



Introduction to Physical and Chemical Hydrogeology

Geo 346C

Fall 2021

COURSE SYLLABUS

Course description and objectives

Dr. Ashley M. Matheny

This course is an introduction to physical and chemical hydrological processes. The objectives of the course are:

- 1) To acquire foundational knowledge in the field of hydrology to support further study and develop the vocabulary and skills to communicate about hydrologic principles
- 2) To develop quantitative and problem-solving skills

The course is divided into several modules:

- 1) Water cycle overview
- 2) Physical hydrology and hydrogeology basics
- 3) Introduction to aqueous geochemistry

Course flags

Our course carries a **Quantitative Reasoning Flag**. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.



Stream flow

In this course we'll discuss ways to both measure and approximate water flow and discharge from both large and small channels. (Jemez River, NM. Hydro field camp 2018)



Rainfall

Duration and intensity of precipitation are expected to be altered with changes to climate. Understanding how rainfall interacts with land cover and the unsaturated zone is critical to the prediction of runoff and the potential for flooding. (Rainy season in Panama City, Panama)



Expectations

Attendance:

- This class will involve an **active participation component**. Because a portion of your grade is based on participation and quizzes, attendance is strongly recommended.
- It is your job to complete any assigned readings before class. It is okay if you don't completely understand everything in the reading – just do your best. My expectation is that you come to class

ready to discuss the material, and to ask questions.

Prerequisites:

Enthusiasm and willingness to learn are the real prerequisites for this course. We will cover a broad variety of topics in hydrology, but will work together to build expertise.

Questions:

I strongly encourage you to ask questions and speak up in class and on Canvas.

Collaboration:

I recommend that you self-organize into study groups and work collaboratively on problem sets. However, everyone is expected to contribute equally and **everyone is expected to turn in their own work**. I expect each student to complete their quizzes and exams individually.

Devices:

Because class participation is mandatory, personal/social calls and messages during class are prohibited. Feel free to use devices to supplement and enhance your learning, but

do so while keeping in mind that it must be course-relevant.

Texts:

The textbook for this course is **Fetter, C.W. Applied Hydrogeology 4th ed. (2001)**. Other required reading will be posted to Canvas. You are encouraged to supplement your reading with any of the following textbooks, which are on hold at the Geology library:

- Chow, V.T., Maidment, D.R. and Mays, L.W., Applied Hydrology (1988)
- Freeze, A. and Cherry, J., Groundwater (1979)
- Dingman, S.L., Physical Hydrology (1998)
- Domenico, P.A. and Schwartz, F.W., Physical and Chemical Hydrogeology (1998)



YOUR INSTRUCTOR:

Dr. Ashley M. Matheny (she/her)

Office: EPS 3.162

Desk phone: (512)471-5855

ashley.matheny@jsg.utexas.edu

↑ **Email is the best way to reach me**

Office hours: Tu 12:30-1:30 and by appointment

Absences:

If you need to miss class (e.g. illness, jury duty, religious holiday), contact your TA by e-mail in advance. You will not be penalized for missing class for reasons approved by the TA and instructor.

There will not be a final examination for this course.

Grade	Cutoff
A	95%
A-	90%
B+	88%
B	83%
B-	80%
C+	78%
C	73%
C-	70%
D	65%
F	<65%



Quizzes:

Quizzes will be posted on Canvas at the end of every Thursday period (with the exception of the exam weeks). These quizzes are meant to develop your problem solving skills and help review key concepts covered that week. They will be due by the end of the day the following Friday. No late quizzes will be accepted.

Exams:

Exams will be administered at the end of each of the three units. These exams are not intended to be cumulative, but you will draw on skills and concepts from previous units.

Problem sets:

Problem sets will be assigned via Canvas on Thursdays and are due at 11:59pm the following Thursday.

Grades:



40% Problem sets



15% Exam 1



15% Exam 2



15% Exam 3



15% Quizzes & participation

Late work:

Late work will be accepted with a penalty of -20% of the total value per day.



With these rights come responsibilities:

- You are responsible for taking care of yourself, managing your time, and **communicating with me if things start to feel out of control or overwhelming.**
- You are responsible for acting in a way that is worthy of respect and always respectful of others.
- Your experience with this course is directly related to the quality of the energy that you bring to it, and your energy help shape the quality of your peers' experiences.
- You are responsible for creating an inclusive environment and for speaking up when someone is excluded.
- You are responsible for holding yourself accountable to these standards, holding each other to these standards, and holding the teaching team accountable as well.

Material Sharing

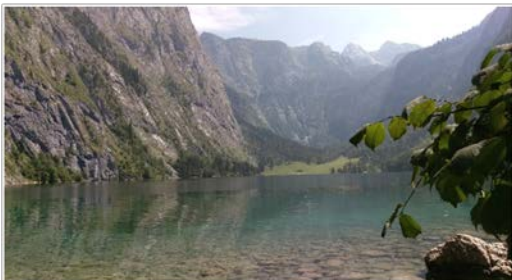
No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, homework assignments), or in-class materials, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. I am well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course. **Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA.**

Personal Pronouns

Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with only the student's legal name. I will gladly honor your request to address you by an alternate name or pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Student Rights & Responsibilities

- You have a right to learn in an environment that is welcoming to all people. No student shall be isolated, excluded, or diminished in any way.
- You have a right to a learning environment that supports mental and physical wellness.
- You have a right to respect.
- You have a right to be assessed and graded fairly.
- You have a right to freedom of opinion and expression.
- You have a right to privacy and confidentiality.
- You have a right to meaningful and equal participation.



University Policies

Academic Integrity

Each student in this course is expected to abide by the University of Texas Honor Code: **"As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity."**

Plagiarism is taken very seriously at UT and in my classroom. Therefore, if you use words or ideas that are not your own, you must cite your sources. Otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT's Academic Honesty and the University Honor Code which can be found here:

http://deanofstudents.utexas.edu/sjs/acint_student.php

Q Drop Policy

If you want to drop a class after the 12th class day, you'll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution. For more information, see:

<http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop>

University Resources for Students

Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course. There are also a range of resources on campus:



Services for Students with Disabilities

This class respects and welcomes students of all backgrounds, identities, and abilities. If there are circumstances that make our learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. If appropriate, also contact Services for Students with Disabilities, 512-471-6259 (voice) or 1-866-329-3986 (video phone). <http://ddce.utexas.edu/disability/about/>

Counseling and Mental Health Center

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you, or anyone you know, experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. <http://www.cmhc.utexas.edu/individualcounseling.html>

The Sanger Learning Center

Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit <http://www.utexas.edu/ugs/slc> or call 512-471-3614 (JES A332).

- *Undergraduate Writing Center:* <http://uwc.utexas.edu/>
- *Libraries:* <http://www.lib.utexas.edu/>
- *ITS:* <http://www.utexas.edu/its/>
- *Student Emergency Services:* <http://deanofstudents.utexas.edu/emergency/>

Important Safety Information

If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

The following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, <http://www.utexas.edu/safety/>

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin

Police Department, or Fire Prevention Services office.

- Link to information regarding emergency evacuation routes and emergency procedures can be found at: www.utexas.edu/emergency

Title IX

Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's relevant policies (<https://titleix.utexas.edu/relevant-policies/>).



Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas universities, including faculty, report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be reported. I am a Responsible Employee and must report any Title IX related incidents that are disclosed in writing, discussion, or

one-on-one. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee. If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email advocate@austin.utexas.edu. For more information about reporting options and resources, visit <http://www.titleix.utexas.edu/>, contact the Title IX Office via email at titleix@austin.utexas.edu, or call 512-471-0419.

Although graduate teaching and research assistants are not subject to Texas Senate Bill 212, they are still mandatory reporters under Federal Title IX laws and are required to report a wide range of behaviors we refer to as sexual misconduct, including the types of sexual misconduct covered under Texas Senate Bill 212.

The Title IX office has developed supportive ways to respond to a survivor and compiled campus resources to support survivors.

Course Outline

All instructions, assignments, readings, and essential information will be on the Canvas website at <https://utexas.instructure.com>. Check this site regularly and use it to ask questions about the course schedule.

This is a living document and changes may be made at my discretion if circumstances require. It is your responsibility to note these changes when announced (although I will do my best to ensure that you receive the changes with as much advanced notice as possible).

<u>Theme</u>	<u>Date</u>	<u>Lecture topics</u>	<u>Due dates and exams</u>	<u>Reading</u>
The Water Cycle	Th 8/26	Introduction		Fetter, Ch 1
	Tu 8/31	Intro to Climate and Watersheds		
	Th 9/2	Water Balance		Fetter, Ch 2
	Tu 9/7	Precipitation		
	Th 9/9	Precipitation	Problem set 1 due	
	Tu 9/14	Evaporation		
	Th 9/16	Transpiration	Problem set 2 due	
	Tu 9/21	Infiltration and runoff		
	Th 9/23	Stream hydrographs		
Physical Hydrogeology	Tu 9/28	Channel hydraulics		Fetter, Ch 3
	Th 9/30	Exam 1	Exam 1	
	Tu 10/5	Darcy's Law		Fetter, Ch 4
	Th 10/7	Darcy's Law #2		
	Tu 10/12	Fluid potential and aquifer properties		
	Th 10/14	Flow nets and lines of equal potential	Problem set 3 due	Fetter, Ch 5
	Tu 10/19	Heterogeneity and Anisotropy		
	Th 10/21	Well hydraulics	Problem set 4 due	
	Tu 10/26	Well hydraulics #2		
	Th 10/28	Surface & Groundwater Interactions		
Chemical Hydrogeology	Tu 11/2	Introduction to chemical hydrogeology		Fetter, Ch 9
	Th 11/4	Exam 2	Exam 2	
	Tu 11/9	Carbonate geochemistry		
	Th 11/11	Redox reactions 1		
	Tu 11/16	Redox reactions 2	Problem set 5 due	

	Th 11/18	Fluid mineral interactions continued		
	Tu 11/23	Solute transport	Problem set 6 due	Fetter, Ch 10
	Th 11/25	Thanksgiving		
	Tu 11/30	Groundwater tracers		
	Th 12/2	Exam 3	Exam 3	
	Tu 12/7	No class meeting		
	Th 12/9	No class meeting		
	Tu 12/14	No class meeting		
	Th 12/16	No class meeting		

Intro to physical and chemical
hydrogeology