Department of Civil Engineering  
McMaster University

ENGINEER 4V04: Physico-Chemical Processes in Water and Wastewater

Instructor:  
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Office Hours: TBD or by appointment

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TBD  
Office: n/a  
Ext: n/a  
e-mail :

Office Hours: TBD

Laboratory Technician:  
Monica Han  
Office: JHE 201/A  
Ext: 27074  
e-mail: hanm7@mcmaster.ca

Communication, Attendance and Schedule:

Classes:  
Monday and Wednesday 8:30-9:20; Friday; 10:30-11:20pm; KTH B124

Tutorials:  
Friday; 3:30-5:20pm; ETB 235

Labs:  
L01: Tuesday; 8:30-9:20am; JHE 220

L02: Monday, 2:30-5:20pm; JHE 220

Important:  
See A2L for the detailed lab and tutorial scheduling.

The major form of communication in this course will be the classroom. Therefore, course attendance is required. There is also an Avenue to Learn (A2L) site, where course notes, assignments, solutions etc. will be posted. 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. The schedule for this course will be posted on A2L, including lectures, examinations, tutorial dates, laboratory dates, the field trip date and all due dates. The schedule may change slightly throughout the term, and any changes will be announced in class and reflected on the A2L calendar.

Course Objectives:

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

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Graduate Attribute</th>
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<tbody>
<tr>
<td>define, describe and discuss the following: conventional drinking water treatment, multi-barrier approach to drinking water treatment, wastewater treatment</td>
<td>1.4, 9.1</td>
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<tr>
<td>discuss and apply coagulation theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Task</td>
<td>References</td>
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<tr>
<td>Compute the amount of coagulant required in various waters</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Design a coagulant mixer</td>
<td>1.4, 4.1, 4.2, 4.3, 4.4</td>
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<tr>
<td>Discuss and apply flocculation theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Design a flocculation tank</td>
<td>1.4, 4.1, 4.2, 4.3, 4.4</td>
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<tr>
<td>Discuss and apply sedimentation (types I, II, III and IV) theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Design a sedimentation tank for non-hindered settling</td>
<td>1.4, 4.1, 4.2, 4.3, 4.4</td>
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<tr>
<td>Discuss granular media filtration (single medium, multimedia, biological)</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Discuss and apply filtration theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Compare the various types of filter media</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Design a drinking water filter</td>
<td>1.4, 4.1, 4.2, 4.3, 4.4</td>
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<tr>
<td>Discuss and apply adsorption theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Discuss and apply disinfection theory and the formation of disinfection by-products</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Discuss membrane processes and membrane fouling</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Discuss and apply ion exchange theory</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Classify contaminant compounds according to which physical/chemical process is suitable for its removal</td>
<td>1.4, 2.2, 2.3</td>
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<tr>
<td>Be familiar with Ontario’s legislation regarding drinking water and wastewater treatment</td>
<td>4.6</td>
</tr>
<tr>
<td>Apply Ontario legislation to design of drinking water treatment unit operations</td>
<td>4.6</td>
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<tr>
<td>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</td>
<td>1.4</td>
</tr>
<tr>
<td>Awareness of emerging issues for the provision of drinking water</td>
<td>2.2, 2.3, 12.1, 12.2</td>
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Course Evaluation:
Assignments (including PBL): 15
Laboratory Reports: 20
Project: 15
Mid-term Exam: 20
Final Exam: 30

Course Textbook:
The purchase of the course textbook is highly recommended.

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

Course 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. The McMaster Standard Calculator (Casio fx991) may be used on examinations.

Assignments:
This course will require the completion of four - six assignments. The assignments will be posted on A2L a minimum of one week before they are due. Assignments are to be submitted through A2L or in the box across the hall from JHE 114 (Civil Engineering Soils Lab) – this will be agreed upon in class announced 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 in one of the following ways: 1) give it directly to the TA; 2) have it date stamped in the civil engineering office and put it in the TA’s mailbox; or 3) scan it and e-mail it 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 may be graded as an 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) will
indicate the tutorial dates. One of the tutorial sessions will involve a field trip to a drinking water treatment plant. This trip will not cost you anything, and further details will be posted on A2L.

**Laboratory Experiments:**
As part of this course, each student must participate in four mandatory laboratory experiments. 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. The dates that these labs will be running will be announced on the A2L calendar.

Lab experiments will be conducted in groups of four. Students may select their own groups during the first safety lab (week of September 9th). 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**

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 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).

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Anti-Discrimination
McMaster University is committed to fostering a respectful and inclusive organizational culture in which all members of the University community work, study, and live free of Discrimination and Harassment. If there is a problem, individuals are reminded that they should contact the course instructor, Department Chair, Consultant on Sexual Violence Prevention and Response, or the Equity and Inclusion Office as soon as possible.
https://www.mcmaster.ca/respectfulcommunity/policy-procedures.html

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. 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. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity. 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
In this course we will be using a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. Students will be expected to submit their work electronically either directly to Turnitin.com or via A2L plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty. Students who do not wish to submit their work through A2L and/or Turnitin.com must still submit an electronic and/or hardcopy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com or A2L. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity.


Avenue to Learn
In this course we will be using A2L. Students should be aware that, when they access the electronic components of this course, 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.


Academic Accommodation
Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. 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”.

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 requiring a RISO accommodation 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.

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.