ARCH 463 — INTEGRATED ENVIRONMENTAL SYSTEMS

COURSE OUTLINE — SPRING 2023

Instructor: Bryn Jones bj2jones@uwaterloo.ca

TAs: Alifiyah Merchant alefiyah.merchant@uwaterloo.ca

Selina Deng xc2deng@uwaterloo.ca

Course Overview: This course is focused on the integrated environmental systems of buildings with an aim to develop the knowledge and skills appropriate to architectural practice. Subjects covered include environmental parameters, air and water systems, heating and cooling loads, energy conservation, ventilating and air conditioning systems, plumbing and waste systems, artificial source lighting and daylighting, acoustics, and fire protection criteria and systems, with reference to building codes and standards.

Recommended Preparation: The course is intended to be suitable for students with a variety of technical backgrounds. Some background in architectural mathematics is recommended. Prior study of building heat transfer fundamentals (including basic energy balances and basic heat and mass transfer) will be helpful.

Prerequisite: Level at least 4A Architecture
Corequisite: ARCH493
Anti-requisite: ARCH263

Key Learning Outcomes: By the end of this course, you should be able to:

1. Develop an awareness of mechanical building systems and terminology;
2. Develop an understanding of the various attributes of mechanical systems, including space requirements; performance, capital costs and energy efficiency;
3. Gain an ability to develop conceptual mechanical system designs for various applications; and
4. Understand performance requirements sufficiently to explore alternative solutions as part of a multidisciplinary design team.

The focus is on the needs of the architect, i.e., the schematic design, appropriate application, and operational aspects of building systems for indoor comfort, energy efficiency and building and occupant protection.

Land Acknowledgment

We acknowledge that the School of Architecture is located on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. The University is situated on the Haldimand Tract, the land promised to the Six Nations that includes 10 kilometres on each side of the Grand River. (see references here: https://uwaterloo.ca/engineering/about/territorial-acknowledgement)

Course Format: This is an active learning course. Student learning will be facilitated using a variety of methods, including independent study and reading, projects, lectures, and discussions. We will be less reliant on lectures than in traditional courses and greater responsibility will be placed on the learner to engage with the course materials and activities. The teaching team will facilitate learning throughout the term and will be available for consultation by email and web meeting. Assessments will include electronically administered quizzes and assignments.

Dates and Times: Dates & times listed in this document refer to the local date & time at the University of Waterloo.

Class Meetings: Our in-person learning sessions will be held in ARC 1101 and are scheduled for Tues 2:30-5:20 pm. This time will be used for lectures, presentations, discussions and the occasional guest lecture. Please reserve these times in your schedule each week.

Waterloo LEARN: Your primary method of accessing course material will be through LEARN. It is recommended that you check LEARN for updates reasonably frequently (e.g. at least twice per week) throughout the term.

Textbook (suggested): Lechner, Norbert. Heating, Cooling, Lighting: Sustainable Design Methods for Architects, Wiley, 2014. Course notes and links to reference documents will be posted in LEARN.

Equipment and Software Requirements: To participate in live web-meetings (should there be a shift away from in-person sessions), you'll need a reasonably reliable internet connection, and preferably webcam, microphone, and headset. For viewing course materials, it will be preferable to use a larger display (e.g. monitor) rather than a small screen (e.g. phone). For some quizzes, students may be required to submit images of calculations or other workings (e.g. captured by camera/scanner).

COVID Special Statement

Given the on-going situation around COVID-19, students are to refer to the University of Waterloo's developing information resource page (https://uwaterloo.ca/coronavirus/) for up-to-date information on academic updates, health services, important dates, co-op, accommodation rules and other university level responses to COVID-19.

Topic Progression (approximate)

Setting the Stage	
Approx. Timing	**Description**
May 8-12	Introduction, overview, and some history Role of services in modern buildings
Stage One: Heat Loss & Heat Gain	
Approx. Timing	**Description**
May 15-19	Psychrometrics, Latent and Sensible Heat
May 22-26	Energy Efficiency, Thermal Comfort, and Control ASHRAE Standard 55
May 29-Jun 2	Effects of design on efficiency and Sustainable features
Stage Two: Environmental & Mechanical Systems	
Approx. Timing	**Description**
Jun 5-9	Generation (Making Hot & Cold)
Jun 12-16	Distribution & Delivery (Air, Water, Direct)
Jun 19-23	Dehumidification & Humidification

Jun 26-30	Ventilation & Filtration: The most important function of HVAC Systems
Stage Three: Building and Occupant Protection and Controls	
Approx. Timing	**Description**
Jul 3-Jul 7	Enclosure Fire Basics and Suppression Systems; triangles, tetrahedrons and myths
Jul 10-14	Explosions, venting and control systems for building protection; dealing with flammables processing and storage
Jul 17-21	Fires and vulnerable population design considerations
Jul 24-28	Communications, Sensors and Instrumentation

Student Workload: For undergraduate engineering courses, it is a typical expectation that students will invest around 100 hours of focused work for each course. This includes time spent reviewing course notes, participating in lectures and/or viewing videos, completing homework, completing projects, and studying for tests. Based on a 14-week schedule, this equates to an average of about 7.5 hours/week. For graduate courses, the workload is usually somewhat greater. Please note that this information is provided only as a guideline.

Practice Problems and Solutions: Practice problems and solutions will be provided with each course module within the class presentations. Careful review of the course notes and completion of the practice problems should be viewed as the primary activities to help you develop understanding of the course material. It is strongly recommended that you be persistent in your attempts to fully solve the problems before referring to the solutions.

ASSESSMENTS

Several quizzes will be held during the term. Each will be approximately 45-50 minutes. All will be open book and administered using LEARN. Each must be completed within a limited window of availability. Some key information has been provided below and additional information will be provided separately.

Quizzes and Academic Integrity: As would be expected for a "regular" in-person quiz, each quiz is to be completed without communicating with any other person except for members of the teaching team. Please be aware that the penalties for academic integrity violations occurring during tests (including "quizzes") can be severe.

Graded Quizzes

Each will be available to start during a brief introduction at the lecture sessions.

Quiz	Stage	Date	Start Window *
Q1	1	May 30	2:30-3:30 pm
Q2	2	Jun 20	2:30-3:30 pm
Q3	2	Jul 4	2:30-3:30 pm
Q4	3	Jul 18	2:30-3:30 pm

* tentative

Assignments

Student will complete several projects/assignments. These may involve a variety of activities including design calculations, investigation/research, and simulation/analysis. For most projects, the primary deliverable will be a brief report or solutions sheet. Specific rules for each will be provided when the project instructions are published.

Project	Topic	Start *	Due
A1	Psychrometrics and Thermal Comfort	May 23	Jun 6
A2	Ventilation and Odor Control	Jun 13	Jun 27
A3	Delivery and filtration systems	Jun 20	Jul 4
PF	Final Project – Integrated environmental design considerations for occupant comfort and societal needs	Jul 11	Aug 8

Notes about Project Submissions

1. Unless otherwise specified, project submissions: i) will be due by 11:59 pm on the due date, ii) will be made using dropbox in LEARN, and iii) should be a single document (pdf).
2. Late Project Submissions: Only in the case of a justified medical or personal reason will these penalties be waived. For verified health concerns, please discuss this with your instructor before submitting a Verification of Illness Form (VIF) to the Academic Services Coordinator and Associate Director, in the Undergraduate Office. Personal extenuating circumstances need to be communicated to your instructor who will coordinate with the Undergraduate Office as needed. This is not the same as the AccessAbility Accommodations or the short term absence process. Information on COVID-19 is available here.

COURSE GRADE

Your overall course grade will be based on the following:

Category	Component	AE450
Quizzes	**Q1**	4 @ 10% each, 40% total
	Q2	
	Q3	
	Q4	
Projects	**A1**	10%
	A2	10%
	A3	10%
	Final Project	30%
Total	-	100%

ADDITIONAL INFORMATION

CACB: The BAS program enables students to achieve the accreditation standards set by the Canadian Architectural Certification Board as described here. This course addresses the CACB criteria and standards that are noted on the Accreditation page of the School of Architecture website.

Mental Health Support: All of us need a support system. We encourage you to seek out mental health supports when they are needed. Please reach out to Campus Wellness (https://uwaterloo.ca/campus-wellness/) and Counselling Services (https://uwaterloo.ca/campus-wellness/counselling-services).

We understand that these circumstances can be troubling, and you may need to speak with someone for emotional support. Good2Talk (https://good2talk.ca/) is a post-secondary student helpline based in Ontario, Canada that is available to all students.

Equity, Diversity and Inclusion Statement: The School of Architecture is committed to foster and support equity, diversity and inclusion. If you experience discrimination, micro-aggression, or other forms of racism, sexism, discrimination against 2SLGBTQ+, or disability, there are several pathways available for addressing this:

A) If you feel comfortable bringing this up directly with the faculty, staff or student who has said or done something offensive, we invite you, or a friend, to speak directly with this person. People make mistakes and dealing them directly in the present may be the most effective means of addressing the issue.

B) you can reach out to either the Undergraduate office, Graduate office, or Director (DirectorArchitecture@uwaterloo.ca). If you contact any of these people in confidence, they are bound to preserve your anonymity and follow up on your report.

C) You can choose to report centrally to the Equity Office. The Equity Office can be reached by emailing equity@uwaterloo.ca. More information on the functions and services of the equity office can be found here: https://uwaterloo.ca/human-rights-equity-inclusion/about/equity-office.

D) Racial Advocacy for Inclusion, Solidarity and Equity (RAISE) is a student-led Waterloo Undergraduate Student Association (WUSA) service launching in the Winter 2019 term. RAISE serves to address racism and xenophobia on the University of Waterloo campus with initiatives reflective of RAISE's three pillars of Education and Advocacy, Peer-to-Peer Support, and Community Building. The initiatives include but are not limited to: formal means to report and confront racism, accessible and considerate peer-support, and organization of social events to cultivate both an uplifting and united community. You can report an incident using their online form.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

Grievance: A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for their actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

Turnitin.com: Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit the alternate assignment.

Grading Scheme: In cases of an academic integrity violation, the grading scheme may be modified at the instructor's discretion such that use of a flexible scheme (i.e. "best grades") does not provide a "loop-hole" that would allow a student to avoid the consequences of the violation.

Acceptable Use of Course Materials: Materials provided to students in any format (including, but not limited to: electronic and hard-copy documents, video recordings, etc.) are provided solely for their personal use in completing the coursework. Students are not permitted to share or distribute course materials by any means (including, but not limited to: uploading to a 3rd party website, emailing, etc.), unless prior written permission is provided by the instructor. Unauthorized distribution of any material will be considered an academic offense and may constitute copyright infringement. (Note: As clarification to the above, it is acceptable for students enrolled in the course to share material with other students enrolled in the course, while they are both enrolled.)

Confidentiality of Tests: The content of all tests (including quizzes and exams) used in this course is confidential. It is a violation of academic integrity to convey and/or transmit content from any test to another person by any means. Further, it is a violation of academic integrity to record, copy, photograph, or store images or descriptions of the content of tests, for any purpose.