

**Western University**  
**Faculty of Engineering**  
**Department of Electrical and Computer Engineering**

**ECE 4439B – Conventional, Renewable and Nuclear Energy**  
**Course Outline 2021-2022**

**Description:**

This course will cover energy-related subjects to allow students to gain an understanding of energy and its various forms of existence, and to learn different technologies to convert energy from various forms into electrical energy. The course will also discuss general energy and environmental issues facing our society at present and in the future.

**Instructor:**

Dr. Reza Jafari, Ph.D.  
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Office hours: TBA

**Academic Calendar Copy:**

Global energy resources, distribution and consumption, sustainability. Principle of fossil, nuclear, biomass, hydroelectric, photovoltaic solar and wind power plants. Distributed generation and renewable energy technologies. Grid integration of distributed generation.

**Contact Hours:** 3 lecture hours, 0.5 course.

**Prerequisites:** ECE 3333a/b, MME 2234a/b.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**Restrictions:** Limited to students enrolled in 4<sup>th</sup> year Electrical or Computer Engineering program, with priority given to those in the Power Systems Option.

**CEAB Academic Units:** Engineering Science 100%

**Required Textbook:** None.

**Other Required References:** Presentation slides and supplementary materials will be posted on the course web site.

**Optional Course Readings**

1. Renewable energy: Volume 1: requirements and sources, Richard A. Dunlap, Morgan & Claypool publishers LLC, 2020.

2. Renewable power and energy. Volume I: photovoltaic systems, Gary D. Price, Momentum Press, LLC, 2018.
3. Design of smart power grid renewable energy systems, Ali Keyhani, third edition, John Wiley & Sons, Inc. 2019.
4. Renewable and efficient electric power systems, Gilbert M. Masters, John Wiley & Sons, Inc., 2004.
5. Design and construction of nuclear power plants, Rüdiger Meiswinkel, et al., Ernst & Sohn GmbH & Co. KG, 2013.

### **General Learning Objectives (CEAB Graduate Attributes)**

Knowledge Base	I	Use of Engineering Tools	D	Impact on Society and the Environment	I
Problem Analysis	D	Individual and Team Work		Ethics and Equity	
Investigation		Communication Skills		Economics and Project Management	
Design		Professionalism		Life-Long Learning	I

Notation: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e.g. no review).

Course Topics and Specific Learning Outcomes	CEAB Graduate Attributes Indicators
<p><b>1. Energy Resources, Environment, and Sustainability</b></p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Develop a qualitative and semi-quantitative understanding of energy resources available.</li> <li>b. Develop an understanding of the methods of their conversion to electricity.</li> <li>c. Classify and assess different energy sources of energy and explain their prospects.</li> <li>d. Explain the concept of efficiency in an energy conversion process.</li> </ul>	<b>KB 3, ET 1, IESE 2, LL 1</b>
<p><b>2. Conventional Electric Power Systems</b></p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Develop an understanding of the traditional power systems in terms of power generation.</li> <li>b. Explain the basic concepts of power grids.</li> </ul>	<b>ET 1, ET 2</b>

<p><b>3. Coal- and Gas-Fired Power Generation</b></p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Explain the principles and sub-systems, and operation of fossil fuel power plants.</li> <li>b. Calculate the efficiency at different stages of energy conversion.</li> </ul>	<b>ET 1, ET 2</b>
<p><b>4. Renewable Energy and Distributed Generation</b></p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Explain the important role that the renewable energy resources play.</li> <li>b. List advantages/disadvantages of renewable energy resources.</li> <li>c. Name five commonly used renewable energy systems for power generation.</li> <li>d. Describe why storage is important in power generation based on renewable resources.</li> <li>e. Explain principle of operation of different renewable energy-based power plants.</li> <li>f. Use basic and advanced numerical modelling tools to simulate renewable energy systems.</li> </ul>	<b>PA 1, PA 2, ET 1, ET 2, ET 3</b>
<p><b>5. Nuclear Energy</b></p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. State the history of discovery and utilization of atomic energy.</li> <li>b. Explain radioactivity, fission, and fusion based nuclear reactions.</li> <li>c. Describe the principles of operation of nuclear power plants.</li> <li>d. Differentiate various types of nuclear reactors.</li> <li>e. Name different reactor types and key components, their functions in nuclear power plants.</li> </ul>	<b>ET 1</b>

## Evaluation

Course Component	Weight
Homework Assignments up to 5 written/computer assignments	20%
Midterm Exam	30%
Final Exam	50%

To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination. A final examination < 50% will result in a final course grade of 48% or less. The midterm and final exams are a closed book.

**Late Submission Policy:** Assignments will be penalized by 4% of the available marks per day for late submission. Assignments submitted more than 3 days late will not be accepted.

**Use of English:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Attendance:** Any student who, in the opinion of the instructor, is absent too frequently from class or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

**Absence Due to Illness or Other Circumstances:** Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf)

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

**Course Delivery with Respect to the COVID-19 Pandemic:** Although the intent is for this course to be delivered in-person, the changing COVID-19 landscape may necessitate some or all of the course to be delivered online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

When deemed necessary, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western’s Remote Proctoring website at: <https://remote-proctoring.uwo.ca>.

**Cheating and Plagiarism:** Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

**Use of Electronic Devices:** Students may use laptops, tablet computers, or smart phones only to access the course OWL site during lectures and tutorials. Use of nonprogrammable calculators only is permitted during quizzes and examinations. No other electronic devices may be used at any time during lectures, tutorials, or examinations.

**Policy on Repeating All Components of a Course:** Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain assignment or test marks from previous years. Previously completed assignments cannot be resubmitted by the student for grading in subsequent years.

**Internet and Electronic Mail:** Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) and making themselves aware of any information that is posted about the course.

**Accessibility:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

**Support Services:** Office of the Registrar, <http://www.registrar.uwo.ca/>  
Student Development Centre, <http://www.sdc.uwo.ca/>  
Engineering Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>  
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, [http://www.health.uwo.ca/mental\\_health/](http://www.health.uwo.ca/mental_health/), for a complete list of options about how to obtain help.