ENVENG 4400/6400
Integrated Environmental Chemical Fate and Transport

Course overview

Instructor: Dr. Andrew May

Email address: may.561@osu.edu

Phone number: 614-688-1206

Office location: Hitchcock Hall 483A

Office hours (Zoom): TBD; by appointment

Course Information

Location: Bolz 410

Days: TR

Time: 11:10am - 12:30pm

Prerequisites: CIVILEN 3130 and ENVENG 3200, or permission of instructor

Website: https://carmen.osu.edu/

Course Pre-requisites

4400: ENVENG 3200 (Fundamentals of Environmental Engineering) and CIVILEN 3130 (Fluid Mechanics), or permission of instructor.

> Note to ESGP GSC: These are not true pre-requisites, per se, as they primarily serve to restrict when undergraduate Civil or Environmental Engineering students can take the course. We cover material related to General Chemistry and Calculus/Differential Equations but review, as needed.

6400: Graduate standing in Engineering, or permission of instructor.

> Note to ESGP GSC: There is an obvious "chicken and egg" problem here. ESGP students need my permission (which I will gladly grant), but "Graduate standing in ESGP" is not a pre-requisite because I was uncertain on the reception of this course to ESGP. (This is not simply "Graduate standing" since my academic advisor who aided with course approval through OAA said "If it just says 'graduate standing', you can't prevent some student who is horribly under-qualified from taking the class")

Course Description

This course focuses on the fate and transport of pollutants within and between air, water, and soil. Understanding this fate and transport requires an understanding of thermodynamics and mass transfer concepts related to environmental engineering, which is the focus of the first portion of the course. In the second portion, students will apply these concepts to develop predictive fate and transport models.

Course Learning Outcomes

By the end of this course, students will be able to:

- Understand what physicochemical properties influence the partitioning of chemicals between environmental media
- Understand how mass is transported within air, water, and soil
- Utilize computational models to predict fate and transport of pollutants within and between environmental media

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Mode of Delivery

This course will be delivered using a hybrid approach with the same material being delivered synchronously in-person and online.

> Note to ESGP GSC: I hope that this course will be fully in-person in SP22, but I am retaining all of this information here. I imagine that there will be many edits in reference to "Zoom" or "Carmen quizzes" that will no longer be relevant. I will, however, retain some of the "information sharing" (e.g., regular Carmen Announcements, MediaSite recordings from SP21)

Online Material: All lecture slides, example problems, homework assignments/submissions, and other course materials will be available through the course Carmen page. These materials may include the following: PowerPoint slides (pptx), videos capturing voice-over-slides (mp4), audio-only files (mp3), portable document files (pdf), and Matlab scripts (.m files). *If you have issues with accessibility with any of this online material, please contact your instructor.*

Class Sessions: In-person attendance is not required, but we will be able to maintain safe physical distancing within the classroom. However, I don't want to force any of you into a situation where you feel uncomfortable attending in person. Therefore, all class sessions will be broadcast live over Zoom. This will hopefully provide a more engaging class experience and enable things like real-time demonstration and/or troubleshooting of Matlab code, screen-sharing, and discussions. These live sessions will be recorded.

Live Office Hours: I will be holding recurring Zoom office hours at some time that is yet to be determined, and I am not opposed to doing some of these at night if there is demand for it. You can also reach out to schedule non-recurring Zoom meetings (either one-on-one or as a group). *There will be no in-person office hours.*

Health and Safety Requirements: All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (https://safeandhealthy.osu.edu), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses. As civil and environmental engineers, these actions are part of our professional and ethical responsibility to protect public health and safety.

Organization and Pace of Material: This course is divided into 11 units (see also "Course Outline" below). These units will be organized as "Modules" on the Carmen page. Each unit will have an associated set of PowerPoint slides, and most units will include several Matlab script examples. Links will also be provided to the recorded lectures; if you are unable to attend (either in-person or via Zoom), there will be a discussion board (on the "Discussion" page) that will provide what material was covered on a given day.

Assessments: There will be one homework assignment associated with most units. These assignments will be submitted electronically (more information below). Assignments will be due roughly 1 week after the completion of the unit. The exam will be conducted electronically. It will not require the use of proctoring software, but be aware that academic misconduct will not be tolerated (more information below).

Attendance and Participation: You will not be directly assessed on attendance and participation as part of your course grade. However, if you do not attend a live lecture, you will be responsible for logging into that Carmen page to determine what material you have missed using the "Pace of Material" discussion board. In either case, I encourage you to attend virtual office hours to verify your understanding, to ask clarifying questions, or to discuss homework problems.

Discussion Boards: I will create one discussion board in Carmen to convey the "Pace of Material" (see above). The "Discussion" page can also be used to pose questions about course content; I will regularly check these, but I encourage "peer-to-peer" help on these topics as well. This page can also be used to share current events related to environmental chemical fate and transport; for example, wildfires are, unfortunately, always in the news somewhere.

Credit Hours and Work Expectations: This is a **3-credit-hour course**. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example).

Tentative Course Outline

Week	Week	Topic	Readings
1	Jan. 11	Syllabus Review of numerical methods Concentration units and dimensions	HF: 1.1 – 1.3
2	Jan. 18	Box models	HF: 1.3 – 1.5 L: 1.4
3	Jan. 25	Energy balances Chemical equilibrium	HF: 1.6 L: 2.3 – 2.4
4	Feb. 1	Basic environmental chemistry	HF: 1.6
5	Feb. 8	Basic environmental chemistry	HF: 1.6
6	Feb. 15	Chemical distribution among phases	HF: 1.7, 2.3 L: 2.5
7	Feb. 22	Advection and diffusion	HF: 1.5, 2.2, 3.2, 3.5, 4.4 L: Ch. 3 – 6, 10 – 12
8	Mar. 1	Advection and diffusion Gaussian plumes	HF: 1.5, 2.2, 3.2, 3.5, 4.4 L: Ch. 3 – 6, 10 – 12
9	Mar. 8	Gaussian plumes	HF: 1.5, 2.2, 3.2, 3.5, 4.4 L: Ch. 3 – 6, 10 – 12
10	Mar. 15	Gaussian plumes Numerical solutions to differential equations	HF: 1.5, 2.2, 3.2, 3.5, 4.4 L: Ch. 3 – 6, 10 – 12
11	Mar. 22	Building towards fate and transport	
12	Mar. 29	Building towards fate and transport	
13	Apr. 5	Project work sessions	

Week	Week	Topic	Readings
14	Apr. 12	Project work sessions	
15	Apr. 19	Project work sessions	

Course Materials and Technology

Reading Material

HF: Hemond, H.F. and Fechner, E.J *Chemical Fate and Transport in the Environment*. 3rd edition, Academic Press. Freely available through the OSU Library.

L: Logan, B.E. *Environmental Transport Processes*. 2nd edition, Wiley. Freely available through the OSU Library.

I may post additional materials for your reference on the course website.

Required Technology, Equipment and Skills

The following computer equipment/software will be necessary for this course:

- Microsoft Word (or equivalent)
  - See https://go.osu.edu/office365help to download
- Matlab
  - See https://ocio.osu.edu/software/directory to download
- Zoom
  - If you don't have this installed, where have you been?
  - See https://osu.zoom.us for help
- Microphone and speakers

The following skills will be necessary for this course:

- Access and navigate Carmen
- Participate in Zoom virtual meetings
- Create documents using a word processor
- Run, edit, and write Matlab code
  - This is something that we will develop as the semester goes on.
- Scan and upload documents
  - If you do not have access to a scanner, many smartphone applications can meet this need. One such application that students have used for my courses is "Cam Scanner", but others exist.

You will need a mobile device with the "Duo Mobile" application for two-factor authentication to access some of these technologies.

If your internet connection is unreliable, please contact me.

For technology support:

- Web: https://ocio.osu.edu/help
- Phone: 614-688-4357
- Email: servicedesk@osu.edu

- TTY/TDD: 614-688-8743

Course Policies

Attendance

All students are expected to attend all classes. I will not formally enforce this (but coming to class is probably in your best interest).

Communication

My preferred method of contact outside of class or office hours is email. Any information that I need to convey to the entire class will be shared as an Announcement in Carmen.

Homework

Homework assignments will allow you to build upon theoretical concepts and in-class example problems to enhance your understanding of the material. During the first portion of the semester, homework sets will primarily be "traditional" assignments (e.g., textbook problems) that enable the student to understand the fundamental concepts related to environmental thermodynamics and mass transfer. After the mid-term exam, the assignments will focus on the numerical modeling of chemical fate and transport that will prepare students for their final project. If you choose to do so, you can work on these homework assignments as a group (and in fact, I encourage this), but each student is responsible for an individual submission.

More information about Homework and related policies is provided at the end of the syllabus.

Exams

There will be one mid-term covering both analytical and conceptual material. The exam will be conducted as a Carmen Quiz, likely in early March. These exams are to be completed individually, in accordance with the Academic Integrity Policy described below.

Final Project

In lieu of a final exam, there will be a project that requires you to synthesize course material. For the project, you will develop a mathematical model that describes a real-world system that includes transport between at least two environmental media. More information about this will be posted to the course Carmen site later in the semester. Projects will be completed individually, with feedback from your instructor.

Article Reviews

Students enrolled in the graduate section of the course will be required to complete 5-7 brief critical reviews of published journal articles related to the fate and transport. Please refer to the document on the course Carmen site related to the article reviews for guidance.

Course Grade

Your final course grade will be based on the following weighting:

Section	4400	6400
Homework	40%	20%
Mid-term Exam	25%	25%
Final Project	35%	35%

Article Reviews	n/a	20%

Grading Scheme

I will most likely follow the standard OSU grading scheme, but there may be some grade adjustments at the end of the semester in the students' favor.

Email Correspondence and Response Times

In order to protect your privacy, all course email correspondence must be done through a valid OSU email account or through the course Carmen site. If you have not activated your OSU email account, please do so at https://my.osu.edu.

I will respond to emails within 24 hours on days when class is in session. I will also subscribe to updates on the Carmen Discussion pages that I create (and recommend that you subscribe to these as well). For homework assignments and exams, you can generally expect to receive feedback within 7 days.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an "excuse" for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

Statement on Diversity and Inclusion

The Ohio State University is committed to fostering a culturally and intellectually diverse environment and encouraging all members of our learning community to reach their full potential. Members of The Ohio State community have the right to be free from all forms of harassment and discrimination based on age, ancestry, color, disability, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy, race, religion, sex, sexual orientation, or protected veteran status. The university's Office of Institutional Equity (OIE) was created to coordinate the university's response to all complaints of harassment, discrimination, and sexual misconduct. To learn more about your rights to be free from harassment and discrimination, to get assistance connecting with support resources, or to file a report, please contact OIE:

- Online – report form at equity.osu.edu
- Call – 614-247-5838
- Email equity@osu.edu

You can also report concerns anonymously through EthicsPoint.

Mental Health

As a student, you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you find yourself feeling isolated, anxious or overwhelmed, please know that there are resources to help: ccs.osu.edu. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

Requesting Accommodations

All students who feel they may need accommodations based on the impact of a disability (whether mental or physical; chronic or acute; or others that do not firmly fit into these categories) should contact the instructor privately to discuss their specific needs. Students with documented disabilities must also contact the Office of Disability Services (ODS) in 098 Baker Hall (slds@osu.edu; 614-292-3307) to coordinate reasonable accommodations for the course. Please register with them through the online portal as early in the semester as possible.

COVID-related accommodations can also be requested through ODS: https://slds.osu.edu/covid-19-info/covid-related-accommodation-requests/

The following information is relevant to homework solutions, submission, and self-grading.

Homework Submissions

All homework sets will be posted on the course website. The assignments will be submitted electronically through the Carmen page, and solutions will be posted automatically at the due date/time (typically, Fridays at 6pm). Students will then self-grade and correct their homework within 3-4 days (e.g., the following Tuesday by 5pm). I will then review the original and the self-graded assignment. Note: due to this scheduling, there may be some weeks where you need to submit both an original and a self-graded/corrected assignment, while there may be some weeks where you will have no submissions.

Each problem will be graded as follows:

- Full credit: there was a serious attempt at solving the problem in the original submission, and the self-graded/corrected solution shows that the original work was correct or that the problem was corrected.
- Half credit: a serious attempt at the problem was not provided in the original submission, but the correct solution is shown in the self-graded/corrected submission.
- No credit: the problem was not attempted in the original solution, and no revision was made in the self-graded/corrected submission.

Note: point values will be provided with each problem in the individual assignments, so please refer to this when self-grading. Also, there is no penalty for having an incorrect solution in the original submission.

If the original submission is late or if the self-graded submission is late, the overall grade for that assignment will be reduced by 40%. If both are late, the overall assignment grade will be reduced by 60%. *No points can be earned if there is no self-graded/corrected solution*. More information about self-grading is provided at the end of the syllabus.

The following provides guidelines for submission of homework assignments. Similar guidelines will apply to the submission of mid-term exam materials.

Original Assignment:

- The assignment will be completed using pencil or black/blue ink or typed.
- The assignment will be well-organized so we can follow your thought process.
- A serious attempt will include (where appropriate):
    - Diagrams
    - Labels
    - Assumptions
    - Intermediate answers (with units)
    - Final answers (with units) that are highlighted in some manner (circled, underlined)
        - You will be required to produce graphs on some assignments. I don't have a preferred plotting software, but the following will be **required** for a serious attempt:
            - Axis labels with units
            - A clear legend if multiple curves are plotted on the same figure
    - Calculations
        - It is fine to do calculations using computer software. However, the following will be **required** for a serious attempt:
            - If you use Excel, provide a sample calculation.
            - If you use Matlab (or Python or some other software of your choosing), provide your code.

File Upload:

- All submissions must be uploaded as a portable document file (pdf). This can include:

  - Typed answers
  - Scanned pages
    - If you use a scanner, scan **in color**. This will be critical when we review self-graded/corrected assignments.
  - Photos
    - Cam Scanner is a mobile application that converts pictures into pdf. This is not an endorsement but a suggestion.

- Ensure that all pages are present and **clear/legible**.
  - Pages that are not present will be treated as work that was not completed.
  - Even though you have uploaded all pages, this does not guarantee that everything is readable.
    - For example, if shadows are present in photographs, we may be unable to read content.
- Files should be named: Name.Number_Homework#, e.g., may.561_1

Self-graded/Corrected Assignment:

- Within 3-4 days of submitting the original assignment, self-grade and correct your solutions and upload as a new file.
- **Use a different color than your original**.
- When grading and correcting, you should add missing steps, figures, assumptions, intermediate answers, and final answers.
- If you did not attempt a problem in the original submission, you can add this for half credit.
- If you do not understand a solution (or think that it is incorrect), please ask!
- Follow the same guidelines for file upload as above using Name.Number_Homework#R, e.g., may.561_1R, to name your file.