

CIVIL 239: Engineering a sustainable built environment

Logistics

Lectures: Wednesday 10:15-12:00

Exercises: 12:15-13:00

Location: INR 219

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Office hours: During exercise session (Wednesday 12:15-13:00)

Course description

This course explicitly addresses the issue of sustainability in the built environment through an engineering lens. It covers the sustainability and energy landscape, approaches to sustainability in civil engineering, and specific tools for enacting sustainability in civil engineering.

Content

The course introduces the intersections between different areas of civil engineering and sustainability topics, the engineering knowledge needed to address sustainability topics, and engineering tools that can be used to analyze and assess sustainability.

Topics covered include:

- The sustainability landscape
- Energy supply and demand
- Mobility and sustainability
- Materials and structures
- Natural systems
- Sustainability in the civil engineering profession

Engineering knowledge and tools covered include:

- Energy
- Systems thinking
- Life cycle assessment
- Engineering economics and decision-making

Learning objectives

- Explain to an engineer, designer, policymaker, or other professional why sustainability is important in civil engineering.
- Assess / Evaluate and be critical of metrics used to measure sustainability.
- Analyze civil engineering systems in the context of sustainability.
- Quantify environmental, economic, and social impacts of the built environment.
- Construct models of systems to understand complexity of engineered civil systems.

Transversal skills

- Communicate effectively, being understood, including across different languages and cultures.
- Demonstrate the capacity for critical thinking
- Take account of the social and human dimensions of the engineering profession.
- Take responsibility for environmental impacts of her/his actions and decisions.

Coursework and assessment

Coursework will consist of graded exercises, one midterm exam, and one final exam.

- Graded exercises (20%)
 - Five graded assignments @ 4% each – 20% (see course schedule)
 - Assignments are due at the start of class on the day indicated in the schedule below
 - Assignments submitted late lose 50% of the grade for the assignment
 - The course language is English, so please submit your assignments in English — you will not be graded on your English grammar.
- Midterm exam (30%)
 - The midterm exam covers the content in the first half of the course
- Final exam (50%)
 - The final exam covers the whole course but focuses more on the content after the midterm

Use of Generative AI in this course

Generative AI tools (such as ChatGPT, Google Gemini, Claude, or CoPilot) can be valuable aids for reflection, studying, and generating ideas. However, they also carry limitations and risks, so their use in this course is restricted to specific, responsible practices.

- **Purpose:** AI may be used only as a study aid—not to generate content for assignments. The goal of this course is to develop your own critical thinking.
- **Conditions:** You may use AI tools only with proper citation and acknowledgment, only after you have developed the skills to use them thoughtfully, and only with your own data. Never input private, sensitive, or copyrighted material without consent. EPFL rules (Lex 1.3.3, Article 4) require that all assessment material that is not the student's personal and original contribution must be recognizable as such.
- **Responsibilities:** If you choose to use AI, you are responsible for evaluating its output. This means checking for errors, bias, plagiarism, and incorrect or missing citations. Any use of AI must be clearly disclosed in your work, including the system used, the date, and a description of how it contributed to your process.
- **Rationale:** AI can enhance learning when used carefully, but it can also undermine your growth if relied on too heavily. I want to hear your ideas, not generic AI responses.

Above all, our classroom values integrity, originality, and the human voice. If you are interested in using AI tools, I encourage you to engage with them critically and come talk with me about your approach. I trust you to uphold high standards of scholarship and professionalism, and I look forward to seeing the unique insights you bring to your work.

Course schedule (subject to change)

Week	Date	Course Content	Engineering knowledge and tools	Due
Course introduction				
1	10-Sep	The climate crisis What is sustainability? Sustainability in civil engineering	The role of the built environment in sustainability	
2	17-Sep	Sustainability indicators New economic thinking	The importance of data	
Buildings and energy				
3	24-Sep	Energy demand: buildings and infrastructure	How design impacts energy demand; Energy and load calcs	Assignment 1
4	1-Oct	Energy supply: Renewables, the grid, and grid integration	Interface between the built environment and energy systems; time-series data analysis	
Mobility and sustainability				
5	8-Oct	Transportation systems	Link between transportation and energy; systems thinking	Assignment 2
6	15-Oct	Sustainable urban design and active mobility Social systems	System dynamics	
7	22-Oct	No Class - Fall Break		
8	29-Oct	Midterm exam AAC 008, AAC 014, AAC 020		Assignment 3
Materials, structures, and life-cycle assessment				
9	5-Nov	Life-cycle assessment	Environmental LCA	
10	12-Nov	Guest lecture: Embodied carbon emissions and materials	The phases of infrastructure life cycles	
Civil engineering and natural systems				
11	19-Nov	Engineering with natural systems; geotechnical engineering, water resources engineering	Multi-criteria decision-making, resilience, sensitivity analysis, nature-based solutions	
12	26-Nov	Guest lecture: Assigning value to natural systems	Sustainability in natural systems; Engineering and sustainability valuation/economics	Assignment 4
Sustainability in the civil engineering profession				
13	3-Dec	Safety and reliability in civil engineering	Load combinations, safety and reliability, safety factors	
14	10-Dec	Guest lecture: Sustainable engineering in the industry	Practical issues	
15	17-Dec	Course wrap up How sustainability targets are implemented Class debate	Sustainability codes and standards	Assignment 5
-	TBD	Final written exam		