ARCH 364: Building Science

Winter 2024

"How to make buildings that work" or "*How to practise architecture and not get sued"*☺

This course develops an understanding of scientific principles, as well as economic, technical, and practical factors that influence *good design for physical performance* (durability, health, safety, resource, and energy efficiency) & thus sustainability of building. Principles of siting, shape, orientation and enclosure design from earlier courses will be briefly reviewed and applied to enclosure design. Enclosure science and technology will be the focus in the context of modern professional practise.

Learning Objectives

At the end of the course students will be able to

- define the functions of the building enclosure and its constituent parts.
- develop enclosure schedules including functional requirements
- calculate the thermal resistance of building assemblies, including thermal bridges as required by current codes
- explain the principles of good building science, i.e., primarily the principles of rain penetration management, air leakage, heat flow, and condensation control
- apply the principles of building science to the detailing of common building enclosure intersections
- produce professional design documentation, especially the provision of the correct information on building enclosure drawings for schematic concept design (SD), design development (DD) and construction documents (CD)

Scope & Approach

The bulk of the course will focus on Canadian multi-unit residential, commercial/institutional buildings designed by architects but different climate zones (such as hot-humid), and single-family will be mentioned.

Common building enclosure assembly materials and designs will be explored through case studies of famous, local, unique, and vernacular building materials, details, sections, etc. both successful and failures.

The course's focus is on the needs of the professional architect, i.e., those involved in the design, rehabilitation, construction and operational aspects of buildings and the building enclosure i.e., walls, windows, roofs, foundations etc.

Instructor:

Dr John Straube, P.Eng. jfstraube@uwaterloo.ca
(preferred method, not Teams chat or text messages)
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Teaching Assistant

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Lectures

Weekly Friday 2:00PM - 4:50PM in ARC1101

These will be traditional lectures and in-class dialogue. In general, pdf's of the lecture slides will be uploaded to the LEARN site shortly *after* the lecture. Slides will not generally be posted prior to lectures for reasons of pedagogy.

Topics will be delivered in support of the learning objectives and should be expected to be adjusted and modified to align with your ongoing studio work and specific interests of the class.

Course Deliverables and Assessment

Marks will be assigned through:

- quizzes / in-class exercises (a total of 10%)
- Assignments (4 @ 10% = 40%)
- enclosure detailing of your studio project (25%), and
- a 2.5 hour final exam (25%).

Short ***on-line quizzes*** (LEARN) will be assigned during or after some lectures to confirm both attendance and comprehension and help keep everyone up to date… this will need to be completed within a short time window that will open after class Friday.

Assignments are all to be submitted into the LEARN Dropbox on the course site. They are due 10 PM Friday to avoid conflicts with other course (and hence late penalties will be enforced). All assignments must be submitted in a single bundled file pdf form with a separate cover page with the students' full name, ID#, and ARCH 364-2024 clearly written or typed. One warning will be issued, after which the assignment will have 25% removed.

The ***final project*** will be handed in on the last day of classes (Apr 8, at 10 PM) and aims to integrate this course with your term studio project. It will be assigned in the final month as your studio project becomes more clearly designed. The final exam date has not yet been scheduled – please coordinate with the front office as to when this is set.

The level of effort, including attending classes and assigned reading is an average of 6 hrs per week. Some weeks will be less (as little as 3 hrs for class attendance), and those weeks with assignments and reading due will be more than 6 hrs total (and hence work on assignments should start *at least a week* before the due date).

Reference Materials and Texts

Recommended textbook *High Performance Building Enclosures*, by John Straube, Building Science Press, Somerville, MA, 2012. 978-0-9837953-9-1. I will sell the book in person for a significant discount for cash but it can be purchased on line @ www.buildingsciencepress.com

Extensive Web notes (via the Learn site) will be provided. Required (tested and discussed in class) readings will be assigned in class and posted to Learn in a folder identified as such.

It is assumed that you have taken the ARCH building technology courses and hence have a copy of, and understand, *Fundamentals of Building Construction*, by Ed Allen (any edition) e.g. Wiley, 2013, ISBN 0471219037 or newer.

Course Delivery Platforms & Communication

Arch 364 will use standard in-person lectures with assigned reasdings/ pre-recorded slide shows/videos (posted or linked from LEARN).

COVID-19 Special Statement

Given the on-going situation around COVID-19, students are to refer to the University of Waterloo's developing information resource page (https://uwaterloo.ca/coronavirus/) for up-to-date information on academic updates, health services, important dates, co-op, accommodation rules and other university level responses to COVID-19.

In the event classes pivot to online delivery, the instructor will deliver lectures through TEAMS or Zoom at the same time as scheduled for in person lectures. In this case, the course's official Notice of Recording document will be found on the course's LEARN site. This document outlines shared responsibilities for instructors and students around issues of privacy and security. Each student is responsible for reviewing this document.

Fair Contingencies for Emergency Remote Teaching

To provide contingency for unforeseen circumstances, the instructor reserves the right to modify course topics and/or assessments and/or weight and/or deadlines with due and fair notice to students. In the event of such challenges, the instructor will work with the Department/Faculty to find reasonable and fair solutions that respect rights and workloads of students, staff, and faculty.

Late submissions:

No projects will be accepted past the final exam period, and will be assigned a mark of zero, i.e. a course failure, without a doctor's note. In term projects will have marks deducted for late submission at the rate of 20% of total grade per day. Only in the case of a justified medical or personal reason will these penalties be waived, and only if these have been officially submitted to the Undergraduate Student Services Co-Ordinator and accepted by the Undergraduate Office. Students seeking accommodations due to COVID-19, are to follow Covid-19-related accommodations as outlined by the university here: (https://uwaterloo.ca/coronavirus/academic- information#accommodations).

Rules and Regulations

Missed Quiz/Exam. Student who miss quizzes must have a doctor's note or equivalent. Plan to be present in school during the official final exam period. *Student travel plans are not considered acceptable grounds for granting an alternative examination time*

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

CITE SOURCES that you use in your work. This includes assistance provide by Artificial Intelligence, such as ChatGPT, and websites like buildingscience.com, pinterest, Dezeen, etc.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.