

MIE515H1 F

Alternative Energy Systems

Fall 2024 Syllabus

Course Meetings

MIE515H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Tuesday, 2:00 PM - 3:00 PM	In Person: MC 252
	Friday, 1:00 PM - 3:00 PM	In Person: BA 1190
TUT0101	Thursday, 6:00 PM - 7:00 PM	In Person: BA 1190

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

Tutorials start on the second week.

Course Contacts

Instructor: Professor Amy Bilton

Email: bilton@mie.utoronto.ca

Office Hours and Location: Tuesdays 12-1pm, MY792 (To confirmed during the first week of the semester)

Head TA: Behrang Mohajer

Email: behrang.mohajer@mail.utoronto.ca

Additional Notes: Main contact for course administration-related issues.

Teaching Assistant: Amirreza Azad

Email: amirreza.azad@mail.utoronto.ca

Teaching Assistant: Alireza Rahimi

Email: ali.rahimi@mail.utoronto.ca

Teaching Assistant: Farshad Tajeddinisarvestani

Email: farshad.tajeddinisarvestani@mail.utoronto.ca

Course Overview

This course covers the basic principles, current technologies and applications of selected alternative energy systems. Specific topics include solar thermal systems, solar photovoltaic systems, wind, wave, and tidal energy, energy storage, and grid connections issues. Limited enrolment.

MIE 515 will be delivered in-person for Fall 2024. The course material has been significantly updated this year. As a result, only material from this year's course website should be used.

The course is administered through the University of Toronto learning management system, Quercus. The course structure is as follows:

- MIE 515 lectures are in-person for most of the semester. Notes will be posted in advance of the lecture and the lecture will be screen-captured and posted afterwards.
- There will be 3 lectures throughout the semester which will be asynchronous due to unavoidable travel required by the instructor. Videos will be posted in advance of those weeks on the course website. Students can choose their own time to view the lectures and engage in the learning experience at a time that is convenient (asynchronous delivery mode). Professor Bilton will supplement these with additional online office hours.
- Once per week, there will be an in-person tutorial session hosted by the teaching assistants.
- Once per week, there will be informal office hours hosted by the instructor. These will be in the instructor's office.
- All term work will be submitted on-line. Term work will consist of problem sets (5 over the course of the term), two written assignments, and one longer assignment that involves energy system simulation and simple economic analysis.
- All student questions about the lectures should be posted on the appropriate discussion board on Piazza, so that all students can benefit from both the question and the instructor's response.
- There will be two exams, a mid-term and a final exam. These will be open book.

List of Topics

The following modules and topics will be covered in this course:

- Radiation heat transfer and solar radiation
- Solar thermal systems
- Solar photovoltaic systems
- Wind energy
- Wave energy
- Tidal energy
- Energy storage and grid connection

Course Learning Outcomes

By the end of this course, you will be able to:

- Understand the fundamentals of thermodynamics as it applies to alternative energy systems.
- Evaluate the fundamental operation of different alternative energy systems, such as solar photovoltaic, solar thermal, wind, wave, and tidal.
- Evaluate how different alternative energy systems fit in energy infrastructure.
- Size an alternative energy system to meet specified needs based on local environmental data.
- Assess the economic viability of different alternative energy systems.
- Understand and explain the broader policy and environmental considerations at play when implementing an alternative energy system.

Prerequisites: MIE210H1, MIE312H1 and MIE313H1 (or equivalent courses).

Corequisites: None

Exclusions: None

Recommended Preparation: None

Credit Value: 0.5

Graduate Attributes:

- 11B. Economics and Project Management: Demonstrate ability to evaluate the economic and financial performance of an engineering activity and compare alternative proposals on the basis of these measures. [Applied]
- 1B. Knowledge Base for Engineering: Demonstrate competence in natural sciences. [Introduced]
- 12B. Life-Long Learning: Demonstrate the ability to develop a strategy to identify and address gaps in knowledge (becoming a self-directed learner). [Applied]
- 2C. Problem Analysis: Demonstrate the ability to formulate and interpret a model. [Applied]
- 2D. Problem Analysis: Demonstrate the ability to execute a solution process for an engineering problem. [Introduced]
- 7B. Communication Skills: Demonstrate the ability to use different modes of communication. [Applied]
- 7C. Communication Skills: Demonstrate the ability to develop communication through an iterative process. [Applied]
- 9A. Impact of Engineering on Society and the Environment: Demonstrate understanding of the relationships among technology and the social, cultural, economic and environmental conditions of society, locally and globally, in both the short-and long-term. [Applied]

Course Materials

There is no textbook required for this course. All course notes and references will be posted.

Marking Scheme

Assessment	Percent	Details	Due Date
Problem Set 1	3%	To be posted 2 weeks before due.	2024-09-20
Problem Set 2	3%	To be posted 2 weeks before due.	2024-09-27
Problem Set 3	3%	To be posted 2 weeks before due.	2024-10-04
Problem Set 4	3%	To be posted 2 weeks before due.	2024-10-11
Problem Set 5	3%	To be posted 2 weeks before due.	2024-11-29
Simulation Exercise	10%	To be posted 3 weeks before due.	2024-11-15
Written Assignment 1	5%	To be posted 3 weeks before due.	2024-11-08
Written Assignment 2	5%	To be posted 3 weeks before due.	2024-11-22
Mid-Term Exam	25%	Open Book	2024-10-25
Final Assessment	40%	Open Book	Final Exam Period

Late Assessment Submissions Policy

All term work must be submitted online through the MIE 515 website on Quercus, the University of Toronto’s learning management system. All term work is due by midnight on the date specified. A late penalty of 20% per day or fraction thereof will be applied to any late submission.

Online Help

All student questions will be answered using Piazza, so please do not email questions to the course staff. While we encourage students to display their identity, students can post questions anonymously or even privately so only instructors can view them. If, in the opinion of the course staff, a private post contains information that the entire class would benefit from, we reserve the right to make the private post public.

- You will need to sign up for Piazza. You can access the class through quercus or visit the following link: <https://piazza.com/utoronto.ca/fall2023/mie515h1flec0101/home>
- Details are provided on the MIE 515 website on Quercus. You do not need to provide any private information on the Piazza site and no work is submitted there. However, if you are uncomfortable signing up for Piazza, then questions can be posted to the discussion board on the course website on Quercus and a TA will respond (and repost the content of the exchange on Piazza so that everyone can see the question and re-sponse).
- Students are encouraged to actively participate in Piazza by asking and answering questions. Students are expected to communicate in a respectful manner with each other and with the course staff much like in a classroom. An online environment is no excuse for unprofessional conduct.

Course Schedule

Week	Subject	Topics
Week 1	Course Introduction & Radiation Heat Transfer – Part 1	Energy Overview Radiation Heat Transfer Concepts
Week 2	Radiation Heat Transfer – Part 2	Directional and Spectral Characteristics Blackbody Radiation Surface Properties
Week 3	Solar Radiation	Atmospheric Losses Sun-Earth Relationships Estimation of Terrestrial Solar

		Radiation
Week 4	Solar Thermal Systems – Part 1	Passive Solar Design Solar Collector Theory and Practice Solar Heating Systems
Week 5	Solar Thermal Systems – Part 2 & Solar PV Systems – Part 1	SPTG Technology and Case Studies Photovoltaic Fundamentals
Week 6	Solar PV Systems – Part 2	Equivalent Circuits and Characteristics PV Case Studies
Week 7	Wind Energy – Part 1	Wind Technology Fundamentals Wind Sources and Influences
Week 8	Wind Energy – Part 2	Predicting Wind Turbine Output Wind Case Studies
Week 9	Wave Energy	Wave Energy Fundamentals Wave Energy Converters and Case Studies
Week 10	Tidal and Current Energy	Tidal Energy Fundamentals Current Energy Fundamentals Tidal and Current Energy Case Studies
Week 11	Energy Storage	Energy Storage Technology Energy Storage Applications
Week 12	Grid Integration and Future Considerations	Integrating Renewables into the Electric Grid Future of Renewable Energy

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](#).

Quercus Information

This course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. The site is dynamic and new information and resources will be posted regularly as we move through the term, so please make it a habit to log in to the site on a regular, even daily, basis. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. Once you have logged in to Quercus using your UTORid and password, you should see the link or "card" for this course. You may need to scroll through other cards to find this. Click on this link to open our course area, view the latest announcements and access your course resources. There are Quercus help guides for students that you can access by clicking on the "?" icon in the left side column.

SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted

are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.

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.