Carleton University
Department of Civil & Environmental Engineering

ENVE 2001: Process Analysis for Environmental Engineering

Winter 2025

Professor:	**Prof. Cole Van De Ven P.Eng., Ph.D.**
Office:	Canal Building 6210
Email:	cole.vandeven@carleton.ca
Office hours:	To be decided based on class survey
Lecture time*:	Please refer to the Public Class Schedule for the most recent information
PA Session time*:	Please refer to the Public Class Schedule for the most recent information
TAs	TBA on Brightspace

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 and energy 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)

The Canadian Engineering Accreditation Board (CEAB) requires graduates of undergraduate engineering programs to possess 12 attributes. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to our programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate. This following list provides the GAs that will be measured in this course, along with the Learning Outcomes that are intended to develop abilities related to these attributes.

2.1 - Problem definition (Assignments)
2.2 - Approach to the problem (Assignments)
2.3 - Use of assumptions (Assignments)
2.4 - Interpreting the solution - validity of results (Assignments)

Outline of Course Topics and Tentative Progression

Please know the approximate weeks are subject to change:

Week* (approximate)	Anticipated Topic*	Assessments
1	Welcome and Chapter 1 - Introduction to process analysis: units, dimensions, engineering calculations, key definitions	Biosheet bonus, Assignment 1 Release
2	Chapter 2 - Processes and process variables: process definitions, analysis, process variables	Assignment 1 Due
3		Assignment 2 Release
4	Chapter 3 - Material balances: conservation of matter, types of processes, material balance equation, solving balances, single material systems, multiple materials	Assignment 2 Due
5		Assignment 3 Release
6	Chapter 4 - Transformations: chemical reactions, equilibrium transformations, time-dependent transformations, reacting mass balances	Assignment 3 Due
7		Midterm
8		Assignment 4 Release
9	Chapter 5 – Energy balances: forms of energy, First law of Thermodynamics, closed systems, open systems, energy balance for fluid flow	Assignment 4 Due
10		
11		Assignment 5 Release
12	Chapter 6 – Life cycle analysis (LCA): principles of LCA, utilizing balances	Assignment 5 Due
13		

* Subject to change. I reserve the right to revise as the course progresses.

Lecture Notes

Blank lecture notes will be posted on Brightspace prior to starting a chapter. The notes are designed to supplement lectures, but do not represent the complete content of the course (for that you should attend the lectures). Some sections of the notes are left blank. We will fill them throughout lectures but filled notes will not be provided. Please be prepared to fill in your notes by hand, tablet, computer, or any approach you find works best for you.

Course Communication

All class-wide communications will be posted on the news page of Brightspace and announced in class. You are welcome to email me with any questions, but emails should be used for important and/or time sensitive matters. Please start your email subject "ENVE 2001 –" then your subject. This will ensure a more rapid response.
All blank notes, assignments, PA session problems, dropboxes, etc. will be posted to Brightspace.

PA Sessions

PA sessions will be run by teaching assistants (TAs), **starting Week 2 or 3 (to be announced)**. During these sessions, TAs will solve example problems that help you prepare for assignments and exams. The last hour of each PA session will be your TA's office hour when they will answer your questions.

Attending PA Session is not mandatory but highly recommended.

Reference Materials (optional, not required)

The following textbooks are good references for this course. **Students are not required to purchase textbooks or other learning materials for this course**.

- Felder, Rousseau & Bullard, Elementary Principles of Chemical Processes, 4th Ed., 2018, Wiley (estimated cost: $99)
- Davis & Masten, Principles of Environmental Engineering and Science, 2nd Ed., 2009, McGraw Hill (estimated cost: $150)
- Nazaroff & Alvarez-Cohen, Environmental Engineering Science, 2001, Wiley (estimated cost: $51)

Assessments

Assessment	Weight
1. Assignments (5)[1]	15%
2. Midterm[1]	30%
3. Final exam [1]	55%
Bonus Biosheet	1%

[1] These assessments will include marks for Engineering Problem Analysis Approach/Skills (described below). These are marks assigned to the assessment, formulation, and interpretation of an engineering

problem and solution. It is imperative that this framework be used to solve engineering problems and are vital skills needed for the remainder of your engineering education and future practice.

Brief descriptions:

Assignments:

To aid your mastery of the course concepts, problems will be assigned as 5 assignments (one for each Chapter from 1 to 5, no assignment for Chapter 6). Doing the assignments 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**. Assignments should be submitted on Brightspace in **1 file** in acceptable format (PDF). Assignments will include marks for Engineering Problem Analysis Approach/Skills.

Midterm:

Midterm will be held during the term (approximately **Week 7** during PA sessions). It will be a closed book (formula sheet will be provided) covering **Chapters 1 to 3**, that serves as formative assessment of your learning. Midterm 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**. The midterm will include marks for Engineering Problem Analysis Approach/Skills.

Final Exam:

This course has a **three-hour** final exam (to be scheduled in final exam period) which will be an individual closed-book test on **all chapters.** Marks are awarded for a complete and proper writing of the solution (including units, assumptions, conclusion statements, etc.), **not just the right answer**. The final will include marks for Engineering Problem Analysis Approach/Skills. Please note:

i) Final exams are for evaluation purpose and will not be returned to students.

ii) Students who are unable to write the final examination because of extenuating circumstances, as defined in the Academic Consideration Policy, may apply for accommodation by contacting the Registrar's office. Consult the Section 4.3 of the University Calendar.

Biosheet Bonus:

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 (it's okay, if you don't have much. You could also talk about interesting projects you've done in school)
- 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.

Engineering Problem Solving Approach/Skills:

For every assessment where engineering problems are solved (i.e., every assignment, midterm and final) at total of 5 marks will be part of the overall mark distribution, which will assess your Engineering Problem Solving Approach/Skills. These are marks assigned to the assessment, formulation, and interpretation of an engineering problem and solution. It is imperative that this framework be used to solve engineering problems and are vital skills needed for the remainder of your engineering education and future practice. For each problem, your solution should be structured in the following way:

1) **Problem Statement:** A concise restatement of the problem, including the given information and a statement of what is required.
2) **Problem conceptualization:** A sketch or diagram of the problem (when applicable).
3) **Assumptions:** A statement of any assumptions needed to solve the problem.
4) **Solution:** The solution itself, clearly laid out with statements of the fundamental principles involved; descriptions of the mathematical steps taken; any additional information, references and citations clearly indicated, as required.
5) **Final conclusion and discussion**: The answer should be clearly indicated and, importantly, discussed in terms of its reasonableness and its consistency with any assumptions made.

Marks will be awarded for each of the 5 components. Mark will be given on a “two-strike basis”, the first time you do not include one of the components, you will lose 0.5 marks for the component, if you don’t include a second time you will receive a 0 for the overall component. This is very important therefore, that is reflected in this grading approach.

As an example, imagine 2 of the 5 questions on an assignment require a process diagram (Problem Conceptualization). If you include all other components but did not include a process diagram for one of the questions, your Engineering Problem Solving Approach/Skills mark would be 4.5/5. If you didn’t include a single process diagram, your Engineering Problem Solving Approach/Skills mark would be 4/5.

Missed Term Work

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for alternate arrangements with the instructor and in all cases, this must occur no later than **three (3) calendar days** after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. The accommodation provided will be shifting the weight to the final exam, only if a self-declaration form has been received within 3 calendar days. To request academic consideration for a missed assessment, please submit a “Self-Declaration Form” to me with 3 calendar days. Consult Section 4.4 of the University Calendar.

Late Submission Policy

Without a valid or recognized accommodation or if no self-declaration form is submitted within 3 calendar days, a penalty of 10% per day will be given for all assessments (this, of course, does not apply to the midterm and final exam which are given 0 if missed). For assignments, late submissions are not accepted after the solution set is posted and will result in a grade of zero, unless appropriate documentation is provided.

Appeals

Please bring any grading appeals to my attention within **5 calendar 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.

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 notes, 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 dates

Students should be aware of the academic dates (e.g., last day for academic withdrawal) posted on the Registrar's office web site https://carleton.ca/registrar/registration/dates/academic-dates/

Academic Integrity

Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: https://carleton.ca/engineering-design/current-students/fed-academic-integrity Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

One of the main objectives of the Academic Integrity Policy is to ensure that **the work you submit is your own.** As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. 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 violations of the policy include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- 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 of information through the use of proper citations when using another's work and/or failing to use quotations marks.

Chat GPT/Generative AI/Large language models usage

The use of Chat GPT/Generative AI/Large language models is strictly prohibited in this course. There is no acceptable use of these tools for any submitted work in this course and will be considered an academic integrity violation.

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*."

Learning and working environment

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

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

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

> **Academic 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 .

You should request your academic accommodations in the Ventus Student Portal, for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

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 your 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, see the Senate Policy on Accommodation for Student Activities (PDF).

Pregnancy Obligation: Please contact your 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 review the Student Guide to Academic Accommodation (PDF).

Religious Obligation: Please contact your 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 review the Student Guide to Academic Accommodation (PDF).

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 where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the Sexual Violence Prevention & Survivor Support.

Engineering Academic Advising

The Engineering Academic Support Service assists undergraduate engineering students with course selection, registration, and learning support from first year through to graduation.
Academic Advisors Contact can be found here: https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/.

Mental Wellness

As a university student you may experience a range of mental health challenges that can significantly impact your academic success and overall well-being. Carleton's **Wellness Services Navigator** is designed to help students connect with mental health and wellness resources.
If you need to talk to someone from the department for more information and support with connecting to resources, you can contact the following faculty members, depending on your program. Or contact the department at orCEEUGChair@cunet.carleton.ca.

ACSE: Prof. Elie Azar
Email: Elie.Azar@carleton.ca, Office: 3432 Mackenzie

CIVE: Prof. Christian Viau
Email: Christian.Viau@carleton.ca , Office: 4535 Mackenzie

ENVE: Prof. Cole Van De Ven
Email: cole.vandeven@carleton.ca , Office: 6210 Canal Building

Here is a list of on-campus and off-campus recourses:

1. **Carleton's Wellness Desk**: Located at 204A MacOdrum Library, is a space for students to learn about resources, connect with our Wellness Coordinator, and decompress during stressful times of the year. You can pop into the Wellness Desk any time during its hours of operation – no appointments necessary! https://wellness.carleton.ca/mental-health/wellness-desk/

2. **Carleton's Health and Counselling Services:** To book an appointment contact the main clinic by calling (613) 520-6674. If urgent, let the Patient Care Coordinator know or go in person to the main clinic (2500 Carleton Technology and Training Centre Building) and indicate that they are in crisis and need to speak to someone right away. https://carleton.ca/health/

3. **Residence Counselling and Wellness Service:** Counselling services specifically for students in residence. https://carleton.ca/health/residence-counselling/

4. **Therapy Dogs:** Carleton's therapy dogs are around campus with their owners (who are Carleton University staff and faculty) to comfort and provide support to help you thrive as a university student. https://wellness.carleton.ca/mental-health/therapy-dogs/

5. Emergencies and Crisis and Emergency Numbers

6. **Good2Talk (1-866-925-5454):** Good2Talk is a free, confidential helpline providing professional counselling and information and referrals for mental health, addictions and well-being to post-secondary students in Ontario, 24/7/36 https://good2talk.ca/

7. **The Walk-In Counselling Clinic (off-campus community resource):** The Walk-in Counselling Clinic has offices in various locations across Ottawa and the greater Champlain region that are open 7 days a week. Individuals will be assisted, with no appointment, on a first-come, first-serve basis during the Walk-in Counselling Clinic hours. The Walk-in Counselling Clinic **offers services in many languages** and is free and confidential. More information can be found at: https://walkincounselling.com/

8. **Distress Centre of Ottawa and Region**: Available 10am-11pm, 7 days/week, 365 days/year. **Distress Line:** 613-238-3311, **Crisis Line:** 613-722-6914 or 1-866-996-0991, **Text:** 343-306-5550. https://www.dcottawa.on.ca/

9. **Distress and Crisis Ontario, Available for chat 2 pm – 2 am EST.** https://www.dcontario.org/

10. **BounceBack Ontario (Toll-Free: 1-866-345-0224) is a free skill-building program managed by the Canadian Mental Health Association (CMHA). It is designed to help adults and youth 15+ manage low mood, mild to moderate depression and anxiety, stress or worry. Delivered over the phone with a coach and through online videos, you will get access to tools that will support you on your path to mental wellness.** https://bouncebackontario.ca/.