

TO: The Faculty of the College of Engineering
FROM: The Division of Environmental and Ecological Engineering
SUBJECT: New Graduate Course, EEE 55401, Water Chemistry for Environmental and Ecological Engineering

The Faculty of the Division of Environmental and Ecological Engineering has approved the following new course which will be cross-listed with CE. This action is now submitted to the Engineering Faculty with a recommendation for approval.

EEE 55401: Water Chemistry for Environmental and Ecological Engineering

Sem. 1, Lecture 3, Credits 3

Prerequisites: no

Course description:

Principles of chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Course topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions in the context of environmental and ecological engineering. Case studies focus on water chemistry in research and practice, such as lead in drinking water, recovery of valuable products from wastewater, chemistry of engineered carbon dioxide capture, and engineered treatment of surface waters. Case studies vary each year.

This course has been taught has CE 59700 for a number of years.

Reasons: Creating a new course and cross listing it with CE.



John W. Sutherland, Professor and Fehsenfeld Family Head
Division of Environmental and Ecological Engineering

EEE 55401: Water Chemistry for Environmental and Ecological Engineering**Level:** Graduate**Course Instructor:** Inez Hua**Course Description**

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Learning Outcomes & Learning Objectives

1. Describe the unique properties of water, and the relevance to natural and engineered systems.
2. Explain fundamental principles of chemical equilibrium and kinetics, and apply principles to calculations and solving contemporary challenges in water chemistry systems.
3. Classify chemical reactions and mass transfer, and deduce which categories are present in a particular system.
4. Evaluate and formulate technological approaches to reduce environmental impacts of anthropogenic activities, based on water chemistry principles.

Previous Teaching:

This course has been taught as CE 59700. What follows is the total enrollment and EEE portion of it.

Spring 2022 – total enrollment 24 with 17 EEE students

Fall 2020 – total enrollment 11 with 7 EEE students

Fall 2019 – total enrollment 14 with 9 EEE students

Fall 2018 – total enrollment 22 with 17 EEE students

Fall 2017 - total enrollment 19 with 14 EEE students

The syllabus for Spring 2022 follows.

Water Chemistry for Environmental and Ecological Engineering
CE 59700 – 173 (CRN 28173) and EEE 59500 – 019 (CRN 28185)
Spring 2022

Course Information and Syllabus

Administrative

Course Instructor

Dr. Inez Hua

Professor of Civil Engineering and Environmental and Ecological Engineering

Lyles School of Civil Engineering and the Division of Environmental and Ecological Engineering

Office: HAMP 2127 Phone: 765-494-2409 Electronic mail: hua@purdue.edu

Office hours: by appointment

Instructional Resources

a) Required textbook: *Water Chemistry*, Patrick L. Brezonik and William A. Arnold, 2011 (ISBN 978-0-19-973072-8).

b) Companion website for *Water Chemistry*:

<http://global.oup.com/us/companion.websites/9780199730728/>

c) Content and activities on Brightspace course pages, including Boilercast recording of all class sessions and screen captures of lecture notes.

Student Performance and Work

The plus/minus grading system applies in this course (e.g., possible “B” grades are: B+, B, and B-). Student performance will be evaluated as follows:

a) Homework assignments: 40% (400 points)

b) Project: 35% (350 points)

c) Class participation and in-class work: 15% (150 points)

d) Problem solving practice and skills development: 10% (100 points)

Letter grades assigned according to the following scale:

A: 930-1000

A-: 900-929

B+: 870-899

B: 830-869

B-: 800-829

C+: 770-799

C: 730-769

C-: 700-729

D+: 670-699

D: 630-669

D-: 600-629

F: <600

Modifications may be made to the scale, such that fewer points are required for each letter grade cut-off.

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Topic Outline and Textbook Reading Assignments

Complete the assigned textbook reading before lecture. All readings are from the required course textbook, unless otherwise noted. More specific readings (e.g., page numbers or sections within chapters) will be assigned throughout the semester. Number of lectures per topic may vary slightly from the table.

Week; Lecture Dates (Lecture number)	Textbook Reading	Topics
1; 1/10, 1/12, 1/14 (1-3)	Ch. 1: All Ch. 2: pp. 41-63	Introduction and Overview Inorganic Composition of Natural Waters
2; 1/19, 1/21 (4-5)	Ch. 3: pp. 79-86; 89-107	The Thermodynamic Basis for Equilibrium Chemistry <i>No class meeting on 1/17, Martin Luther King Jr. Day.</i>
3; 1/24, 1/26, 1/28 (6-8)	Ch. 4: pp. 116-129; 132-134	The Thermodynamic Basis for Equilibrium Chemistry Activity-Concentration Relationships
4; 1/31, 2/2, 2/4 (9-11)	Ch. 5: pp. 144-163; 167-174; pp. 180-183.	Fundamentals of Kinetics
5; 2/7, 2/9, 2/11 (12-14)	Ch. 7: pp. 220-240; 248-252	Solving Ionic Equilibrium Problems
6; 2/14, 2/16, 2/18 (15-17)	Ch. 7; Ch. 8: pp. 267-285; 292-293; pp. 293-295; 298-305	Solving Ionic Equilibrium Problems: Acid-Base Systems; open and closed
7; 2/21, 2/23, 2/25 (18-20)	Ch. 9: pp. 311-323; 325-353	Complexation Reactions and Metal Ion Speciation
8; 2/28, 3/2, 3/4 (21-23)	Ch. 9 (continued)	Complexation Reactions and Metal Ion Speciation
9; 3/7, 3/9, 3/11 (24-26)	Ch. 10: pp. 364-389 Ch. 7: pp. 252-255; pp. 240-248	Solubility: Reactions of Solid Phases with Water
10; Spring Break		<i>Academic holiday. No classes.</i>
11; 3/21, 3/23, 3/25 (27-29)	Ch. 10: pp. 391-400	Solubility: Reactions of Solid Phases with Water
12; 3/28, 3/30, 4/1 (30-32)	Ch. 11: pp. 406-435	Redox Equilibria and Kinetics
13; 4/4, 4/6, 4/8 (33-35)	Ch. 11: pp. 442-403	Redox Equilibria and Kinetics

14; 4/11, 4/13, 4/15 (36-38)	Ch. 12: pp. 451-459; pp. 465-469; Ch. 13: all	Dissolved oxygen, chemistry of chlorine and other oxidants/disinfectants in water treatment
15; 4/18, 4/20, 4/22 (39-41)	Ch. 16: pp. 601-615; pp. 619-625; Ch. 17: pp. 637-649	Nutrient cycles and the chemistry of nitrogen and phosphorous; fundamentals of photochemistry
16; 4/25, 4/27, 4/29 (42-44)		Final presentations and special topics, course review and synthesis

Any student who needs an accommodation based on the impact of a disability should contact Professor Hua to discuss specific needs. Please contact the Disability Resource to coordinate reasonable accommodations for students with documented disabilities.

Academic dishonesty

Dishonest conduct as defined in Sections B.2.1 and B.2.2 of the University Regulations will be reported to the Dean of Students. Other penalties will also apply, including a reduction in the assignment or course grade, depending on the nature of the misconduct.

Excerpt from the Purdue University policy:

Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Excerpt from Purdue University's Miscellaneous Misconduct Regulations, Item 10:

"1. Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

2. Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor..."

Sharing, transmitting or posting course material from CE 597 (including, but not limited to notes, homework assignments, projects, etc.) is *prohibited*.

Nondiscrimination Statement

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and

mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

Mental Health/Wellness

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours. CAPS also offers resources specific to COVID-19 on its [website](#). Topics range from "Adjusting to the New Normal" to "How to Talk with Professors about Personal Matters."

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it relates to COVID-19, students may submit requests for emergency assistance from the [Critical Need Fund](#)

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

This syllabus is subject to change. The most current version will be posted on the course website on Brightspace.