

MIE507H1 F

HVAC Fundamentals

Fall 2024 Syllabus

Course Meetings

MIE507H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Friday, 9:00 AM - 12:00 PM	In Person: BA B025
PRA0101	Tuesday, 9:00 AM - 11:00 AM	In Person: MC 120
TUT0101	Friday, 12:00 PM - 2:00 PM	In Person: HA 401

Refer to ACORN for the most up-to-date information about the location of the course meetings.

Labs and tutorials will be held periodically throughout the term. Different lab groups will have their labs on different days. The Lab TA will inform you what days your labs will be held on.

Course Contacts

Instructor: Marianne Touchie

Email: marianne.touchie@utoronto.ca

Office Hours and Location: Online or in-person (GB314B) on Fridays from 2-3pm

Additional Notes: If you are emailing the instructor or one of the TAs, please include the course code in the subject line "MIE507". Emails will be responded to within two business days. Note that questions related to course content or logistics should be directed to Piazza. Piazza is designed to get you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, you are strongly encouraged to post your questions on Piazza. Your peers will know that others have the same question, and when it's answered on Piazza, it's answered for everybody. Sign up for our class link here:

<https://piazza.com/utoronto.ca/fall2024/mie507h1flec0101> All course material will be posted to Quercus. You are responsible for checking this website regularly and for ensuring your Quercus settings will notify you immediately of course announcements and other important information.

Teaching Assistant (Project, field trip and lab): Mostafa Elaskalany

Email: melaskal@mie.utoronto.ca

Teaching Assistant (Problem sets): Mohammad Hosseinzadeh

Email: m.hosseinzadeh@mail.utoronto.ca

Course Overview

Introduction to the fundamentals of HVAC system operation and the relationship between these systems, building occupants and the building envelope. Fundamentals of psychrometrics, heat

transfer and refrigeration; determination of heating and cooling loads driven by occupant requirements and the building envelope; heating and cooling equipment types and HVAC system configurations; controls and maintenance issues that influence performance; evaluation of various HVAC systems with respect to energy and indoor environmental quality performance.

Course Learning Outcomes

At the end of the course, students will be familiar with the following concepts:

- Determining required indoor air quality and thermal comfort conditions
- Using heat transfer and solar calculations to estimate heat gain and loss of a building
- Applying thermodynamics and psychrometrics to heating and cooling analysis
- Employing fluid dynamics concepts to design or select air handling devices and ducts
- Calculating energy and estimating seasonal energy cost
- Evaluating HVAC control strategies and systems

Credit Value: 0.5

Course Materials

This textbook is not required but provided here as supplementary material, in case you need it:

Heating and Cooling of Buildings: Principles and Practice of Energy Efficient Design, Third Edition, by T.

Agami Reddy, Jan F. Kreider, Peter S. Curtiss, and Ari Rabl, CRC Press, 2017

Marking Scheme

Assessment	Percent	Details	Due Date
Midterm test	35%	Completion of the Midterm Test is mandatory for completion of this course.	2024-10-18
Design Project	30%		2024-12-03
Design Project Presentation	15%		2024-12-03
Problem Sets	10%		2024-09-20,2024-10-04,2024-11-15,2024-11-29
Lab Assignment	5%		Date to be specified
Individual Reflection on Design Project	3%		2024-12-03
Field Trip Assignment	2%		2024-11-08

Late Assessment Submissions Policy

Design Project, Lab Assignment, Problem Set and Field Trip submissions will incur a penalty of 20% per day. After three calendar days they will be worth zero.

Course Schedule

W	Dates	Topic	Chapters	Assignments	Tutorials
1	Sep 6	Introduction to HVAC and the course Thermal Comfort and IAQ	1, 3	PS#1 Assn (Fri)	
HEAT GAINS AND LOSSES					
2	Sep 13	<i>Self-directed review: Heat Transfer Videos</i> Envelope conduction heat transfer Incident solar radiation on a plane Heat gain/loss through windows	2.7-2.10 2.82, 7.3 4.1-4.6 5	Term project assigned (Fri)	PS#1 help (Mohammad)
3	Sep 20	Sol-air temperature Infiltration Internal Gains	7.2 6.1-6.6 7.4	PS#1 Due (Fri) PS#2 Assn (Fri)	Introduction to project (Mostafa)
4	Sep 27	<i>Self-directed review: Psychrometric Videos</i> Single zone heat balance Intro to transient heat flow	13.1-13.5 7.5 8		PS#2 help (Mohammad)
HEATING AND COOLING LOADS					
5	Oct 4	Winter and Summer Design Conditions Heating load calculations Cooling load calculations	9.2	PS#2 Due (Fri)	
6	Oct 11	Annual energy use calculations Psychrometric Processes	9.3, 9.4-9.7 10.1-10.5 13.6		Interim project submission help (Mostafa)
7	Oct 18	Midterm during lecture	-	MIDTERM (Fri)	

HVAC SYSTEMS					
8	Oct 25	Overview of different HVAC system types/configurations Review: Fluid mechanics (pressure losses) Air Distribution: Diffusers, ducts, fans, pumps	11 2.1 20.1-20.4	Interim project submission (Thu) PS#3 Assn (Fri)	Virtual Mech room tour
9	Oct 28- Nov 1	Fall Study Week (NO CLASSES – Take a break!)			
10	Nov 8	Thermal Principles related to HVAC Systems Heat Exchangers (LMTD, ϵ -NTU)	2.5-2.6 12.6	Virtual Tour assignment due (Fri)	PS#3 help (Mohammad)
11	Nov 15	Heating Equipment Cooling Equipment HVAC Myths: Guest Lecture	15 17	PS#3 Due (Fri) PS#4 Assn (Fri)	Lab (Nov 12) (Mostafa)
12	Nov 22	HVAC Control Systems Pre-recorded lecture will be posted this week	21	Lab Assignment Due (TBD)	PS#4 help (Mohammad)
13	Nov 29	HVAC Commissioning: Challenges and Opportunities: Guest Lecture Design for Efficiency and assessing performance Course Wrap up and review	24	PS#4 Due (Fri)	Final Project Submission Help (Mostafa)
14	Dec 3			Final project submissions and presentations (Tues Dec 3)	

Policies & Statements

University Land Acknowledgement

I wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

Learn more about Canada's relationship with Indigenous Peoples [here](#).

Indigenous Students' Supports

If you are an Indigenous engineering student, you are invited to join a private Discord channel to meet other Indigenous students, professors, and staff, chat about scholarships, awards, work opportunities, Indigenous-related events, and receive mentorship. Email [Professor Bazylak](#) if you are interested.

Indigenous students at U of T are also invited to visit Nations House's (FNH) Indigenous Student Services for culturally relevant programs and services. If you want more information on how to apply for Indigenous specific funding opportunities, cultural programs, traditional medicines, academic support, monthly social events or receive the weekly newsletter, go to the FNH [website](#), [email](#) or follow FNH on social media: [Facebook](#), [Instagram](#), or [TikTok](#). A full event calendar is on the CLNX platform. Check CLNX often to see what new events are added!

Wellness and Mental Health Support

Your personal wellness and mental health are important. The University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that can support your well-being.

As a U of T Engineering student, you have a Departmental [Undergraduate Advisor](#) or a Departmental [Graduate Administrator](#) who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the [U of T Engineering Mental Health & Wellness webpage](#), and a small selection are also included here:

- [U of T Engineering's Student & Community Wellness Coordinator](#)
- [Health & Wellness](#) and the [On-Location Engineering Wellness Counsellor](#)
- [Health & Wellness Peer Support Program](#)
- [Accessibility Services](#) & the [On-Location Advisor](#)
- [Graduate Engineering Council of Students' Mental Wellness Commission](#)
- [SKULE™ Mental Wellness](#)
- [U of T Engineering's Learning Strategist](#) and [Centre for Learning Strategy Support](#)
- [Registrar's Office](#) and [Scholarships & Financial Aid Office & Advisor](#)

We encourage you to access these resources as soon as you feel you need support; no issue is too small. You may reach out to the counsellors at [U of T Telus Health Student Support](#) for 24/7 free and confidential counselling support.

If you find yourself feeling distressed and in need of more immediate support visit uoft.me/feelingdistressed or U of T Engineering's [Urgent Support – Talk to Someone Right Now](#).

Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, visual impairments, chronic health conditions, addictions, D/deaf, deafened or hard of hearing, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students [register with Accessibility Services](#) as soon as possible.

We know that many students may be hesitant to reach out to Accessibility Services for accommodations. The process of accommodation is private; we will not share details of your needs or condition with any instructor.

If you feel hesitant to register with us, we encourage you to reach out for further information and resources on how we can support. It may feel difficult to ask for help, but it can make all the difference during your time here.

Phone: 416-978-8060

Email: accessibility.services@utoronto.ca

Equity, Diversity and Inclusion

Looking for community? Feeling isolated? Not being understood or heard?

You are not alone. You can talk to anyone in the Faculty that you feel comfortable approaching, anytime – professors, instructors, teaching assistants, [first-year](#) or [upper years](#) academic advisors, student leaders or the [Assistant Dean of Diversity, Inclusion and Professionalism](#).

You belong here. In this class, the participation and perspectives of everyone is invited and encouraged. The broad range of identities and the intersections of those identities are valued and create an inclusive team environment that will help you achieve academic success. You can read the evidence for this approach [here](#).

You have rights. The [University Code of Student Conduct](#) and the [Ontario Human Rights Code](#) protect you against all forms of harassment or discrimination, including but not limited to acts of racism, sexism, Islamophobia, antisemitism, homophobia, transphobia, ableism, classism and ageism. Engineering denounces unprofessionalism or intolerance in language, actions or interactions, in person or online, on- or off-campus. Engineering takes these concerns extremely seriously and you can confidentially disclose directly to the Assistant Dean for help [here](#).

Resource List:

- [Engineering Equity, Diversity & Inclusion Groups, Initiatives & Student Resources](#)
- [Engineering Positive Space Resources](#)
- Request a religious-based accommodation [here](#)
- Email Marisa Sterling, P.Eng, the Assistant Dean, Diversity, Inclusion & Professionalism [here](#)
- Make a confidential disclosure of harassment, discrimination or unprofessionalism [here](#) or email engineering@utoronto.ca or call 416.946.3986
- Email the Engineering Society Equity & Inclusivity Director [here](#)
- [U of T Equity Offices & First Nations House Resources](#)

Plagiarism Detection Tool

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (<https://uoft.me/pdt-faq>).

Academic Integrity

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts.

Plagiarism—representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program—is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the [U of T writing support website](#). Consult the [Code of Behaviour on Academic Matters](#) for a complete outline of the University's policy and expectations. For more information, please see the [U of T Academic Integrity website](#).

Cell Phones and Laptop Usage

Technology can support student learning, but it can also become a distraction. Research indicates that multi-tasking (texting, surfing the Internet, using social networks) during class time can have a negative impact on learning (Clapp, Rubens, Sabharwal & Gazzaley, 2011; Ellis, Daniels, Jauregui, 2010; Hembrooke & Gay, 2003). Out of respect for your fellow learners in this class, please refrain from using laptops or mobile phones for entertainment during class and do not display any material on a laptop which may be distracting or offensive to your fellow students. Laptops may be used only for legitimate classroom purposes, such as taking notes, downloading course information from Portal, or working on an assigned in-class exercise. Checking social media, email, texting, games, and surfing the Web are not legitimate classroom

purposes. Such inappropriate laptop and mobile phone use is distracting to those seated around you.

Lecture Capture by Instructor

If lecture recordings are provided, they are only for the exclusive use of enrolled students, for their personal learning. Lecture recordings are not to be shared in any way beyond enrolled students.

Expectations for handwritten and scanned submissions

Any handwritten and scanned submissions should be neat, easy to read, organized in a logical fashion, and include the following information as appropriate: significant assumptions; sketches and discussions to illustrate or describe the relevant concepts and results; equations, procedures or methods that were used for analysis; results of problem or analysis clearly indicated; units; and variable definitions. All pages should be numbered (e.g. 1/5), and include your name and student ID number.