



Title: Modeling Techniques for Hydrogeology (GEO SCI 730)

Term: Spring 2021

Credits: 3 Credits Graduate

Description: Theory and application of analytical and numerical modeling methods in hydrogeology. Includes Laplace transforms and finite difference methods for understanding and predicting groundwater flow and contaminant transport.

Duration: 2.5 hours lecture per week

Prerequisites: calculus 1 and 2, physical hydrogeology, computer programming, and graduate standing or consent from instructor

Lecture: 9:45 AM to 12:25 PM, Mon. Jan. 25 to May 13, online, Canvas Collaborate Ultra, recorded live

Teacher: Dr. C.J. Paradis, E-mail: paradisc@uwm.edu, Teams phone: 414-251-7267, office hours by appointment and online via Teams

Textbook: None

Grading Weights: 50% mid-term project, 50% final project

Grading Scale: A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), F (<60)

Final Exam: None

Time Investment: No less than 48 hours (lecture, laboratories, examinations, preparation, etc.) per 1 credit hour per semester, i.e., no less than (3 credits)*(48 hour/credit) = 144 hours (≈ 9 hours/week)

Course Schedule

Date	Lecture Number
1/29	1: Darcy's Law and Laplace Equation
2/5	2: Finite Difference Steady-State Flow Confined Aquifer (Laplace)
2/12	3: Finite Difference Iterative Solutions
2/19	4: Finite Difference Steady-State Flow Confined Aquifer with Source/Sink Terms (Poisson)
2/26	5: Finite Difference Steady-State Flow Unconfined Aquifer (Dupuit)
3/5	6: Finite Difference Transient Flow Confined and Unconfined Aquifers
3/12	7: Numerical Solution Techniques
3/19	Mid-term Project Presentations
3/26	No Class (Spring Break)
4/2	8: Flow Model Calibration and Verification
4/9	9: Advection-Dispersion-Reaction (ADR) Equation
4/16	10: Analytical Solutions (Laplace Transforms)
4/23	11: Effects of Advection, Dispersion, Sorption, and Reaction
4/30	12: Analytical versus Numerical Transport Modeling
5/7	13: Transport Model Calibration and Verification
5/14	Final Project Presentations



Syllabus COVID Statement

1. Panther Community Health and Safety Standards

UWM has implemented reasonable health and safety protocols, taking into account recommendations by local, state and national public health authorities, in response to the COVID-19 pandemic. As a member of our campus community you are expected to abide by the Panther Community Health and Safety Standards and the Interim COVID-Related Health & Safety Rules (SAAP 10-12), which were developed in accordance with public health guidelines. These standards apply to anyone who is physically present on campus, UWM grounds, or participating in a UWM-sponsored activity.

With respect to instructional spaces (classrooms, labs, performance spaces, etc.):

- Six-foot social distancing must always be maintained.
- Masks are always required on campus, with limited exceptions—environments where hazards exist that create a greater risk by wearing a mask (for example, when operating equipment in a lab with the risk of a mask strap getting caught in machinery, or when flammable materials are being used).
- A student who comes to class without wearing a mask will be asked to put on a mask or to leave to get one at a mask handout station. Failure to do so could result in student conduct processes.
- You should check daily for COVID symptoms by completing the self-check at <https://uwm.edu/coronavirus/symptom-monitor/>. Symptoms may appear 2-14 days after exposure to the virus and include fever, cough, or shortness of breath or difficulty breathing. See the CDC's Website for more information about COVID-19 symptoms.

Students who test positive for or who are diagnosed based on symptoms with COVID-19 should complete this Dean of Students form:

https://cm.maxient.com/reportingform.php?UnivofWisconsinMilwaukee&layout_id=4. By doing so, students will get information on resources, help UWM identify individuals they may have come into contact with on campus so that UWM can work with the local health department, and allow UWM to clean campus areas you visited as appropriate.

2. Attendance Policy

Do not attend your in-person class if you have COVID-19, if you are experiencing symptoms consistent with COVID-19, if you have been in close contact with others who have symptoms, if you need to care for an individual with COVID-19, or have other health concerns related to COVID-19.

Students who miss class due to the above conditions will not be penalized for their absence and will not be asked to provide formal documentation from a healthcare provider.



If you are unable to attend class, take the following steps.

- Notify me in advance of the absence or inability to participate, if possible.
- Participate in class activities online and submit assignments electronically, to the extent possible.
- Reach out to me if illness will require late submission or other modifications to deadlines.
- If remaining in a class and fulfilling the necessary requirements becomes impossible due to illness or other COVID-related circumstances, contact me to discuss other options.

As your instructor, I will trust your word when you say you are ill, and in turn, I expect that you will report the reason for your absences truthfully.

3. Synchronous Online Class Recording

Our class sessions will be audio-visually recorded for students who are unable to attend at the scheduled time. Students who participate with their camera engaged or who utilize a profile image are agreeing to have their audio/video or image recorded. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded.

4. Potential for Reversion to Fully Online Instruction

Changing public health circumstances for COVID-19 may cause UWM to move to fully online instruction at some point during the semester. UWM will communicate with students about moving to fully online instruction if the situation develops.

5. Navigate Student Success Platform and Mobile App

Students are encouraged to use a tool called Navigate. This tool can help you learn about academic resources, set up study groups in your courses, make appointments with your academic advisor, get reminders on important dates, and much more. In addition, Navigate allows instructors to send Progress Reports to students throughout the term, allowing for updates on your academic progress in a course in addition to your grade. You can log into the platform here: <https://uwmilwaukee.campus.eab.com/> or by finding the Navigate link under the Current Students tab on the UWM home page. More information on how you can use Navigate and the app, including tutorials, can be found on UWM's Navigate website.

6. Other

- To enable safe entry/exit from classrooms, all in-person instruction will end 15 minutes early, with additional course content to be covered online.
- All individual student meetings with faculty and teaching assistants will happen online.



University Policies: <http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf>

1. Students with disabilities: <http://uwm.edu/arc/>
2. Religious observances: https://www4.uwm.edu/secu/docs/other/S_1.5_ACCOMMODATIONS_BELIEFS.pdf
3. Students called to active military duty: <http://uwm.edu/active-duty-military/>
4. Incompletes: https://www4.uwm.edu/secu/docs/other/S_31_INCOMPLETE_GRADES.pdf
5. Discriminatory conduct: https://www4.uwm.edu/secu/docs/other/S_47_Discrimination_Policy.pdf
6. Title IX/Sexual Violence: <https://uwm.edu/sexual-assault/> and <http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/>
8. Complaint procedures: https://www4.uwm.edu/secu/docs/other/S_47_Discrimination_Policy.pdf
9. Grade appeal procedures: https://www4.uwm.edu/secu/docs/other/S_28_Grade_Appeal_by_Students.pdf
10. LGBT+ resources: <http://uwm.edu/lgbtrc/>
11. Smoke and Tobacco-Free campus: https://www4.uwm.edu/secu/docs/other/S_49_Smoke_Tobacco_Free_Policy.pdf
12. Final Examinations: https://www4.uwm.edu/secu/docs/other/S_22_Final_Examinations.pdf