Fall 9-1-2021

GEO 572.01: Advanced Hydrogeology

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SYLLABUS – GEO 572 Fall 2021
Advanced Hydrogeology

Schedule: T, Th 9:00-10:30, CCHB 334
Instructor: W. Payton Gardner, CCHB 353
Office hours: T-Th, 2-3pm

Course Description: In this class we will develop a fundamental understanding of processes controlling the movement of groundwater, dissolved species and thermal energy in the subsurface. We will identify the fundamental processes which govern coupled groundwater, heat and chemical transport, derive the partial differential equations which describe them, numerically simulate solutions to the boundary value problem using numerical model, and quantify uncertainty in the model results. The focus of the class will be on numerical modeling of groundwater flow systems, and the application of modeling to real world problems. The final goal is to develop a groundwater model of flow and solute transport in a real-world subsurface system.

Learning Objectives: Students will be able to develop a numerical model which solves the boundary value problem from the ground up.

1. Students will be able to derive the correct governing equation for groundwater flow and transport.
2. Students will be able to develop a reasonable conceptual model for a groundwater flow and transport problem.
3. Students will be able to build and realistically parameterize a numerical model of groundwater flow and transport.
4. Students will be able to perform manual calibration and uncertainty quantification of their model.
5. Students will be able to accurately describe and convey their scientific methods, results and conclusions in a professional and thorough manner.

Grading: 100-90 A, 89-80 B, 79-70 C, 69-60 D, 59 or less F

Weighting:

Assignments:	35%
Reading Summaries:	5%
Final Project:	50%
Field Trip:	10%

Students will be evaluated on their ability to master the topics covered and their participation in class. The ability of students to learn and apply the concepts presented will be evaluated with assignments and a final project which will require much of the material covered in class. This is a fast-paced quantitative class, there's a lot to do, a lot to learn and it will likely be challenging. Don't miss class, stay up on your reading and lectures, and keep cranking on your assignments and final project.

Homework:
Don't expect to be able to finish the home work the night before it is due. You'll have no chance. Start it as soon as you get it. Homework must be turned in by 5:00 pm the day it is due. Late homework will not be accepted unless there are significant setbacks work the night before its due - start working on it as soon as you get it. Homework must be turned in by 5:00 pm the day it is due. **Late homework will not be accepted** unless there are significant external causes that are discussed and cleared with me prior to the due date - not allotting enough time is not a valid excuse.

Homework should be clean, clear and well documented. You are working on becoming a professional, and adequately conveying your methods and results is absolutely critical. Treat me like a client, a committee member or journal reviewer. I will not hunt for information; you must make sure I can easily understand. I will grade according to how easy it is for me to understand you results

Reading:
Do your reading! Good science requires knowing the fundamentals and the current state of the art. The only way to be a good scientist is to read – a lot. You will be expected to read the assignments I have posted here. They have been curated and put here for a reason. You will turn in a reading summary for each paper/chapter assigned each week. Reading summary forms can be downloaded on the Moodle page. Reading summaries will be turned in for credit in each week's Moodle section.

Final Project:
The final project will be to develop a MODFLOW-MT3D model of a real-world groundwater flow and transport problem. Students will write a professional report on their modeling results. The objective is for students to utilize the fundamental understanding developed in this class towards simulating a complex engineering project, and end with scientific communication of the results.

COVID-19 Information:

- Mask use is required within the classroom or laboratory.
- If you feel sick and/or are exhibiting COVID-19 symptoms, please don't come to class and contact the Curry Health Center at (406) 243-4330.
- If you are required to isolate or quarantine, you will receive support in the class to ensure continued academic progress.
- UM recommends students get the COVID-19 vaccine. Please direct your questions or concerns about vaccines to Curry Health Center.
- Where social distancing (maintaining consistent 6 feet between individuals) is not possible, specific seating arrangements will be used to support contact tracing efforts.
- Class attendance and seating will be recorded to support contact tracing efforts.
- Drinking liquids and eating food is discouraged within the classroom.
- Mask use is required in vehicles when traveling to field sites as part of class/fieldwork.
- Please note this class is being recorded. Notifying students is a requirement if this is the case.

Students and accommodations:

Students needing accommodations must work with Disability Services for Students (DSS). DSS will work with students and instructors to facilitate student accommodations. Please note that it is normally not a reasonable accommodation for students to not wear a face covering. DSS will generally recommend to students who cannot wear a face covering for a medical reason to attend class remotely. If a student reports that they have a medical exemption from wearing a face covering, and does not provide a letter from DSS, instructors may prohibit them from attending class without a face covering until they can verify this information with DSS.

If a student becomes sick and needs to quarantine, they should inform their advisor for help staying on track academically. Graduate students should advise their graduate program director. Graduate students who are TAs or RAs should also inform their supervisors and chairs.