

**CARLETON UNIVERSITY**  
**DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**  
**ENVE 4105 – FALL 2020**  
**GREEN BUILDING DESIGN**

**Instructor:** Burak Gunay, PhD, PEng

**Virtual meeting room:** Zoom link

**Office Hour: Email to make an appointment for a one-on-one meeting.** I will keep the following timeslots available: Monday 5 pm to 6 pm and Wednesday 5 pm to 6 pm.

**Email:** burak.gunay@carleton.ca

The class will meet on Wednesdays at 6:05 pm via Zoom. Lectures will be recorded and posted on cuLearn. After the lecture, there will be time allocated to answer your questions.

Software tutorial and problem analysis session videos will be posted on cuLearn.

Teaching assistants will hold office hours on two different timeslots.

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### Teaching Assistants

**Email to make an appointment for a one-on-one meeting.** Following timeslots will be kept available.

Tareq Abuimara (tareq.abuimara@carleton.ca - Wednesday 11 am to 12 pm)

Brodie Hobson (brodie.hobson@carleton.ca - Monday 1 pm to 2 pm)

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### Learning Objectives:

1. Understand metrics and methods to assess building performance
2. Understand integrated design process
3. Apply design principles for high-performing envelopes
4. Understand fundamentals of solar geometry and design of fixed shading systems
5. Understand principles of lighting and daylighting design
6. Perform steady-state thermal analysis
7. Understand common HVAC and building-integrated renewable energy systems

### Supplementary text:

Reddy, A., Kreider, J.F., Curtiss P.S., and Rabi, A. 2016. Heating and Cooling of Buildings: Principles and Practice of Energy Efficient Design. CRC Press.

ASHRAE. 2017. Handbook of Fundamentals. American Society for Heating, Ventilation, and Air-conditioning Society.

### Software:

LBNL Therm

LBNL Window

LBNL Comfen

UCLA Climate Consultant

eQUEST

## **Course Plan:**

### **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

### **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

### **Midterm**

### **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

### **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

### **Design process and principles**

*Lesson 15:* Passive solar design

*Lesson 16:* Integrated design process

*Tutorial 14:* Final exam review

**Grade Distribution:**

Midterm 20%

Four assignments 30%

Final exam 50%

**Letter Grade Distribution:**

>= 90.00 A+

85.00 - 89.99 A

80.00 - 84.99 A-

77.00 - 79.99 B+

73.00 - 76.99 B

70.00 - 72.99 B-

67.00 - 69.99 C+

63.00 - 66.99 C

60.00 - 62.99 C-

57.00 - 59.99 D+

53.00 - 56.99 D

50.00 - 52.99 D-

<= 49.99 F

**Academic Regulations, Accommodations, Plagiarism** University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website here.

**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](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

**For Religious Obligations** Students requesting academic accommodation on the basis of religious obligation should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student. Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services

Department for assistance.

**For Pregnancy** Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.

**Plagiarism** Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, the potential penalties and the procedures refer to the section on Instructional Offences in the Undergraduate Calendar.

**What are the Penalties for Plagiarism?** A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

**What are the Procedures?** All allegations of plagiarism are reported to the faculty of Dean of FASS and Management. Documentation is prepared by instructors and/or departmental chairs. The Dean writes to the student and the University Ombudsperson about the alleged plagiarism. The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

Plagiarism and cheating at the graduate level are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (See here.). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

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