

COURSE INFORMATION

Course Name: Physico-Chemical Processes in Water & Wastewater Course Code: ENGINEER 4V04

Session Offered: Fall 2020

Calendar Description: Water/waste water quality/characteristics; physical and chemical unit processes including coagulation, flocculation, sedimentation and filtration for particle removal in water treatment; inactivation of microorganisms in disinfection; advanced treatment, including ion exchange, adsorption, advanced oxidation using radical reactions and membrane filtration.

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Office Hours/Contact: TBD

Teaching Assistant: Bayshakhi Deb Nath
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Office Hours/Contact: TBD

Class Schedule Day(s): Mon, Wed, Thu

Time: 10:30-11:20

Location: Virtual

Tutorial Schedule Day(s): Wed

Time: 2:30-4:20

Lab Schedule Day(s): L02 Mon; L01 Tue

Time: L02-2:30-5:20; 01-L8:30-11:20

1. COURSE OBJECTIVES

When this course is complete, the student will be capable of completing the following tasks:

- define, describe and discuss the following: conventional drinking water treatment, multi-barrier approach to drinking water treatment, wastewater treatment
- discuss and apply coagulation theory
- compute the amount of coagulant required in various waters
- design a coagulant mixer
- discuss and apply flocculation theory
- design a flocculation tank
- discuss and apply sedimentation (types I, II, III and IV) theory
- design a sedimentation tank for non-hindered settling
- discuss granular media filtration (single medium, multimedia, biological)
- discuss and apply filtration theory
- compare the various types of filter media
- design a drinking water filter
- discuss and apply adsorption theory
- discuss and apply disinfection theory and the formation of disinfection by-products
- discuss membrane processes and membrane fouling
- classify contaminant compounds according to which physical/chemical process is suitable for its removal
- be familiar with Ontario's legislation regarding drinking water and wastewater treatment
- apply Ontario legislation to design of drinking water treatment unit operations
- discuss and apply theory for some the following processes based on class interest and time available: desalination, distribution systems, advanced oxidation processes, radical reactions and gas transfer
- awareness of emerging issues for the provision of drinking water

2. COURSE SPECIFIC POLICIES

The major form of communication in this course will be the Avenue to Learn (A2L) site. All notes, recordings, assignments, labs, and solutions will be available on the A2L site. The course calendar including class, lab, and tutorial times, virtual meeting locations, and due dates are also available on the A2L site. The schedule may change slightly throughout the term, and any changes will be announced in class and reflected on the A2L calendar. Additionally, there is a discussion board on A2L where you can communicate with each other, myself, the TA (TBD) and Monica regarding the labs, tutorials, assignments, and the project.

This course will be delivered online using a synchronous format during our regularly scheduled class times in order to facilitate interactions between us, and attendance is expected. However, class sessions will also be recorded, captioned, and put on the A2L site in case of internet outages, time zone restrictions, etc.

Textbook:

The purchase of the course textbook is highly recommended.

Water Treatment: Principles and Design (3rd Edition), MWH, John Wiley & Sons, Inc., New Jersey, 2005. ISBN: 978-0-470-40539-0

Additionally, there are numerous textbooks on physical & chemical water and wastewater treatment processes available through the 3U03 course reserve in the Thode Library.

Notes:

Course notes will be posted on A2L in sections over the duration of the term. You may print these notes and add the necessary details during class, or you can take your own notes in class. The course notes are not intended to replace the textbook.

Examinations:

There will be two examinations in this course: a mid-term and a final. The final examination will test cumulative knowledge from the entire term, and you must pass the final examination to pass this course. Examinations are open-book, and the McMaster Standard Calculator (Casio fx991) may be used during examinations.

Assignments:

This course will require the completion of four - six assignments. The assignments will be posted on A2L one week before they are due. Assignments are to be submitted through a dropbox on A2L. Problem set solutions will be posted on A2L one week after the due date. Late assignments will be penalized 5% per day, up to a maximum of 35% at which point they will receive a grade of zero (since the solutions will be released). Therefore, if you know you will have a problem meeting an assignment due date, you are strongly encouraged to speak to the TA or instructor ahead of time. If your assignment is late, you may submit it by e-mail to the TA. Late assignments submitted in any other way will not be accepted.

Tutorials:

The tutorial sessions will be used for a range of activities, including extra examples, extra help, and introduction of case studies to solidify class material (which will be graded as a "tutorial assignment"). Attendance at tutorials is

expected. Tutorials will not take place every week; there will be no tutorial during lab weeks, or the midterm week. The course calendar (on A2L) indicates the tutorial dates. One of the tutorial sessions will involve a “virtual” field trip to a drinking water treatment plant.

Laboratory Experiments:

As part of this course, each student must participate in four mandatory laboratory experiments, as well as a mandatory lab safety session. The labs provide supplemental exposure to several of the concepts we will be covering over the course of this term and will provide you with some of the data you will require for your design project. Unfortunately, we are unable to conduct the labs in person this year. Instead, we have prepared a video demonstrating the procedure for each lab and will provide data to each group for analysis and reporting purposes. Lab videos will be posted on the A2L site at the appropriate times over the semester. Labs have been scheduled, and the laboratory technician (M. Han) will be available in a virtual classroom during scheduled lab times to answer questions. The lab schedule is available on the A2L calendar.

Lab write-ups will be conducted in groups of three (or four where numbers require). Students may select their own groups during the first safety lab. All group members must participate in all labs. Each group is responsible for submitting all four lab reports. Each group member is expected to take the lead in the preparation of one report, which will be worth 10.1% of that student’s final grade; the remaining three laboratory reports will make up 3.3% of that student’s final grade each. The grade assigned to the reports will be given to all group members. The deadline for submission of the laboratory reports will typically be two weeks after the lab is conducted and will be posted on the A2L calendar.

A formal report structure is expected for each laboratory write-up. Suppose that you are working as a professional engineer and prepare your laboratory reports accordingly. Guidelines for the report structure and the marking scheme are available under the Laboratory link on A2L. Follow these guidelines carefully to achieve the best possible grade on your laboratory reports. Late laboratory reports will receive a penalty of 10% per day late. Lab work missed due to illness or personal circumstances may be made up; however, you must submit appropriate documentation. It is your responsibility to follow up with the lab coordinator (Monica). No grade will be entered for the missed work unless the Associate Dean’s office gives its approval.

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”. It is your responsibility to understand McMaster University Workplace and Environmental Health and Safety programs and policies. For information on these programs and policies please refer to McMaster University Environmental & Occupational Health Support Services at: <https://hr.mcmaster.ca/about-us/our-services/environmental-occupational-health-support-services/>. The Lab Safety Handbook is available at: <https://hr.mcmaster.ca/app/uploads/2019/07/2019-McMaster-Lab-Manual.pdf>, as well as on A2L. Please pay particular attention to the “Emergencies – Accidents & Spills” section of this manual.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment. A laboratory-specific set of rules can also be added in order to ensure that students fully understand laboratory safety rules that are in place prior to their first session.

The first lab session will be a safety orientation to JHE 220. 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 lab.

- Glasses or 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 allowed.
- Long hair must be tied back.
- Gloves must be worn when working with hazardous chemicals (as indicated by the laboratory instructor).

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.

- Glasses or 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 allowed.
- Long hair must be tied back.
- Gloves must be worn when working with hazardous chemicals (as indicated by the laboratory instructor).

3. SCHEDULE

WEEK 1	Introduction to Drinking Water and Wastewater Treatment	
WEEK 2	Coagulation (Lab: Safety Training)	
WEEK 3	Mixing (Tutorial: Flint Case Study)	
WEEK 4	Flocculation (Lab: Coagulation/Flocculation)	Assignment 1 Due
WEEK 5	Flocculation (Tutorial: Walkerton Case Study)	Tutorial Assignment 1 Due
MIDTERM BREAK		
WEEK 6	Sedimentation (Lab: Sedimentation)	Assignment 2 Due; Lab 1 Due
WEEK 7	Sedimentation	MIDTERM EXAM
WEEK 8	Filtration	Tutorial Assignment 2 Due; Lab 2 Due

	(Lab: Filtration)	
WEEK 9	Filtration (Tutorial: Membrane Case Study)	
WEEK 10	Disinfection (Lab: Disinfection)	Lab 3 Due; Assignment 3 Due
WEEK 11	Disinfection (Tutorial: Virtual WTP Tour)	Tutorial Assignment 3 Due
WEEK 12	Disinfection / Adsorption (Tutorial: Review Session)	Assignment 4 Due; Lab 4 Due
WEEK 13	Adsorption/review (Tutorial: Review Session)	Project Due
FINAL EXAMINATION	Scheduled during the regular University Final Examination period established by the Registrar's Office	
4. ASSESSMENT OF LEARNING		WEIGHT %
Class and Tutorial Assignments (evenly distributed)		15
Laboratory Reports		20
Project		15
Mid-term Exam		20
Final Exam		30
5. LEARNING OUTCOMES		
1.4 Competence in Specialized Engineering Knowledge		
2.2 Ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem.		
2.3 Ability to obtain substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions.		
4.1 Recognizes and follows an engineering design process.		
4.2 Recognizes and follows engineering design principles.		
4.3 Obtains experience with open-ended problems.		
4.4 Have experience with techniques for generation of creative ideas such as brainstorming and structured inventive thinking.		
4.6 Determines and employs applicable standards and codes of practice.		
9.1 Is able to identify and quantify the full range of short-term, long-term, local and global impacts of their engineering projects on society, including: economic aspects; social, cultural, and human health aspects, and; ecosystem integrity aspects.		
12.1 Be able to critically evaluate and apply knowledge, methods and skills procured through self directed and self identified sources, including those that lie outside the nominal course curriculum.		
12.2 Is aware of the wide range of engineering societies, literature, conferences, and other information sources.		
6. COMMUNICATIONS		
It is the student's responsibility to:		
<ul style="list-style-type: none"> • 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.

7. 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](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), 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.

8. 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