ENGG*3080 Energy Resources & Technologies

01

Fall 2020
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - September 08, 2020

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1 Course Details

1.1 Calendar Description

The challenges of changing the global energy system to reduce dependence on finite fossil energy sources, and transition to environmentally sustainable energy sources, are examined. The reserves, consumption, applications and environmental and human impacts of oil, coal and natural gas usage are examined. The fundamental principles, applications and status of a range of renewable energy sources and technologies will be covered to provide a solid background for further study of sustainable energy.

Co-Requisites: ENGG*3260
Restrictions: ENGG*2030

1.2 Timetable

Lectures:

Tuesday	11:30 AM – 12:50 PM	Virtual - Zoom
Thursday	11:30 AM – 12:50 PM	Virtual - Zoom

Laboratory:

Tuesday	Sec 02	3:30 PM - 5:20 PM	THRN 3404

Thursday Sec 01 3:30 PM - 5:20 PM THRN 3404

1.3 Final Exam

Wednesday, December 9th, 2020 - 11:30 AM - 1:30 PM

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Ryan Clemmer
Email: rclemmer@uoguelph.ca
Telephone: +1-519-824-4120 x52132
Office: THRN 1337
Office Hours: Email to arrange an appointment

Lab Technician: Michael Speagle
Email: mspeagle@uoguelph.ca
Telephone: +1-519-824-4120 x56803
Office: THRN 1102

2.2 Teaching Assistants

Teaching Assistant: Mohammadi Rouzbahani Hossein
Email: hmoham15@uoguelph.ca
Office Hours: By appointment

Teaching Assistant: Aidan Hickie-Bentzen
Email: ahickieb@uoguelph.ca

Teaching Assistant: Dhruv Patel
Email: dpatel23@uoguelph.ca

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3 Learning Resources

3.1 Required Resources

Course Website (Website)
http://courselink.uoguelph.ca
Course material, news, announcements, and grades will be regularly posted to the ENGG*3080 Courselink site. You are responsible for checking the site regularly.

Required Texts (Textbook)
Additional resources will be posted on Courselink as needed.

3.2 Recommended Resources

R.A. Dunlap, "Sustainable Energy," SI Edition, Cengage Learning, 2015. (Textbook)

F.M. Vanek, L.D. Albright, & LT. Agnenent, "Energy Systems Engineering: Evaluation and Implementation", 2nd edition, McGraw-Hill, 2012. (Textbook)

G.J. Aubrecht, "Energy: Physical, Environmental, and Social Impact," 3rd edition, Pearson, 2006. (Textbook)

G. Boyle, "Renewable Energy: Power for Sustainable Future," 3rd edition, Oxford, 2012. (Textbook)

3.3 Additional Resources

Lectures (Notes)

Lectures will be synchronously delivered online through Zoom and can be accessed through Courselink. Lectures will be a combination of powerpoint slides and written notes.

Lab Information (Lab Manual)

The lab manual and schedule for the laboratory exercises will be posted on Courselink. Be sure to read the appropriate lab section prior to attending the lab. Labs will be performed with groups of 4 - 5.

Assignments (Other)

In addition to the lab reports, there will be two project assignments: An Energy Audit and an Energy System design project. Both projects are to be completed in groups of 2 or 3. Details of both projects will be posted on Courselink.

3.4 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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4 Learning Outcomes

Sufficient and reliable supplies of energy are essential for a society to function. Some energy resources are inexpensive and reliable, but come with significant political and environmental concerns. Other energy resources are environmentally benign, but have geographic or dispatchability limitations. Harnessing and delivering the needed energy in a sustainable and reliable manner, particularly with a growing global population, is a pressing challenge for energy engineers.

This course highlights the fundamental principles of traditional (oil, coal, natural gas, and nuclear) and renewable energy resources (solar, wind, water, biomass and geothermal), technologies used to convert energy resources into useful forms of energy, and the potential

social, economic, and environmental impact associated with using energy resources.

4.1 Course Learning Outcomes

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

1. Summarize the fundamental principles of energy conversion from traditional energy sources such as oil, coal, natural gas, and nuclear, and alternative energy sources such as solar, wind, water, biomass, and geothermal.
2. Recognize the merits and limitations of each energy resource in terms of reliability and sustainability.
3. Explain how the performance of photovoltaic cells, wind turbines, and fuel cells are affected by their ambient operating conditions.
4. Evaluate the social, economic, and environmental impacts of energy usage and generation from various energy resources and technologies.
5. Present, analyze, and discuss experimental data, analysis and synthesis in the format of written lab and project reports.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2
3	Investigation	3, 6
3.3	Analyze and interpret experimental data	3, 6
3.4	Assess validity of conclusions within limitations of data and methodologies	3, 6
7	Communication Skills	6
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	6
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	6
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	6

#	Outcome	Learning Outcome
9	Impact of Engineering on Society and the Environment	5
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	5

5 Teaching and Learning Activities

5.1 Lecture

Week 1

Topics: Introduction: Energy Systems & Sustainability
Learning Outcome: 1

Week 2

Topics: Fossil Fuels: Oil, Gas, Coal

Learning Outcome: 1, 2

Week 3

Topics: Introduction to Thermodynamics & Energy Systems

Learning Outcome: 1

Week 4

Topics: Fuel Cell Technology

Learning Outcome: 1, 2, 3, 6

Week 5

Topics: Solar Energy - Operation

Learning Outcome: 1, 2

Week 6

Topics: Solar Energy - Photovoltaics

Learning Outcome: 3, 6

Week 7

Topics: Wind Energy

Learning Outcome: 1, 2, 3

Week 8

Topics: Nuclear Energy

Learning Outcome: 1, 2

Week 9

Topics: Hydroelectric Power

Learning Outcome: 1, 2

Week 10

Topics: Biomass Energy

Learning Outcome: 1, 2

Week 11

Topics: Energy applications: transportation.

Learning Outcome: 2, 5

Week 12

Topics: Energy: Future Outlook

Learning Outcome: 5

5.2 Course Activity Schedule

Energy Audit Project & Energy System Design Project

Groups of 2 to 3 students will complete an energy audit project and energy system design project. Details will be provided on Courselink.

Fuel Cell Lab

Students will complete a performance analysis of a fuel cell system using data collected from a test system. This is a group project (4 - 5 students): each lab group will complete and submit one analysis and report. All project reports must be submitted for marking electronically in the Dropbox in Courselink. The GTA will be available during the lab time to answer questions. Additional lab information will be posted on Courselink.

Solar & Wind Lab

Solar energy labs will be held in THRN 3404 from October 5 to November 6. One group member (4 - 5 students/group) may attend the lab in-person. The remaining group members can attend remotely through live streaming. Students attending the lab in-person will need to complete a safety orientation prior to starting. Those groups not wanting to attend the lab in-

person may view a demonstration video and complete their analysis using a data set provided by the GTA. A schedule will be determined once groups have decided on the method of lab attendance. The table below summarizes when solar lab activities are performed and when the corresponding report is due. All lab reports must be submitted for marking electronically in the dropbox in Courselink. The GTA will be available during the lab time to answer questions. Additional lab information will be posted on Courselink.

Table 1. Dates of major course assessment activities and due dates of corresponding deliverables.

Activity	**Date(s)**	**Report Due Date(s)**
Energy Audit		October 1, 11:59 PM in Courselink
Fuel Cell Lab		October 22, 11:59 PM in Courselink
Solar & Wind Lab	Oct. 5 - Nov 6	November 12, 11:59 PM in Courselink
Energy System Design Project		December 1, 11:59 PM in Courselink
Final Exam	Dec 9	

5.3 Other Important Dates

- Monday, October 12th - Thanksgiving holiday, no classes
- Tuesday, October 13th - Fall Study Break Day, no classes
- Thursday, December 1st - Tuesday Schedule in effect. Make up for Fall Study Break Day
- Friday, December 2nd - Monday Schedule in effect. Make up for Thanksgiving

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6 Assessments

6.1 Marking Schemes & Distributions

Passing grade: An overall final grade of 50% is required to pass the course.

Name	Scheme A (%)
Personal Energy Audit	10
Fuel Cell Lab Report	10
Solar & Wind Lab	20
Energy System Design Project	20
Final Exam	40

Name	Scheme A (%)
Total	100

6.2 Assessment Details

Personal Energy Audit (10%)
Due: Thu, Oct 1, 11:59 PM, Submit to Courselink Dropbox
Learning Outcome: 6

Fuel Cell Lab Report (10%)
Due: Thu, Oct 22, 11:59 PM, Lab Demonstratoin
Learning Outcome: 3, 6
Lab data and a video demonstration will be provided on Courselink. Groups will write a single report using the provided data.

Solar & Wind Lab (20%)
Due: Thu, Nov 12, 11:59 PM, THRN 3404
Learning Outcome: 3, 6
Lab data and a demonstration video will be provided to groups wanting to remain off-campus. There is an opportunity for a single group member to attend the lab in-person from October 5 - November 6. The whole group will write one report using the data collected during the lab time. More information regarding the lab schedule will be posted on Courselink.

Energy System Design Project (20%)
Due: Tue, Dec 1, 11:59 PM, MCKN 029
Learning Outcome: 1, 1, 2, 5
More information will be posted on Courselink.

Final Exam (40%)
Due: Wed, Dec 9, 11:30 AM - 1:30 PM, Room TBA on Webadvisor
Learning Outcome: 1, 1, 2, 5

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7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: An overall final grade of 50% is required to pass the course.

Lab Work: You must complete all labs. Unless academic consideration is granted, failure to complete a lab will result in a mark of zero for that lab report.

The laboratory work is group based. You will need to organize yourselves into **groups of four (4) or five (5) within your lab section during the first week of class**. Group sign-up will be facilitated through Coureslink.

Each group will be responsible for conducting the labs and writing a single report for each lab. You will be equally responsible for your group's laboratory reports. Each group member must make a significant contribution to the writing of the lab report and sign the lab report cover page in order to receive a lab report mark. Lab reports will be marked and the marks posted on Courselink. **Note that clear communication is an essential part of completing the lab. Unclear or poorly presented material will not be considered for marking.** If you have questions about your mark, see the GTA responsible for that lab and they will discuss it with you.

Late Lab or Project Reports: There will be a late penalty of 20% per day or part thereof for any late reports. Reports submitted more than 48 hours late will not be graded and a mark of zero will be assigned. That is, reports submitted within 24 hours after the initial due date will lose 20%, reports submitted between 24 and 48 hours after the initial due date will lose 40%, and reports submitted after 48 hours will receive a mark of zero and will not be evaluated. Lab reports are considered late if they are submitted after the specified time they are due.

7.2 Sustainable Energy Lab Safety

This section outlines some of the safety related procedures and information for use in the Sustainable Energy Lab in THRN 3404. Safety in the laboratory is critical. **You will not be allowed to conduct the labs unless you attend the safety session and sign a form indicating that you have done so.** If you have any concerns or comments related to safety in this laboratory you can reach Mike Speagle, at ext. 56803, in THRN 3502.

1. Be prepared. You should download and print a copy of the ENGG*3080 Lab Manual from Courselink. Be sure to carefully read the specific manual section before you go to perform each of the laboratory exercises.
2. You must do as instructed by the laboratory demonstrator. If you are not sure about something ask the demonstrator. Inform the demonstrator if you become aware of a potential hazard.
3. Food and beverages cannot be stored or consumed in this laboratory

4. Safety glasses are mandatory for all experiments. You will not be allowed to perform an experiment without them.
5. Proper footwear is mandatory for all the experiments. This means no open toed shoes or sandals.
6. The fire extinguisher, first aid kit, and phone are located at the front of the lab (THRN 3404). Dial ext. 52000 in case of emergencies.
7. All accidents should be reported to the demonstrator.

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or

compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
