Western Engineering

DEPARTMENT OF CHEMICAL & BIOCHEMICAL ENGINEERING

CBE 3307 – ENERGY AND ENVIRONMENT

Course Outline Fall 2026

Professor: Dr. G. Nakhla

LECTURE:	3 hours/week
LAB or TUTORIAL:	Tutorial: 1 hour/week
COREQUISITE(s):	None
ANTIREQUISITE(s):	N/A
PREREQUISITE(s):	CBE 2214, CBE 2221, CBE 2290
CEAB Academic Units:	Basic Science 30%; Engineering Science 38%; Engineering Design 32%
Recommended Reference Texts:	Davis, M. L. (2013). Principles of Environmental Engineering & Science, 3rd ed., McGraw-Hill Education. Estimated publisher hard-copy cost: C$120. Vanek, F. M., Albright, L. D., Angenent, L. T., Ellis, M. W., & Dillard, D. (2022). Energy Systems Engineering: Evaluation and Implementation, 4th ed., McGraw Hill. Estimated publisher hard-copy cost: C$142. De Nevers, N. (2017). Air Pollution Control Engineering, 3rd ed., Waveland Press. Estimated publisher hard-copy cost: C$142.
COURSE DESCRIPTION (50 words max) This course introduces the relationship between energy and the environment, including energy fundamentals, transformations, and basic process design. It examines traditional and emerging sustainable energy generation and storage technologies, as well as air, water, and soil pollution from the energy sector and relevant pollution-control technologies.	

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base		Engineering Tools		Impact on Society	**D**
Problem Analysis		Individual & Teamwork		Ethics and Equity	**I**
Investigation		Communication		Economics and Project Mgmt.	
Design		Professionalism	**D**	Life-Long Learning	

Rating: 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).

Learning Outcomes	CEAB Graduate Attribute
Professionalism: The student will recognize the roles and responsibilities of professional engineers in society, especially the primary role of protection of the public and the public interest.	PR2 (Developed)
Impact of Engineering on Society and the Environment (IE): The student will demonstrate understanding of the concept of sustainable design and development and an ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions, and the concepts of sustainable design and development and environmental stewardship.	IESE2 (Developed)
Ethics and Equity (E&E): The student will demonstrate the knowledge of professional ethics and the ability to apply professional ethics, accountability, and equity.	EE1 (Introductory)

Evaluation Components

Name	% Worth	Due Date	Learning Outcomes
Assignments (5)	25%	Communicated through OWL Brightspace	Calculation of key process design parameters
Mid-term Project	20%	Not specified in course outline	Critical technology review and design
Final Project	20%	Not specified in course outline	Critical technology review and design
Final Examination	35%	Not specified in course outline	

Note: The Mid-term Project and Final Project are group-based assessments and must be carried out in groups of three students. Groups for the mid-term project and final project must be the same.

EXTRA COURSE INFORMATION

GENERAL COURSE OBJECTIVES

- Become familiar with energy forms, units, conversions, and availability.
- Explain traditional and emerging sustainable technologies for power generation and energy storage.

- Understand the underlying process design parameters and key performance indicators for various types of energy.
- Design a basic energy transformation unit, including analysis and reduction of associated environmental pollution.
- Identify water, air, and soil pollutants generated by the energy sector.
- Apply relevant chemistry and chemical engineering principles to pollutant fate and transport.
- Evaluate treatment technologies for air, water, and soil pollutants generated from energy production and transportation.
- Identify and estimate the environmental footprint of major primary energy sources.

TERM STRUCTURE

Unit 1 (Weeks 1–2): Energy Fundamentals and Energy in Society

- Understand forms, units, conversions, availability, and thermodynamic fundamentals of energy.
- Describe the historical and contemporary importance of energy in society.
- Distinguish among primary, intermediate, and end-use forms of energy.

Unit 2 (Weeks 3–4): Primary Energy Sources and Environmental Footprints

- Identify the main renewable and fossil-fuel-based primary energy sources.
- Understand the underlying principles of energy sources.
- Relate energy choices to sustainable growth and development.

Unit 3 (Weeks 5–6): Energy Conversion, Power Generation, and Storage

- Apply the basics of energy conversion to energy transformation devices.
- Examine traditional and emerging sustainable power-generation technologies.
- Understand the role and basic design considerations of energy-storage systems.

Unit 4 (Week 7): Environmental Engineering Fundamentals for the Energy Sector

- Identify air, water, soil, and solid-waste pollution associated with energy production and use.
- Apply water and air chemistry, acid-base chemistry, stoichiometry, equilibrium, kinetics, and oxidation-reduction concepts to environmental pollutants.

Unit 5 (Weeks 8–9): Pollutant Fate, Transformation, Transport, and Dispersion

- Analyze fate and transformation processes for inorganic and organic pollutants.
- Understand transport processes in natural and engineered systems, including air-dispersion fundamentals.

Unit 6 (Weeks 10–12): Pollution Control and Treatment Technologies

- Evaluate particle-control processes based on sedimentation and filtration.
- Apply phase-transfer processes including sorption, absorption, and volatilization.
- Evaluate reaction-based treatment processes including incineration and chemical precipitation.
- Apply treatment principles to the basic design of air- and water-pollution control devices.

Unit 7 (Week 13): Sustainability and Integrated Environmental Management

- Integrate energy-system design with environmental protection and sustainable development.
- Review environmental footprint concepts and the management of solid and hazardous wastes related to energy production.

KEY DATES

Specific assignment topics and due dates will be communicated through OWL Brightspace and are intentionally not listed in the course outline.

BRIGHTSPACE RESOURCES

PowerPoint presentations and other course materials will be provided through OWL Brightspace.

COURSE MATERIALS AND UNITS

Both SI and imperial units will be used.

DELIVERY MODE AND TUTORIAL INFORMATION

Delivery mode: In-person lectures and tutorials.

Lecture: Monday 2:30–3:30 pm in ACEB 1410; Thursday 3:30–5:30 pm in ACEB 1450.

Tutorial: Wednesday 1:30–2:30 pm in SEB 1059.

UNDERGRADUATE ASSISTANT

TEB 477 | 519-661-2111 ext. 82131 | cbeundergraduate@uwo.ca

ASSESSMENTS

1. Students must pass the final examination to pass this course. Students who fail the final examination will be assigned 48% if the aggregate mark is higher than 50%, or the aggregate mark.

2. Assignments are to be submitted online on the specified due date.

FACULTY OF ENGINEERING AI POLICY

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.
- GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

POLICY FRAMEWORK: MISSED CLASSES, LATE WORK, AND ACADEMIC INTEGRITY

I. Absence/Late Accommodation Policy

1. Students must familiarize themselves with the University Policy on Academic Consideration – Undergraduate Students in First Entry Programs posted on the https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf. This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

2. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through STUDENT ABSENCE PORTAL.

3. All requests for Academic Considerations must be made within 48 hours after the assessment date or submission deadline. All Academic Consideration requests must include supporting documentation. However, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

examinations scheduled during official examination periods; Midterm Tests and other designated assessments as noted on the course outline; any assessment already covered by a flexible deadline. If a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above that do not require academic consideration, the request cannot be recalled and reapplied. This privilege is forfeited.

4. Requests without supporting documentation are limited to one per term per course.
5. An undocumented absence is only valid for a 24-hour period, from midnight on the day specified to midnight of the following day. An appropriate use of an undocumented absence would be for an in-class assessment that takes place that day. Where the time given to complete the assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given to complete the assessment, and flexibility considerations in submitting the assessment will override the undocumented absence.
7. NOTE: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
8. It is the student's responsibility to check the date, time and location of the Special Examination.

II. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

III. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit Academic Integrity Western Engineering for more information.

IV. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, 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

V. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement -Academic Accommodation.

VI. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

VII. Health and Well-Being

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.
- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.
- Gender-Based Violence and Survivor Support - “Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website: https://www.uwo.ca/health/student_support/survivor_support/gethelp.html To connect with a case manager or set up an appointment, please contact support@uwo.ca.

IMPORTANT CONTACTS

Engineering Undergraduate Services	SEB 2097	519-661-2130	engugrad@uwo.ca

Office of the Registrar/Student Central	WSSB 1120	519-661-2100	

IMPORTANT LINKS

- WESTERN ACADEMIC CALENDAR
- ACADEMIC RIGHTS AND RESPONSIBILITIES
- ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS
- UNIVERSITY STUDENTS' COUNCIL (USC) - SERVICES
- IMPORTANT DATES AND DEADLINES
- ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS
- ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS
- SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS
- STUDENT FORMS
- OFFICE OF THE REGISTRAR
- RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES (SYLLABI)
- ACADEMIC APPEALS
- STUDENT ABSENCE PORTAL