Civil Engineering
CIVENG 4P04
Engineering Hydrogeology
Fall 2025

McMaster University

ENGINEERING

Instructor Information

Dapo Awolayo
Email: awolayoa@mcmaster.ca
Office Hours:
Friday, 11.30 – 1.00 pm or by appointment
During office hours, you will have the option to attend virtually (Meeting ID: 245 238 755 218, Passcode: ewJ6AT) 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.

TA Information

Name: Ashkan Ajrian
Email: ajriana@mcmaster.ca
Office Hour: Wednesday, 12.30 – 2.00 pm or by appointment

Class Times

Lectures:

Tu 1:30 pm - 2:20 pm

Th 12:30 pm - 2:20 pm

Tutorials:

Tu 4:30 pm - 6:20 pm

Class Format

In Person

Course Dates: 09/02/2025 - 12/04/2025
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 or CIVENG 2J04, MATH 2Z03 Antirequisite(s): EARTHSC 3W03

Instructor-Specific Course Information

Course materials: Course materials will be posted on Avenue to Learn (A2L). Students are encouraged to access and review the materials prior to the scheduled session.

Attendance: Attendance at lectures and tutorials is strongly encouraged, but it will not be reflected in the grading assessment. Active participation in class activities at the end of each module will also earn bonus marks. Students must notify the instructor of any scheduled absences for sports or other activities during the first two weeks. This early notification allows for adequate time to make necessary arrangements for makeup work as deemed feasible. Tutorials, conducted in person, will reinforce lecture concepts and introduce the MODFLOW software package for term projects.

Homework Assignments: These are designed to reinforce your understanding of the class material, with problems that mirror the typical expectations for exam questions. These assessments also serve as examples of the instructor's testing style and provide practice problems. It is important to note that they should not be interpreted as a guarantee that

you will be tested on the same problems during exams. The instructor formulates fresh exam questions that might have some overlap with these assessments.

Term projects: Students will be required to work on a design project, which will involve developing numerical models, analyzing data, constructing figures, working in groups, and preparing a report and presentation—skills that you will be expected to use as engineers. Each group, consisting of three students, will present their research findings during the last class of the semester and submit a final project report. More details about this assignment will be provided a few weeks into the term.

Important Links

- Mosaic
- Avenue to Learn
- Student Accessibility Services - Accommodations
- McMaster University Library
- eReserves

Course Learning Outcomes

- learn the basic concepts, theorems and their applications in hydrogeology including the Hydrologic Cycle, Aquifer, Aquitard, Recharge, Discharge, Hydraulic head, Hydraulic Conductivity, Darcy Flux, Heterogeneity, Anisotropy, and Aquifer Storage
- describe and define different aquifer types and their properties
- interpret groundwater flow patterns and rates based on geologic and hydraulic data using Darcy equation, flow nets and the General Groundwater Flow Equation.
- conceptualize and solve hydrogeologic problems such as pumping tests, groundwater resources and groundwater-surface water interactions

- understand and analyze groundwater problems and mitigation strategies in water resources systems

Graduate Attributes

The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering programs. This section lists the Graduate Attribute Indicators associated with the Learning Outcomes in this course.

1.4 Competence in Specialized Engineering knowledge

2.1 Identifies and states reasonable assumptions and suitable engineering fundamentals, before proposing a solution path to a problem.

3.2 Synthesizes the results of an investigation to reach valid conclusions.

4.3 Develops models/prototypes; tests, evaluates, and iterates as appropriate.

5.2 Successfully uses engineering tools.

7.3 Composes and delivers an effective oral presentation for the intended audience.

Course Schedule

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

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

Week 3: Aquifer Properties

Week 4-5: Principles of Groundwater flow and Groundwater modelling (*Assignment 2 assigned*)

Week 6-7: Well hydraulics (*Assignment 3 assigned*)

Week 8: Groundwater-Surface water interactions (*Midterm Exam*)

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

Week 10–12: Groundwater contamination and Mass transport (*Assignment 5 assigned*)

Week 13: Project Presentations and Course Review

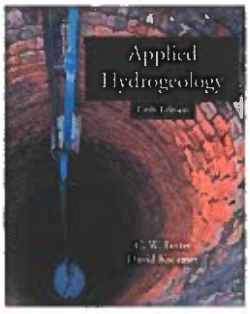
Required Materials and Texts

Please sign in with your MacID here to view your booklist

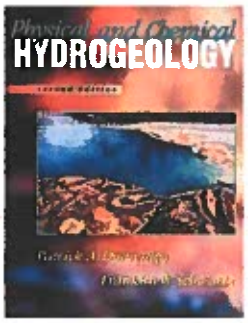
N/A

Optional Course Materials

Please sign in with your MacID here to view your booklist



Applied Hydrogeology
ISBN: 9781478646525, 1478646527
Authors: C. W. Fetter; David Kreamer
Publisher: Waveland Press
Publication Date: 2022
Edition: 5th
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

Course Evaluation

Component	Weighting
Homework.	20%
Midterm Exam	20%
Term Project	30%
Final Exam	30%

Course Evaluation Details

- Homework assignments are the only optional component. If not completed, their weight will automatically be transferred to the final exam. If completed, full credit will be awarded for each submission, with the **top four (4)** out of five (5) submissions contributing to the final grade.
- Term project reports and presentations must be completed in groups of 2-3, with equal contributions from each student required to earn credit.
- Active participation in class activities and discussions can earn up to 5% bonus marks.
- There will be **one midterm** and **one final exam**. The McMaster Standard Calculator must be used during examinations. Students may bring one crib sheet (letter size, double-sided). Each exam will cover all material to date, including homework assignments, classroom notes, and tutorial contents. Exams are non-cumulative, with an emphasis on material covered since the previous exam.
- The final exam is scheduled during the regular university final examination period established by the Registrar's Office.

Undergraduate Grading Scale

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages

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

Graduate Grading Scale

Graduate Student Grading Scale (Except for MBA and Master of Finance)

Grade	Points	Equivalent Percentage	Pass/Fail
A+	12	90-100	P+
A	11	85-89	
A-	10	80-84	
B+	9	77-79	P
B	8	73-76	
B-	7	70-72	
F	0	69 and under	F

MBA and Master of Finance Grading Scale

Grade	Points	Equivalent Percentage	Pass/Fail
A+	12	90-100	P+
A	11	85-89	P
A-	10	80-84	
B+	9	75-79	
B	8	70-74	

Grade	Points	Equivalent Percentage	Pass/Fail
B-	7	60-69	
F	0	59 and under	F

Late Assignments

It is the student's responsibility to regularly attend class and check A2L and McMaster email for updates and announcements. For assignments and the term project, late submissions without approved extensions will incur a 20% penalty per day. Any submission made even a few minutes past this deadline will be considered a day late.

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, 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.

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.

Equity, Diversity, and Inclusion

The Faculty of Engineering is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Faculty, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

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.

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.