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Fall 2015

ENCE 6313

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University of New Orleans

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ENCE 6313 WATER AND WASTEWATER TREATMENT CHEMISTRY (LECTURE), 3 cr.
Fall 2015

Meeting times: W 4:30 – 7:15 pm EN 315
Instructor: Dr. Enrique J. La Motta
Office Hours: EN 815, M 2:00 – 4:00 pm
(504) 280 6093
elamotta@uno.edu

Student Learning Objectives

After successfully completing this course, students will be able to:

- Solve acid-base equilibrium problems, with specific application to the carbonic acid system, and corrosion control by carbon dioxide removal.
- Analyze and solve solid-liquid equilibrium problems, with specific applications to control of scaling in pipes and hardness removal.
- Discuss oxidation-reduction principles, with applications to water and wastewater treatment.

Attendance Policy

Attendance is required. If you cannot attend class for some reason, call the instructor or the Engineering administrative assistant and explain why.

Required textbook

Water Chemistry by Vernon L. Snoeyink and David Jenkins, John Wiley & Sons (1980). ISBN 0-471-05196-9

Additional references

Water Chemistry by Mark Benjamin, Second Edition (2015), Waveland Press.

A Problem Solving Approach to Aquatic Chemistry by James N. Jensen, John Wiley & Sons

Aquatic Chemistry by Stumm and Morgan, John Wiley & Sons.

Course Prerequisites

Consent of the department. Registration in ENCE 6314 Water And Wastewater Treatment Chemistry (Lab) is strongly recommended.

Criteria for Grading and Grading Standards.

There will be two mi-term exams and a final exam, all with equal weight, which will represent 80 % of the grade. There will also be six homework assignments, which will represent 20% of the grade. The overall average will be normalized to a 100-point scale by dividing each average by the highest score in class. The final grade will be given according to the following scale: A > 90; B from 80 to 89; C from 70 to 79; D from 60 to 69; and F < 60.

It is the policy of the graduate faculty of the Civil and Environmental Engineering Department that a graduate student will be dropped from the Civil and Environmental Engineering graduate program if he/she makes an "F" grade or two "D" grades in his/her course of study.

Tentative Class Schedule

| Date | Topic | Reading Assignments, S & J |
|---------|---|------------------------------|
| F 8/21 | | |
| M 8/24 | Review of Chemistry of Solutions: Impurities in water | pp. 1 - 23 |
| | Brønsted acids and bases, equivalent weight. Chemical equilibrium | pp. 58-60; 86-93 |
| F 8/28 | Lab. No. 1. Nonideality corrections to equilibrium. pH measurement | pp. 74 - 82; 95-114; handout |
| M 8/31 | Mass and charge balances. Equilibrium calculations. | pp. 95-114 |
| | Graphical solutions. The logarithmic concentration diagram | pp. 114-123 |
| F 9/4 | Lab No.2: The spectrophotometer and Beer's Law | Handout |
| M 9/7 | Labor Day | |
| F 9/11 | Lab No. 3: Determination of turbidity | Handout |
| M 9/14 | The proton condition | pp. 95-114 |
| | The carbonic acid system: equilibrium calculations | pp 156-173 |
| F 9/18 | Lab No. 4: Acid-base titration curves and acid-base indicators | Handout |
| M 9/21 | Carbonic acid system. Dissolution of atmospheric CO ₂ . Alkalinity | pp 156-173 |
| F/ 9/25 | Alkalimetric and acidimetric titrations of carbonic acid (lecture) | pp. 173-192 |
| | Different forms of alkalinity and acidity. Buffer capacity | pp. 146-156 |
| M 9/28 | Precipitation and dissolution. Solubility of CaCO ₃ | pp. 243-312 |
| | Dissolution of CaCO ₃ with exchange of CO ₂ with the atmosphere | Handout |
| F 10/2 | Lab No. 5: Alkalinity and the carbonate system | Handout |
| M 10/5 | Review session | Handout |
| F 10/9 | First exam: Through alkalinity | |
| M 10/12 | Chemical stabilization by tray aeration | Handout |
| F 10/16 | Mid-semester break | |
| M 10/19 | Precipitation of hardness | Handout |
| | The Caldwell-Lawrence diagrams | Handout |
| F 10/23 | Lab No. 6: Buffer design and intensity | Handout |
| M 10/26 | Softening calculations with the C-L diagrams | Handout |
| | Precipitation of Fe (II) | pp 243-312; handout |
| F 10/30 | Lab No. 7: Hardness determination | Handout |
| M 11/2 | Problem session | |
| F 11/6 | Second exam: Through C-L diagrams | |
| M 11/9 | Precipitation of Fe III and Al III | Handout |
| F 11/13 | Using Visual Minteq for equilibrium calculations | Handout |
| M 11/16 | Precipitation of phosphorus. Thermodynamic concepts | |
| F 11/20 | Gibbs free energy and the equilibrium constant | pp. 60-74 |
| M 11/23 | Electron activity in redox reactions | pp. 316-414 |
| F 11/27 | pe - log concentration diagrams | pp. 316-414 |
| M 11/30 | pe - pH diagrams | pp. 316-414 |
| F 12/4 | Final exam review session | |
| M 12/5 | 5:30 - 7:30 pm Final exam (COMPREHENSIVE) | |

Tentative Due Dates For Assignments and Exams

| ASSIGNMENT/EXAM | TOPIC | DUE DATE |
|-----------------|-------------------------------------|----------|
| Assignment 1 | Mass and charge balance | 9/4 |
| Assignment 2 | Acid-base equilibrium | 9/14 |
| Assignment 3 | Polyprotic acids | 9/21 |
| Assignment 4 | Tray aerators | 10/19 |
| Assignment 5 | Water softening | 11/2 |
| Assignment 6 | Redox reactions | 11/30 |
| First test | Through alkalinity | 10/9 |
| Second test | Through Caldwell-Lawrence Diagrams. | 11/6 |
| Final exam | Comprehensive | 12/5 |

Academic Integrity

Academic integrity is fundamental to the process of learning and evaluating academic performance. Academic dishonesty will not be tolerated. Academic dishonesty includes, but is not limited to, the following: cheating, plagiarism, tampering with academic records and examinations, falsifying identity, and being an accessory to acts of academic dishonesty. Refer to the UNO Judicial Code for further information. The Code is available online at

http://www.uno.edu/~stlf/policy%20Manual/judicial_code_pt2.htm.

Accommodations for Students with Disabilities

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities should contact the Office of Disability Services as well as their instructors to discuss their individual needs for accommodations. For more information, please go to <http://www.ods.uno.edu>



Important Dates*

| | |
|--|------------------|
| Last day to adjust schedule w/out fee | 08/18/2015 |
| Semester Classes Begin | 08/19/2015 |
| Last day to adjust schedule w/fee, or withdraw with 100% refund | 08/25/2015 |
| Last day to apply for December commencement | 09/25/2015 |
| Final day to drop a course or resign | 10/14/2015 |
| Mid-semester examinations | 10/05-10/09/2015 |
| Final examinations | 12/07-12/11/2015 |
| Commencement | 12/18/2015 |

*Note: check Registrar's website for Saturday and A/B sessions, and for items not listed here: <http://www.registrar.uno.edu>

Fall Semester Holidays

| | |
|--------------------------|------------------|
| Labor Day | 09/07/2015 |
| Mid-semester break | 10/15-10/16/2015 |
| Thanksgiving | 11/26-11/27/2015 |

Withdrawal Policy – Undergraduate only

Students are responsible for initiating action to resign from the University (withdraw from all courses) or from a course on or before dates indicated in the current Important dates calendar. Students who fail to resign by the published final date for such action will be retained on the class rolls even though they may be absent for the remainder of the semester and be graded as if they were in attendance. Failure to attend classes does not constitute a resignation. Check the dates on the Registrar's website, <http://www.registrar.uno.edu>. Please consult The Bulletin for charges associated with dropping and adding courses.

Incomplete Policy – Undergraduate only

The grade of I means *incomplete* and is given for work of passing quality but which, because of circumstances beyond the student's control, is not complete. The issuance of the grade of I is at the discretion of the faculty member teaching the course. For all graduate and undergraduate students, a grade of I becomes a grade of F if it is not converted before the deadline for adding courses for credit (as printed in the Important Dates Calendar) of the next regular semester including summer semester.

Repeat Policy

When a student is permitted to repeat a course for credit, the last grade earned shall be the one which determines course acceptability for degree credit. A student who has earned a C or better in a course may not repeat that course unless, (1) the catalog description indicates that the course may be repeated for credit, or (2) the student's Dean gives prior approval for documented extenuating circumstances.

Graduate Policies

Graduate policies often vary from undergraduate policies. To view the applicable policies for graduate students, see the Graduate Student Handbook: <http://www.uno.edu/grad/documents/GraduateStudentHandbookk2014.pdf>

Academic Dishonesty Policy

<http://www.uno.edu/student-affairs-enrollment-management/documents/academic-dishonesty-policy-rev2014.pdf>

Safety Awareness Facts and Education

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: <http://www.uno.edu/student-affairs-enrollment-management/>

UNO Counseling Services and UNO Cares

UNO offers care and support for students in any type of distress. Counseling Services assist students in addressing mental health concerns through assessment, short-term counseling, and career testing and counseling. Find out more at <http://www.uno.edu/counseling-services/>. First-year students often have unique concerns, and UNO Cares is designed to address those students succeed. Contact UNO Cares through <http://www.uno.edu/fye/uno-cares.aspx>.

Emergency Procedures

Sign up for emergency notifications via text and/or email at E2Campus Notification: <http://www.uno.edu/ehso/emergency-communications/index.aspx>. All emergency and safety procedures are explained at the Emergency Health and Safety Office: <http://www.uno.edu/ehso/>.

Diversity at UNO

As the most diverse public university in the state, UNO maintains a Diversity Affairs division to support the university's efforts towards creating an environment of healthy respect, tolerance, and appreciation for the people from all walks of life, and the expression of intellectual point of view and personal lifestyle. The Office of Diversity Affairs promotes these values through a wide range of programming and activities. <http://diversity.uno.edu/index.cfm>

Learning and Support Services

Help is within reach in the form of learning support services, including tutoring in writing and math and other supplemental instruction. Visit the Learning Resource Center in LA 334, or learn more at <http://www.uno.edu/lrc/>.

Affirmative Action and Equal Opportunity

UNO is an equal opportunity employer. The Human Resource Management department has more information on UNO's compliance with federal and state regulations regarding EEOC in its Policies and Resources website: <http://www.uno.edu/human-resource-management/policies.aspx>