

## 4.463 Building Technology Systems: Structure and Envelopes // Fall 2025

Instructors: Holly Samuelson and Keith J. Lee // TA: Nebyu Haile

### Subject Overview



Lead Designer: [Allison Grace Williams](#)

### Subject Description

Addresses building materials, advanced structures, exterior envelopes, and thermal conditioning with a focus on building performance and environmental impact of design strategies across these systems. Includes technical overview of embodied carbon and sourcing concerns for building materials, with specific focus on structural steel, reinforced concrete, and timber; full-building structural systems and load path, including spanning systems, floor systems, lateral systems, vertical systems, and foundations; exterior envelope design with a focus on thermal performance and climate-based design criteria; environmental systems for active and passive conditioning 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.

#### Instructors

Holly Samuelson, Associate Professor  
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Keith J. Lee, Lecturer  
Office: 1-253B  
Email: [keithjl@mit.edu](mailto:keithjl@mit.edu)

#### Meeting Times

Lecture: Monday, Wednesday, 9:30-11, in 5-234  
Lab: Friday, 10am-12pm, in 3-133

#### Units and Level

3-2-4, Graduate

#### Teaching Assistant

Nebyu Haile, PhD Student  
Office: 5-414  
Email: [nebyu@mit.edu](mailto:nebyu@mit.edu)

#### Readings

Readings will be provided via Canvas website

### Subject Canvas Website

<https://canvas.mit.edu/courses/34187>

### Subject Meeting Structure and Schedule

This subject will be offered fully in person for the Fall 2025 semester. Students will be expected to attend and participate live in the classroom during our three weekly meetings. Additional office hours with the instructor and TA will be available mostly in person but occasionally on Zoom (see below for details).

**Mondays 9:30-11:** Lecture that students should attend and participate in with questions, discussion, etc.

**Wednesdays 9:30-11:** Lecture or 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). Students should bring questions or discussion topics from lecture, lab, homeworks, studio projects, etc. to this session.

**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 TA 24 hours before deadline). Homeworks will typically be assigned in lab on Fridays and due 10 days later. 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% (15% penultimate review submission, 25% final review and submission)

Attendance and Participation: 15%

### **Office Hours**

Meetings with the instructor will be by appointment (and discussion sessions should be used as the first option for subject-related questions). The TA will hold a weekly two-hour period in person (or on Zoom if necessary) for students to come and ask questions about the class's content, assignments, etc. There will also be ample opportunities to ask questions in class. Students are asked to be respectful of the TA's schedule and should prepare questions in advance of deadlines. The TA will not be able to respond promptly outside of business hours, on weekends, etc.

### **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 TA in advance of class. Excused absences will always be granted for medical or personal reasons, but must be arranged ahead of time with the TA via email. Please do not come to class if you feel unwell. The instructor and TA 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

### **Semester Schedule**

| Week | Lecture<br>Mon. 9:30-11, 5-234 | Discussion<br>Weds. 9:30-11, 5-234 | Lab<br>Fri. 10-12, 3-133 |
|------|--------------------------------|------------------------------------|--------------------------|
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|----|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 01 |                                                                                                      | W 9/3<br>Introduction [Lee, Samuelson]                                                                                         | F 9/5<br><b>Module 1: Materials</b><br>Materials and carbon [Lee]<br><a href="#">HW1 given</a> |
| 02 | M 9/8<br>Light and Heavy Timber<br>[Rachel Blowes]                                                   | W 9/10<br>Reinforced concrete and compression systems<br>[Nebyu Haile]                                                         | F 9/12<br>Tools for Circularity and Material Reuse [Lee]<br><a href="#">HW2 given</a>          |
| 03 | M 9/15<br>Structural steel<br>[Juliana Berglund-Brown]<br><a href="#">HW1 due</a>                    | W 9/17<br>Carbon, materials, and climate change [Lee]<br><a href="#">HW3 given</a>                                             | F 9/19<br><i>No Class</i>                                                                      |
| 04 | M 9/21<br><b>Module 2: Structural systems</b><br>Structural systems [Lee]<br><a href="#">HW2 due</a> | W 9/24<br>Discussion: Load paths [Lee]                                                                                         | F 9/26<br>Structural modeling [Lee]<br><a href="#">HW4 given</a>                               |
| 05 | M 9/30<br>Spanning systems [Lee]<br><a href="#">HW3 due</a>                                          | W 10/1<br>Discussion: One-way + two-way spanning systems [Lee]                                                                 | F 10/3<br>Tools for Struct Modeling [Lee]<br><a href="#">HW5 given</a>                         |
| 06 | M 10/6<br>Floor systems [Lee]<br><a href="#">HW4 due</a>                                             | W 10/8<br>Lateral systems [Lee]                                                                                                | F 10/10<br>Structural Materialization [Lee]                                                    |
| 07 | M 10/13<br><i>No Class</i>                                                                           | W 10/15<br>Foundations [Lee]<br><a href="#">HW5 due</a>                                                                        | F 10/17<br>Structural Connections [Lee]                                                        |
| 08 | M 10/20<br><b>Module 3: Envelopes</b><br>Introduction to envelopes [Samuelson]                       | W 10/22<br>Discussion: Conditioned + unconditioned spaces [Samuelson]                                                          | F 10/24<br>[Samuelson]<br><a href="#">HW6 given</a>                                            |
| 09 | M 10/27<br>Facade systems [Samuelson]                                                                | W 10/29<br>Discussion: Passive strategies [Samuelson]                                                                          | F 10/31<br>Climate Analysis Tools [Samuelson]<br><a href="#">HW7 given</a>                     |
| 10 | M 11/3<br>Glazing systems [Samuelson]<br><a href="#">HW6 due</a>                                     | W 11/5<br>Discussion: SHGC + coatings [Samuelson]                                                                              | F 11/7<br>Tools for Thermal Performance 1 [Samuelson]<br><a href="#">HW8 given</a>             |
| 11 | F 11/10<br><i>No Class</i>                                                                           | W 11/12<br><b>Module 4: Space Conditioning</b><br>Passive space-conditioning strategies [Samuelson]<br><a href="#">HW7 due</a> | F 11/14<br>Construction Site Visit [Lee, Samuelson]                                            |
| 12 | M 11/17<br>Active conditioning [Samuelson]                                                           | W 11/19<br>Tools for HVAC [Samuelson]                                                                                          | F 11/21<br>Discussion: Conditioning [Samuelson]                                                |

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|    | HW8 due                                                            |                                                                | HW9 given                             |
| 13 | M 11/24<br>Penultimate Review [Lee, Samuelson]                     | W 11/26<br>Desk Crits [Lee, Samuelson]                         | F 11/28<br><i>No Class</i>            |
| 14 | M 12/1<br>Roof systems and water management [Samuelson]<br>HW9 due | W 12/3<br>Desk Crits [Lee, Samuelson]                          | F 12/5<br>Desk Crits [Lee, Samuelson] |
| 15 | M 12/8<br>Semester Summary [Lee, Samuelson]                        | W 12/10<br>Desk Crits (Final Project) [Lee, Samuelson]         |                                       |
| F  | M 12/15                                                            | Final Review<br>9am-12pm<br>Date/Time: TBD<br>[Lee, Samuelson] |                                       |

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