1 INSTRUCTIONAL SUPPORT

1.1 Instructor
Instructor: Sheng Chang, Ph.D., P.Eng.
Office: THRN 2519, ext. 56619
Email: schang01@uoguelph.ca
Office hours: by appointment

2 LEARNING RESOURCES

2.1 Course Website
Course material, news, announcements, and grades will be regularly posted to the ENGG*6790 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources
   1. S. Chang, Chemical Principles for Water and Wastewater treatment, Lecture notes

2.3 Recommended Resources
2.4 Additional Resources
Assignments: To be given through the lecture notes.

3 ASSESSMENT

3.1 Dates and Distribution
Assignment: 60% (Assignment 1 (15%) due on October 8; Assignment 2 (15%) due on October 31; Assignment 3 (15%) due on Nov 12; Assignment 4 (15%) due on Nov 30)
Project and presentation: 20% (due on November 28 Week)
Final Exam: 20% (December 2 Week)

3.2 Course Grading Policies
Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, Students must obtain a grade of 60% or higher.

Missed assignment and projects: If you missed your assignment and project, the weight of the missed assignment will be added to the final exam. Late submissions of the assignment will not be accepted.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Course description
This course introduces the chemical equilibrium, the acid-base equilibrium, the metal complexation and the hydrolysis, and the redox reaction principles involved in water and wastewater treatment.
4.2 Course Aims

This course is an introductory course to the chemical principles of the water and wastewater treatment for the engineering graduate student. The main objectives of this course are (1) to teach the key chemical concepts involved in the chemical equilibrium, the acid-base reaction, the metal complexation and hydrolysis, and the redox reaction; and (2) to develop student skills to analyse the chemical factors affecting water and wastewater treatment. This course provides the essential knowledge required to undertake water and wastewater treatment research and process development.

4.3 Learning Objectives

At the successful completion of this course, the students will have demonstrated the ability to:

1. Calculate the chemical potential of chemical species and determine the chemical process direction based on the free energy change;
2. Calculate the activity of chemical species at different states and the equilibrium constant of chemical systems based on the energy equilibrium concept;
3. Determine the main species of weak acid and base and the pH by using logC-pH diagram;
4. Calculate the alkalinity and buffer intensity based on water compositions;
5. Conduct process calculation related to the pH adjustment in water and wastewater treatment;
6. Determine the dominated metal species based on the solubility equilibrium and the optimal pH condition for coagulation and metal precipitation processes;
7. Analyze effect of the metal complexation on the reactivity and removal of heavy metals;
8. Develop the overall redox equation using tabulated half-cell reactions;
9. Calculate the redox potential, the free energy change, and the reaction equilibrium constant;
10. Determine the dominated species of redox couples using the log C-pe diagram;
11. Analyse the process principles of oxidation/reduction and electrochemical processes;
12. Apply water chemistry principles to analyse the main factors affecting the water pH, the disinfection, the coagulations, the precipitation, and the chemical oxidation processes.
4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

<table>
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<th>Graduate Attribute</th>
<th>Learning Objectives</th>
<th>Assessment</th>
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<td>1-10</td>
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<td>2. Problem Analysis</td>
<td>3, 6, 7, 10, 11,</td>
<td>Assignment, Exams,</td>
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<td></td>
<td>12</td>
<td>Project</td>
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<td>3. Investigation</td>
<td>11</td>
<td>Project</td>
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<tr>
<td>4. Use of Engineering Tools</td>
<td>11</td>
<td>Project</td>
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<tr>
<td>5. Communication</td>
<td>11</td>
<td>Project</td>
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4.5 Instructor’s Role and Responsibility to Students

The instructor’s role is to develop and deliver course materials in ways that facilitate learning for a variety of students. Lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students’ Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided. Students, especially those having difficulty with the course content, should attend the lectures and make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Follow-on Courses:
ENGG*6680*01 Advanced Water and Wastewater Treatment
ENGG*6630*01 Environmental Contaminants: Fate Mechanisms
5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

<table>
<thead>
<tr>
<th>Lectures:</th>
<th>Tuesday 1:00 to 3:50 pm</th>
<th>Room: 3527</th>
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5.2 Lecture Schedule

<table>
<thead>
<tr>
<th>weeks</th>
<th>Lecture Topics</th>
<th>References</th>
<th>Learning Objectives</th>
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<td>Chapter 1</td>
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<td>4-6</td>
<td>Acid/base equilibrium</td>
<td>Chapter 2</td>
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<td>7-8</td>
<td>Metal complexation and hydrolysis</td>
<td>Chapter 3</td>
<td>6, 7, 12</td>
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<td>9-10</td>
<td>Redox reaction principles</td>
<td>Chapter 4</td>
<td>8, 9, 10, 11, 12</td>
</tr>
<tr>
<td>11</td>
<td>Project presentation</td>
<td></td>
<td>12</td>
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6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.
Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/e08/e08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at: http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide. The School of Engineering has adopted a Code of Ethics that can be found at: http://www.uoguelph.ca/engineering/undergrad-counselling-ethics