ACSE3105/ENVE4105: Green building Design

Course Syllabus – Fall 2023

Instructor: Elie Azar, PhD
Associate Professor
Civil and Environmental Engineering
Office: Canal Building (Room 4204)
Email: elie.azar@carleton.ca
Website: https://carleton.ca/cee/profile/elie-azar/

Teaching Assistants
TBD

Lecture: Tuesdays and Thursdays, 8:35 AM – 9:55 AM,
Lab: Varies per section. Please refer to the Public Class Schedule.

Office hours:
Elie: By appointment, Tuesdays and Thursdays, 10:00 AM – 11:00 AM.
TAs: TBD

COURSE DESCRIPTION (AS PER CATALOG)
Concepts, calculations, modeling; design of green buildings and their components; sustainable sites and landscaping; passive design; building envelope; building materials; daylighting; heating, cooling, and ventilation; building-integrated renewable energy systems; indoor environmental quality; overview of building standards and codes.

LEARNING OUTCOMES
1. Understand and perform calculations related to weather.
2. Apply building performance simulation (BPS).
3. Perform detailed calculations for solar geometry and energy.
4. Understand and apply design and engineering principles for lighting and daylighting.
5. Understand and apply design and engineering principles for building envelopes.
6. Understand and apply design and engineering principles for passive techniques.
7. Understand basic operational and design principles for HVAC systems.
8. Apply the integrated design process.
9. Understand and perform basic calculations on IAQ and natural ventilation.
10. Understand basic concepts related to occupant behavior.
11. Design and perform calculations on building-integrated renewable energy systems.
12. Perform steady-state thermal analysis.
COURSE DELIVERY
This course will be delivered fully in-person, this class is not catered towards online students or students who cannot access campus. Assessments will be held in-person (except for assignments).

PREREQUISITES AND RECOMMENDED KNOWLEDGE
Third-year status in B.Eng. in Architectural Conservation and Sustainability Engineering, Civil Engineering, or Environmental Engineering or fourth-year standing in B.A.S. concentration in Conservation and Sustainability.
All students should be familiar with basic heat and mass transfer, trigonometry, basic calculus and algebra, and use of Excel or similar spreadsheet software.

GRADUATE ATTRIBUTES
The Canadian Engineering Accreditation Board (CEAB) requires graduates of undergraduate engineering programs to possess 12 attributes. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to our programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate. This following list provides the GAs that will be measured in this course, along with the Learning Outcomes that are intended to develop abilities related to these attributes.

<table>
<thead>
<tr>
<th>GA - Indicator</th>
<th>Assessment Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.14.C-GASSS Discipline-specific concept: CEE-14 Green building design</td>
<td>Overall grade</td>
</tr>
</tbody>
</table>

For information on GAs and continual curriculum improvement, visit the Accreditation section of Engineers Canada website.

ACCREDITATION UNITS

<table>
<thead>
<tr>
<th>Math</th>
<th>Natural Science</th>
<th>Complementary Studies</th>
<th>Engineering Science</th>
<th>Engineering Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
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TEXTBOOK(S)/REFERENCES
The primary reference material (slides and tutorials) will be posted to BrightSpace. Supplementary text:

SOFTWARE
You may install these software on your personal computer or access them remotely via our virtual computer lab. See instructions for remote access to computers with the required software. [https://carleton.ca/dbom/wp-content/uploads/CEE-Computer-Lab-Instructions.pdf](https://carleton.ca/dbom/wp-content/uploads/CEE-Computer-Lab-Instructions.pdf)

- LBNL Therm
- LBNL Window
- LBNL Comfen
- eQUEST
- UCLA Climate Consultant

**COURSE COMMUNICATION**

The teaching team will use the announcement function in Brightspace to send out weekly updates with important information related to the course. Using the announcement function is helpful because it keeps all communication from me about this course in one place instead of searching through your email every time you need to find a previous communication.

We also have an “ask the teachers” forum in Brightspace in which you can post your questions about weekly course content and wording of assignment questions. This is done for 2 reasons (i) Out of fairness so that all students can have access to the same answers provided to other students and (ii) efficiency, instructors often get the same questions and instructors are not always available to answer emails right away. Having the forum allows instructors to put the answer to questions there and reduce the wait time on your end and reduce the response time.

**When should I email the professor directly?** You should email if you are writing about a personal issue (e.g., illness, excused absence, want to discuss your course performance, would like to learn more about research opportunities in my lab, or talk about other academic matters). Please allow for a 24-hour turn around. Important: start your email subject with “ACSE3105” or “ENVE4105” to ensure the email reaches my inbox as I use filters to organize my emails.

**TOPICS AND TENTATIVE PLAN (SUBJECT TO CHANGE)**

**Introduction**

Lesson 1: Background in green buildings
Lesson 2: Course overview

**Weather and climate**

Lesson 3: Weather and climate metrics
Lesson 4: Air psychrometry
Lesson 5: Solar geometry

*Tutorial 1: Climate data analysis in Climate Consultant*
*Tutorial 2: Working with data in EXCEL*
*Tutorial 3: Solving problems using psychrometric chart*
  - Assignment #1

**Envelope**

Lesson 6: Thermal analysis and design of building envelope
Lesson 7: Airtightness and natural ventilation
Lesson 8: Thermal properties of windows
Lesson 9: Design of fixed shading systems
  Tutorial 4: Solving envelope design problems
  Tutorial 5: Solving shading design problems
  Tutorial 6: Envelope thermal analysis with LBNL Therm
  Tutorial 7: Window thermal analysis with LBNL Window
  Tutorial 8: Midterm review
    Assignment #2

Midterm Exam

HVAC and renewable energy systems
  Lesson 10: HVAC systems
  Lesson 11: Steady-state load calculations
  Lesson 12: Building-integrated renewable energy systems
    Tutorial 9: Calculating sensible and latent heating and cooling loads
    Tutorial 10: Calculating optimal PV spacing and estimating generation potential
    Tutorial 11: Whole-building energy modelling with eQUEST
      Assignment #3

Lighting and daylight
  Lesson 13: Lighting and daylight performance metrics
  Lesson 14: Design and control for lighting and daylight
    Tutorial 12: Computing daylight performance metrics
    Tutorial 13: Daylight analysis in LBNL COMFEN
      Assignment #4

Design process and principles
  Lesson 15: Passive solar design
  Lesson 16: Integrated design process
    Tutorial 14: Final exam review

Final Exam

EVALUATION AND MARKING SCHEME

a) Grade Distribution
  Midterm  20%
  Four assignments  30%
  Final exam  50%

b) Exam format: Both the mid-term and final exams will be held in person.

c) Deferred term work and self-Declaration form: Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases. Contact the instructor with the completed self-declaration form no later than 3 days after the date/deadline of term work including test/midterm, labs, assignments.
d) **Deferred Final Examinations**: Students who are unable to write the final examination because of a serious illness/emergency or other circumstance beyond their control may apply for accommodation by contacting the Registrar’s office. Consult the [Section 4.3 of the University Calendar](https://carleton.ca/registrar/registration/dates/academic-dates/).

e) **Late submission policy for assignments**: Assignments are due by the beginning of the lecture on their due date. Late assignments will be accepted but at a reduced mark, at a rate of 1 percentage (of final grade) point per day. Assignments are to be completed individually (unless express permission is given otherwise); evidence of direct copying or plagiarism will be treated as cheating and will be handled according to university policy. An extended (justified) delay (see point “c”) might result in the weight of the assignment being shifted to the final exam.

f) **Missed Midterm Examinations**: Refer to point “c”; if the documentation is accepted, the weight of the missed test will be added to that of the final exam. If not, a grade of 0 will be given. No make-up exams will be offered.

**ACADEMIC DATES**

Students should be aware of the academic dates (e.g., last day for academic withdrawal) posted on the Registrar's office web site [https://carleton.ca/registrar/registration/dates/academic-dates/](https://carleton.ca/registrar/registration/dates/academic-dates/).

**ACADEMIC INTEGRITY AND PLAGIARISM**

a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: [https://carleton.ca/engineering-design/current-students/fed-academic-integrity](https://carleton.ca/engineering-design/current-students/fed-academic-integrity). Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that the work you submit is your own. As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- using another’s data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
- failing to acknowledge sources of information through the use of proper citations when using another’s work and/or failing to use quotations marks.

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The materials (including the course outline and any slides, posted notes, videos, labs, project,
assignments, quizzes, exams and solutions) created for this course and posted on this web site are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s).

**LEARNING AND WORKING ENVIRONMENT**

The University and all members of the University community share responsibility for ensuring that the University’s educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone’s personal beliefs, choices, and opinions.

**ACADEMIC ACCOMMODATIONS**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

- **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca.

  You should request your academic accommodations in the Ventus Student Portal, for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Senate Policy on Accommodation for Student Activities (PDF).

- **Pregnancy Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF).

- **Religious Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF).
- **Survivors of Sexual Violence**: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the [Sexual Violence Prevention & Survivor Support](https://carleton.ca/sexual-violence-prevention-survivor-support/).

**ENGINEERING ACADEMIC ADVISING**

The Engineering Academic Support Service assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation. Academic Advisors Contact can be found here: [https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/](https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/).

**STUDENT MENTAL HEALTH AND WELLNESS**

As a university student you may experience a range of mental health challenges that can significantly impact your academic success and overall well-being. Carleton’s [Wellness Services Navigator](https://carleton.ca/wellness/) is designed to help students connect with mental health and wellness resources.

If you need to talk to someone from the department for more information and support with connecting to resources, you can contact the following faculty members, depending on your program.

Or contact the department at [CEEUGChair@cunet.carleton.ca](mailto:CEEUGChair@cunet.carleton.ca).

- **ACSE**: Prof. **Scott Bucking**, Email: [scott.bucking@carleton.ca](mailto:scott.bucking@carleton.ca), Office: 5209 Canal Building
- **CIVE**: Prof. **Heng Khoo**, Email: [heng.khoo@carleton.ca](mailto:heng.khoo@carleton.ca), Office: 3364 Mackenzie
- **ENVE**: Prof. **Shoeleh Shams**, Email: [shoeleh.shams@Carleton.ca](mailto:shoeleh.shams@Carleton.ca), Office: 4242 Mackenzie

Here is a list of on-campus and off-campus resources:

1. **Carleton’s Health and Counselling Services**: To book an appointment contact the main clinic by calling (613) 520-6674. If urgent, let the Patient Care Coordinator know or go in person to the main clinic (2500 Carleton Technology and Training Centre Building) and indicate that they are in crisis and need to speak to someone right away. For more information, please see [https://carleton.ca/health/](https://carleton.ca/health/).
2. **Emergencies and Crisis** and [Emergency Numbers](https://carleton.ca/emergencies/)
3. **Good2Talk (1-866-925-5454)**: Good2Talk is a free, confidential helpline providing professional counselling and information and referrals for mental health, addictions and well-being to post-secondary students in Ontario, 24/7/365 [https://good2talk.ca/](https://good2talk.ca/).
4. **Empower Me**: Undergraduate students have access to free counselling services in the community through Empower Me, either in person, by telephone, video-counselling or e-counselling. This free service is accessible 24/7, 365 days per year. Call [1-844-741-6389 (toll free)](tel:1-844-741-6389) to make an appointment with a counsellor in the community. More information is available [https://students.carleton.ca/services/empower-me-counselling-services/](https://students.carleton.ca/services/empower-me-counselling-services/).
5. **The Walk-In Counselling Clinic (off-campus community resource)**: The walk-in Counselling Clinic have offices in various locations across Ottawa and the greater Champlain region that are open 7 days a week. Individuals will be assisted, with no appointment, on a first-come, first-serve basis during the Walk-in Counselling Clinic hours. The Walk-in Counselling Clinic offers services...
in many languages and is free and confidential. More information can be found at:
https://walkincounselling.com/

6. Distress Centre of Ottawa and Region: Available 10am-11pm, 7 days/week, 365 days/year.

7. Distress and Crisis Ontario, Available for chat 2 pm – 2 am EST.
   https://www.dcontario.org/

8. BounceBack Ontario (Toll-Free: 1-866-345-0224) is a free skill-building program managed by the Canadian Mental Health Association (CMHA). It is designed to help adults and youth 15+ manage low mood, mild to moderate depression and anxiety, stress or worry. Delivered over the phone with a coach and through online videos, you will get access to tools that will support you on your path to mental wellness. https://bouncebackontario.ca/.