Engineering 4V04: Physico-Chemical Processes in Water and Wastewater Treatment

Instructor: Wendy Huang, huangw23@mcmaster.ca
Office Hours: TBD

Laboratory Instructor: Monica Han, hanm7@mcmaster.ca, JHE 201
Teaching Assistant: Nicholas Piccolo

Course Objectives: Upon the completion of this course, students will have a solid understanding of the fundamentals in physico-chemical treatment processes for water and wastewater treatment. They will be able to use relevant skills and techniques in designing and evaluating individual treatment processes.

Course Topics:
1. Water Quality
   - Terminology use in water and wastewater, measurements (standard methods, field methods, estimations)
   - Standards and regulations for drinking water quality and wastewater discharge
2. Flocculation and Coagulation
   - Particle interactions, chemical reactions and pH dependency, reactor and mixing design
3. Sedimentation
   - Settling mechanics in water and wastewater treatment, clarifier design
4. Filtration (media filtration)
   - Particle interactions, slow-sand filters, rapid filters, filtration system design
5. Membrane filtration
   - Membrane pore sizes and processes, fouling and cleaning
   - Membrane bioreactors
   - Filtration membranes, ion exchange membranes
6. Disinfection
   - Disinfection technologies, advantages/disadvantages (chlorine/chloramine, ozone, UV)
   - Disinfection byproducts, chlorine residual and distribution, contact time and dose
7. Additional Treatment
   - Activated carbon adsorption, hard water and water softening


Evaluation:
- Assignments: 15%
- Term Project: 10%
- Midterm Exam: 25%
- Final Exam: 35%
- Laboratory Attendance and Reports: 15%

Assignments: All assignments will be posted on Avenue to Learn and there will be 3-4 assignments. Late assignment will be penalized 10% per academic day.

Term Project: Term project topic will be posted after the midterm examination. Term projects will be completed as a group project with your laboratory group. Group members are equally responsible and there is no job captain for the term project, and all members will receive the same grade.
Examinations: The McMaster Standard Calculator may be used during examinations. The use of a crib sheet (1 double-sided page for midterm, 2 double-sided pages for final exam) will be permitted.

Tutorials: Tutorials will be used for the preview and review of exams and homework assignments, as well as review sessions for prerequisite materials. Tutorial will not be held weekly, and will be announced in class and on Avenue to Learn.

Laboratory Experiments: Laboratory participation is mandatory. The laboratory sessions will involve practical exposure to concepts covered in lectured. There will be four lab sessions in addition to a mandatory preliminary lab to cover lab safety and expectations. Laboratory sessions will generally be held biweekly, and dates will be posted on Avenue to Learn. Laboratory experiments will be performed in groups of 4. Each member is expected to contribute in every lab, and each member will act as job captain for one lab. The lab report will be weighted more heavily on the job captain for each report. A formal write-up is expected for each lab report, and detailed expectations will be outlined during the preliminary lab and posted in Avenue to Learn under the lab section. Lab reports are due the next lab session. A late penalty of 20% per academic day will be applied.

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.


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 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).

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.

Academic Accommodation for Students with Disabilities: 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: 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”. MSAF will not be accepted for missed exams or term projects. Missed work will not have the weight transferred to other work.

Academic Accommodation for Religious, Indigenous or Spiritual Observances: 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.