

Fall 2026 | ENVE 3002: Environmental Engineering Systems Modelling
Carleton University
Department of Civil and Environmental Engineering

Teaching Team

Instructor:

Dr. Shoeleh Shams, shoelehshams@cunet.carleton.ca, Office: Mackenzie 4242

Office Hours

Tuesdays 2-3 pm

TAs:

Information to be announced on Brightspace

Course Description and Requirements

1. Schedule

	Day	Time	Location
Lectures	Tuesday/Thursday	4:05 - 5:25 pm	Please refer to the Public Class Schedule for the most recent information
Tutorials	Wednesday (starting week 3)	12:35 – 2:25 pm	
Labs	Schedule can be found on page 4.		

2. Course Description

This course covers reaction kinetics and reactor design principles commonly used in chemical and biochemical systems and processes. It relies on an understanding of the conservation of mass principle applied to reacting systems and develops the capability to design and analyze systems governed by the rate of reactions. Natural or engineered systems where chemical/biochemical reactions play a major role are frequently encountered in environmental engineering and thus constitute a fundamental aspect of environmental engineering practice. The course is therefore a prerequisite for some key courses in the Environmental Engineering Program: ENVE3001, ENVE3004, ENVE 4005, and ENVE4101.

3. Prerequisites and recommended knowledge

Prerequisites: CHEM 1002/1101, MATH 2004 (or concurrent). Recommended: ENVE 2001

4. Intended Learning Outcomes

Upon completion of this course, you should be able to:

- Formulate reaction kinetics and follow the techniques used for collecting kinetic data
- Identify and compare transport mechanisms in fluids
- Analyze the fluid flow behavior in natural and engineered systems in ideal models
- Apply mass balance and kinetic data in different ideal reactors (reacting systems with different transport) to analyze their performance or determine the required size for design
- Assess the effect of divergences from ideal systems in terms of the expected performance or required size of reactors

5. 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. The 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.

GA - Indicator	Assessment Tool
3.1 - Complex problem assessment	Assignment question
3.3 - Experimental procedure	Lab reports
3.4 - Data reduction methods and results	
3.5 - Interpretation of data (synthesis) and discussion	

For information on GAs and continual curriculum improvement, visit the [Accreditation section of Engineers Canada website](#).

6. Accreditation Units

Math/Stats	Natural Science (chemistry)	Complementary Studies	Engineering Science	Engineering Design
-	25%	-	25%	50%

7. References

Recommended Textbooks

Students are **not required to purchase** textbooks or other learning materials for this course. The following textbooks can be used as reference material:

1. Levenspiel, O., Chemical Reaction Engineering, John Wiley & Sons, 1999.
2. Fogler, H.S., Elements of Chemical Reaction Engineering, Prentice Hall, 2016.
3. William W. Nazaroff, Lisa Alvarez-Cohen, Environmental Engineering Science, Wiley 2001
4. Benjamin, M.M. and D.F. Lawler, Water Quality Engineering: Physical/Chemical Treatment Processes, 2013.

Lecture Notes

Lecture notes will be posted **periodically** on Brightspace. 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.

Lectures will NOT be recorded by the instructor and students do NOT have permission to record lectures.

8. Topics and Tentative Plan

Week* (approximate)	Anticipated Topic*	Assessment*
1-2	Chapter 1: Overview of environmental engineering and major environmental measurements	-Biosheet, Sept. 14 -A 1 (CH 1&2), Oct. 5
3	Chapter 2: Review of mass balance	
4-5	Chapter 3: Chemical reaction kinetics: reaction rate, molecularity and order, rate constants, kinetic models, method of analysis for batch reactor	A2 (CH 3&4), Oct. 26
6-7	Chapter 4: Introduction to transport phenomena: flux, advection, diffusion, dispersion, settling	
8-10	Chapter 5: Reaction engineering and design: ideal batch, plug flow and mixed flow reactors	A3 (CH5-1), Nov. 2 MIDTERM** A4 (CH5-2), Nov. 16
11	Chapter 6: Reaction engineering and design: residence time distribution and non-ideal flow	A5 (CH 6&7), Dec. 11
12	Chapter 7: Bioreactors and Review	
13	Indigenous Learning Bundle: "Our Original Instructions": Engaging with Lands and Waters	

* Subject to change

** Midterm will be during the week of November 9th. The exact date will be decided based on the most popular date determined by survey results.

9. Evaluation and Marking Scheme

Your overall course grade will be determined using the following scheme:

Assignments (5)	Biosheet	Lab Reports (3)	Midterm	Final	Bonus - Academic Resilience Modules
10%	-	15%	30%	45%	3%

Homework Assignments

To aid your mastery of the course concepts, problems will be assigned as 4 assignments. You will see solutions to problems similar to the assignments as **tutorials**. 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. Assignments should be submitted on Brightspace in **1 file** in acceptable formats (pdf and word document).

Biosheet

Provide a **one-page** Biosheet with the following components:

A photo of yourself, your name and preferred name (if applicable), hometown, reason for choosing your discipline of engineering, your favorite course so far, work experience, and career Aspiration. The format is up to you.

Lab Reports

This course includes 3 lab experiments which provide important practical exposure to the material covered in the course. **Lab groups of 5 students** will be self-selected, or else randomly assigned. Attending lab sessions is **mandatory**. Lab groups will be required to submit 3 lab assignments (each includes a memo and a formal report) based on the experiments. You may find the deadlines below. Students must have completed all laboratory work with a passing grade to be eligible to write the Final Exam.

Lab	Topic	Schedule	Deadline*	
			Memo	Report
1	Kinetics of Biochemical Oxygen Demand – BOD test	Oct. 5	Oct. 16	Oct. 23
2	Flow Behaviour in Continuous Flow Stirred Tank Reactors	Nov. 9	Nov. 16	Nov. 23
3	Flow Behaviour in a Plug Flow (Tubular) Reactor	Nov. 23	Nov. 30	Dec. 7

* Subject to change

Midterm

Midterm will be held during a class or tutorial during the week of November 9th. The exact date will be decided based on the most popular date determined by survey results. It will be a closed book test that serves as formative assessments of your learning. The 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**. Further details and instructions will be posted separately.

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. The 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**. Further details and instructions will be posted separately.

Those who have not submitted all the lab reports are not eligible to write the final exam.

Bonus - Academic Resilience Modules

Students registered in ENVE 3002 will have the opportunity to earn **3% bonus marks** by completing modules related to academic resilience.

To earn these bonus marks, go to Discover in Brightspace and search for "**Rethinking Resilience – Undergraduate**". Click Enroll in Course to access the modules.

The course consists of interactive videos and activities designed to help students understand stress, coping, and resilience. The modules are intended to help students build academic resilience and reduce stress associated with university life. There are four modules to complete, and each module takes approximately 1–2 hours. After completing all modules, you will be prompted to enter your email address to receive a PDF certificate of completion.

After completion, please submit your certificate through the designated Dropbox in the Assignments section of the ENVE 3002 Brightspace. The **deadline** to complete all modules and submit your certificate is **December 11** (the last day of classes). The 3% bonus marks will be added to your final course grade once completion has been verified.

10. Policies

a) Final Examination

- i. Final exams are for evaluation purpose and will not be returned to students.
- i. **Deferred Final Examinations:** 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](#)

b) Assignment Late Submission Policy

Assignments should be submitted by the due date. If you cannot meet a deadline, please make arrangements with the instructor **before** the deadline; otherwise a penalty of **10% per day** will be deducted from your grade up to **3 days** or until the solution set is posted. **Late submissions are not accepted after solution set is posted and will result in a grade of zero**, unless appropriate documentation is provided.

c) Deferred Term-work and late submission policy (Assignments and Midterm)

Students who claim extenuating circumstances defined in the [Academic Consideration Policy](#), as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases. This must occur no later than three (3) 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. Consult [Section 4.4 of the University Calendar](#).

d) Appeals

You should bring any grading appeals to your instructor's attention **within 7 days** of grades being returned. A brief description of your concern should be submitted in an email to your instructor. Teaching Assistants will not change any marks.

11. 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/> or [Calendar website](#).

Academic Integrity and Plagiarism

- a) 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.
- b) 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.

Unauthorized Dissemination

As per Carleton’s [Academic Integrity Policy](#), Unauthorized Dissemination is a violation of the standards of academic integrity to publish, disseminate, or otherwise make available to a third-party instructional material where the instructor has explicitly prohibited their dissemination.

The materials (including the course outline, slides, posted notes, videos, labs, projects, assignments, quizzes, exams, and solutions) created for this course are intended for personal use only. They may not be reproduced, redistributed, or disseminated in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without written permission from the author(s), both during and after the semester.

Generative Artificial Intelligence (GenAI)

As our understanding of the uses of GenAI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of GenAI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Safer Learning and Working Environment

Carleton 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, [Ombuds Services - Carleton University](#) or submit an anonymous human rights concern through [this form](#).

Academic Accommodations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline)

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/>.

Student Mental Health and 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.

Department: CEEUGChair@cunet.carleton.ca

Prof. Shoeleh Shams

Email: shoelehshams@cunet.carleton.ca, Office: 4242 Mackenzie

ACSE: Prof. Cara [Lozinsky](#)

Email: caralozinsky@cunet.carleton.ca, Office: 2374 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. [Emergencies and Crisis](#)
2. **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/>
3. **Carleton's Care and Support Team:** The role of a Care and Support Team is to support students with any questions or concerns they may have relating to their academics, well-being, finances or any other challenges they may be experiencing. <https://wellness.carleton.ca/mental-health/student-care-and-support-team/>
4. **Carleton's Health and Counselling Services:** To book an appointment visit the [CHR Connect App](#) or contact the main clinic by calling 613-520-6674 ext. 2. 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://wellness.carleton.ca/counselling/>
5. **Carleton's Single Session Counselling:** To book an appointment visit the CHR Connect App. <https://thconnect.telushealth.com/mobile-app-information/xz6lzGrv>
6. **Residence Counselling and Wellness Service:** Counselling services specifically for students in residence. To book an appointment call 613-520-2600 ext. 8061. <https://carleton.ca/health/residence-counselling/>
7. **Carleton's 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/>
8. **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/>
9. **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/>
10. **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/>
11. **Distress and Crisis Ontario,** Available for chat 2 pm – 2 am EST. <https://www.dcontario.org/>
12. **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/>