2021

GEOL 746: Groundwater Hydrology

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Geol746 Groundwater Hydrology, 28362
School of Earth and Environmental Science
Fall 2021 – in-person TTh 5 – 6:15 pm SB E231

Instructor Information

Dr. Timothy T. Eaton - **Timothy.Eaton@qc.cuny.edu.** Please email me from your college email account - I try to answer emails as soon as possible during the business day (before 5 pm). However, responses to evening and weekend emails will generally be the next business day.

Phone: 718-997-3327 (leave message or better to use email to contact me)

Office hour: immediately before class: 4 pm on Tuesdays, or by appointment

Books, materials, tools, and accounts

Text: This is a **zero-cost textbook** course, but required readings are assigned from texts available online and to be provided on Blackboard. See course schedule below and available texts at The Groundwater Project at https://gw-project.org/books/

Required tools and accounts: I will be using Blackboard mainly to keep track of your grades in this class. As grad students, you should be familiar with Blackboard, but for help, check out the Bb support page, email Helpdesk@qc.cuny.edu, or call the Student Support Hotline (718-997-3000). Make sure you have *a QC email as your email address in Bb* so I can contact you!

Course Description and Information

Course Description: This is an upper-level graduate course in quantitative hydrology. We will cover physical principles of groundwater flow, Darcy's law, flow equations, flow nets, pumping tests, methods of groundwater investigation, groundwater geology. Numerical calculations and problems will be emphasized. Case histories are presented that describe different types of groundwater systems. You are expected to have some background in geology and quantitative methods, notably physics, and ideally calculus principles.

Goals and Objectives: My goals for this course and objectives for you are to :

1. Provide the theoretical background in groundwater hydrology for research and professional development relevant to working in New York City.
2. Master principles of groundwater flow, Darcy's law, flow equations, flow nets, pumping tests, methods of groundwater investigation, groundwater geology.
3. Demonstrate skill with solving problems involving case histories of different types of groundwater systems.
4. Successfully complete homework and exam questions involving principles of groundwater hydrology
5. Analyze hydrogeology using equations and software for specific scenarios and settings presented in class

Grading

I use a point system (500 pts total) to assess grades with a percentage distribution as follows:

Course component	**Total Grade points and percentage**
Final Exam	150 pts (30%)
Midterm Exam	150 pts (30%)
Biweekly homeworks (5)	30 each, total 150 pts (30%)
Exercises and class participation	50 pts (10%)

Class Schedule

This schedule is subject to change. Students will be notified in writing of such changes.

For the most up to date information and activities, always refer to this document and the course site on Blackboard.

Date	**Theme/Topic**	**Readings (sections incl.)**	**Assignments due**
Week 1: Aug 26 only	Intro. to groundwater: online class orientation	Poeter+ Sec 1-3	**Start on reading for next week!**
Week 2: Aug 31 – Sep 2	Groundwater landscapes/issues, Intro to hydraulic head	Poeter+ Sec 4-4.2; CohenCherry 1-2, WoessPoeter 1-2	
Week 3: Sep 7 – Sep 9	**NO CLASS TUES** Aquifers, head gradients, porosity	Poeter+ Sec 4.3-5 WoessPoeter 3 CohenCherry 4	
Week 4: Sep 14 – Sep 16	Mathematics of Darcy's Law and head gradients **NO CLASS THURS**	Poeter+ 6 CohenCherry 5 WoessPoeter 4	**HW1 due**
Week 5: Sep 21 – Sep 23	Hydraulic conductivity and aquifer types, Transmissivity and storage concepts	WoessPoeter 5,6	
Week 6: Sep 28 – Sep 30	Equations of groundwater flow, boundary conditions	WoessPoeter 7-7.4	**HW2 due**
Week 7: Oct 5 – Oct 7	Review, Well boundaries **MIDTERM THURS**		
Week 8: Oct 13 – Oct 14	Well hydraulics: pumping and slug test analysis	Heath: Basic GW Hydrology USGS WSP2222 pp.34-51	
Week 9: Oct 19 – Oct 21	Ground water resource dev't, sustainability	KonikBrede 1-3	
Week 10: Oct 26 – Oct 28	Groundwater storage depletion	KonikBrede 4-5 Poeter+ 8	
Week 11: Nov 2 – Nov 4	Interpreting groundwater flow: examples	WoessPoeter 8	**HW3 due**
Week 12: Nov 9 – Nov 11	Groundwater quality/governance: global and local	Poeter+ 7,9	
Week 13: Nov 16 – Nov 18	Wellhead protection and contaminant transport	PFAS/dioxane/nitrate	**HW4 due**

Week 14: Nov 23 only	Catchup. Happy T-giving		
Week 15: Nov 30 – Dec 2	Quantitative GW flow: methods and frameworks	WoessPoeter 7.5	VisAEM
Week 16: Dec 7 – Dec 9	Intro to GW modeling	Reilly: Model Guidel. Bear-Cheng or Luka	**HW5 due**
	Final Exam TBA		

General grading rubric

This rubric will be used to quantitatively grade class homework, test problems and other assignments. Questions involve calculations and conceptual explanations.

Criteria	**Meets criteria (>85% of points)**	**Approaches criteria (70-85% of points)**	**Below criteria (<70% of points)**
Interpretation *and* ***representation*** *of data and results*	Clearly presents or converts data into mathematical or graphical form that enables inferences and standard methods to be used	Competent selection of analysis or graphical method, with some errors in execution. Some mistakes in unit conversion, partially affecting results.	Incorrect selection of equation or graphical method to analyze data. Or major mistakes in conversion of units, undermining results.
Calculation, application *and* ***analysis*** *of data*	Appropriate analyses selected and completed skillfully. Calculations correct and clearly presented to support interpretations. Use of scientific notation and significant figures.	Successful completion of analyses with some errors or omissions affecting accuracy of results. Inconsistent use of scientific notation and significant figures.	Analyses flawed because of incorrect methods, major errors, omissions or lack of understanding. Completed only a portion of calculations needed to solve problem
Assumptions *made and* ***explanation/ communication*** *of results*	Compelling explanation, in student's own words, of concepts and analysis leading to logical conclusions. Awareness of simplifications needed for analysis as well as limitations. Effective verbal presentation of results based on quantitative analyses	Workmanlike, or reference-text-based explanation of concepts or results with limited support by mathematical analysis. Some acknowledgement of limitations or simplifications used. Explanations lacking adequate detail or clear expression.	Verbal presentation shows lack of understanding or has been taken from published sources. Doesn't use quantitative analysis, inadequate connection to, or incorrect explanation of results. No awareness of assumptions or limitations of analysis.

Reasonable Accommodations For Students With Disabilities

Candidates with disabilities needing academic accommodation should: 1) register with and provide documentation to the Special Services Office, Frese Hall, Room 111; 2) bring a letter indicating the need for accommodation and what type. This should be done during the first week of class. For more information about services available to Queens College candidates, visit http://www.qc.cuny.edu/studentlife/services/specialserv/Pages/default.aspx, or contact: Special Service Office; Director, Miriam Detres-Hickey, Frese Hall, Room 111; 718-997-5870 (Monday – Thursday 8:00 a.m. to 5:00 p.m. & Friday 8:00 a.m. to 4 pm.).

CUNY Policy On Academic Integrity

Academic Dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion as provided at https://www.cuny.edu/about/administration/offices/legal-affairs/policies-procedures/academic-integrity-policy/. Please read this document, paying careful attention to the sections on plagiarism and Internet plagiarism. If you are not sure how to cite work you have found on the internet, please review the APA Guidelines provided by the Purdue OWL.

Netiquette

Please maintain a professional demeanor when posting online. You can be respectful even when you have a difference of opinion. Treat others as you'd want to be treated yourself. Don't type in all caps, as that is the online equivalent of shouting. If you need to emphasize a word or phrase, use italics.

Statement on student wellness

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. QC services are available free of charge. You can learn more about confidential mental health services available on campus at: https://www.qc.cuny.edu/StudentLife/services/counseling/counseling/

Use of Student Work

All programs in New York State undergo periodic reviews by accreditation agencies. For these purposes, samples of student work are occasionally made available to those professionals conducting the review. Anonymity is assured under these circumstances. If you do not wish to have your work made available for these purposes, please let the professor know before the start of the second class. Your cooperation is greatly appreciated.

Course Evaluations [for Fall and Spring semesters only]

During the final four weeks of the semester, you will be asked to complete an evaluation for this course by filling out an online questionnaire. Please remember to participate in these course evaluations. Your comments are highly valued, and these evaluations are an important service to fellow students and to the institution, since your responses will be pooled with those of other students and made available online, at the Teaching Evaluations Data: Spring 2010 – Present (http://ctl.qc.cuny.edu/evaluations/data/). All responses are completely anonymous; no identifying information is retained once the evaluation has been submitted.