ENV335H1-S – Environmental Design

I CONTACTS



INSTRUCTOR Name: Kelsey Saunders Email: <u>kelsey.saunders@utoronto.ca</u> 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 handson 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 selfdeclaration form on ACORN (if appropriate) and let me know as soon as possible.

DATES	Торіс	Activities & Assignments
Week 1	Course introduction	Activity
January 9		Evaluating the comfort of our
	Architectural goals: comfort, energy,	classroom compared to
	productivity, and program	measurements
	<u>Case Study</u>	
	Berkeley CBE survey results	
	Payette glazing and comfort study	
Week 2	Toronto climate analysis	<u>Activity</u>
January 16		Using 'Climate Consultant' with
	Definition of net-zero "something"	different climate file data
	buildings: energy, carbon, site, and	sources
	source	
	<u>Case Study</u>	
	Pearl River Tower	
	Bullitt Centre	
Week 3	Building heat balance and introduction	<u>Activity</u>
January 23	to heat transfer	Conductive heat transfer
(online only)		calculations under steady state
	Envelope design: Conduction	conditions
	<u>Case Study</u>	<u>Assignment</u>
	Georgia Tech Solar Decathlon House	HW#1 – Conductive heat
	(opaque and translucent envelope)	transfer

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

Week 4	Envelope design: Convection and	Activity
January 30	Radiation	Convective and radiative heat
,	Guest Lecturer: Alstan Jakubiec	transfer calculations
	<u>Case Study</u>	Assignment
	Packard Foundation	HW#2 – Radiant heat transfer
	Solar decathlon (transparent	(Out)
	envelope)	
Week 5	External thermal loads, internal	Activity
February 6	thermal loads	(None today – quiz review)
(online only)		
	Quiz review	<u>Assignment</u>
		HW#1 – Conductive heat
		transfer (Due)
Week 6	Midterm quiz	
February 13		
February 20 – 24	READING WEEK - no classes	1
Week 7	Envelope design: Shading design	Activity
February 27		Simple geometric shading
	<u>Case Study</u>	design calculations
	"Carbon Lighters" Lowdown	
	Showdown	<u>Assignment</u>
	Competition Entry	HW#2 – Radiant heat transfer
		(Due)
		HW#3 – Shading Design (out)
Week 8	Thermal simulations, beyond the	Activity
March 6	steady state	Spreadsheet thermal
		simulation tool
	<u>Case Study</u>	
	Harvard Graduate School of Design	Assignment
	"Carbon Lighters" Lowdown	HW#3 – Shading design (Due)
	Showdown Competition entry (part 2)	Analysis project (Out)
Week 9	Daylighting and electric lighting	Activity
March 13	systems	Daylight factor estimations and
		benchmarking for the Toronto
	<u>Case Study</u>	climate
	Mark Rothko Chapel	
	Subjective lighting quality study	Assignment
		HW#4 – Climate-based daylight
		estimations (out)
Week 10	Natural ventilation	Activity
March 20		Coolvent thermal and natural
	<u>Lase Study</u> MIT Groom Parilding	ventilation combined
	MIT Green Building	simulations
	HULIC building, Tokyo	
	Manitoba Hydro	Assignment
		Hw#4 – Climate-based daylight
		estimations (Due)

Week 11	HVAC systems, removing and adding	Activity
March 27	heat and humidity	Learning the psychrometic
		chart
	<u>Case Study</u>	
	Buro Happold Engineering works	
Week 12	Renewable energy sources	<u>Activity</u>
April 3		NREL's PVWatts calculator tool
	Embedded carbon vs. operational	and back of the envelope PV
	energy	calculations
	<u>Case Study</u>	<u>Assignment</u>
	Andy McNeil's PV Optimization	Analysis project (Due)
	"Carbon Lighters" Lowdown	
	Showdown Competition Entry (part 3)	
Exam Period	Final quiz to be scheduled.	

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

Attendance10% of final marksHomework assignments40% of final marksMidterm quiz15% of final marksAnalysis project20% of final marksFinal quiz15% 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: <u>https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/</u>

Advice for students more broadly regarding online learning is available here: <u>https://onlinelearning.utoronto.ca/getting-ready-for-online/</u>

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-behaviouracademic-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/).

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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 <u>Accessibility Services</u> 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 <u>Student Life</u>
- Full library service through <u>University of Toronto Libraries</u>
- Resources on conducting online research through <u>University</u> <u>Libraries Research</u>
- Resources on academic support from the <u>Academic Success Centre</u>
- Learner support at the <u>Writing Centre</u>
- Information for <u>Technical Support/Quercus Support</u>