CE 570: ENVIRONMENTAL AQUATIC CHEMISTRY

Course Syllabus - Fall 2017

Class: 3:05 PM – 4:20 PM Tuesday & Thursday, 120 Sackett Building

Instructor: **Prof. Christopher Gorski**
231F Sackett Building; gorski@psu.edu; 814-865-5673

Office Hours: Mondays and Wednesday 2:30 – 3:30 PM or by appointment
You may also email directly at gorski@psu.edu

Text: *Water Chemistry*. Benjamin, M.M. (2014). Waveland Pr Inc.; 2nd edition.
ISBN: 978-1478623083

Notes: Skeletal lecture notes will be provided online through Canvas >24 hours before class.

Course Description: This course provides students with the conceptual frameworks and techniques necessary to evaluate chemical reactions in aquatic systems. Topics covered in this course include: chemical equilibrium thermodynamics, acid-base chemistry, metal complexation, mineral precipitation and dissolution, reduction-oxidation reactions and heterogeneous reactions that occur at solid-water interfaces.

Course Objectives. The overall goal of this course is to enable students to evaluate and interpret complex chemical equilibrium problems for aquatic systems. To accomplish this goal, students will be able to:

i. Formulate and solve chemical equilibrium problems for complex aquatic systems using exact numerical solutions.
ii. Estimate the speciation of chemical compounds using approximations and identifying the dominant/controlling mechanisms in a complex aquatic system.
iii. Apply graphical and computational techniques to assist in solving chemical equilibrium problems.
iv. Assess the relevance and implications of reactions that occur in aquatic systems.
v. Interpret experimental aquatic chemistry data and studies.

Evaluation:

3 Quizzes (equally weighed)	30 %
9 Homeworks (equally weighed)	40 %
Final Exam	30 %
Total	100 %

The standard grading system will be used to assign final letter grades in this course (A = 94–100%, A– = 90–93%, B+ = 87–89%, B = 84–86%, B– = 80–83%, C+ = 77–79%, C = 74–76%, C- = 70-73%, D = 60–69%, F = 0–59%).

Homework: Nine homework assignments will be given over the course of the semester at regularly spaced intervals. Each homework assignment will be worth 20 points. Homework will be due at the start of class. Because feedback is meant to be quick, **late homework will *only* be accepted within 24 hours of the time it is due.** Late homework can be turned into Dr. Gorski's mailbox in 217 Sackett, and 25% will be deducted from the score for tardiness. **You must show your work to receive full credit.** Neatness counts: illegible or messy work will not be graded. Effort also counts: you will receive partial credit for trying problems even if the solution is incorrect.

Quizzes: This course will have approximately 3 quizzes over the course of the semester in lieu of exams. These quizzes will cover approximately 3-4 weeks of material. Like the frequent homework, frequent quizzes are done to provide more immediate feedback about progress. No makeups will be allowed, although with legitimate justification (e.g., job interview, family emergency, etc.), quizzes may be excused.

Final Exam: This course will have a final exam during finals week (December 11-15). I will let you know the date, time, and place as soon as I find it out.

Participation: You are expected to attend class and participate. In extreme cases, points will be deducted if you do not participate and/or attend.

Academic Honesty: Students are encouraged to work together on homework assignments; however, original solutions are required. The University defines academic integrity as the pursuit of scholarly activity in an open, honest, and responsible manner. All students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. *Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions.* If you are not familiar with what constitutes as an academic integrity violation, please read Penn State's policies: http://www.engr.psu.edu/FacultyStaff/AcademicIntegrity.aspx.

Disabilities: Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at http://equity.psu.edu/ods/.

To receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at http://equity.psu.edu/ods/guidelines/ documentation-guidelines). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.

Tentative Course Schedule

Week	Date	Class	Homework
1	8/22	Course Intro	
	8/24	1 What is in water?	
2	8/29	2 Units of water chemistry	
	8/31	3 Activity	
3	9/5	4 Equilibrium	HW 1 due
	9/7	5 Thermodynamics	
4	9/12	6 Acids and bases	HW 2 due
	9/14	Quiz 1	
5	9/19	7 Algebraic solutions	
	9/21	8 Graphical solutions	
6	9/26	9 Titrations	HW 3 due
	9/28	10 Buffers	
7	10/3	***No class***	
	10/5	***No class***	
8	10/10	11 Gas-Liquid Equilibrium	HW 4 due
	10/12	12 Alkalinity	
9	10/17	13 Metal Complexation 1	HW 5 due
	10/19	Quiz 2	
10	10/24	14 Metal Complexation 2	
	10/26	15 Solid-aqueous equilibria	HW 6 due
11	10/31	16 Solids and other ligands	
	11/2	17 Practice Problems – Dissolution-Precip	
12	11/7	18 Introduction to redox chemistry	HW 7 due
	11/9	Quiz 3	
13	11/14	19 Reduction potentials	
	11/16	20 Constructing E_H-pH diagrams	
14	11/28	21 Adsorption	HW 8 due
	11/30	22 Surface Complexation modeling	
15	12/5	23 Lead in drinking water	
	12/7	Buffer day / Review	HW 9 due