

## 4.463 Building Technology Systems: Structure and Envelopes // Fall 2023

Instructors: Kiley Feickert + Eduardo Gascón Alvarez

### Subject Overview



### Subject Description

Addresses advanced structures, exterior envelopes, and building material systems with a focus on building performance and environmental impact of design strategies across these systems. Addresses spanning systems, floor systems, lateral systems, vertical systems, and foundations, and a range of structural materials and their properties. The contemporary exterior envelope is discussed with an emphasis on the classification of systems, their performance attributes, climate-based design criteria, and advanced manufacturing technologies. Environmental systems for active and passive conditioning are also reviewed in their relation to integrated building design. State-of-the-art computational methods and tools are introduced and utilized for structural, envelope, and environmental system design.

#### Co-Instructor

Kiley Feickert, PhD candidate

Office: 5-414 Desk 5

Zoom room: <https://mit.zoom.us/j/4702029833>

Email: [feickert@mit.edu](mailto:feickert@mit.edu)

#### Co-Instructor

Eduardo Gascón Alvarez, PhD candidate

Office: 5-414 Desk 14

Zoom room: <https://mit.zoom.us/j/3686136318>

Email: [egascon@mit.edu](mailto:egascon@mit.edu)

#### Meeting Times\*

Lecture: Monday, Wednesday, 9:30-11, in 5-234

Lab: Friday, 10am-12pm, in 3-133

\*see below for more details

#### Textbook

Readings will be provided via Canvas website

#### Units and Level

3-2-4, Graduate

### Subject Canvas Website

<https://canvas.mit.edu/courses/22422>

### Subject Zoom Room\*

<https://mit.zoom.us/j/95345513701>

\* All classes will be held in person, but we have a Zoom room as a backup if necessary.

## Semester Schedule

	<b>Lecture</b> Mon. 9:30-11, 5-234	<b>Discussion</b> Weds. 9:30-11, 5-234	<b>Lab</b> Fri. 10-12, 3-133
01		W 9/6 Introduction	F 9/8 <b>MODULE 1: Materials</b> Intro to materials HW 1: Material properties + performance tradeoffs
02	M 9/11 Light and heavy timber + insulation	W 9/13 Reinforced concrete	F 9/15 HW2: Precedents analysis
03	M 9/18 Steel HW1 due	W 9/20 Carbon, materials + climate change HW3: Material Reuse	F 9/22 No Class
04	M 9/25 <b>MODULE 2: Structures</b> Intro to structures HW2 due	W 9/27 Discussion: Load paths	F 9/29 HW4: Structural modeling
05	M 10/2 Spanning Systems HW3 due	W 10/4 Discussion: One-way + two-way span systems	F 10/6 HW5: Structural materialization
06	M 10/9 No Class	W 10/11 Floor systems HW4 due	F 10/12 Discussion: Systems interactions
07	M 10/16 Vertical, lateral, + foundation systems HW5 due	W 10/17 Discussion: Lateral stability	F 10/20 HW6: Structural connections
08	M 10/23 <b>MODULE 3: Envelopes</b> Intro to envelopes 10/24 Midterm Review Core 3	W 10/25 Discussion: Conditioned + unconditioned spaces	F 10/27 (EGA out) HW 7: Climate analysis
09	M 10/30 Facade systems HW6 due	W 11/1 Discussion: R-value calculation + code requirements	F 11/3 HW8: Thermal mass + insulation
10	M 11/6 Glazing systems HW7 due	W 11/8 Discussion: SHGC + coatings HW9: R-value + detailing	F 11/10 No Class
11	M 11/13 Roof systems HW8 due	W 11/15 Discussion: Construction sequence 11/16 3/4 Review Core 3	F 11/17 HW10: Final review preview
12	M 11/20 <b>MODULE 4: Space-conditioning</b>	W 11/22 Discussion: HVAC layout	F 11/24 No Class

	Active systems HW9 due		
13	M 11/27 Systems integration + coordination HW10 due	W 11/29 Desk Crits	F 12/1 Desk crits
14	M 12/4 Semester Summary	W 12/6 Desk Crits	F 12/8
15	M 12/11 Desk Crits 12/13 Final Review Core 3	W 12/13 Desk Crits (Optional)	
F	M 12/18	Final Review* Time: TBD Location: TBD	

\* Final review will be held during Final Exam Week and the date will be finalized by the third week of classes.

### Subject Meeting Structure, Schedule and Content

This subject will be offered fully in person for the Fall 2023 semester. Students will be expected to attend and participate live in the classroom during our three weekly meetings. Additional office hours with the instructors will be available mostly in person but occasionally on Zoom (see below for details). If students are not able to attend in-person class due to medical or personal reasons, they will be able to access presented slides and class recordings on the Canvas site, but recordings will not be made by default this semester. See below for more details on the attendance policy. Content for this class is adapted from Professor Caitlin Mueller.

Mondays 9:30-11: Lecture that students should attend and respond to with questions, discussion, etc.

Wednesdays 9:30-11: Typically, two 45-minute discussion sessions with groups of ~15 students (students only need to attend one session, which will be randomly assigned each week for variety). These sessions are noted on the semester schedule. Some Wednesday classes will be dedicated to lecture or lab content if required.

Fridays 10-12: Lab session Interactive problem-solving and tool demonstrations, distribution and beginning work on homework assignments (due on Monday 10 days later).

### Assignments and Project

The main focus of this subject is a semester-long design project, supported by ten short homework assignments. For MArch students in the Core 3 studio, this project will integrate with the main Core 3 studio project. Other students will work on independent projects. Most assignments are to be submitted individually by students. Late assignments will not be accepted, unless extreme circumstances warrant an extension (must be arranged with instructors 24 hours before deadline). Homeworks will typically be assigned in the lab on Fridays and due 10 days later at 5:00pm. Time in the lab each week will be devoted to completing portions of the homework. Each student's homework with the lowest grade will be excluded from their final grade calculation.

**Grading Breakdown**

Assignments: 45% (5% each)

Project: 40% (10% interim submission, 30% final review and submission)

Attendance and Participation: 15%

**Office Hours**

Instructors will hold weekly office hours in person (or on Zoom if necessary) for students to come and ask questions about the class's content, assignments, etc, by appointment. There will also be ample opportunities to ask questions in class.

**Absence Policy**

Attendance and participation are mandatory and part of this subject's grade (15%). Missed lectures, discussion sessions, or labs will be counted against the grade unless special arrangements are made with the instructors in advance of class. Excused absences will always be granted for medical or personal reasons, but must be arranged ahead of time with the instructors via email. Please do not come to class if you feel unwell. The instructors will make reasonable efforts to work with students to access missed material for excused absences.

**NAAB Student Performance Criteria**

Realm B: Integrated Building Practices, Technical Skills and Knowledge: B8, B9, B10, B12