Aquatic Chemistry and Lab (CHEM 4490.001 and CHEM 4490.101)
Department of Physical and Environmental Sciences
Fall 2015

A. COURSE INFORMATION
Course number/section: CHEM 4490.001, CHEM 4490.101
Class meeting time: Lecture 2:00-3:15 PM, T/R, Lab 3:30-6:20 PM, T
Class location: Lecture CI 108, Lab CS 221
Course Website:

B. INSTRUCTOR INFORMATION
Instructor: Dr. Xinping Hu
Office location: Science Lab #2 104
Office hours: M/W, 2:00-5:00 PM
Telephone: 825-3395
e-mail: Xinping.hu@tamucc.edu
Appointments: Email or phone in advance.

C. COURSE DESCRIPTION
Catalog Course Description
A study of the chemistry of natural and polluted waters. Topics include chemical kinetic and equilibrium principles as applied to natural and polluted waters, and the ecotoxicological aspects of aquatic chemistry. In addition, critical readings in current literature and research on environmental issues will be discussed. Includes a laboratory component.

Extended Course Description
Thermodynamics and equilibrium principles are applied to processes in natural waters, including both freshwater and seawater. Topics include acid and base chemistry, buffering system, precipitation and dissolution of inorganic solids, complex formation and chelation, and oxidation-reduction reactions. Quantitative problem solving and the visualization of chemical speciation are emphasized.

D. PREREQUISITES AND COREQUISITES
Prerequisites
CHEM 1411, CHEM 1412, or permission of instructor

Corequisites
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES
Required Textbook(s)

Optional Textbook(s) or Other References
There will also be some extra reading materials

Supplies
None

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT
Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students will understand applications of spatial and temporal scales of chemical reactions in natural aquatic systems, which is different from those of the laboratory. Students should be able to:

1. Solve chemical equilibrium equations to determine the speciation of acids, bases, and minerals in aqueous solutions
2. Construct pH diagrams and titration curves, and solve the proton balance, electroneutrality, and mass balance equations for the speciation of solutions of acids, bases, and minerals
3. Determine the solubility of dissolved carbon dioxide, mineral salts, and metal oxides, hydroxides, and carbonates
4. Solve redox reactions

G. INSTRUCTIONAL METHODS AND ACTIVITIES
Classroom lecture and lab experiments; field sampling is also an integrated component of instruction.

H. MAJOR COURSE REQUIREMENTS AND GRADING
Learning outcome, i.e., the ability to solve chemical equilibria (, will be assessed through conducting lab experiments, writing lab reports, and exams.
### ACTIVITY | % of FINAL GRADE
---|---
Exams | 60
Homework | 20
Lab Reports | 20
**Total** | **100**

### I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
<th>EXAM (NOTES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 (8/23)</td>
<td>Introduction</td>
<td>1</td>
<td></td>
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<tr>
<td>Week 2 (8/30)</td>
<td>Chemical Thermodynamics and Kinetics</td>
<td>2</td>
<td></td>
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<tr>
<td>Week 3 (9/6)</td>
<td>Acids and Bases</td>
<td>3</td>
<td></td>
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<tr>
<td>Week 4 (9/13)</td>
<td>Aqueous Buffer System – Freshwater</td>
<td>4</td>
<td></td>
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<tr>
<td>Week 5 (9/20)</td>
<td>Aqueous Buffer System – Seawater</td>
<td>4 and handout</td>
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<tr>
<td>Week 6 (9/27)</td>
<td>Ocean Carbon Cycle and Acidification</td>
<td>Handout</td>
<td>9/27 EXAM 1</td>
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<tr>
<td>Week 7 (10/4)</td>
<td>Atmosphere-Water Interactions</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Week 8 (10/11)</td>
<td>Trace Metal Complexation</td>
<td>6</td>
<td></td>
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<tr>
<td>Week 9 (10/18)</td>
<td>Trace Metal Cycling</td>
<td>10</td>
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<tr>
<td>Week 10 (10/25)</td>
<td>Precipitation and Dissolution</td>
<td>7</td>
<td>10/27 EXAM 2</td>
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<tr>
<td>Week 11 (11/1)</td>
<td>Oxidation and Reduction</td>
<td>8</td>
<td>(11/6 Last day to drop class)</td>
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<tr>
<td>Week 12 (11/8)</td>
<td>Kinetics of Redox Processes</td>
<td>11</td>
<td></td>
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<tr>
<td>Week 13 (11/15)</td>
<td>Photochemical Processes</td>
<td>12</td>
<td></td>
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<tr>
<td>Week 14 (11/22)</td>
<td>Kinetics at the Solid-Water Interface</td>
<td>13</td>
<td>(11/26 Thanksgiving)</td>
</tr>
<tr>
<td>Week 15 (11/29)</td>
<td>Regulation of the Chemical Composition of Natural Waters</td>
<td>15</td>
<td>(12/1 Last Day of Class)</td>
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<tr>
<td>Week 16 (12/6)</td>
<td>Final Exam</td>
<td>Last material covered</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

**Aquatic Chemistry (CHEM-5421)**

**Fall 2015 Lab Schedule**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Data presentation - precision and accuracy, error propagation, units</td>
</tr>
<tr>
<td>Week 2</td>
<td>Dissociation constant of m-cresol purple</td>
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<tr>
<td>Week 3</td>
<td>pH measurement using pH electrodes and a spectrophotometric method</td>
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<tr>
<td>Week 4</td>
<td>Field sampling to the Copano Bay</td>
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<tr>
<td>Week 5</td>
<td>Total CO₂ and pH (field samples from previous week)</td>
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<tr>
<td>Week 6</td>
<td>Alkalinity gran titration and salinity</td>
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<tr>
<td>Week 7</td>
<td>$p\text{CO}_2$ calculation using CO2SYS (Computer lab or personal laptop needed)</td>
</tr>
<tr>
<td>Week 8</td>
<td>Copper - 5-sulfosalicylic acid complexation stability constant</td>
</tr>
<tr>
<td>Week 9</td>
<td>Trace Metal Complexation</td>
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<tr>
<td>Week 10</td>
<td>Chlorinity measurement of estuarine waters</td>
</tr>
<tr>
<td>Week 11</td>
<td>Winkler titration for dissolved O₂</td>
</tr>
<tr>
<td>Week 12</td>
<td>Chemical oxygen demand of natural waters</td>
</tr>
<tr>
<td>Week 13</td>
<td>Photochemical acid production</td>
</tr>
<tr>
<td>Week 14</td>
<td>Not planned for previous experiment carryover</td>
</tr>
<tr>
<td>Week 15</td>
<td>Presentation of field trip by the graduate students, undergraduate student attendance is required.</td>
</tr>
<tr>
<td>Week 16</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. **COURSE POLICIES**

**Attendance/Tardiness**
The student is expected to be on time and attend every class. If absent, it is the responsibility of the student to obtain missed information from a classmate. Missed information includes not only lecture notes, but also any possible information regarding syllabus changes. The student is expected to arrive on time prepared to take notes and work on in-class problems with pen or pencil, paper, calculator and colored markers/pencils.

**Late Work and Make-up Exams**
It is the responsibility of the student to notify the instructor for possible lab submission of lab report or missed exam(s) in advance due to unforeseen events (illness, passing of relatives etc.). Delays in lab report submission and makeup exam(s) are only allowed upon validation of reasons for absence.

**Extra Credit**
Up to 15 points extra credit will be included in each exam.

**Cell Phone Use**
Prohibited

**Laptop Use**
Allowed

**Food in Class**
Prohibited

**Missed Exam**
See above.

**Participation**
Undergraduate students can voluntarily attend the field trip.

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**K. COLLEGE AND UNIVERSITY POLICIES**

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to
do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be
operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

• Academic Advising
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.