Carleton University
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
COURSE OUTLINE
Winter 2022
ENVE 3004 Contaminant and Pollutant Transport in the Environment

	Lect./Lab/P.A.
	3 0 1

Learning Outcomes

Contaminant and Pollutant Transport in the Environment focuses on the transport and fate of contaminants in the environment. This includes contaminant transport in air, surface water and groundwater and the partitioning of contaminants in different environments.

By the end of this course, successful students will have achieved the following learning outcomes:

- **Strong conceptual understanding** of the basic concepts of advection, dispersion and diffusion in air, surface water and groundwater
- Evaluate contaminant concentrations in air, surface water and groundwater in response to releases and/or spills in the environmental
- Design stack heights to protect downgradient receptors from emissions from a stack at manufacturing or energy facilities
- Evaluate the impacts of effluent discharges in a river and understand the impacts of a bank discharge versus a discharge at the centre of a river
- Evaluate contaminant concentrations in an aquifer that has been impacted by an accidental spill or release
- Evaluate how a contaminant released in a lake will partition between the water, sediment, aquatic life and the atmosphere

After successfully completing this course, students will have the technical knowledge and skills desired by consulting engineering firms offering services in the environmental field and regulators monitoring and enforcing environmental standards.

Graduate Attributes (GAs): Engineering programs are accredited by the Canadian Engineering Accreditation Board (CEAB). As part of this process, we collect GA data to assess how effectively we are teaching or conveying the GAs with a goal to continually improve our programs. The GA data are not collected in this course but three GAs are conveyed in this course; Knowledge Base (GA1), Problem Analysis (GA2) and Design (GA4).

For information on GAs and continual curriculum improvement, visit the Accreditation section of Engineers Canada website: https://engineerscanada.ca/

Week	*Topic*
1-2	***Introduction***. Processes and terminology associated with contaminant transport; advection, diffusion and dispersion; conservation of mass; retardation mechanisms
3-4	***Contaminant Transport in the Air***. Global atmospheric processes, local conditions, atmospheric dispersion, dispersion models, introduction to governing equations.
5-8	***Contaminant Transport in Surface Waters.*** Rivers, streams, lakes, estuaries, ocean outfalls, equations used to model transport in the different surface water environments; source terms.
9-10	***Contaminant Transport in Ground Water.*** Introduction to contaminant transport in the subsurface, equations governing flow and transport, Ogata-Banks 1D transport equation; parameter sensitivity analysis.
11-12	***Partitioning.*** Distribution of contaminants within the environment

Required Text

There will be no required texts. A collection of references are provided and are available in the library. The references included are as follows:

1. Ramaswami, Anu.; Milford, Jana B.; Small, Mitchell J., Integrated environmental modeling : pollutant transport, fate, and risk in the environment, Wiley, 2005
2. Dunnivant, F.M and Anders, E. Pollutant Fate and Transport in Environmental Media, Wiley, 2019 (not currently in library although has been requested)
3. Wark, K., Warner, C.F., Davis, W.T., *Air Pollution - its origin and control*, 3rd ed. Addison & Wesley, 1998, ISBN0-673-99416-3, 573 pages.
    a. Chapter 3. Meteorology, p.109-142
    b. Chapter 4. Dispersion of Pollutants in the Atmosphere, p.143-187
4. Robert V. Thomann and John A. Mueller, *Principles of Surface Water Quality Modeling and Control*, Harper Collins Publishers Inc., 1987.
    a. Chapter 2 Rivers and Streams, p.29-81
    b. Chapter 3 Estuaries, Bays, and Harbors, p.91-165
5. Bedient, P.B., Rifai, H.S., and Newell, C.J., *Ground Water Contamination- Transport and Remediation*, Prentice-Hall, 1994.
    a. Chapter 6. Contaminant Transport Mechanisms, p.159-201
    b. Chapter 7. Contaminant Fate Processes, p.203-236
6. Samirullah, Y.S., *Prediction of the Environmental Fate of Chemicals*, Elsevier, 1990.
    a. Chapter 4, Modelling Strategies, p.74-85.
    b. Chapter 5. Predicting the Environmental Partitioning of Organic Contaminants and Their Transfer to Biota, Donald Mackay and Kathryn E. Clark, p.159-188.

Lecture Material

Lecture notes in pdf format will be posted in Brightspace.

Marking Scheme

Assignments	20%
Midterm	30%
Final	50%

On-line Section W will use Carleton's e-Proctoring system: This course has timed written assessments, which include midterm and final examinations. The Carleton University e-Proctoring system will be used in your assessments, and requires the use of webcams, microphones, and smart phones.

In-class Section A may use Carleton's e-Proctoring system if the University is fully on-line during any assessment period: This course has timed written assessments, which include midterm and final examinations. The Carleton University e-Proctoring system may be used in your assessments, and requires the use of webcams, microphones, and smart phones.

Instructor	Paul Van Geel	paul.vangeel@carleton.ca
	Room 6210 CB	Phone 520-2600 ext. 1884
T.A.	TBD	
Lectures	Tuesday 8:35-9:55	301 Azrieli Theatre
	Thursday 8:35-9:55	301 Azrieli Theatre
Problem Analysis	Tuesday 16:35-17:25	KM-TH Southam Hall

Please note:
Final exam papers will not be returned to students.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. Visit https://students.carleton.ca/course-outline/#accommodation-for-student-activities for information. For an accommodation request the processes are as follows:

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, visit the above website.

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, visit the above website.

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 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 (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 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: https://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 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 policy (https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf)