

Civil Engineering
CIVENG 4P04
Physical Hydrogeology
Fall 2023



ENGINEERING

Instructor Information

Dapo Awolayo

Email: awolayo@mcmaster.ca

Office: JHE 338

Office Hours:

Thursday, 12.30–2.30 pm or by appointment

During office hours, you will have the option to [attend virtually](#) if you prefer. Whether you choose to attend in person or virtually, I am available to assist and address any questions or concerns you may have.

Course Information

Lectures:

MoTh 09:30 am - 10:20 am

Tu 10:30 am - 11:20 am

Tutorials:

Mo 12:30 pm - 02:20 pm

Course Dates: 09/05/2023 - 12/06/2023

Units: 4.00

Course Delivery Mode: In Person

Course Description: This course covers the fundamental concepts of movement and

storage of water within aquifer systems and its importance in the hydrologic cycle. The topics include Darcy's equation, the groundwater flow equations, aquifer properties, heterogeneity, anisotropy, aquifer testing, well hydraulics, groundwater-surface water interaction, groundwater resources and management. Physical processes influencing groundwater contamination are also introduced. Three lectures, one tutorial (two hours); one term Prerequisite(s): CIVENG 2O04, CIVENG 2J03, MATH 2Z03

Instructor-Specific Course Information

Course materials: Course materials will be posted on Avenue to Learn (A2L).

Attendance: Lecture attendance is expected but will not be reflected in grading. Full attendance, along with active participation in discussions, will lead to a better grade. Tutorials, conducted in person, will reinforce lecture concepts and introduce the software package (MODFLOW) for term projects.

Assignments: Six assignments will be assigned during the term, and the top five grades will count toward the final grade. Problems will reflect standard exam question.

Term projects: Each student is required to work on an individual design project, deliver a presentation, and submit term project reports.

Examinations: There will be one midterm exam and one final exam. The McMaster Standard Calculator must be used during examinations. Students may bring one crib sheet (letter size, double-sided).

Late submission penalty Policy: Late submission of assignments and project without granted extensions will incur a 10% penalty per day. Any submission made within a timeframe spanning 30 minutes to 24 hours after the set deadline is considered a day late.

MSAF Policy: When a self-reporting relief is submitted for missed work, the work will be granted an extension equivalent to the absence period specified in the submitted MSAF. It is your responsibility to notify the instructor of your MSAF submission. The weight of any appropriately reported and MSAF-approved missed work will be automatically transferred to the final examination weight. No additional accommodations will be made

for missed work. However, for project reports/presentations, MSAF submissions will NOT be considered.

Important Links

- [Mosaic](#)
- [Avenue to Learn](#)
- [Student Accessibility Services - Accommodations](#)
- [McMaster University Library](#)
- [eReserves](#)

Course Learning Outcomes

For accreditation reasons, these learning outcome statements must be tied back to CEAB graduate attributes (GAs), including those that are measured in this course. If you are unsure how to do this, please contact the Associate Chair Undergraduate in your department.

- interpret groundwater flow patterns and rates based on geologic and hydraulic data using Darcy equation and flow nets.
- describe and define different aquifer types and their properties
- conceptualize and solve hydrogeologic problems such as pumping tests, groundwater resources and groundwater-surface water interactions
- predict responses of groundwater systems to pumping.
- understand and analyze groundwater problems and mitigation strategies in water resources systems

Required Materials and Texts

Textbook Listing: <https://textbooks.mcmaster.ca>

Applied Hydrogeology**ISBN:** 978-0130882394**Authors:** Fetter, C.W**Publisher:** Pearson**Publication Date:** 2001**Edition:** 4th

Textbook to complement lecture notes

Physical and Chemical Hydrogeology**ISBN:** 978-0-471-59762-9**Authors:** Patrick A. Domenico, Franklin W. Schwartz**Publisher:** John Wiley & Sons, Inc.**Publication Date:** 1997**Edition:** 2nd

Textbook to complement lecture notes

Class Format

In Person

Course Evaluation

Below assessment distribution will be applied unless a valid and compelling reason justifies an alternative weighting. Missed assignments and tests will receive a zero grade, unless supported by legitimate and documented reasons.

Component	Weighting
Assignment (best 5 of 6)	30%
Midterm Exam	15%
Project Report and Presentation	30%
Final Exam	25%

Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

Course Schedule

Week 1: Introduction to hydrogeology, Groundwater and the hydrologic cycle

Week 2: Fundamentals of hydrogeology (*Assignment 1 assigned*)

Week 3: Properties of aquifers, porosity, permeability, water release and storage
(*Assignment 2 assigned*)

Week 4: Principles of Groundwater flow, differential equations for groundwater flow

Week 5: Groundwater modeling (*Assignment 3 assigned*)

Week 6: Well hydraulics

Week 7: Groundwater-Surface water interactions (*Midterm Exam*)

Week 8: Groundwater resources

Week 9: Groundwater sustainability (*Assignment 4 assigned*)

Week 10: Mass transport in Groundwater (*Assignment 5 assigned*)

Week 11: Fracture Hydrogeology

Week 12: Groundwater quality and contamination (*Assignment 6 assigned*)

Week 13: Project Presentations and Course Review

Laboratory Overview, Operation, and Safety

The Faculty of Engineering is committed to McMaster University's Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs and policies". It is your responsibility to understand McMaster University's Risk Management system, which is supported by a collection of Risk Management Manuals (RMMs) that contain programs and policies in support of the Risk Management System. The RMMs are available from https://hr.mcmaster.ca/employees/health_safety_well-being/our-safety/risk-management-manuals-rmms/.

Additionally, McMaster University's workplace health and safety guidance related to COVID-19 must always be followed (available from <https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/>).

Late Assignments

It is the student's responsibility to regularly check A2L and McMaster email for updates and announcements. For assignments and projects, late submission without approved extensions will result in a 10% penalty per day. Any submission made within a timeframe of 30 minutes to 24 hours after the designated deadline will be considered one day late.

Turnitin.com

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Generative AI: Some Use Permitted

Students may use generative AI for [editing/translating/outlining/brainstorming/revising/etc.] their work throughout the course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside the stated use of [editing/translating/outlining/brainstorming/revising/etc] without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use and to be clear on the expectations for citation and reference and to do so appropriately.

APPROVED ADVISORY STATEMENTS

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious

consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/), located at <https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/>

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

Authenticity / Plagiarism

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

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Courses with an On-line Element

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and

program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

Academic Advising

For any academic inquires please reach out to the Office of the Associate Dean (Academic) in Engineering located in JHE-Hatch 301.

Details on academic supports and contact information are available from:

<https://www.eng.mcmaster.ca/programs/academic-advising>

Requests for Relief for Missed Academic Term Work

In the event of an absence for medical or other reasons, students should review and follow the [Policy on Requests for Relief for Missed Academic Term Work](#).

Academic Accommodation for Religious, Indigenous, or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office *normally within 10 working days* of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.