NJIT
CIVIL AND ENVIRONMENTAL ENGINEERING

ENE 663 – WATER CHEMISTRY

SPRING 2024 - SYLLABUS

Instructor: Prof. Arjun Venkatesan, Ph.D.
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Office Hours: By appointment (Webex or In-Person)
Tuesdays and Wednesdays: 10:00 am to 11:00 am

Room: CKB 310 **Day and Time:** Thursday, 6:00 – 8:50 pm

Description:
The course provides a comprehensive survey to aqueous-phase equilibria impacting the water quality in natural waters, and water distribution and treatment facilities. We will cover thermodynamics and kinetics and how they can be used to understand the distribution and cycling of chemical species in natural waters and related processes, including dissolution and precipitation, oxidation and reduction, acid-base interactions, and complexation. We will also cover special topics related to current issues in water quality.

Course Objectives:

1. Students will understand how to apply common chemistry methods and models to describe water quality.
2. Students will learn to predict the distribution of chemicals of interest in natural and engineered aqueous systems.
3. Students will quantitatively and qualitatively describe the primary chemical reactions and natural processes that control water quality.

Textbook(s)/Materials Required:

1) Water Chemistry, Mark M. Benjamin, 2nd Edition, Waveland Press, Inc., 2015.

Supplemental Materials:

- Handouts/slides
- Chemistry for Environmental Engineering and Science, Sawyer, McCarty, Parkin, 5th Edition

Grading:

Midterm exam	25%
Final Exam	25%
Homework	20%
Class Project	25%
Class participation	5%

The final letter grades are computed as follows:
A = > 90.0%, B+ = 85.0% - 89.9%, B = 80.0% - 84.9%, C+ = 75.0% - 79.9%, C = 70.0% - 74.9%, F = < 69.9%

Tentative class schedule

Week	Date	Topics	Reading Assignments	Deliverables
1	01/18	Introduction General Chemistry Concepts Chemical Reactivity	 Chapter 1 Chapter 2	
2	01/25	Reaction Kinetics & Equilibrium	Chapter 3	HW 1
3	02/01	Kinetics & Thermodynamics	Chapter 4	
4	02/08	Acid & Base Chemistry	Chapter 5	HW 2
5	02/15	Acid/Base Speciation & Chemical Equilibrium Modeling	Chapter 6,7	Project Title and Objectives Due
6	02/22	Titrations & Buffers	Chapter 8	HW 3
7	02/29	Gas/Liquid Equilibrium	Chapter 9	
8	03/07	**Course Review**		HW 4
9	03/14	**Spring Break**		
10	03/21	**Midterm Exam**		
11	03/28	Metals in aqueous systems – solution phase reactions	Chapter 10	Term Paper Draft
12	04/04	Metals in aqueous systems – precipitation & dissolution reactions	Chapter 11	HW 5
13	04/11	Redox Chemistry	Chapter 12	
14	04/18	Adsorption	Chapter 13	HW 6
15	04/25	**Project Presentations** **Course Review**		Term Paper Due
16	**TBD**	**Final Exam**		

POLICIES & PROCEDURES

Academic Integrity:
Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university**. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

Communication: All communications by the instructor will be during the class and via NJIT e-mail. It is your responsibility to check your NJIT e-mail regularly. Expect an e-mail response/reply from the instructor only on Monday - Friday between 9am - 5pm.

Lectures/Class: Some weekly lectures will start with quizzes. During the class, the instructor can often ask you to work on a problem or brainstorm ideas with the people next to you and you will be called on to provide one or more of your answers. The goal of this in-class work and discussion is to get you started on a problem (not necessarily to finish) and improve how you think about the problem which will then be discussed. Lectures will NOT be recorded for subsequent access to students; therefore, students have the burden of making up for missed lectures. Please be respectful to the course instructor and your classmates. You should always bring a pencil and calculator with you to class. Please put your cell phones on silent or turned off during class.

No late homework is accepted (no exceptions): Homework assignments must be handed in or submitted before the beginning of the class. Assignments must be typed, however, hand sketches (as necessary) may be submitted. If plots or calculations are required, either use hand calculations of the problem in your submitted HW solution or you can use Excel program and attach the solution excel files along with pdf homework submissions. Begin each problem on a new page and number all pages; collate all homework pages together and have your name written clearly on the front page. As with many conceptual problems, multiple solutions may be possible. This means that all rational solutions to the assignments may be considered for acceptance. Homework will be due at the beginning of class on the date it is due. Late Homework will NOT be accepted after the due date.

Exams: There will be two exams held during class time: midterm and final exam. All exams in this course will be in-person. Exams are open-book and open-note and they can cover any material presented in the class. Missed exams may not be made up except for special circumstances such as for health reasons, the instructor must be notified of an absence prior to the exam. No electronic devices (such as laptops/cellphones/tablets/smart watches, etc.) are allowed during quizzes/exams. No recording devices shall be allowed during class or examinations.

Term Project and Presentation: There will be a term project/assignment for this course that must be carried out as a group. This term project is made up of two parts: (1) term project paper/report, and (2) term project presentation. Necessary background information and knowledge, in addition to the expectations and format of the term project will be provided during class lectures throughout the semester.

Quizzes. There will be short (15 - 25 min.) quizzes given during class. These quizzes primarily cover recent material. Quizzes will require both essay and mathematical proficiency and will be based largely on homework problems and reading.

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly, fairly, and consistently.

Students with Documented Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at: (http://www.njit.edu/counseling/services/disabilities.php).

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our Program Educational Objectives are reflected in the achievements of our recent alumni:

1. Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward safe, practical, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. Professional Growth: Alumni will advance their technical and interpersonal skills through professional growth and development activities such a graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.
3. Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies