Dalhousie University School of Architecture
ARCH 3207.03 Fall 2023 Course Outline

# *B1 Building Technology*

CHANGES AND UPDATES Dates and other outline details are subject to change.
They will be updated in Brightspace but not in this .pdf document.

## QUICK REFERENCE

**Teaching Team**


Instructor: Brian Lilley
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**Computer Help Desk:**
Matthew Beck (M2) - mt530242@dal.ca
Ryan Torosantucci (B1) - ry970975@dal.ca

Help desk studio locations mapped and signposted

**Class Information**

| Weekly Class Meetings | | |
|---|---|---|
| **Room** | **Day** | **Time** |
| | | |
| B Bldg 308, Medjuk B102 | Monday | 2:30 – 5:30pm |
| B 015 | Thursday | 10:00 – 11:30am |

**Brightspace:** https://dal.brightspace.com/d2l/home/184992

**Required Texts:**
- Allen and Iano *The Architect's Studio Companion* (Wiley)
- Allen and Iano *Fundamentals of Building Construction* (Wiley)

Both are free to all Dal users as e-books from the library via Novanet.

**Additional:**
- Various - any required readings will be posted, free, to Brightspace

**Recommended:**
- John Fernandez, *Material Architecture* (Routledge) - available online
- Tregenza and Wilson *Daylighting* (Routledge)
- Francis D.K. Ching *Building Construction Illustrated* (Wiley)

- Sandaker et al. *The Structural Basis of Architecture* (Routledge)
- Michael Ashby *Materials and the Environment* (Butterworth-Heinemann)

**Studio & Lab:**

Students may be required to purchase materials for labs. When required, material list and required quantities will be provided to assist students in purchasing/sourcing materials. For lab materials, students sharing purchases and salvaging materials can, spend less than $50.00; you may opt to spend more. Hand tools Students are encouraged to begin building a kit of light hand tools; base your purchases on in-class discussion.

Personal Protective Equipment (PPE) – safety gloves, steel toed footwear, safety glasses, hardhat, and vest for visibility. We require students in B1 to acquire PPE that will be useful for both undergraduate and graduate courses in Architecture going forward.

# ACADEMIC DETAILS

## Calendar description

Through hands-on and observational exercises, this course develops tacit understanding of materials, their properties, and applications. Readings introduce terminology, theory, and sizing. Primary topics are the exclusion and inclusion of water; structural behaviours providing bracing, bearing, and span; and the rudiments of natural light and heat.

## Additional Course Description:

"The materials of architecture have always been pivotal in the development of its form and the implication of future form. Ancient concrete and masonry construction, gothic stonework, the standardized steel bar joists of modern buildings, the reinforced concrete of bridges and tall buildings have shaped the direction of design and the production of novel forms of architecture."

John Fernandez, Material Architecture (2006, 7)

This course is about materials: How we work with them, how we test them, and how we select and design with them. Materials are inherently linked to the spaces we design, build, and inhabit. To create and shape responsive and meaningful atmospheres, environments and spaces not only requires design invention but also a deep technical understanding of the materials we have at our disposal (Fernandez 2006, 6). How we choose, place, form and shape our materials have drastic impacts on our architecture and built environment. At the same time, the limits of the materials we have at our disposal set the boundaries by which we can feasibly shape the topology, space, and form within our built environment. As such, developing a deep knowledge of materials and methods within architecture is a critical skill for future practitioners and designers to develop.

As such, this course works to deliver succinct hands-on experiences centered around materials and methods. This will be facilitated through a sandbox kit which weekly labs will utilize to demonstrate key concepts surrounding materials as they relate to environmental phenomena; and, material testing methods that can be conducted at a desktop scale. The sandbox kit will contain a variety of physical tools,

digital tools and materials intended to support student exploration and learning. The course will work on culturing ability around material testing, analysis, selection and design as it pertains to architecture, building science, and practice. These hands-on experiences will be paired with a variety of lectures, in-class sketching exercises, demonstrations, and readings to support in-person labs and deliver critical course concepts, ideas, and terminology. The hands-on experiences and supporting exercises, demonstrations, and lectures are meant to develop and build material knowledge, understanding, and methodologies.

Throughout the term, students will be given the tools and opportunity to integrate the key concepts, principles, and processes into coursework and deliverables. The emphasis of this work is not only on the uptake of terminology, concepts, and ideas but of equal importance is the synthesis and application of these ideas within your own work. Over the course of the term, you will develop and build a term logbook. The logbook will provide a chance to demonstrate this uptake and synthesis of key material and method concepts, ideas, and terminology. The logbook will be a comprehensive document that includes three main deliverables for the course:

1. Lab work: which involves the documentation, synopsis and analysis of weekly lab testing and modeling
2. Glossary: which catalogues a visual compendium of drawings and sketches, from in-class sketching and reading assignments, that demonstrate key ideas, and terms.
3. Integrated Design Work: which involves a demonstration of materials and methods synthesis into term design work.

Additionally, the logbook can also be a place for students to record and think through technology and design related ideas. The logbook and its sub-parts will provide a consistent framework to assess the up-take and synthesis of key concepts, ideas, and terminology. All assessment will be conducted at log-book reviews scheduled throughout the term. Additionally, the logbook is meant to be the technology courses contribution to the terms process portfolio.

**Transfer credit**

B1 students who have already met 80% of the course learning objectives may be granted an exemption from ARCH 3207. If you're interested, please gather outlines from other relevant courses and contact Brian and/or Alex. About equal weight is given to the three areas of content on the one hand and to fundamental skills on the other.

**Additional qualifications**

This course and many others involve working with and around a variety of materials. All Dal architecture students must therefore complete Dalhousie's online WHMIS course that sets out the latest Workplace Hazardous Materials Information System. Please do so in the first four weeks of term. Many students have WHMIS certification from another organization, but Dalhousie recognizes only its own course. Students must also complete the Skills Tutorials scheduled for the early weeks of the term. Details will be posted on the landing bulletin board.

**Additional skills**

Students need to be or become familiar with basic spreadsheet functions using Excel, with the graphics software Adobe inDesign, and with a CAD software (Rhino 7 is recommended) Most software is free to students. Visit the School's Design Software page for details. Software tutorials and assistance will be provided by the School's Computer Help Desk free of charge. Many other avenues of support are available online.

**Format**

This course emphasizes hands-on experiences through labs. The course will additionally provide supplementary lectures, demonstrations, and readings to prepare students for hands-on experiences. In balancing time between your various courses and other commitments, you should allot approximately 9 hours per week for this course, budgeted, roughly as follows:

| Course Component | Time Breakdown (hrs) | % Breakdown |
|---|---|---|
| | | |
| Class Lectures & In-Class Demonstrations | 1.5 | 33% |
| Readings & Term Glossary Work | +/- 2.0 | 22% |
| Weekly Labs & Lab Book | 4.0 | 33% |
| Design Work Assessment | +/- 1.5 | 11% |

You will be responsible for managing your own time. The weekly time allocations will vary depending on the module deadlines.

# COURSE CONTENT

**Topic Areas**
The course introduces three areas of building technology:

***Module One: Materials & Methods***

How do we select materials for our buildings? How do we weigh material options against one another? What are the key material concepts that architects need to understand? This module focuses on the material and methods surrounding the material reality of architecture. This module will work to set up concepts and ideas that will connect to succeeding topics.

***Module Two: Forces (Structures)***

How do buildings hold up against gravity, wind, and earthquakes? How do we keep them stable during construction? Can structure have an aesthetic dimension? This module looks at structure and how we can leverage material qualities to work against the loads and forces our buildings are subjected to.

***Module Three: Light***

How do we bring the richness and complexity of daylight into our architecture, while protecting

ourselves from the sun? How can we leverage a material's intrinsic properties to modulate light within and outside our buildings? This module focuses on material relationships to environmental lighting, and how we can configure, design and place our materials to leverage this relationship.

## Learning Objectives

The main learning objective of this course is to develop material knowledge and methodologies through a mixture of introductory experiences. These experiences are inclusive of lectures, live demonstrations, in-class sketching assignments, lab assignments, and reading assignments. Over the semester, you will develop an understanding and facility with material testing, analysis, selection & design as it pertains to architecture, building science, and practice. You will be given the tools and opportunity to integrate the key concepts, principles, and processes into design studio work – synthesis of these ideas within design work will also be a key objective. Additionally, throughout the course, you should specifically develop the ability and motivation to:

1. *Develop literacy around technological ideas, skills, concepts, and terminology*
    - Take in and digest concepts & terminology through, readings, lectures, demonstrations, and lab work,
    - develop an understanding of graphic standards for technical drawings
    - make simple technical drawings and sketches, either through analog or digital means.
    - synthesize and apply concepts & terminology through discussion, sketching, lab and design work
    - document and catalogue in term logbook (Glossary + Lab Book)

2. *Explore materials' properties, attributes, and characteristics in relation to environmental phenomena*
    - develop and apply understanding of extrinsic and intrinsic material properties
    - consider the contextual impacts our physical environments have on our materials
    - pull key ideas from CAD material testing tools used in class demonstrations
    - hypothesize material-environment relationships in material selection, design work and detailing

3. *Conduct small-scale material testing and analysis*
    - develop hands-on testing methods for materials and models with the course's sandbox/toolkit
    - conduct safe use of hand tools, jigs, molds, handheld power tools, and low-hazard stationary tools
    - consider manipulation of wood, plaster, clay, and other materials
    - express material relationships to environmental phenomena through testing scenarios
    - generate iterative and performance-driven testing options
    - rationalize and balance empirical findings against design requirements and needs
    - write and/or draw diagrammatic analytical and critical assessments of documented lab work

4. *Conduct technological analysis and exploration in the context of design*
    - develop technology tools to move forward design studio projects
    - generate a variety of analytical options and responses to design briefs
    - express technology ideas in cogent and articulate diagrams, models and/or drawings.
    - hypothesize and select material functions, combinations and performances
    - document and catalogue in term logbook (design work assessment)

## Term Schedule

| week & date | | Monday (M) Lab B-Building Room 308 | Thursday (Th) Lecture Room B015 (Auditorium) | Readings | Assignments and Assignments Due Dates |
|---|---|---|---|---|---|
| 1 | (M) Sept 11th (Th) Sept 14th | **Course Introduction + Q+A** (0.5 hr)<br><br>**Lecture: Materials and Methods** (1.0hr)<br><br>**Lab Introduction + Q+A** (0.5hr)<br><br>**Sandbox Distribution** (0.5hr) | **Lecture One:** Materials II Wood (1.0hr).<br><br>**Introduce Glossary** (0.5 hr) (in-class exercise – running through a demo of what we are expecting + an overview)<br><br>**Demo:** Making a pdf | **R1** | **Introduce Term Logbook:** Inclusive of Glossary and Lab work |
| 2 | (M) Sept18th (Th) Sept 21nd | **Lab One: Folding, Crumpling + Origami)** | **Lecture Two:** Materials III Metals (1.5hr) | **R2** | |
| 3 | (M) Sept 25th (Th) Sept 28th | **Lab Two: Strip Bending + Weaving** | **Site Visit or site lecture: tbc** (1.5hr) | **R3** | **Lab One Due (Thurs Sept 28)** |
| 4 | (M) Oct 2rd (Th) Oct 5th | Truth and Reconciliation Holiday – No Class | **Lecture Three:** Materials IV Ceramics (1.5hr) | **R4** | **Lab Two Due (Thurs Oct 5)** |
| 5 | (M) Oct 9th (Th) Oct 12h | Thanksgiving Holiday – No Class | **Lecture Four:** BSI + Structures (1.0hr)<br><br>**Mid Term Glossary** Tutorial | **R5** | |
| 6 | (M) Oct 16th (Th) Oct 19th | **Lab Three: Plaster Casting** (3 hr) | **Lecture Five:** Structures II (1.0 hr)<br><br>**Midterm Review of Glossary -** selected examples | **R6** | **Midterm Glossary due- (Thurs Oct 19)** |

| | | | | | |
|---|---|---|---|---|---|
| 7 | (M) Oct 23th<br>(Th) Oct 26th | **Lab Four: Stacking, Retaining** (3 hr) | **Lecture Six:** Structures III (1.0hr)<br><br>**Demo: Grasshopper and structure** (0.5hr) | **R7** | **Lab Three Due (Thurs Oct 26)** |
| 8 | (M) Oct 30st<br>(Th) Nov 2rd | **Lab Five: Cantilevering + Bridging** (3 hr) | **Lecture Seven:** Light I + Heat Intro 1.0hr)<br><br>**Introduce Integrated Design Work I** (0.5 hr) | **R8** | **Lab Four Due (Thurs Nov 2)** |
| 9 | (M) Nov 5th<br>(Th) Nov 8th | **Material Palette 1 Workshop** (3 hr) | **Lecture Eight:** Light II (1.5hr) | **R9** | **Integrated Design Work I Due with Design Pres (Tues Nov 7)** |
| 10 | Nov 13th – Nov17th | **Reading Week - No Classes** | | | |
| 11 | (M) Nov 20st<br>(Th) Nov 23rd | **Lab Six: Light** (3 hr) | **Lecture Nine:** Light III (1.0hr)<br><br>**Demo: Situating with Light** (0.5hr) | **R10** | **Lab Five Due (Mon Nov 20)** |
| 12 | (M) Nov 27th<br>(Th) Nov 30th | **Site Visit tbc** (3 hr) | **Lecture Ten:** Lifecycle (1.0hr)<br><br>**Revisit Integrated Design Work II** (0.5 hr) | **R11** | **Lab Six Due (Thur Nov 30)** |
| 13 | (M) Dec 4th<br>(Th) Dec 7th | **Material Palette 2 Workshop** (3 hr) | **Design Integration Tutorial**<br><br>**SLEQs** (0.5 hr)<br>Last Day of Classes | **R12** | **Final Review of Glossary (Thurs Dec 7th)** |
| 14 | **BEDS Final Reviews** | | | | **Integrated Design Work II Due with Design Pres** |

**SLEQs**: Student Learning Experience Questionnaire (SLEQ) will be completed in week 13.

# ASSESSMENT

## Assignments

Over the course of the term, you will develop and build a term logbook. The logbook will provide a chance to demonstrate this uptake and synthesis of key material and method concepts, ideas, and terminology. The logbook will be a comprehensive document that includes the courses three main deliverables:

1. **Lab work (60%)**: which involves the documentation, synopsis and analysis of weekly lab testing and modeling (6% per lab)
    i. Lab book to be handed in after every lab. There are 10 weekly labs in total.
    ii. Teamwork: all members get the same mark for lab work. Individual marks: for Analysis of Lab work.
    iii. Generally assigned Monday, due prior to the start of the following week's lab.
    iv. Lab book should not only document Lab exercises completed within Technology Groups but should also showcase individual analysis and synthesis of lab work in relation to lecture and demo content.

2. **Glossary (20%):** which catalogues a visual compendium of drawings and sketches, from in-class sketching and reading assignments, that demonstrate key ideas, and terms.
    i. Individual work, but consultation among team members is welcomed
    ii. Mid-term submissions in week 7: 10%. final submission in week 12: 10%
    iii. Work includes glossary sketches from in-class sketching sessions surrounding lectures, in-class demonstrations, as well as glossary sketches from assigned readings.
    iv. Additional visual and written work from related design work and labs are welcome entries within the glossary. Glossary to be included in Term Process Portfolio

3. **Integrated Design Work (20%):** which involves a demonstration of materials and methods synthesis into term design work. Team or individual work, as per design project. For team projects, all members receive the same mark.
    1. **Integrated Design Work I (5%)** will focus on the B1 Design Case Study Assignment.
        a. The deliverable will involves the assembly of a material palette that is representative of the group's assigned case study. Additionally, the group will be required to build a material matrix for said palette that links both intrinsic and extrinsic material properties to the configuration and use within the case study.
    2. **Integrated Design Work II (15%)** will focus on the Counterpoint Pavilion assignment,
        a. The deliverable will involves building on the material palette and matrix built in the B1 Design Case Study. Using the palette and matrix, develop a variety of palette combinations & recombinations for your Counterpoint Pavilion design.
        b. You will be required to work iteratively and outline your rationale for each material combination. You will also have to provide rationale for the palette combinations you end up selecting for your final counterpoint design.

Additionally, the logbook can also be a place for students to record and think through technology and design related ideas. The logbook and its sub-parts will provide a consistent framework to assess the up-take and synthesis of key concepts, ideas, and terminology. All assessment will be conducted at log-book reviews scheduled throughout the term. Additionally, the logbook is meant to be the technology courses contribution to the terms process portfolio.

All assignments are to be submitted to Brightspace in pdf. format

## Grading feedback and rubrics

After each review, students will receive a letter grade, with detailed rubric evaluations. Additionally, reviews provide each student (or team) with extensive qualitative feedback on each assignment, while in the two process portfolio reviews during the term, faculty discuss with each student their design work, progress in the course, strengths, and areas that need work. Students are welcome to record oral feedback.

| Grade | Point | Percent | Definition | Description |
|---|---|---|---|---|
| A+ | 4.30 | 90-100 | Excellent | Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base. |
| A | 4.00 | 85-89 | | |
| A– | 3.70 | 80-84 | | |
| B+ | 3.30 | 77-79 | Good | Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with precedents/the literature. |
| B | 3.00 | 73-76 | | |
| B- | 2.70 | 70-72 | | |
| C+ | 2.30 | 65-69 | Satisfactory | Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience. |
| C | 2.00 | 60-64 | | |
| C- | 1.70 | 55-59 | | |
| D | 1.00 | 50-54 | Marginal Pass | Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills. |
| F | 0.00 | 0-49 | Inadequate | Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature. |
| INC | 0.00 | | Incomplete | |
| W | Neutral | | Withdrew after deadline | |
| ILL | Neutral | | Illness, compassionate reasons | |

## Format and other assignment details

Each assessment component is described in greater detail on Brightspace under Content > Assessment Components > Assignments. These outlines include rubrics or checklists that set out grading criteria.

## Submission of work

As a rule, you will submit work both physically (in 2d or 3d form) and digitally in a .pdf or another file. Details vary with the assignment. Digital work to be submitted on Brightspace; physical work as instructed in the assignment brief.

### Marks and grades

Numerical marks will be given by Instructor and TA's working collaboratively or by. They will be posted to Brightspace at the earliest opportunity. Accumulating grades will converted to a letter grade (tinyurl.com/dal-grading) in the Brightspace spreadsheet according to the Dalhousie system. Term grades may be adjusted by the instructor and are not final until approved by the School.

### Feedback

Written feedback will be brief and generally refer directly to rubrics; students are encouraged to seek oral elaboration. Lab and in-class grades accumulate steadily. Feedback for Glossary & Design related work will be delivered after their respective deadlines in a timely manner. Please refer to term schedule for dates of deadlines.

### Team and individual work

Architectural practice is collaborative, so in preparation for that you'll be doing a fair amount of work in teams of 4 or 5. Care is taken to make the teamwork agreeable and productive, e.g. students help make the teams as equitable as possible. Evident fairness between teams enables us to keep teams consistent, and this gives time for effective group patterns to develop.

### Integration with other courses

Four of the exercises in this course are designed to complement or support your work in Design, and work for the two courses may be reviewed together. However, only work assigned in the technology course will be graded in the technology course.

## COURSE-SPECIFIC POLICIES

### Attendance

There is no attendance requirement *per se*. However, there are in-class assessment components that reward attendance.

### Absences

Both in-class and out-of-class assignments involve teamwork and peer evaluation, so please discuss any absences with your team as well as with the teaching team, pre-emptively where possible. Where individual components of teamwork cannot reasonably be made up through

individual work, and if legitimately missed and documented in a Student Declaration of Absence, the grading component may be dropped and the term grade pro-rated.

## Due dates and late submissions

Deductions for late submissions encourage time management and maintain fairness among students.

| | Due date | Is a late assignment accepted? | If so, what is the deduction per weekday? * | Is there a final deadline for a late submission? | What happens after that? |
|---|---|---|---|---|---|
| Weekly Labs 1 - 6 | Due on the following Thursday** (10 days) | yes | 3% | Two weeks after submission date | Receives 0% and no comments |
| Glossary Review I | Oct 19th | yes | 3% | Two weeks after submission date | Receives 0% and no comments |
| Integrated Design Work I | Nov. 7th | yes | 3% | Two weeks after submission date | Receives 0% and no comments |
| Glossary Review II | Dec. 7th | yes | 3% | end of term | Receives 0% |
| Integrated Design Work II | Dec. 12th | yes | 3% | end of term | Receives 0% |

* For example, if an assignment is evaluated at 75% before applying a 3%-per-weekday deduction, it would receive 72% for being 1–24 hours late; 69% for 25–48 hours late; etc.
** The exception is that Lab 5 is due the Monday after reading week, on Nov. 20th.

**Note:**

The following University or School policies take precedence over course-specific policies:

- No late assignments are accepted after the last day of weekly classes (the Friday before review week).
- With a Student Declaration of Absence (maximum two per course), an assignment may be submitted up to three weekdays late without penalty. An SDA cannot be used for the final assignment.
- With a medical note submitted to the school office, a course assignment (including a final assignment) may be submitted more than three week-days late without penalty. The number of weekdays depends on how long you were unable to work, as indicated in the medical note. If more than one course is affected, you should consult with the Undergraduate/Graduate Coordinator to set a new schedule of due dates.
- A student with an accessibility plan that allows for deadline extensions does not need to submit an SDA.

### Plagiarism

No plagiarism software is used in this class beyond ordinary search engines. It is expected that students will make creative use of architectural and technical precedent, and that sources will be credited (tinyurl.com/dal-arch-writing).

### Lecture notes and recordings

It is hoped that a team of student volunteers will help record lectures for posting to Brightspace. Other recordings are discouraged. Lecture slides and/or notes will, as a rule, be posted to Brightspace. Some lectures will include handouts; some of these will be completed during the lecture and handed in at end of class.

## FACULTY POLICY

### Equity, Diversity and Inclusion

The Faculty of Architecture and Planning is committed to recognizing and addressing racism, sexism, xenophobia and other forms of oppression within academia and the professions of architecture and planning. We, the faculty, are working to address issues of historic normalization of oppressive politics, segregation, and community disempowerment, which continues within our disciplines today. If you have particular interests or issues you'd like to discuss, here's a link to our EDI committee webpage.

## UNIVERSITY POLICIES AND RESOURCES

This outline is written in accordance with Dalhousie's Syllabus Policy. This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate.

See the School's "Academic Regulations" page (tinyurl.com/dal-arch-regulations) for links to university policies and resources regarding:

- Academic Integrity
- Accessibility
- Code of student conduct
- Culture of respect
- Equity, diversity and inclusion
- Student declaration of absence
- Recognition of Mi'kmaq territory
- Work safety
- Services available to students, including writing support
- Fair dealing guidelines (copyright)
- Dalhousie University Library

**Date**: 2023.09.11