CIV ENG 3L03: Water Quality (Winter 2018)

Lecture: MoTh 3:30pm; Lab: MoTuWeThFr 11:30am; Tutorial: Tu 3:30am, We 9:30am

Instructor: Younggy Kim (JHE 334; ext.24802; younggy@mcmaster.ca; No avenue email; Office hour Fr1:30-3:00pm)

Lab Supervisor: Monica Han (JHE 201; ext. 27074; hanm7@mcmaster.ca); Available by appointment

Teaching Assistants:
- Andrew Alex (JHE 330; alexa1@mcmaster.ca); Available by appointment
- Hui Guo (JHE 329/A; guoh15@mcmaster.ca); Office hour: TBA
- Mahshid Jannati (JHE 330; jannatim@mcmaster.ca); Available by appointment

Textbook:
No textbooks are required.

Suggested Reading:
- Water Chemistry, Snoeyink & Jenkins
- Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters, 3rd ed., Stumm & Morgan

Learning Outcomes (Course Topics)
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. For detailed learning outcomes and CEAB graduate attributes/learning indicators, see Appendices. (Appendices are available on Avenue.) The main course topics are:
- Introduction of water quality
- Physical, chemical and biological characteristics of water
- Water quality standards and parameters
- Nitrogen and phosphorus cycles
- Stoichiometry
- Chemical equilibrium and thermodynamics
- Acid/base chemistry
- Carbonate system
- Reaction kinetics and reaction orders
- Redox chemistry
- Mass balance
- Mathematical modelling of contaminant transport and degradation in natural water systems
- Optional topics: adsorption; precipitation and dissolution; complexation
- Emerging issues on water quality (problem-based learning in tutorials)

Grading Schemes

Allocation: Mid-term exam: 25% (3:30-4:20pm on Feb 15, Thursday)
Final exam: 36%
Assignments: 20%
Quizzes: 4%
Laboratory: 15%

(2% bonus if you have completed all academic work, including late assignments but not missed ones with an MSAF)

Attendance: Lecture attendance is expected but will not be reflected in grading. It is strongly recommended that you not miss lectures. Note that lab attendance is mandatory.

Examinations: The exams cover all materials taught in this course. You may use the McMaster Standard Calculator.
You can have one crib sheet (letter size; double sided) in the mid-term exam. You can bring one additional crib sheet to the final exam (a total of two pieces).
- Crib sheets must be prepared only by hands (hand-written or hand-drawn materials only).
- Photocopied or printed information of any size is NOT allowed.
- Photocopy of your own handwriting (including homework assignments and class notes) is NOT allowed.

Assignments: 4-5 assignments will be posted on Avenue. Late assignments will be assessed a penalty of 20% per academic day. Late assignments may not be accepted depending on course schedule. It is your responsibility to communicate with the instructor or lab supervisor on how you submit your late assignment or lab report.

Quizzes: We will be asked to submit about 4 quiz reports during tutorials. The quiz date will be announced a few days in advance.

Laboratory experiments: Each student must participate in four regular laboratory sessions, which will provide supplemental exposure to several of the concepts we will be covering over the course of this term. The results you obtain from these lab periods will provide the data required for your laboratory project. The lab dates will be announced on the avenue calendar. Lab experiments will be conducted in groups of four. All group members must participate in all lab periods. Each group is responsible for submitting one final lab project (note: data from all four lab
periods will be collected and put into one report (project) – you are not required to hand in a report after each lab period). All group members are expected to take part in the lab report preparation. The grade assigned to the lab report will be given to all group members. The deadline for submission of the lab report will be announced on Avenue. A late penalty of 20% per academic day will be applied. Each group member 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 lab evaluation. There will be a preliminary lab session (in addition to the four regular lab sessions) for a safety presentation and group assignment. Attendance at this preliminary lab is also mandatory.

**Lecture Materials**
Power point files will be provided on Avenue after the lecture.

**Tutorials (not every week)**
Tutorials are an important part of this course to initiate your lab project as well as explore and research water-related topics based on problem-based learning. If necessary, prerequisite materials and calculation examples may also be covered in tutorials. 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 still your responsibility to notify the instructor of your MSAF submission. For group work (e.g., lab attendance, lab reports, or term project reports), an MSAF will NOT be accepted.

**Laboratory Safety: The lab space can be a dangerous place if you do not follow safety rules!**
The Faculty of Engineering is committed to McMaster's University 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 and Health Support Services Occupational Safety Risk Management Manual at (suggested reading: Sections 10 through 16):  
(You can also find this lab safety handbook on Avenue under the Content tab of this course.) It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment.

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**
“Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.”

Appendix A: CEAB Graduate Attributes & 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.

4. Design: The ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.

4.4 Have experience with techniques for generation of creative ideas such as brainstorming and structured inventive thinking.

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

6.2 Develops and implements processes and methodologies to manage the effectiveness of a team both in terms of the quality of the work produced by the team as well as the inter-personal relationships within the team.

6.3 Works in a group, taking a leadership role as appropriate and relinquishing the leadership role as appropriate.

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.

7.2 Presents instructions and information clearly and concisely as appropriate to the audience

12. Lifelong Learning: The ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.

12.1 Critically evaluates and applies knowledge, methods and skills procured through self-directed and self-identified sources, including those that lie outside the nominal course curriculum.

12.2 Shows an awareness of the wide range of engineering societies, literature, conferences, and other information sources.

Appendix B: Learning Outcomes (Corresponding Graduate Attributes in Parenthesis)

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

- List the physical, chemical and biological characteristics of water, and demonstrate an understanding of the significance of each of these characteristics, and its associated parameters, through: (a) the development of an analytical protocol to answer specific water quality questions; and (b) the analysis of these analytical data. (4.4, 6.2, 6.3, 7.2, 12.1, 12.2)

- Understand the federal and provincial legislation relating to water quality – including treatment and source water protection - and understand which issues fall under which jurisdictions. (12.2)

- Use the principles of thermodynamics and acid-base chemistry to solve chemical equilibrium problems. (12.1)

- 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. (4.4)

Note that there are other learning outcomes in this course that are not measured. See the list of main course topics on page 1.