

# ARCH 2614/5614 Building Technology I: Materials and Methods



"If one takes technique, utilitarian requirements, etc., as the point of departure, there is a risk of losing every chance of success, for intuition is then troubled by intelligence." -- Piet Mondrian

**Course description:** Building construction is examined from the following standpoints: life safety (including fire safety and zoning constraints on site planning); building service systems (plumbing, electrical, vertical transportation, security, fire protection); materials, sustainability, and life-cycle analysis; accessibility; technical documentation and outline specifications; building enclosure systems; and interior finish systems.

Architecture is both logical and expressive. The expressive function of architecture needs to be built upon an underlying logical base. Eschewing logic as a basis for expression is possible (see Mondrian quote above), but the buildings that result from such an attitude will have many problems. Life is hard enough as it is: resist the temptation.

**Fall 2021**

**Mon-Wed 9:40 – 11:55 am**

**Instructor: Jonathan Ochshorn ([jo24@cornell.edu](mailto:jo24@cornell.edu))**

3 credit hours, required course for B.Arch and M.Arch students

*revised 07/13/21*

Instructor: Jonathan Ochshorn  
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Office Hours: 10:00 – 11:00 am Fridays — see:  
<https://jonochohorn.com/academics/officeHours/>

Grading: Letter grade only for B.Arch and M.Arch students

### **I. Rationale:**

Building construction is examined from the following standpoints: life safety (including fire safety and zoning constraints on site planning); building service systems (plumbing, electrical, vertical transportation, security, fire protection); materials, sustainability, and life-cycle analysis; accessibility; technical documentation and outline specifications.

Professional architecture students need to learn about building materials, methods of construction, and other aspects of building technology in order to properly design buildings.

### **II. Course Aims and Objectives:**

#### ***Aims***

The goal of this course is to provide students with an introduction to building technology.

#### ***NAAB Specific Learning Objectives:***

The department is required by the National Architectural Accrediting Board (NAAB), as part of the accreditation process, to collect specific course material for each course taught. See Section XIV below.

### **III. Format and Procedures:**

Course is in lecture format.

### **IV. My Assumptions**

Architecture is both logical and expressive. The expressive function of architecture needs to be built upon an underlying logical base. Eschewing logic as a basis for expression is possible (see Mondrian quote above), but the buildings that result from such an attitude will have many problems. Life is hard enough as it is: resist the temptation.

### **V. Course Requirements:**

**1.** Attendance is required. Students with an excused absence (in general, this means illness, death in family, or other circumstances beyond one's control) may make arrangements to take make-up exams or turn in assignments late without penalty. Students in these circumstances should contact the professor as soon as possible. Project due dates or extraordinary quantities of work assigned in other courses do *not* constitute an excuse for missing the midterm exam or turning in a late assignment. If I'm able to record the lectures, then students who miss any class must watch the recorded lecture.

#### **2. Course readings:**

**(a)** Required text: Edward Allen, *Fundamentals of Building Construction*, 7th edition, John Wiley & Sons, New York, 2019 (except where noted otherwise) – available electronically through the Cornell library catalogue.

(b) Students should get a free subscription to the *Construction Specifier* by filling out an online form linked from the course website.

3. How many credits? 3

4. Additional requirements:

(a) Most assignments will have a drawing component; students will be asked to create plans, elevations, and sections; also axonometric or perspective views, using CAD/modeling software. Some simple mathematical skills are required when dealing with zoning, building code, movement, and thermal issues.

(b) Most assignments may be turned in on the Monday following the Wednesday due date without penalty (but try not to abuse this allowance). For no grade penalty, turn in assignment no later than 9:40 am (Ithaca time) on the Monday after the assignment is due. For one week *after* that Monday—i.e., until 9:40 am (Ithaca time) on the Monday following the Monday after the Wednesday after the assignment is due—assignments will be accepted and will be graded, but there will be a grade penalty. Beyond that time, assignments will not be graded and students will receive no credit for that assignment.

**VI. Grading Procedures: Grades** will be based on:

- **Assignments**, 8 total = 50% course grade
- **Midterm exam**, 20% course grade
- **Final exam**, 20% course grade
- **Attendance (AKA “participation”)**, 10%

#### **VII. Academic Integrity**

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity:

<https://theuniversityfaculty.cornell.edu/dean/academic-integrity/code-of-academic-integrity/>

Any work submitted by a student in this course for academic credit will be the student's own work, except in the cases of projects that are specifically structured as group endeavors. Work by others shown in presentations and excerpted in papers must be properly cited and credited.

Students are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. Students can give "consulting" help to or receive "consulting" help from such students.

Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any

collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Pursuant to Copyright Law of the United States (Title 17 of the U.S. Code) and Cornell University Policy 4.15, faculty own the copyright to all original course content – their copyright embodies course lectures as well as notes summarizing or capturing the lecture content. Students may take and use lecture notes solely for personal scholarship, and may share lecture notes only with others enrolled in the subject course. Students may not post, copy, republish, distribute or share lecture, course, or class content in any form or medium with anyone not enrolled in the subject course absent the express written permission of the faculty copyright holder. This prohibition applies to any platform or medium to which course lectures or notes are posted for the purpose of further distribution, whether for-profit or fee-free. Impermissible uses of copyrighted content constitute acts of copyright infringement and may further subject the student to violation(s) of the Code of Academic Integrity.

#### 1. Student IP:

Student work is the intellectual property of the student. Permission from a student needs to be secured before sharing student work on any platform. Faculty must use an Image Use Permission form (available from the AAP Communications Department) each time they wish to use a student project. Blanket permissions are NOT valid.

#### 2. Images of students:

For reasons including FERPA, DACA, and other privacy concerns, student permission is required before sharing photos or videos taken in studio, class, or on a field trip.

### **VIII. Diversity and Inclusion**

We (i.e., the administrators who created this text, but not necessarily the course instructor, who believes that “design,” aka “architecture,” is more often a tool to reinforce wealth and power) believe that design is a principal instrument of positive social change, and that progress and innovation are driven by a commitment to inclusion across race, class, ethnicity, gender, age, religion, ability and identity. For this reason, we explicitly confirm our resolute commitment to accelerate Cornell University’s actions to be a diverse and inclusive institution. We embrace the responsibilities of ongoing internal critical reflection, dialogue, and action as individuals and as a community. We support the Cornell teaching community—our faculty, staff, and students—in their efforts to act with an ethos of inclusivism and antiracism in creating and sustaining diverse teaching and learning environments.

### **Bias-related Incident Reporting System**

Cornell University is committed to fostering a safe, respectful, and inclusive living, learning, and working environment for our entire community. The bias-related incident reporting system is one step toward promoting that we, as an institution, live out these values. The reporting system allows for you to safely and anonymously report an incident you may have experienced or witnessed, receive support, and explore options for resolution.

To report an incident, individuals can use one of the following methods:

- *By submitting an incident report online at <https://www.biasconcerns.cornell.edu/> (non-emergency)*
- *By contacting the [Cornell University Police Department](#) (CUPD) at (607) 255-1111 or 911 for emergency assistance*

### **IX. Accommodations for students with disabilities**

In compliance with the Cornell University policy and equal access laws, the instructor is available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for in unusual circumstances, so arrangements can be made. Students are encouraged to register with Student Disability Services to verify their eligibility for appropriate accommodations.

### **X. Religious Holidays**

Cornell University is committed to supporting students who wish to practice their religious beliefs. Students are advised to discuss religious absences with their instructors well in advance of the religious holiday so that arrangements for making up work can be resolved before the absence.

The New York State Legislature (since July 1, 1992) requires all institutions (public and private) of higher education not to discriminate against students for their religious beliefs. Accordingly, the pertinent parts of Sections 3 and 4 of the law state:

“3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of his or her religious beliefs, an equivalent opportunity to . . . make up any examination, study or work requirements which he or she may have missed because of such absence on any particular day or days...”

“4. If . . . classes, examinations, study or work requirements are held on Friday after four o’clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so.”

A list of religious holidays can be found here:

<https://scl.cornell.edu/religiousholidays>

### **XI. Land Acknowledgement**

The Department of Architecture acknowledges that Cornell University is located on the traditional homelands of the Gayogohó:nq’ (Cayuga Nation). The Gayogohó:nq’ are members of the Haudenosaunee Confederacy, an alliance of six sovereign Nations with a historic presence on this land. The Confederacy precedes the establishment of Cornell University, New York State, and the United States of America. We acknowledge the painful history of Gayogohó:nq’ dispossession, and honor the ongoing connection of Gayogohó:nq’ people, past, and present, to these lands and waters.

## **XII. Tentative Course Schedule**

### **I. Life-Safety, Accessibility, Sustainability, and Technical Documentation**

#### **Week 1**

ARCH 2614/5614 classes begin next week

#### **Week 2**

Mon., Aug. 30: Systems, CSA Masterformat

Lecture notes | Assign. #1 issued

Wed., Sept. 1: Fire sprinklers and fire areas; construction types and occupancy

Lecture notes

#### **Week 3**

Mon., Sept. 6: Labor Day, NO CLASS

Wed., Sept. 8: Area calculations, examples

Lecture notes | Assign. #1 due | Assign. #2 issued

#### **Week 4**

Mon., Sept. 13: Mixed occupancies, barriers, and assemblies

Lecture notes

Wed., Sept. 15: Egress

Lecture notes | Assign. #2 due | Assign. #3 issued

#### **Week 5**

Mon., Sept. 20: Accessibility

Lecture notes

Wed., Sept. 22: Introduction to sustainability

Lecture notes | Assign. #3 due | Assign. #4 issued

#### **Week 6**

Mon., Sept. 27: Materials, life-cycle analysis, and life-cycle cost

Lecture notes

Wed., Sept. 29: Security systems

Lecture notes | Assign. #4 due

#### **Week 7**

Mon., Oct. 4: Midterm exam (material from weeks 2 – 6)

[Week 7 continues below]

## II. Construction systems

### Week 7 (continued)

Wed., Oct. 6: Overview of technical docs, specs  
Lecture notes

### Week 8

Mon., Oct. 11: Fall break; no class

Wed., Oct. 13: Working drawings  
Lecture notes

### Week 9

Mon., Oct. 18: Structure, enclosure, and building systems  
Lecture notes

Wed., Oct. 20: Control layers  
Lecture notes | Text: chapter 16 | Assign. #5 issued

### Week 10

Mon., Oct. 25: Movement, joints, and flashing  
Lecture notes | Text: chapter 10

Wed., Oct. 27: Sealant joints  
Lecture notes | Text: chapter 16 | Assign. #5 due | Assign. #6 issued

### Week 11

Mon., Nov. 1: Wall sections: foundations  
Lecture notes | Text: chapter 2

Wed., Nov. 3: Wall sections: brick and stone veneer (video)  
Lecture notes | Text: chapters 8–10 | Assign. #6 due

### Week 12

Mon., Nov. 8: Wall sections: curtain walls and glazing systems  
Lecture notes | Text: chapters 18, 19, and 21

Wed., Nov. 10: Wall sections: metal and precast panels  
Lecture notes | Text: chapters 20–21 | Assign. #7 issued

### Week 13

Mon., Nov. 15: Wall sections: EIFS  
Lecture notes | Text: chapter 20

Wed., Nov. 17: Roofing  
Lecture notes | Text: chapter 17 | Assign. #7 due | Assign. #8 issued

**Week 14**

Mon., Nov. 22: Large-scale views (stairs, elevators, escalators)

Lecture notes | Text: find topics (e.g., stair, elevator, etc.) in index

Wed., Nov. 24: no class (Thanksgiving Break)

**Week 15**

Mon., Nov. 29: Schedules and interior finishes

Lecture notes | Text: chapters 22–24 | Assign. #8 due

Wed., Dec. 1: Plumbing and electrical systems

Lecture notes

**Week 16**

Mon., Dec. 6: No class

**Final exam: TBA**

**XIII. Additional Resource Readings*****References on course reserve, Fine Arts Library***

1 Allen, *Fundamentals of Building Construction*, 7th edition (electronic resource)

2 Allen and Rand, *Architectural Detailing* NA2840 .A38 2007

3 Allen, *The Architect's Studio Companion* NA 2750 .A42 A6 1995

4 Brand, *Architectural Details for Insulated Buildings* TH1715 B66x 1990

5 Brock, *Designing the Exterior Wall* TH2235 .B76 2005

6 Lstiburek, *Builder's Guide to Cold Climates* TH153 .L78x 2000

***Basic construction references, Fine Arts Library***

1 *Architectural Graphic Standards*, latest edition (permanent reserve)

2 USGBC, *Reference Guide v4* (permanent reserve: TH880 .G734 2013)

***Internet sources***

1 Construction products and systems: [Sweet's online](#)

2 Accessibility: [ADA/ABA technical chapters](#) | [History of disability legislation](#)

3 Sustainability: [LEED](#) | [Green Globes](#) | [Brundtland Report \(\*Our Common Future\*\)](#) | [Indoor air quality](#) | [Architecture 2030](#) | [Summary and critique of LEED 2009 reference guide](#) | [Critique of Milstein Hall](#)



4 Specifications: [Arcat](#) | [CSI](#) | [4specs](#)

5 Building failure: [Defects and deterioration in buildings online](#)

6 The perfect wall: [The Perfect Wall](#)

7 Attic ventilation: Find link to [Roof and Attic Ventilation Issues in Hot-Humid Climates](#)

8 Masonry details: [International Masonry Institute Detailing Series](#)

9 Materials of the future: 1952 Asbestos-Cement promotional film ("According to Plan") [Part 1](#) | [Part 2](#)

10 Building code: [IBC and NYS Building Code links](#)

11 Parametrics: [Schumacher, "The Parametricist Epoch: Let the Style Wars Begin," 2010](#)

12 Dew point calculator: [Image Permanence Institute, Rochester Institute of Technology](#)

13 [Building technology calculators](#)

14 [Milstein Hall construction videos](#)

**XIV. Co-meeting Courses**For co-meeting courses only: Graduate assignment: Per New York State Department of Education, graduate level courses must be 5000 level and must be differentiated from the undergraduate course. Please be specific about how the assignment(s) for graduate and undergraduate students will differ.

- There is no difference between B.Arch (undergraduate) and M.Arch (graduate) instruction or assignments in this course, since there is no rationale for differentiating between undergraduate and graduate students within building technology pedagogy. Undergraduate students and graduate students at Cornell have the same background and preparation (i.e., none) for this course. The same accreditation expectations for course content apply equally to undergraduate and graduate professional architecture students. There is nothing in graduate students' prior education that might justify a differentiated curricular response in this course. This is an introductory course for *both* undergraduate and graduate students and does not build upon prior intellectual knowledge or practical experience that might otherwise distinguish graduate students from their undergraduate peers.

## **XV. NAAB**

### **A. Program Criteria (PC)**

**PC.3 Ecological Knowledge and Responsibility**—How the course instills in students a holistic understanding of the dynamic between built and natural environments, enabling future architects to mitigate climate change responsibly by leveraging ecological, advanced building performance, adaptation, and resilience principles in their work and advocacy activities.

Course specific elaboration:

- Wed., Sept. 22: Introduction to sustainability
- Mon., Sept. 27: Materials, life-cycle analysis, and life-cycle cost

**PC.5 Research and Innovation**—How the course prepares students to engage and participate in architectural research to test and evaluate innovations in the field.

Course specific elaboration:

- Students should get a free subscription to the *Construction Specifier* by filling out an online form linked from the course website.

**SC.1 Health, Safety, and Welfare in the Built Environment**—How the course ensures that students understand the impact of the built environment on human health, safety, and welfare at multiple scales, from buildings to cities.

- Sept. 1: Fire sprinklers and fire areas; construction types and occupancy
- Sept. 8: Area calculations, examples
- Sept. 13: Mixed occupancies, barriers, and assemblies
- Sept. 15: Egress
- Sept. 20: Accessibility
- Sept. 29: Security systems

**SC.3 Regulatory Context**—How the course ensures that students understand the fundamental principles of life safety, land use, and current laws and regulations that apply to buildings and sites in the United States, and the evaluative process architects use to comply with those laws and regulations as part of a project.

- See SC.1

**SC.4 Technical Knowledge**—How the course ensures that students understand the established and emerging systems, technologies, and assemblies of building construction, and the methods and criteria architects use to assess those technologies against the design, economics, and performance objectives of projects

- See course schedule.