ENV335H1-S – Environmental Design

I CONTACTS

INSTRUCTOR
Name: Kelsey Saunders
Email: kelsey.saunders@utoronto.ca
Office hours: Mondays 16:00-17:00pm (By appointment)
  In person: ES 1042
  Online: Zoom (Link to be shared via Quercus)

TA
To be determined.

II COURSE OVERVIEW

LOCATIONS:
Physical meeting location: ES B124
Digital meeting location: Zoom (Link to be shared via Quercus)

MEETING TIMES:
In person and/or synchronous online sessions - Mondays: 13:00 – 16:00 ET

* The class meetings will be recorded and uploaded to Quercus in the same day.

COURSE DESCRIPTION:
Environmental design, in the context of this course, refers to design strategies that account for the ability of supporting ecosystems to continue to meet human needs and those other lifeforms without diminishing biological diversity or environmental quality. This course takes a hands-on approach to investigating several environmental issues specific to architectural design: climate-responsive design, energy consumption, health and comfort, natural lighting, natural ventilation, mechanical HVAC systems, and on-site renewable energy generation. The Environmental Design course will expand upon these concepts through lectures, case studies, and hands-on activities in class. By the end of the term, students will propose a design of a net-zero energy/carbon residential building.

STUDENT LEARNING OUTCOMES:
By the end of this course, a successful learner will be able to do the following:
1. Understand the impacts of architectural design on operational and embedded energy.
2. Predict and describe the impacts of architectural design on energy consumption and human health and comfort.
3. Analyze a subset of environmental design issues in architecture based on measured data, mathematical estimations, or physically-based performance simulations.
4. Make recommendations towards the design of a net-zero energy (or carbon) housing development based upon novel analysis (group analysis project).

PREREQUISITE COURSE(S):
This course assumes you have completed 8.0 FCE including ENV221H1/ENV222H1 or have permission of the Undergraduate Associate Director.

III  HOW THE COURSE IS ORGANIZED

Weekly class meetings are divided between slide lectures, case studies and hands-on exercises/tutorials. All the class meetings will be recorded and uploaded to Quercus in the same day. Participation in the course requires the submission of four homework activities, two quizzes, and a final analysis project. Attendance will be taken using a short Quercus quiz during each class period. If you are not able to attend a weekly session due to illness or otherwise, please fill out the self-declaration form on ACORN (if appropriate) and let me know as soon as possible.

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

<table>
<thead>
<tr>
<th>DATES</th>
<th>Topic</th>
<th>Activities &amp; Assignments</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Course introduction</td>
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<tr>
<td>January 9</td>
<td>Architectural goals: comfort, energy, productivity, and program</td>
<td>Activity Evaluating the comfort of our classroom compared to measurements</td>
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<td>Case Study</td>
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<td>Berkeley CBE survey results</td>
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<td>Payette glazing and comfort study</td>
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<td>Week 2</td>
<td>Toronto climate analysis</td>
<td>Activity Using ‘Climate Consultant’ with different climate file data sources</td>
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<td>January 16</td>
<td>Definition of net-zero “something” buildings: energy, carbon, site, and source</td>
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<td>Case Study</td>
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<td>Pearl River Tower</td>
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<td>Bullit Centre</td>
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<td>Week 3</td>
<td>Building heat balance and introduction to heat transfer</td>
<td>Activity Conductive heat transfer calculations under steady state conditions</td>
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<td>January 23</td>
<td>Envelope design: Conduction</td>
<td>Assignment HW#1 – Conductive heat transfer</td>
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<td>(online only)</td>
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<td></td>
<td>Case Study</td>
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<td>Georgia Tech Solar Decathlon House (opaque and translucent envelope)</td>
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| Week 4  | January 30 | Envelope design: Convection and Radiation  
**Guest Lecturer: Alstan Jakubiec**  
Case Study  
Packard Foundation  
Solar decathlon (transparent envelope) | Activity  
Convective and radiative heat transfer calculations  
Assignment  
HW#2 – Radiant heat transfer (Out) |
|---|---|---|---|
| **Week 5**  
**February 6 (online only)** | External thermal loads, internal thermal loads  
Quiz review | Activity  
(None today – quiz review)  
Assignment  
HW#1 – Conductive heat transfer (Due) |
| **Week 6**  
**February 13** | Midterm quiz |  |
| **February 20 – 24** | READING WEEK - no classes |  |
| **Week 7**  
**February 27** | Envelope design: Shading design  
Case Study  
“Carbon Lighters” Lowdown Showdown Competition Entry | Activity  
Simple geometric shading design calculations  
Assignment  
HW#2 – Radiant heat transfer (Due)  
HW#3 – Shading Design (out) |
| **Week 8**  
**March 6** | Thermal simulations, beyond the steady state  
**Case Study**  
Harvard Graduate School of Design  
“Carbon Lighters” Lowdown Showdown Competition entry (part 2) | Activity  
Spreadsheet thermal simulation tool  
Assignment  
HW#3 – Shading design (Due)  
Analysis project (Out) |
| **Week 9**  
**March 13** | Daylighting and electric lighting systems  
**Case Study**  
Mark Rothko Chapel  
Subjective lighting quality study | Activity  
Daylight factor estimations and benchmarking for the Toronto climate  
Assignment  
HW#4 – Climate-based daylight estimations (out) |
| **Week 10**  
**March 20** | Natural ventilation  
**Case Study**  
MIT Green Building  
HULIC building, Tokyo  
Manitoba Hydro | Activity  
Coolvent thermal and natural ventilation combined simulations  
Assignment  
HW#4 – Climate-based daylight estimations (Due) |
### WEEKLY ACTIVITY OBJECTIVES:
The weekly activities (see course schedule) are intended to build novice skills in building performance analysis. They should also enable students to assess and interpret building performance information that may be generated by themselves, found in periodicals or on the internet, or that are generated by professionals. Understanding of the tools and methods taught during the weekly activities will be critical for completing the homework assignments and doing well on the course final analysis project.

### IV EVALUATION/GRADING SCHEME

See the course schedule for homework assignment and midterm quiz timing. Assignments will be due on Fridays at 11:55 pm during the weeks indicated. The final quiz will be scheduled by FAS. The final analysis project will be due on the last day of the final assessment period.

**MARK BREAKDOWN**

- Attendance: 10% of final marks
- Homework assignments: 40% of final marks
- Midterm quiz: 15% of final marks
- Analysis project: 20% of final marks
- Final quiz: 15% of final marks

**Note:** if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the assessments.

**CRITERIA FOR EVALUATING WORK**
The primary criteria used in evaluating assignments and the analysis project will be disseminated during the course on a per-assignment basis.


V COURSE POLICIES

- This statement from the university is of utmost importance: “The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another’s differences. U of T does not condone discrimination or harassment against any persons or communities.”

- I will respond to e-mail inquiries within 24 hours on weekdays. Contact through Quercus is also fine but less preferable.

- Students must watch available recorded lecture content on their own time prior to attending synchronous or in-person sessions. Online synchronous sessions will be recorded and made available for all students.

- All assignments are due at the specified time and date. Late submission will result in a 10% deduction (of each assignment’s total grade) per day.

- Attendance will be taken using a short Quercus quiz during each class period. If you are not able to attend a synchronous session due to illness or otherwise, please fill out the self-declaration form on ACORN (if appropriate) and let me know as soon as possible. We will not be requiring verification of illness this term.

- Students who for reasons beyond their control are unable to submit an assignment by its deadline must obtain approval from their instructor for an extension within the term.

- All assignment submissions will take place through Quercus.

VI TECHNOLOGY REQUIREMENTS

Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: [https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/](https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/)

Advice for students more broadly regarding online learning is available here: [https://onlinelearning.utoronto.ca/getting-ready-for-online/](https://onlinelearning.utoronto.ca/getting-ready-for-online/)

This course requires the use of computers, and of course sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own
computer), and schedule enough time when completing an assignment to allow for delays due to technical difficulties. Computer viruses, crashed hard drives, broken printers, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension.

VII INSTITUTIONAL POLICIES AND SUPPORT

ACADEMIC INTEGRITY

On Academic Integrity:
Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student’s individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto’s Code of Behaviour on Academic Matters ([https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019](https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019)) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:
1. Using someone else’s ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:
1. Using or possessing unauthorized aids.
2. Looking at someone else’s answers during an exam or test.
3. Misrepresenting your identity.

In academic work:
1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see [https://www.academicintegrity.utoronto.ca/](https://www.academicintegrity.utoronto.ca/)).
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ACCESSIBILITY NEEDS
Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

ADDITIONAL SERVICES and SUPPORT
The following are some important links to help you with academic and/or technical service and support

- General student services and resources at Student Life
- Full library service through University of Toronto Libraries
- Resources on conducting online research through University Libraries Research
- Resources on academic support from the Academic Success Centre
- Learner support at the Writing Centre
- Information for Technical Support/Quercus Support