

Instructor: Prof. Chad T. Jafvert 3145D Civil Engineering
Office hrs: any time (I may postpone)

Required Text: Stumm W.; Morgan J. J., **Aquatic Chemistry**, Wiley

Corequisite: CHM 257 or equivalent. CE 597D (554) is recommended for first and second year graduate students in environmental engineering and science and related disciplines (CE, ChE, Chem, Agry, Biol, EAS, ABE, and NRES).

Other Suggested Texts: Snoeyink V. L., and Jenkins, D., **Water Chemistry**, Wiley, 1981.
Morel, Francois M.M. and Hering, Janet G. **Principles and Applications of Aquatic Chemistry**, Wiley and Sons, 1993.
Benjamin, M. M. **Water Chemistry**, McGraw-Hill, 2002

Schedule: Lecture: MWF 8:30 p.m., Civil 1266
Web Page: <http://bridge.ecn.purdue.edu/~jafvert/ce554.html>

Description: Principles of physical, quantitative, organic, and inorganic chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Lecture topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions. Emphasis is placed on the dynamic and equilibrium systems of mathematical equations that describe and can be used to predict these phenomena.

Evaluation: Students will be evaluated by their performance on the following tasks, with the associated weighted percentage. Homework will not be accepted past the due hour. Homework and reports will be due at the beginning of designated class or laboratory periods.

Problem Assignments	15%
Exam 1	20%
Exam 2	25%
Exam 3	25%
Project(s)	15%

Course Objectives: Students completing this course will:

1. know how to develop and solve systems of chemical mass action – mass balance eqs.
2. know how to develop and solve dynamic systems involving chemical reactions.
3. know the fundamentals of aquatic chemistry well enough to read corresponding literature, proposals, and/or workplans with a critical view.
4. develop an appreciation for the extent to which these chemical principles are beneficially exploited in engineered environmental systems.

CE 554 Course Outline

	<u>Periods</u>
I. Introduction/Basic Concepts units, conventions, M.A., M.B.	1
II. Systems of Equations: Acid-base / Complexation / Precipitation / etc. forms of the equations (M.A., M.B., & C.B.) simple mathematical solutions and relationships acids & bases (+ graphical + CO ₂) complexes precipitates (+ graphical) systems of equations	9
III. Chemical Thermodynamics chemical potentials, free energies, activities	8
IV. Chemical Kinetics simple and complex systems (numerical solutions), statistical analysis	6
V. Modeling Concepts Completely mixed lakes Compartmentalization and flow-through reactors	5
VI. Oxidation - Reduction Reactions pE as a master variable	5
VII. Introduction to Photochemistry	6
VIII. Exams and Final (announced)	3