Spring 2025 Syllabus
EVHY 5559: Environmental Water Quality

Instructor Details

Instructor:	Frederick Cheng (he/him)
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Office Hours:	TBD
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	Please include EVHY 5559 Environmental Water Quality in email subject

Course Information

Tu, Th	2:00-3:15 PM	Clark Hall G004

Course Overview:
This course explores the principles and processes that affect water quality in natural and engineered aquatic systems. Students will develop a comprehensive understanding of the physical, chemical, and biological processes and models that govern the transport and transformation of contaminants at ecosystem and watershed scales. Through a combination of theoretical concepts and practical applications, students will acquire the skills needed to assess, quantify, and manage water resources in diverse environmental contexts.

Recommended: A hydrology course, one semester of college-level chemistry and calculus

Overall Course Goals:
After successful completion, the course is structured so that you will:

- Think like a biogeochemist and consider environmental problems from a **systems approach**
- Explain the **role of key biogeochemical and transport processes** in modifying water quality at the ecosystem and watershed scales
- Formulate and apply **appropriate process-based or empirical models to estimate water quality**
- **Interpret observation data** in conjunction with model results to critically evaluate model results

Course Content and Textbook:
Course notes available via Canvas. It is recommended that you bring the notes (printed or in pdf format) to follow along and annotate during class. I will strive to have relevant content uploaded 24 hrs prior to the class.

The following textbooks are optional, but they are useful for giving additional information on the topics covered in class and may be helpful for future reference if pursing this topic in your future career:

- Chapra, S. C. (2008). *Surface water-quality modeling* (Reissued). Long Grove, Ill: Waveland Press.

- Schlesinger, W. H., & Bernhardt, E. S. (2020). *Biogeochemistry: an analysis of global change* (4th ed). London: Academic press, an imprint of Elsevier.

Use of Coding to Learn
We will assume you do not have coding experience. We will be using R to enhance our learning in this course, but it is not a course on how to code. The focus will be on modifying pre-existing code to visualize and understand concepts.

Grading:
Grades are based on assignments (40 points), a group presentation (15 points), a data analysis project (35 points), in-class activities (20 points).

Why does that add up to 110 points? We will be using a **no-excuses necessary** policy regarding late or missed deliverables. I recognize that this is not the only course you're taking, nor is coursework your only responsibility/commitment; at other times, life happens and you might not be able to put your full effort into the work. Thus, please note the following grading policy for this course:

- **10 bonus points**: You'll be able to earn up to 110 points in this course, but your final grade will simply be calculated out of 100
- **No make-ups:** The bonus points are structured such that you can skip an assignment, some in-class activities, etc. if necessary. Late work will only be accepted if prior arrangements have been made >24 hours in advance (i.e. I should not be notified the night before!).
- **Flexibility in exceptional circumstances:** We are using this policy so that you shouldn't feel the need to justify yourself for normal reasons why you're missing a deliverable. However, if there are exceptional circumstances, please talk with me and we can figure out a way to accommodate the situation.

Letter grades will be determined based on the following scale:

A+	≥98 pts	B+	≥88 pts	C	≥70 pts
A	≥92 pts	B	≥82 pts	D	≥60 pts
A-	≥90 pts	B-	≥80 pts	F	<60 pts

Assignments (4*10 points = 40 points)

There will be four assignments in this course, each will typically be split into two components:

Part A: short answers and calculations. These questions must be completed individually.

Part B: computations/analysis in R. Prior knowledge in R is not required in this course and the class exercises are designed to build up your skills for the homework. These exercises may be completed individually OR in pairs. Your partner does not have to be the same between assignments or the same person you are completing your tutorials/project with. Both students must submit their work themselves and have both your names on the assignment.

Guidance will be provided on formatting, work shown, etc. to achieve full marks. **Both parts of an assignment will be due on Canvas at 11:59PM on the day indicated in the course schedule below**.

Focused Topic Presentation (15 points)

In groups of 3 or 4, students will select an advanced topic related to water quality to investigate that we didn't/won't cover in class. Your group will present a mini-lecture or equivalent within a 20 min timeslot to the class (with another 5 min for questions). The aim of the project will be to identify key concepts and terms, highlight current issues, and/or illustrate connections to concepts taught in the course. Further details will be provided throughout the semester.

Data Synthesis/Analysis Project (35 points)

In groups of 2 to 3 (undergraduates) or 1 to 2 (graduates), students will synthesize environmental data to answer a basic research question about water quality. Students are encouraged to incorporate existing datasets that you're using for research. If you do not have existing topics, a list of potential datasets to explore will be provided.

The project will be scaffolded via various deliverables so that feedback can be provided throughout the term:

- Project proposal (5 pts)
- Preliminary outline showing data sources, workflow, etc. (10 pts)
- Preliminary results (10 pts)
- Final report (10 pts)

It is common for students to propose ambitious projects that are more suitable for a master's degree project or PhD chapter – but we have to remember that we have less than a term! The objective of this project is to give students a chance to use and analyze environmental data within a complex workflow. It is acceptable to have negative or messy results as long as the workflow is reproducible, has scientific rigor, and discussed within the final report.

In-Class Activities (10*2 points = 20 points)

While this course will not have physical labs (either wet or dry labs), we will be making use of a combination of tutorials, hands-on activities on the computer (with R), and other activities to help reinforce the content. These activities will occur approximately once per week, are typically done in groups of 2-3 and will be scored on effort/participation/achieving milestones, rather than correct answers. I will indicate the class before if the activity requires a laptop; if you do not have access, we will arrange that you be in a group that has access to one!

Additional Class Information

Communication and Office Hours: I am available for questions and discussion about the course via email and during office hours. My office hours will be in person. Conversations about your academic programs, future goals, broader interests in hydrology and environmental sciences are welcome too! I will try my best to reply to your email within 24 hours during the regular work week.

Inclusive Teaching Philosophy: Factors such as social identities, visible and invisible disabilities, family circumstances, physical location, mental health, access to the internet all influence the experiences that everyone can have in my courses this and every semester. I am committed to building an environment so that you will be successful and supported. Students requiring accommodations for university-sanctioned events, religious observances, learning needs should provide documentation as soon as possible so that we can discuss alternate options.

Generative AI: Tools such as ChatGPT and Claude are powerful and exciting. Both students and faculty have been experimenting with their use in academic settings. While these tools have applications that foster student learning and understanding, these tools can also be used in ways that bypass key learning objectives. I will strive to be clear about course/assignment learning objectives so that we can understand the underlying reasons for doing tasks yourself, or if AI tools can be used to assist in learning. *For this course*, we will consider generative AI analogously to assistance from another person. In particular, using generative AI tools to substantially complete an assignment or exam (e.g. by entering exam or assignment questions) is not permitted. If you're unsure if using generative AI aligns with the course learning objectives or is a permissible usage, please ask me and we can have a discussion. In general, students should acknowledge the use of generative AI (other than incidental use) and default to disclosing such assistance when in doubt.

Honor Policy: Given the availability of old exams, worked problem sets, and laboratory exercises that are increasingly becoming available from third-party venues, the Environmental Sciences Department considers student access of these materials for Environmental Sciences courses, without explicit instructor permission, to be a violation of the UVA Honor Code. Uploading class materials such as lecture slide, assignments/questions, exams to online repositories or generative AI platforms from this course is not prohibited.

Mental Health and Well-being: If you are feeling overwhelmed, stressed, or isolated, there are many individuals here to help. The Student Health and Wellness Center offers Counseling and Psychological Services (CAPS) for its students; call 434-243-5150 to speak with an on-call counselor and/or schedule an appointment. If you prefer to speak anonymously, you can call Madison House's HELP Line at any hour of any day: 434-295-TALK. Alternatively, you can call or text the Disaster Distress Helpline (1-800-985-5990, or text TalkWithUs to 66746) to connect with a trained crisis counselor; this is toll free, multilingual, and confidential, available to all residents in the US and its territories. For information on CARES Act Student Emergency Funding, Bridge Scholarships, and Emergency Loans, please visit Student Financial Services Operational Updates. You might also be eligible for an Honor Loan.

Course Schedule

Below is a tentative schedule of topics to be taught in class.

Week	Starting	Topic
Part 1: Building Blocks of Hydrology and Biogeochemistry		
1	Jan 13	Introduction
2	Jan 20	Biogeochemistry Recap
3	Jan 27	Biogeochemical Cycling
Part 2: Ecosystem Processes – Fate, Transport, and Transformation of Contaminants		
4	Feb 3	Mass Balance
5	Feb 10	Lentic Systems
6	Feb 17	Lentic Systems Cont'd
7	Feb 24	Lotic Systems: Advective Systems
8	Mar 3	Applications
9	Mar 10	Spring Break
Part 3: Watershed Processes – Human Impacts on Watershed Water Quality		
10	Mar 17	Watershed Processes
11	Mar 24	Best Management Practices
12	Mar 31	Water Quality Monitoring
13	Apr 7	Watershed Modelling
14	Apr 14	Watershed Modelling
15	Apr 21	Regulation and Management
16	Apr 28	Wrap-Up