

CIV ENV 440 Environmental Transport Processes

Class Tuesday/Thursday 9:30 – 10:50 in Annenberg Hall G32.

Discussion section Tuesday 12:30 – 1:50 in Tech LG52. (Labs will be in Tech LG17)

Instructor: Aaron Packman
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Office Hours: After class or by appointment

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Textbook: Clark, *Transport Modeling for Environmental Engineers and Scientists, 2nd Edition*

Course Description:

This course presents the *fundamental processes* that control the transport of constituent substances in fluids, and the *implications of these processes* for a variety of important applications in natural and engineered environmental systems. Basic physical conservation principles will be introduced and initially applied to understand the behavior of important classes of environmental flows. Fundamental hydrodynamic transport processes will then be analyzed, and the differential equations that describe mass transport in environmental systems will be solved for various boundary and initial conditions. The inter-relationship of hydrodynamic transport with biological and biogeochemical processes will be discussed, and these concepts will be unified within the context of case studies involving the transport of reactive species in complex environmental systems.

After taking this course, you should:

- Understand the fundamental processes responsible for fluid flow, mixing, chemical mobility, and mass transport in the environment.
- Understand the important types of environmental flows and the processes that control them.
- Identify the key physical and chemical features of major environmental systems, and the implications of these features for overall system dynamics.
- Be able to develop appropriate mathematical representations of transport processes, and obtain solutions for cases commonly found in environmental systems.
- Be able to apply basic models for mixing and transport of reactive substances in environmental systems, and recognize and address the additional complexities that can occur in specific cases.

Grading and Expectations:

- **You may freely discuss homework, lab assignments, and literature with other students in the class, but you must turn in your own work.**
- Final reports must be all original work. NU plagiarism standards will be strictly enforced.
- Homework (5): 30%. Laboratories (3): 30%. Written evaluation and verbal discussion of papers from the literature: 15%. Final report (case study): 25%.
- You should participate in class discussions.

Northwestern University Syllabus Standards

This course follows the [Northwestern University Syllabus Standards](#). Students are responsible for familiarizing themselves with this information. NU's Syllabus Standards includes specific guidance and university regulations on the following topics:

- [Academic Integrity](#)
- [Academic Support and Learning Advancement](#)
- [Accessibility](#)
- [Course Details Subject to Change](#)
- [Exceptions to Class Modality](#)
- [Guidance on Class Recordings](#)

- [Providing Display/Preferred Names and Pronouns](#)
- [Prohibition of Recording of Class Sessions by Students](#)
- [Religious Observance](#)
- [Support for Wellness and Health](#)
- [Undergraduate In-Person Arrival and Course Engagement](#)
- [The Writing Place](#)
- [Use of Generative AI Systems](#)

All of the rules on those pages apply to you, so please read them. There are also useful resources on Accessibility, Student Support, Wellness and Health. I want to highlight a few specific items:

Academic Integrity:

The course involves written submissions of paper summaries, lab reports, and a final case study. You have to write your own materials for this. Discussing homeworks and lab data analysis is fine, but the materials you submit for a grade have to be your own. The case study must be done completely on your own, including ideation and writing. Plagiarism standards will be strictly enforced.

Class Teaching Modality and Illness:

Class sessions for this course will occur in person. Individual students will not be granted permission to attend remotely except as the result of an Americans with Disabilities Act (ADA) accommodation as determined by AccessibleNU. Should public health recommendations prevent in person class from being held on a given day, the instructor or the university will notify students.

If you are sick with a respiratory virus, do not attend class to prevent spread of infection. If you are ill or have a medical emergency, contact the instructor as soon as possible to arrange to complete coursework. We can also set up live video and/or recording for anyone who is ill, but this has to be arranged in advance.