Green Building Design (GBD) – ENVE 4105
“Sustainable building design from back-of-the-envelope calculations to dynamic simulation”
Fall 2022, Lectures: Mondays, 18:05-20:55, TB342
Tutorials and Labs: various times/locations (see your schedule)
Instructor: Prof. Liam O’Brien, PhD, liam_OBrien@carleton.ca, CB 5208; office hours: by appointment.
TAs: TBD

Course description
The course provides an overview of green buildings and their systems, technologies, and design processes. The concepts will be supported with both theory and case studies. Emphasis will be placed on good design practice, the integrated design process, and quantitative design. A major objective of the course is to provide engineering students and architecture students an appreciation of their counterparts’ roles in the building design process. The tutorial component will involve software, experiments, and/or practice problems.

All evaluation (assignments, exams) will be in SI units. However, it would be beneficial for students to be comfortable with basic conversions to IP units (e.g., inches and °F).

Required background knowledge
All students should be familiar with basic heat and mass transfer, trigonometry, basic calculus and algebra, and use of Excel or similar spreadsheet software.

Learning objectives
After taking the course, students should be familiar with and be able to apply concepts related to:
- Calculations and analysis for design of buildings and their subsystems at a wide range of details, from back-of-the-envelope to detailed simulations.
- Climate, weather, and site selection
- Building performance simulation (BPS)
- Solar geometry and energy
- Lighting and daylighting
- Building envelopes, fenestration, and shading
- Passive techniques
- HVAC systems and Building controls
- Occupant comfort (thermal, visual, acoustic)
- Indoor air quality and natural ventilation
- Occupant behaviour
- Building-integrated renewable energy systems
- Embodied energy
- Design processes

By the end of the course, students should be able to bring any green building-related aspects to conceptual design.

Evaluation

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Course Outline

Course Materials
The primary reference material will be posted to BrightSpace. Course notes (slides and hand-written on the blackboard) will supplement these. Blackboard notes will not be posted.

Additional reference texts include:

- The ASHRAE Fundamentals Handbook. The SI-unit version is highly favourable.
- ASHRAE Stds. 55, 62.1, and 90.1
- Other posted readings and reference materials.

Assignments
They 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 weekday. 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.

Design project
Detailed to be posted approximately one month into the course. The project shall be structured such that students apply the concepts taught to a real building design (specification in a separate document). The project will contain written and oral components. Oral presentations will occur in the last few lectures.

Exams
The final exam covers all material of the course and will take place during the formal exam period. Students must bring a calculator, pen, pencil, eraser, and a single-sided 8.5 by 11-inch formula sheet.

Building design/analysis software (freely available)
A major component of the course will be to learn and use a number of freely-available tools (mostly Window-based). Students are encouraged to install them on their personal computers if possible, as there is not a dedicated computer lab for the course.

Academic integrity
Students should familiarize themselves with Carleton’s Academic Integrity Policy (available here: http://www1.carleton.ca/studentaffairs/academic-integrity/). The professor has a zero-tolerance policy.