Engineering Physics
ENGPHYS 3ES3
Course Title
Introduction to Energy Systems
Fall 2025
Course Outline

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Mr. Mohammad Rezaul Islam
islamm42@mcmaster.ca

Office Hours:
by appointment (Online/In-person)

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TBA
a@mcmaster.ca

TBA
b@mcmaster.ca

Office Hours:
TBA

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The official means of communication with students is via the course webpage on Avenue to Learn.
It is the students' responsibility to regularly check the course webpage for updates and announcements.
Microsoft Teams and Zoom may be used if needed for consultations outside of lecture hours.

CLASS FORMAT

Course Dates: 09/02/2025 - 12/04/2025
Units: 3
Course Delivery Mode: All classes are in-person. McMaster is an in-person university.
Course Description: A survey course on energy systems with emphasis on the analytic tools needed to evaluate them in terms of performance, resources, environmental sustainability, costs, and other relevant factors over their life cycles. Science, technology, policy, and human factors that influence the development of energy systems will be discussed. Energy resources, production, consumption, conversion, storage, and fuel transportation will be examined within a global context, considering their societal and environmental impacts. The issues related to long-term sustainability, sustainable development and net-zero carbon emissions will be assessed for both current and future energy systems. The environmental effects and climate change caused by energy production will be analyzed. Innovations in energy technologies and systems will also be discussed. Students will be guided through project-based research on innovative and challenging energy technologies and existing solutions.
Prerequisite(s): Registration in level III or above of an Engineering program
Antirequisite(s): MECH ENG 4O04 and CHEM ENG 4A03

The course is scheduled as follows:

- C01: lecture Tuesday 11:30 – 12:20 pm see Mosaic or Avenue for location
- C01: lecture Thursday 11:30 – 12:20 pm see Mosaic or Avenue for location
- C01: lecture Friday 11:30 – 12:20 pm see Mosaic or Avenue for location

Lectures will not be recorded. Students are required to attend the lecture in person. It is the student's responsibility to check the course webpage for updates and announcements regularly.

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- Utilize comprehensive knowledge of energy systems, including the science, technology, and human factors that influence them, along with the concept of a net carbon zero goal for expanding and replacing current energy systems.
- Apply comprehensive scientific knowledge and physical principles related to established and emerging energy resources and systems, including fossil fuels, nuclear energy, renewable sources, hydrogen fuel, and waste-to-energy systems.
- Analyze how energy is produced and used in different sectors, including houses, industries, areas with challenging environmental conditions, remote sites, and space exploration.
- Understand the role of energy policies and regulations in shaping the energy landscape, with a focus on strategies for sustainability.
- Understand the aspects of energy storage, transmission and distribution systems, fuel transportation, and how these factors are considered to meet energy demand.
- Develop the ability to assess and suggest future energy sources, considering resources, energy demand, and their potential to support sustainability.
- Identify the pathway to sustainability, the link between energy systems and climate change, the lifecycle of energy systems, and the importance of energy policy and sustainable planning.
- Utilize the training and skills gained in the course to research energy systems and their components.

COURSE SCHEDULE

A weekly breakdown of the course schedule

Date/Week	Topic	Readings
Sep – 2 / Week – 1	Course Introduction, Overview of Energy Systems, Components, Performance Metrics, Resources, Transportation, Economics, Sustainability	Lecture notes, Online resources
Sep - 9 / Week – 2	Discussion on Project Topics, Life Cycle of Power Plants, Storage, Waste Management, Human Factors, Energy Policies, Canadian Power Plants	Lecture notes, Online resources
Sep - 16 / Week – 3	Energy Systems overview: Thermal-, Combined Cycle Gas Turbine Power Plants, Fossil Fuel and Related Issues	Lecture notes, Online resources
Sep - 23 / Week – 4	Energy Systems overview: Nuclear Power Plants, Modular Reactors, Nuclear Waste Management	Lecture notes, Online resources
Oct - 2 / Week – 5	Energy Systems overview: Hydroelectric, Geothermal, Marine (Tidal, Wave, Ocean thermal energy)- based Power Plants	Lecture notes, Online resources
Oct - 7 / Week – 6	Solar Power Plants, Photovoltaic Thermal (PVT), Modular Solutions at Home, Offices, Vehicles and Roadways	Lecture notes, Online resources
Oct - 21 / Week – 7	Wind, Biogas, Biomass, Hydrogen-fueled Power Plants, Energy harvesting from Lightning Group Meeting on Project Proposal	Lecture notes, Online resources
Oct - 28 / Week – 8	Group Meeting on Project Proposal Smart-grid, Micro-grid, SCADA, Synchronization, Backup, Startup System, Repairing and Maintenance	Lecture notes, Online resources
Nov - 4 / Week – 9	Energy Storage, Transmission Lines, Distribution Network, Demand Analysis, Peak and Off-Peak Considerations, Loadshedding	Lecture notes, Online resources

Nov - 11 / Week – 10	Sustainability, Impact on Environment and Climate, Carbon Emissions and Net Zero Emission target	Lecture notes, Online resources
Nov - 18 / Week – 11	Energy systems for Industry, Energy Systems in Challenging conditions: Rovers, Satellites, CERN, ISS, Deep-space Missions, Hybrid Vehicles, etc.	Lecture notes, Online resources
Nov - 25 / Week – 12	Project Presentation and Viva Exam	None
Dec - 2 / Week – 13	Project Presentation and Viva Exam	None

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

REQUIRED/OPTIONAL MATERIALS AND FEES

Required Texts:
None

Recommended Additional Texts: (Optional)

i. Title: Sustainable Energy, Choosing among options (Available in McMaster library)
Authors: Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, William A. Peters
Edition: 2nd edition, Publisher: MIT Press, USA, 2012

ii. Title: Sustainable Energy Transitions in Canada (Available online)
Editors: Mark Winfield, Stephen Hill, and James Gaede
Publisher: UBC Press, Canada 2023
Link: https://www.ubcpress.ca/asset/88357/1/9780774869461_OA.pdf

iii. Title: Sustainable Energy — without the hot air (Available online)
Author: David JC MacKay
Publisher: UIT, Cambridge, England
Link: https://www.withouthotair.com/

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:
None

COURSE ASSESSMENT DETAILS

Component	Due Date	Weight
Quiz – 1	Sep 16	5%
Quiz – 2	Sep 23	5%
Quiz – 3	Oct 2	5%
Quiz – 4	Oct 7	5%
Quiz – 5	Oct 21	5%
Project Proposal	Oct 23	5%
Quiz – 6	Oct 28	-
Project Meeting	Oct 21- Oct 28	5%

Project Presentation	Nov. 25 – Dec 4	5%
Viva Exam on Project	Nov. 25 – Dec 4	10%
Final Project Report	Dec 4	25%
Final Exam	Dec 6 – Dec 19	25%
Total		100%

GRADING SCALE

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

MSAF policy:

- An MSAF for a missed quiz will automatically allocate the missed grade to the total quiz grade component. Such a request will be accepted only once throughout the semester. A total of six quizzes will be taken, and the best five will be counted towards final grade calculations.
- An MSAF for any other missed components, like the project proposal, meeting, presentation, viva exam, and final report, will automatically lead to a maximum of 1-week extension, but it still needs to be submitted. It is the student's responsibility to communicate with the course instructor and teaching assistants for scheduling assessments or delayed submissions.
- There will be a penalty for late submissions without a proper reason or prior approval from the course instructor.

GENERATIVE AI

- Students are encouraged to use generative AI throughout this course in whatever way enhances their learning; no special documentation or citation is required.
- However, students are required to write their reports themselves, be able to explain the work they submit, and answer questions related to their work and lecture notes.

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics and the Faculty of Engineering are committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:
1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and

program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

ACADEMIC ADVISING

Academic Advisors are available to assist you with any problems or questions you may have. This includes course selections, changes to your enrolment, McMaster Student Absence Form (MSAF), Religious, Indigenous, or Spiritual Observances (RISO) forms, exams, taking courses at another university (for credit at McMaster), Petitions for Special Consideration, and much more. Below is the contact information for the Office of the Associate Dean (Academic) in the Faculty of Engineering:

JHE-Hatch 301
https://www.eng.mcmaster.ca/programs/academic-advising
(905) 525-9140 ext. 24646

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work". An abbreviated version is provided below.

The University recognizes that students periodically require relief from academic work due to extenuating circumstances. Students seeking relief for missed academic term work are expected to read the ***McMaster Student Absence Form Policy***. The Policy aims to manage these requests by taking into account the needs and obligations of students, instructors and administrators. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in their course. Any concerns regarding the granting of relief should be directed to the Faculty Office.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three (3) calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.
    - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
    - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
    - The MSAF cannot be used for academic work that has already been completed or attempted.
    - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
    - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three (3) calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal

study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.