CIV E 779 Advanced Topics in Structural Engineering

Fall 2025 - September 03 to December 08

Class time: Tuesday, Thursday 11:00-12:20 Location: NRE 2-117

Instructor:

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Donadeo Innovation Centre For Engineering
Office Hours: by appointment

Course Description:

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Course synchronous and asynchronous content delivery schedule:

All course content will be delivered synchronously.

Land Acknowledgment:

The University of Alberta respectfully acknowledges that we are situated on Treaty 6 territory, traditional lands of First Nations and Métis people.

TA Information:

Bowen Yang, by1@ualberta.ca

Course Objectives & General Content:

The fundamentals of building sciences and engineering - mainly the advanced concepts and theories of heat, air, and moisture (HAM) transfer and energy performance simulations for built environments - will be covered in this course. The influences of exterior weather conditions and the operations of building systems on the indoor temperature and humidity levels will be analyzed. By taking this course, students will be able to interpret common building phenomena, analyze and simulate indoor environmental conditions, and develop better building designs and operations.

Learning Outcomes:

By the end of this course, students should be able to:

1. Be able to apply numerical methods to calculate 1D steady-state or transient heat transfer in building components;
2. Apply the theories of vapor diffusion to analyse 1D steady-state vapor diffusion in building assemblies;

3. Evaluate the hygrothermal properties of opaque building assemblies, and select proper designs for given building conditions;
4. Interpret the movement of the sun relative to a building and calculate the solar radiation incident on a given surface at a given time;
5. Calculate the thermal and optical properties of windows, and select the proper designs for a given climate;
6. Determine the psychometric conditions of an indoor space for different climatic and building operational conditions;
7. Interpret the metrics of occupant thermal comfort and evaluate the thermal comfort conditions in a given room;
8. Select suitable materials and systems for given climates and building types.

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Five assignments	Synchronous	See Schedule below and course website	40%
Mid-term exam	Synchronous	See Schedule below and course website	20%
Final exam	Synchronous	December 11, 09:30 to 11:30	40%

Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

Term Work

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work, shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

Additional Notes

The final exam is open-book, allowing the use of any hard-copy and electronic materials. Permitted devices include calculators, computers, and tablets, but please note that Internet access is strictly prohibited.

Calculator Policy

There is no calculator policy in this course; students are free to use the calculator they wish for all assessments.

Expectations for AI use

In this course, our primary focus is to cultivate an equitable, inclusive, and accessible learning community that emphasizes individual critical thinking and problem-solving skills. To ensure a fair and consistent learning experience for all students, the use of advanced AI tools such as ChatGPT or Dall-E 2 is strictly prohibited for all academic (written/coding/creative/etc.) work, assignments, and assessments in this course. Each student is expected to complete all tasks without substantive assistance from others, including AI tools.

Any use of AI tool in your academic work may result in academic penalties and be considered an act of cheating and a violation as outlined in the relevant sections of University of Alberta (November 2022) Code of Student Behaviour .

Text and References (Mandatory):

N/A

Text and References (Recommended):

- o Hutcheon N.B. and Handergord G.O.P. “Building Science for a Cold Climate (BSCC)” (UofA library)
- o ASHRAE Handbooks, HVAC systems, HVAC applications, Fundamentals, (UofA library)
- o F. Kreith, “Principles of Heat Transfer (PHT), 7th edition” (UofA library)
- o Lienhard, “A Heat Transfer Textbook (HTT)” (free online)
- o Other course materials to be provided in eClass

Website:

Canvas - https://canvas.ualberta.ca/courses/26933

Previous Examples of Evaluative Materials:

Available on the course website

Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!

Weekly Schedule

Topics	Weeks and Lectures	References	Notes
Course introduction; Environment, people & buildings; Energy and buildings;	Week #1, Sept. 2-5, Lecture Intro	BSCC Ch 1 & 2;	Discussion of course logistics;
Basics of heat transfer	Week #2, Sept. 8-12, Lecture Intro	BSCC Ch 8; Fundamentals Ch 4; PHT Ch 1; HTT Ch 1;	Watch out for the last day to add/drop the course
Basics of thermal conduction	Week #2, Sept. 8-12, Lecture Cnd	BSCC Ch 8; Fundamentals Ch 4; PHT Ch 2 & 3; HTT Ch 2;	
Basics of thermal convection	Week #3, Sept. 15-19, Lecture Cnv	BSCC Ch 8; Fundamentals Ch 4;	Release of Assignment #1 (Conductive and convective heat transfer in a building)
Whole building simulation, Part #1	Week #3, Sept. 15-19, Lecture Sim		Lecture Sim has three parts.
Basics of radiant heat transfer	Week #4, Sept. 22-26, Lecture Rad	BSCC Ch 4; Fundamentals Ch 4; PHT Ch 9; HTT Ch 10;	Release of Assignment #2 (overall heat transfer and thermal network);
Solar radiation and buildings	Week #5, Sep. 30 - Oct. 10, Lecture Slr	BSCC Ch 9; Fundamentals Ch 14	No lecture on Tuesday, Sept. 30
Midterm	Week #6, Oct. 6-10		In class, 11:00 – 12:20 AM Topics: Lectures before solar radiation.
Windows	Week #7, Oct. 13-17 Lecture Win	BSCC Ch 9; Fundamentals Ch 15;	Release of Assignment #3 (Solar radiation through windows)

Air ex/infiltration, ventilation	Week #8, Oct. 20-24 Lecture Air	BSCC Ch 10; Fundamentals Ch 16, 24;	
Whole building simulation, Part #2	Week #9, Oct. 27–31 Lecture Sim		
Psychrometrics and air conditioning	Week #10, Nov. 3-7 Lecture Psy	BSCC Ch 11; Fundamentals Ch 1; BSCC Ch 3, 5, 6, 12, 13.17 to 13.20;	Release of Assignment #4 (air and moisture movement in buildings)
Week #11, Nov. 10 to 14	**Fall Term Reading Week. No Classes**		
Building envelope	Week #12, Nov. 17-21 Lecture Env	BSCC Ch 12 Fundamentals Ch 25, 26, 27; Applications Ch 44	
Indoor thermal comfort	Week #13, Nov. 24-28 Lecture Com;	BSCC Ch 13 & 14; Fundamentals Ch 9	
Whole building simulation, Part #3	Week #13, Nov. 24-28 Lecture Sim		Release of Assignment #5 (indoor environment and energy consumption);
Case studies of buildings in cold regions;	Week #14, Dec. 1-5 Lecture Eco	Reading materials in course website	
Guest lecture or course review	Week #14, Dec. 1-5	Materials prepared by the speaker	The potential guest lecture could be switched with a lecture on an earlier date.
Final exam	University exam schedule		December 11th, 9:30 to 11:30 Topics: all topics

Additional Information on Marking Scheme

- Assignments: 40%, five assignments, 8% each.
- Exams: the weight of the midterm exam is 20%, final exam is 40%. Open-book, free-solo style (i.e., all tools/materials, except AI and Internet, are allowed, yet must be individual work);
- No replacement assignment or midterm will be available. If a student misses the midterm exam, its weight will be transferred to the final exam. In that case, the final exam will be 60%.
- Course project: bonus marks, up to 10%, at the discretion of the instructor. Can be submitted only after finishing five assignments. Must be submitted before the final exam.

Notes on exams

- Make sure you have read and understood the integrity and ethics policy of the University of Alberta as stated earlier in the syllabus.
- Exams will be held in-person. Special accommodation will be arranged for reasonable circumstances.

Notes on assignments

- One solution file in PDF format for each assignment should be submitted in the course website before due time. Students should download their files from the course website and check the legibility of the files.
- Any request for due time extension should be emailed to the instructor before the due time. Extensions will only be granted under reasonable circumstances. Extension is up to one week after due time.
- No penalty will be applied for less than 1-hour late submission. No submission will be accepted after this 1 hour or answers have been posted.

Assignment format (sections and their content, see assignment examples in course website)

- Methodology
    - For each question, use one or two paragraphs to describe your general approach (use schematic if necessary)
    - List all key equations and explain their parameters (real and assumed).

- Results and discussion:
    - Present your answers with important figures.
    - Explain your answers with a few sentences for each figure. (e.g., are they reasonable and expected and why? if not, why not).
- Appendix
    - References (sources of data, models, and methods taken from other people and used in the solution);
    - Supporting information (source codes, supplemental tables, figures)

Notes on course project

- The course project is a literature review and technology survey, related to any topics covered in this course.
- The course project should be a teamwork of two persons.

Structure and content of project report:

- The project report should be between 1500 and 1800 words (about 5 to 6 pages, double spacing), excluding equations, figures, tables, reference, and appendix.
- The report should include the following five sections and the meet their content requirements:
    1) Introduction
        a) Background
        b) Objective, and significance
        c) Scope and approach
    2) Literature review and technology survey
        - Presentation of source data.
        - Quantitative and/or qualitative comparison and evaluation
    3) Conclusion
    4) References
    5) Appendix (optional)

University and faculty policies

Respect and professionalism

The Faculty of Engineering is committed to fostering and protecting an equitable, inclusive, and respectful work and study environment in line with University of Alberta policies and professional engineering industry standards.

The faculty prepares students to uphold industry standards to become a Professional Engineer (P.Eng). Therefore, respect, professionalism, and accountability must be upheld within the Faculty of Engineering and the University of Alberta.

Academic integrity and student conduct

The University of Alberta is committed to the highest standards of academic integrity and honesty, as well as maintaining a learning environment that fosters the safety, security, and the inherent dignity of each member of the community, ensuring students conduct themselves accordingly. Students are expected to be familiar with the standards of academic honesty and appropriate student conduct, and to uphold the policies of the University in this respect.

Students are particularly urged to familiarize themselves with the provisions of the Student Academic Integrity Policy and the Student Conduct Policy, and avoid any behaviour that could

potentially result in suspicions of academic misconduct (e.g., cheating, plagiarism, misrepresentation of facts, participation in an offence) and non-academic misconduct (e.g., discrimination, harassment, physical assault). Academic and non-academic misconduct are taken very seriously and can result in suspension or expulsion from the University.

All students are expected to consult the Academic Integrity website for clarification on the various academic offences. All forms of academic dishonesty are unacceptable at the University. Unfamiliarity of the rules, procrastination or personal pressures are not acceptable excuses for committing an offence. Listen to your instructor, be a good person, ask for help when you need it, and do your own work -- this will lead you toward a path to success. Any academic integrity concern in this course will be reported to the College of Natural and Applied Sciences. Suspected cases of non-academic misconduct will be reported to the Dean of Students. The College, the Faculty, and the Dean of Students are committed to student rights and responsibilities, and adhere to due process and administrative fairness, as outlined in the Student Academic Integrity Policy and the Student Conduct Policy. Please refer to the policy websites for details on inappropriate behaviours and possible sanctions.

The College of Natural and Applied Sciences (CNAS) has created an Academic Integrity for CNAS Students eClass site. Students can self-enroll and review the various resources provided, including the importance of academic integrity, examples of academic misconduct & possible sanctions, and the academic misconduct & appeal process. Students can also complete assessments to test their knowledge and earn a completion certificate.

"Integrity is doing the right thing, even when no one is watching." -- C.S. Lewis

The Faculty of Engineering expects an environment free of harassment, discrimination, and bullying. We encourage you to talk to the Office of Safe Disclosure and Human Rights about experiences, questions, or concerns. Additional resources and support for students are attached below.

Engineering students studying in the province of Alberta must also follow the Code of Ethics set by the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

Course outline policies, course requirements, evaluation and grading information can be found in the University Calendar.

Safety during learning activities

In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control.

Anyone found to be unable to function safely in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors in alignment with the Student Academic Integrity Policy and Student Conduct Policy. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of unsafe work.

Audio and video recording

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan.

Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Only those items specifically authorized by the instructor may be brought into the exam facility. Students must not bring any unauthorized electronic device into an examination room, including cell phones or other devices.

Student services and support

Health & Wellness Support

Counselling and Clinical Services

Free, short-term, appointment-based counselling and psychiatric services. Also offers drop-in workshops. Book an initial consultation. Visit uab.ca/CCS to learn more.

Wellness Supports Social Workers

Free one-on-one support for students in the areas of housing, finances, academics, personal wellness, life skill development, family dynamics, system navigation, and any area of life where there is a desire to invite change. Visit uab.ca/wellness to learn more.

Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling. Visit uab.ca/UASAC to learn more.

The Office of Safe Disclosure & Human Rights (OSDHR)

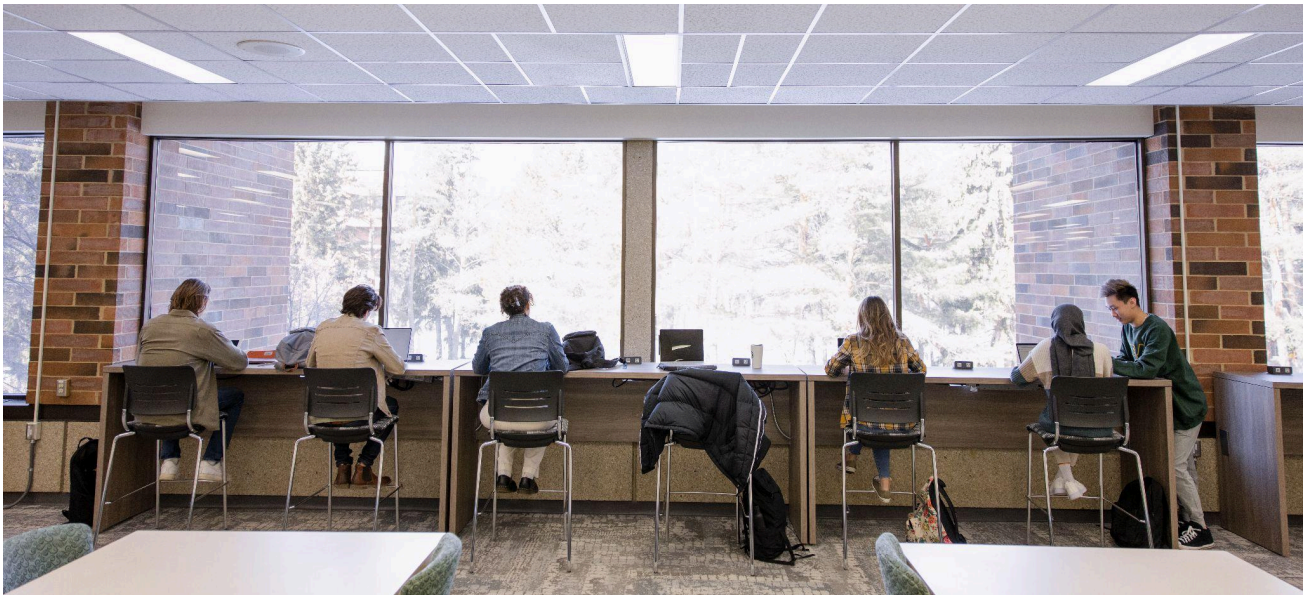
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

HIAR (Helping Individuals at Risk)

If you're worried about someone, contact HIAR, who can help assess risk and connect individuals to support. Learn more at uab.ca/HIAR.

Immediate External Supports

Health Link Alberta: 811
Suicide Crisis Helpline: 988



Academic support

Academic Success Centre
Access to a variety of services to maximize your academic success. Learn more at uab.ca/ASC.

Accessibility Resources
Connects students with disabilities to accommodations. Learn more at uab.ca/Access under accommodations + accessibility.

Decima Robinson Support Centre
Academic support for 100- or 200-level introductory calculus, linear algebra and statistics courses. Visit uab.ca/DSC to learn more.

Engineering Student Success Centre
The Faculty of Engineering provides drop-in tutoring for first-year courses. Visit uab.ca/ESSC to learn more.

Office of the Student Ombuds
Call for complex problems and conflict mediation. Learn more at uab.ca/ombuds.

Financial support

Student Service Centre

For awards and other funding support. Learn more at uab.ca/ask.

Campus Food Bank

The Campus Food Bank Society is an independent charity supporting University of Alberta students, faculty, staff, and alumni for up to five years. For additional information visit their website at campusfoodbank.com.