ChEE 500R Water Chemistry for Engineers
Fall 20xx

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TEXT BOOK: *Water Chemistry,* 2nd edition Waveland Press Inc. 2015

OFFICE HOURS: At least two hours per week. I will try to select these hours so that everyone can make it to at least one session.

WELCOME!

Welcome to ChEE00R: *Water Chemistry for Engineers.* Water chemistry is an essential part of what we do in environmental engineering. The objective of the course is for you to synergize key aspects of fundamental chemistry and engineering problem solving intuition to enable you to pursue mathematical solutions to water chemistry problems in the context of an environmental engineer. This course should be an excellent experience for you. If you have suggestions that will improve that experience for others, please make them known.

There is a wet laboratory course for environmental engineering graduate students (ChEE 500L). If you are an environmental graduate student, you should sign up for the lab and go to all meetings.

If you have any type of disability that may hamper your full participation in course activities, it is your responsibility to inform me of your need for accommodations as soon as possible. I expect to hear from you within the first two weeks of the semester so that appropriate accommodations can be arranged. Complete information on the services available at UA can be found at the Disability Resource Center (DRC): https://drc.arizona.edu/. Some accommodations may take time to arrange., including qualifying for extra time on exams or need other accommodations, so please make arrangements in a timely manner

COURSE SCHEDULE

Reading assignments are from the chapters indicated. I will try to be more specific about reading as we get into the course. The book is excellent, with lots of detailed explanation. Please take advantage of it. Below are the topics covered and approximate timing of topics in environmental chemistry:

Background and review. Concentrations, unit conversions, water structure and properties, activity coefficients, elementary kinetics, temperature dependence of equilibrium constants, combining and reversing reactions. Mostly getting up to speed.	Chapters 1-3 2 weeks
Chemical thermodynamics and introduction to acid-base equilibria. Definitions, strengths of acids and bases, pH as a master variable, α _values, pC/pH diagrams, multiprotic acids (carbonate system, equilibrium speciation, non-ideal solutions).	Chapters 4 & 5 3 weeks
Use of pC/pH diagrams to solve acid-base speciation problems. General solution strategy, the proton condition, finding dominant species (introduction to titration concepts), graphical solutions.	Chapters 6 2 weeks
Software for solving chemical equilibrium problems. Computer algorithms and software for solving simple and more complex acid/base problems and developing LOG C- pH diagrams.	Chapter 7 1 week
Titrations and buffers. Interpretation of data, weak acid/strong base titrations, etc., multiprotic acids and bases, equivalence points and alkalinity, acidity, buffers and buffer intensity. Predominant species analysis.	Chapters 8 2 weeks
Gas/liquid equilibrium. Henry's Law, application to the carbonate system, the proton condition in gas/liquid problems.	Chapters 9 1 week
Metals in aqueous systems. Speciation, ligands and chelators, pC/pH diagrams, metal in buffers, predominance area diagrams precipitation/dissolution reactions. In some years, this precedes the section on chemical thermodynamics.	Chapters 10-11 3 weeks
Redox chemistry. Electron activity and the E_H scale, energy changes in redox conditions, speciation problems, pC/pε _diagrams, water reactions, pε/pH predominance area diagrams.	Chapters 12 2 weeks

GRADING

The assignments, quizzes, midterms, and final are designed to engage and test you on your knowledge of the course content. The graded components of the course contribute to the final grade as follows:

Item	Percent
Homework	10
Quizzes	5
In-class participation	5
Midterms (2)	40
Final Exam	40
Total Class Percent	100

If you are taking this course as a graduate student, you will be given extra homework and exam problems, and as part of a team, will be responsible for preparing a class lecture on software for solving chemical equilibrium problems.

HOMEWORK

Homework will be assigned on a regular basis. Homework assignments can be done and submitted in groups of two, three or four. If you prefer, however, you may act as a group of one. Find your partners as soon as possible, and let me know if you would like assistance finding a group. I will post solutions for homework assignments. Although homework is a group effort, each individual is responsible for contributing and knowing ALL of the content in every assignment. **Homework will be normally be given out in class on Mondays and turned in the following Monday—one paper per homework group.** Late homework will not be accepted. Your homework must be done on engineering paper (the green stuff), one sided only. Most importantly, your homework must be organized and your thought process be easy to follow.

QUIZZES

There will be pre-lecture online "quizzes" throughout the semester. Quizzes must be completed on Moodle outside of class and lab time. The quizzes will cover material from the assigned reading material for lectures and labs. Quizzes will be posted several days before they are due. The due dates will be posted on the D2Lcalendar and be due immediately before class.

EXAMS

There will be two midterm exams during the semester and a final exam. The final exam will be worth more than the midterms and will be cumulative. **Your final examination for this class is on (day / time / location TBD).**

Examinations will be closed book; however, you will be allowed a crib sheet (hand written, front and back, 8 ½" x 11"). It is my experience that students come to the exam best prepared when all their thoughts are organized in one place. Make-up exams will only be given in extreme events and the instructor must be notified at least 24 hrs ahead of time. Avoid make-up exams at all costs; for some reason, they are always more difficult.

ATTENDANCE AND CLASSROOM CONDUCT

This course will integrate active learning activities that require you to be in class. In addition to the traditional lectures, we will be working in small groups on problems, holding class discussions and working on assignments during class time. I expect you to come to class prepared to engage in learning with your peers. I will be posting handouts on D2L prior to class; it is up to you to print them out. Although I will not be taking attendance, there will be in class assignments and quizzes that will provide guidance for your out of class assignments and count toward your course grade. You are responsible for material missed during your absence. Points earned for in class assignments cannot be made up.

You can expect that I will **facilitate a learning environment that is worth your time**. Disruptive behavior such as persistent questioning, incoherent comments, verbal attacks, unrecognized speaking out, incessant arguing, intimidating shouting, and inappropriate gestures will not be tolerated. This includes dominating or not participating in conversation, interrupting peers/professor, and/or being rude and impatient towards others. Use of personal electronic devices or computers will not be tolerated unless they are part of a classroom activity (specified by instructor). If you feel that the class atmosphere is diminished by other students behavior please let me know.

COMMUNICATION

I strongly encourage students to visit during office hours with any questions. You do not need to make an appointment during regularly scheduled office hours. Be aware that office hours are on a first-come, first-served basis and if there is a line outside the office door, I will limit the amount of time I spend with any one student. I also encourage you to drop by with a group of students during office hours if you find there are several of you with the same questions. **If the office hours do not work with your schedule, or you would like to ensure a private meeting, please email to make an appointment, preferably 24 hours in advance.** The best way to communicate with me is by email.

I will also communicate with the class on a regular basis through email and D2L. You are responsible for checking your email and the course D2Lsite on a regular basis for updated course information.

ACADEMIC HONESTY

I expect each of you to be honorable. I encourage students to learn from one another and to help fellow students to learn. Group work projects illustrate the collaborative approach. Collaboration on coursework is authorized in this course provided it is done in the spirit of mutual learning and sharing of ideas. You should carry an equal or more than equal share of the load in your homework group, but only you and your partners will know what your contribution is. Exams must be your own work. **The copying of someone else's work or ideas (including spreadsheets, homework, and other written documents) and representing them as your own is unethical and prohibited.** As in most, if not all issues involving ethical considerations, it may be hard to know where to draw the line. If you have questions regarding ethical considerations or academic honesty, come ask. **Academic dishonesty WILL result in an "F" grade on all assignments, including drafts, and/or WILL result in failure of the course. Academic dishonesty on examinations and final written documents WILL result in failure of the course.** All instances of academic dishonesty will be reported to Student Affairs and will be kept on file.

Please know that copying of material from the web or any other written material is plagiarism and is a breach of the UA Student Code of Conduct. Students that breach the UA Student Code of Conduct will be given an "F" in the class and will be reported to the Student Discipline Coordinator. **I expect all students to abide by the UA Code of Conduct**. ***If you are unclear on where to draw the line, it is your responsibility to ask.***

As Dr. Arnold puts it "…it the opinion that you will develop about yourself and the sense of personal honor that you will carry throughout the majority of your life. We are born neither honorable nor dishonorable. We acquire honor through continuous practice. Honor in much more difficult to acquire than it is to lose, something that is true of just about anything of great value."

OTHER NOTES

1. The class **will not** meet on the following holidays: xxx (Labor Day Holiday) and xxx (Veterans Day) and xxx (Thanksgiving Holiday).
2. (Day, Date) is the last day of class.
3. Don't sleep in class, or if you do, have a (clean) joke to share with your classmates when you awaken. If you have trouble remembering jokes, write one down ahead of time. Our class is immediately before lunch.
4. Water Chemistry should enable you to test and expand your problem solving abilities in an interesting subject area. You will have to solve water chemistry problems in order to pass this course. It should also be a lot of fun! The fun part depends primarily on your ability and willingness to stay up with or ahead of classroom presentations of materials.