McMaster University | Civil Engineering

2025-26 COURSE OUTLINE

COURSE INFORMATION

Course Name: Water Quality Course Code: CIV ENG 3L03

Session Offered: Winter 2026

Calendar Description: 3 units. Physical, chemical and biological characteristics of water; stoichiometry; thermodynamics; acid/base chemistry; carbonate system; nitrogen and phosphorous cycles; mathematical modeling of physical systems; water quality standards. (Prerequisite: Credit or registration in CHEMENG 2D04 or CIVENG 2B04)

Instructor: Younggy Kim (younggy@mcmaster.ca; no Ave-to-Learn email)

Class Schedule:
Lecture: Fri 12:30-2:20pm Office hr: Th 1:30pm-2:20pm (or by appointment)
Lab: Tu 11:30am-2:20pm; Tu We Th 2:30-5:20pm; Th 8:30-11:20am
Tutorial: We 12:30-2:20pm; Fr 10:30am-12:20pm

Lab instructor: Monica Han (hanm7@mcmaster.ca; available by appointment)

Teaching Assistants: Natalia Shiu (shiun2@mcmaster.ca), Sandali Panagoda (panagods@mcmaster.ca), Suaibu Badmus (badmuss@mcmaster.ca), Elaf Seif (seife1@mcmaster.ca)

1. COURSE OBJECTIVES

At the end of the course, the students will have solid understanding of fundamentals of water chemistry and its applications as environmental engineers. The students will also practice and obtain relevant skills and techniques for determining water quality parameters

2. COURSE SPECIFIC POLICIES

Attendance: Lecture attendance is expected but will not be reflected in grading. It is strongly recommended that the students should not miss any lectures. Instructor's written notes will not be shared while power point presentations and handouts will be posted on Avenue to Learn.

Textbook and course materials: There are no designated textbooks in this course. In case you are interested in water quality engineering, you can read 'Water chemistry' by Snoeyink and Jenkins. Course materials will be posted on A2L.

Examinations: The McMaster Standard Calculator may be used during examinations. You may bring 1 crib sheet (letter size; double sided) in mid-term exam; and 2 sheets for the final examination.
- Crib sheets must be prepared only by hands (hand-written or hand-drawn contents only).
- Photocopied or printed information of any size is NOT allowed.
- Photocopies of your own handwriting (e.g., homework assignments and note) are NOT allowed.

Assignments: 3 homework assignments will be posted on A2L. Late assignments will be assessed a penalty of 20% per academic day in general; however, late assignments may not be accepted depending on course schedule.

Laboratory experiments and term project: Each student must participate in mandatory laboratory sessions, which will provide supplemental exposure to several important concepts that are covered in this course. We will have four regular lab sessions in addition to a preliminary lab. The dates for lab sessions are available on the Avenue calendar. Lab experiments will be conducted in groups of four students. All group members must participate in all labs. All group members are expected to take part in report/presentation preparation. Expected formats and structure of report/presentation will be posted on Avenue. A late penalty of 20% per academic day will be applied. All group members must read the lab handout prior to a lab session. There may be pre-lab

quizzes to ensure that you have read the lab handouts and understand experimental steps and materials. Both of the lab report and quiz will be included in your term project evaluation. During the preliminary lab session, we will have a safety presentation and group assignment. Attendance at this preliminary lab is also mandatory.

Tutorials and term projects: Detailed plans and contents on 3 term projects will be provided and discussed in tutorials while you need to obtain water quality information during the lab sessions. We will have final presentations for Project#3 during the tutorial sessions on [March 20, 25, 27, April 1]. We do not have tutorials every week, but we may have both tutorials and labs in a week. The tutorial dates will be announced on Avenue.

MSAF Policy: When a self-reporting relief is submitted, the portion of the missed academic work will be automatically transferred to the final examination. It is your responsibility to notify the instructor of your MSAF submission. For a group assignment (including lab attendance, term project reports/presentations), MSAF will NOT be accepted.

3. SCHEDULE (TENTATIVE)

WEEK 1	Basics of water quality and water chemistry	
WEEK 2	Basics of water quality and water chemistry	Safety lab (Mandatory)
WEEK 3	Acid/base chemistry	Lab1 (Project#1)
WEEK 4	logC-pH diagram, closed carbonate systems	Tutorial #1 (Report submission)
WEEK 5	Henry's law, open carbonate system, alkalinity	Lab2 (Project#1 continued) Tutorial #2 (logC-pH diagram practice) HW1 due
WEEK 6	Precipitation and dissolution, turbidity	Tutorial #3 (logC-pH diagram practice)
WEEK 7	Midterm recess	
WEEK 8	Complexation for turbidity removal and chelating agents for heavy metal removal	Lab3 (Project#2) Midterm exam (12:30-2:20pm on Feb 27)
WEEK 9	Redox chemistry: thermodynamics	Tutorial #4 (Report submission) HW2 due
WEEK 10	Thermodynamics (continued), ideal reactors, mass balance	Lab4 (Project#3)
WEEK 11	Material transport, reaction kinetics	Tutorial #5 (Final presentation)
WEEK 12	Gas transfer: Two film theory, water quality modelling	HW3 due Tutorial #5 (Final presentation)
WEEK 13	Biological water quality parameters, phosphorus cycle	Tutorial #5 (Final presentation)
FINAL EXAMINATION	Scheduled during the regular University Final Examination period established by the Registrar's Office	

4. ASSESSMENT OF LEARNING	WEIGHT %
Assignment (3 homework assignments)	18% (6% each)
Tutorial report (2 group reports)	4% (2% each)
Term projects (3 projects)	18% (6% each)
Mid-term examination	30%
Final examination	30%

5. LEARNING OUTCOMES

CEAB Learning Indicators Measured in This Course

The following Graduate Attributes (GAs) and Learning Indicators are being measured in this course. While some other GAs are also relevant to this course, they are not being measured in this course and therefore are not listed here.

1. Knowledge Base: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

1.2 Competence in Natural Sciences

2. Problem Analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

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

6. Individual and teamwork: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

6.1 Actively contributes to the planning and execution of a team project.

7. Communication Skills: An ability to communicate complex engineering concepts within the profession and with society at large. Such abilities include reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

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

When this course is complete, the student will be able to:

- Use the fundamental knowledge on equilibrium, acid/base chemistry, stripping/dissolution chemistry, chemical precipitation, and complex chemistry. (1.2)
- Use the fundamental knowledge on microbiology, redox chemistry, mass balance, thermodynamics, kinetics, gas transfer, and nitrogen- and phosphorus-cycles. (1.2)
- Use relevant engineering tools and assumptions (e.g., logC-pH diagram, colony forming units) to analyze environmental engineering problems (e.g., chemical and biological water quality parameters). (2.1)
- Apply stoichiometry, reaction kinetics, material balances and reactor theory to develop mathematical models of contaminants moving through complex environmental systems, including rivers, estuaries, lakes, reservoirs and groundwater systems. (2.1)
- Work as a team to conduct laboratory experiments (e.g., quantification of various physical, chemical and biological water quality parameters for given water samples). (6.1)
- Work as a team to discuss the experimental results, draw conclusions, and provide engineering consulting services. (6.1)
- Give oral presentations for engineering clients (e.g., drinking water treatment facility) (7.3)

Note. There are other learning outcomes in this course that are not measured. (See the list of main course topics in 3. Schedule.)

6. LABORATORY 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/.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for specific experiments (see course lab manuals) and the laboratory equipment https://www.eng.mcmaster.ca/sites/default/files/civil_lab_health_and_safety_manual.pdf

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/).

The safety requirements for [JHE 220] are listed below. Students not abiding by these safety requirements will be given one warning. Second offences will result in the student being asked to vacate the laboratory and receiving a grade of zero for that particular lab.

[JHE 220]

• Safety glasses/goggles must be worn in the lab at all times.

• Contact lenses are not to be worn in the lab.

• No short (i.e., above the knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.

• Closed-toe shoes must be worn at all times.

• No loose clothing is allowed.
• Long hair must be tied back.
• Disposable latex or nitrile gloves must be worn when working with hazardous chemicals.
• Heat resistant gloves must be worn when removing hot items from the drying oven (as indicated by the laboratory instructor).

7. COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their "@mcmaster.ca" alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

8. POLICIES

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-procedures-guidelines/.

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 DETECTION

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.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), 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.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period. You may submit a maximum of 1 Academic Work Missed requests per term. It is **your** responsibility to follow up with your Instructor immediately regarding the nature of the accommodation. If you are absent more than 5 days or exceed 1 request per term you **must** visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation. This form should be filled out immediately when you are about to return to class after your absence.

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.

PROTECTION OF PRIVACY ACT (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades, and all other personal information at all times.

For example, the submission and return of assignments and the posting of grades must be done in a manner that ensures confidentiality – see http://www.mcmaster.ca/univsec/fippa/fippa.cfm.

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer, or the Human Rights Consultant, as soon as possible.
https://www.mcmaster.ca/policy/General/HR/Discrimination_and_Harassment.pdf

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, A2L and/or McMaster email.

9. MCMASTER 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