengths, areas for improvement]. 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

N/A

Required Texts and Materials

- Stanford, H.W. and Spach, A.F., 2019. Analysis and Design of Heating, Ventilating, and Air-Conditioning Systems. CRC Press. (electronic version is available in the HKUST library)

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.