**Course Description**

The objective of this course is to introduce students to common environmental engineering processes and their solutions/analysis. This relies on understanding and quantifying environmental parameters and formulating links between known and unknown variables. For that, definition and quantification of major parameters will be reviewed, principles of mass and energy balances for different environmental engineering systems will be discussed, and their implementation in problem solving and process analysis will be practiced.

**Course Learning Outcomes (CLOs)**

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

1. Understand and implement definitions, dimensions, and units of common environmental engineering parameters.
2. Identify and quantify common environmental engineering processes.
3. Formulate material and energy balances in environmental engineering processes.
4. Implement material balances to analyze systems with and without reactions.
5. Apply thermodynamic principles to analyze closed and open systems with energy transfers.
6. Recognize examples of life cycle analysis in environmental engineering.

**Graduate Attributes (GAs)**

GAs are assessed in preparation for accreditation by Engineers Canada. It is to ensure that authorities recognize our graduates as meeting the academic requirements for licensure.

This course is used to assess the following GAs:

2.1 - Problem definition
2.2 - Approach to the problem
2.3 - Use of assumptions
2.4 - Interpreting the solution - validity of results
Course Modality

*Synchronous Course:*
This course is a real-time, online course where we meet via web conferencing tools (Zoom, see BrightSpace), at scheduled days and times. Instructors and students share information, ideas, and learning experiences in a virtual course environment. Participation in synchronous courses requires students to have reliable, high-speed internet access, a computer (ideally with a webcam), and a headset with a microphone. Please consult the following ITS website which describes the requirements for learning in an online environment (https://carleton.ca/its/help-centre/learning-in-an-online-environment/).

Recordings

Recordings of the lectures will be made available to students who are currently living in a different time zone or do not have access to high-speed and reliable internet, as well as PMC students. Recordings will be made available for 3 days after the end of lecture. If you need access to recordings, you should inform the instructor before January 14th. If a student misses a lecture due to technical/connection issues, they can request access to recordings for that specific lecture.

Outline of course topics

Please know the approximate weeks are subject to change:

<table>
<thead>
<tr>
<th>Week* (approximate)</th>
<th>Anticipated Topic*</th>
<th>Homework Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Welcome and Chapter 1 - Introduction to process analysis: units, dimensions, engineering calculations, key definitions</td>
<td>-</td>
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<tr>
<td>2</td>
<td>Chapter 2 - Processes and process variables: process definitions, analysis, process variables</td>
<td>1 (chapter 1)</td>
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<tr>
<td>3</td>
<td>Chapter 3 - Material balances: conservation of matter, types of processes, material balance equation, solving balances, single material systems, multiple materials</td>
<td>-</td>
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<tr>
<td>4</td>
<td>Chapter 4 - Transformations: chemical reactions, equilibrium transformations, time-dependent transformations, reacting mass balances</td>
<td>-</td>
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<tr>
<td>5</td>
<td>Chapter 5 – Energy balances: forms of energy, First law of Thermodynamics, closed systems, open systems, energy balance for fluid flow</td>
<td>-</td>
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<tr>
<td>6</td>
<td>Chapter 6 – Life cycle analysis (LCA): principles of LCA, utilizing balances</td>
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* Subject to change
Course Communication

All class-wide communications will be posted on the news page of BrightSpace. You are welcome to email me with any questions, but emails should be used for important and/or time sensitive matters. If your question can wait until class time, that would be preferred.

All notes and assignments will be posted to BrightSpace.

Labs/Tutorials

Lab sessions (tutorials) will be run by teaching assistants (TAs), starting Week 2. During these sessions, TAs will solve example problems that help you prepare for assignments and exams. The last hour of each lab session will be your TA’s office hour when they will answer your questions. Attending labs is not mandatory but highly recommended.

Textbooks (optional)

The following textbooks are good references for this course. Please note that it is not necessary to purchase these books.


Assessment

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>1. Homework assignments (5)</td>
<td>20%</td>
</tr>
<tr>
<td>2. Midterm</td>
<td>30%</td>
</tr>
<tr>
<td>3. Final exam</td>
<td>50%</td>
</tr>
<tr>
<td>Bonus Biosheet</td>
<td>1%</td>
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</tbody>
</table>

Brief descriptions:

Homework Assignments:
To aid your mastery of the course concepts, problems will be assigned as 5 assignments. Doing the homework will help prepare you for exams. Marks are awarded for a complete and proper writing of the solution (including units, assumptions, conclusion statements, etc.), not just the right answer. ALL problem sets must be submitted to be eligible to pass this course. Using methods/equations that are not covered in class and not included in formula sheet is not acceptable and such solutions will not receive a grade. Failing to submit one (or more) assignment(s) will result in disqualification from writing the final exam and passing the course. Assignments should be submitted on Brightspace in 1 file in acceptable format (PDF).

Midterm:
Midterm will be held during the term (approximately Week 6-7 during PA sessions). It will be a closed book (formula sheet will be provided) test on Chapter 1 to 3, that serves as formative assessments of your learning. Midterm will be proctored by the teaching team. To be eligible to pass the course, you
must receive a minimum 40% of the midterm. Marks are awarded for a complete and proper writing of the solution (including units, assumptions, conclusion statements, etc.), not just the right answer. Using methods/equations that are not covered in class and not included in formula sheet is not acceptable and such solutions will not receive a grade.

If you miss an assessment (homework assignment or midterm) due to extenuating circumstances, you are responsible for informing your instructor within 3 days of the test. Documentation verifying the severity of the situation will be required to provide accommodations.

Final Exam:
This course has a two-hour final exam (to be scheduled in final exam period) which will be an individual closed book test on all the chapters. Final Exam will be proctored by the teaching team. Marks are awarded for a complete and proper writing of the solution (including units, assumptions, conclusion statements, etc.), not just the right answer. Using methods/equations that are not covered in class and not included in formula sheet is not acceptable and such solutions will not receive a grade.

*Those who have not submitted all the assignments or have received below 40% (or missed) in the midterm, are not eligible to write the final exam.

Biosheet:
Provide a one-page Biosheet with the following components:
- A photo of yourself
- Your name and preferred name (if applicable)
- Hometown
- Favorite first-year course
- Reason for choosing your discipline of engineering
- Work experience
- Career Aspiration

The format is up to you. Please note, the biosheet must be submitted by the detailed due date or you will not receive the bonus marks.

Late submission policy
Accommodation may be made for valid reasons, requirements for which are outlined below. Without a valid or recognized accommodation, a penalty of 10% per day will be given for all assessments. Late submissions are not accepted after solution set is posted and will result in a grade of zero, unless appropriate documentation is provided. If you miss an assignment due to extenuating circumstances, you are responsible for informing your instructor within 3 days of the deadline. Documentation verifying the severity of the situation will be required to provide accommodations.

Appeals
Please bring any grading appeals to my attention within 10 days of grades being posted. Please write a brief description of your concern and submit to me. I will then review and discuss with you, if needed. Teaching Assistants will not change any marks. These concerns must be directed to the instructor.
Inclusivity in the classroom

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space (virtual) which we work in will be safe for everyone. Please be considerate of everyone’s personal beliefs, choices, and opinions.

Course Material Copyright

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors, guest lecturers and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, recordings, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to record lectures on their own. Students are not permitted to reproduce or distribute lecture notes, recordings, and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Academic Integrity

The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
- failing to acknowledge sources through the use of proper citations when using another’s work and/or failing to use quotations marks.

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course or even suspension or expulsion from the University.
Final Grades
Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Course Completion
Please take careful note of Section 5.1 of the Academic Regulations in the Undergraduate Calendar (https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/grading/#credit): “To obtain credit in a course, students must satisfy the course requirements as published in the course outline.” As per the note (*) above, you will fail the entire course if you do not complete the assignments and do not obtain at least 40% on the midterm.

Academic Accommodation
Students with diverse learning styles and needs are welcome in this course. You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows. For more information, please consult: http://students.carleton.ca/course-outline

Pregnancy Obligation
Please contact the instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please consult: http://students.carleton.ca/course-outline

Religious Obligation
Please contact the instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please consult: http://students.carleton.ca/course-outline

Accommodations for Students with Disabilities
The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (http://www.carleton.ca/PMC) for the deadline to request accommodations for the formally scheduled exam (if applicable).

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working, and living environment where sexual violence will not be tolerated, and survivors are supported through academic
accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available and to obtain information about sexual violence and/or support, please visit: http://www.carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact the instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more information, please consult: http://students.carleton.ca/course-outline

Mental Wellness

If you find yourself suffering during this or any other term from anxiety, stress, or issues related to mental health, this is nothing to be ashamed of. It is highly recommended that you seek help; refer to Counselling Services. You are also welcome to reach out to your instructor to discuss on-campus resources.

COVID-19

With the return of some in-person activities (PA sessions) for this course (to commence January 31, 2022 - this date may change and is at the discretion of the University), all public health measures will be followed. If you do not feel well in any way, please do not come to campus for these activities. Please contact your instructor if this is the case and accommodations will be made. Ensure the health and safety of all students, TAs, and instructors is of primary concern. Please follow all rules and regulations as outlined by the University (https://carleton.ca/covid19/policies-and-protocols/).