
Course number	EES 212/412 (4 credits)
Course title	A Climate Change Perspective to Chemical Oceanography
Term	Fall 2019
Meeting times and location	Class Lecture: TR 12:30-1:45PM, Hylan Hall, Room 201 Review Sessions: Recitations will be conducted on either Wednesday or Friday of every week. Please see below for specific dates and times. <u>Note: the recitations will not be conducted in our normal classroom, but in Hutchison Hall, room 205.</u>

Prerequisites

CHM 131 and MTH 161

College Credit Hour Policy

This course follows the College credit hour policy for four-credit courses. This course meets two times weekly for three academic hours per week. The course also includes (1) a recitation once a week for one academic hour per week to both review and dive deeper into topics introduced during lecture and (2) independent out-of-class assignments.

Course Description

Most introductory courses to chemical oceanography cover a variety of topics that are only related because they are under the broad umbrella of chemical oceanography. Some of these topics include carbon dioxide and inorganic carbon chemistry, salinity, marine nutrients, dissolved gases, and organic constituents. Similarly, most discussions of climate change and chemical oceanography only touch on ocean acidification. This course seeks to provide the same broad perspective to conventional chemical oceanography courses but will interweave the unifying theme of climate change into these numerous and diverse topics.

Learning Goals and Outcomes

The primary goals of this course are (1) to familiarize students with the current state of knowledge in the diverse topics of chemical oceanography and (2) to equip them with the ability to formulate, and create plans for testing, hypotheses regarding current unknowns in chemical oceanography and climate change science.

More specifically, at the end of this course, the student will be able to describe both with words and equations:

- 1) how chemical measurements in ocean waters are both modified by and help quantify geological, biological, and physical processes,
- 2) the transport of gases across the air-sea boundary,
- 3) the cycling and dynamics of organic matter and related chemical constituents (e.g. nutrients, trace metals, oxygen) in the water column from production to decomposition as well as in ocean sediments throughout the processes of deposition, remineralization, and burial,
- 4) the cycling of bulk carbon, inorganic carbon, nutrients, O₂, and silicates throughout the global ocean.

Instructor Information

Name Professor John Kessler
Office location Hutchison Hall, Room 210
Email address john.kessler@rochester.edu
Telephone number (585) 273-4572
Office hours When I am not teaching or in the lab, my office door is almost always open. Please feel free to just stop by or you can make an appointment

Teacher's Assistant Information

Name Katie Gregory (graduate student)
Office location Hutchison Hall, Room 107D
Email address kgregor2@ur.rochester.edu
Office hours Tuesdays 2:15-3:45pm, Hutchison Hall, room 107D (or by appointment)

Name Skylar Schutter (undergraduate student)
Email address sschutte@u.rochester.edu
Office hours Thursdays 10:30-11:30am, Carlson Library, 1st floor

Textbook and/or Resource Material

1) [Ocean Biogeochemical Dynamics](#) (2006), by Jorge Sarmiento and Nicolas Gruber.
ISBN: 0691017077; ISBN-13: 9780691017075

2) The lecture slides, assignments, computer labs, and additional course materials will be posted on *BlackBoard* as needed.

Course Structure

This course is structured where the first half of each week will be spent with *Descriptive* lectures of specific oceanographic processes. The second half of each week will be conducted in a more *Quantitative* manner as the oceanographic processes introduced earlier are described mathematically. Occasionally, the instructor will use *Mathematica*® to explore these oceanographic processes with actual measurement data. Overall, we will seek to uncover what controls various chemical properties and distributions and how they may change with changing conditions. *Note: The course structure described here may deviate slightly from this general organization in order to accommodate examinations, holidays, and slight variations in the speed at which material is covered.*

Review Sessions and Recitations

The Teacher's Assistants and I will conduct weekly recitation/review sessions in **Hutchison Hall, room 205**. The review sessions will either be conducted on Wednesday or Friday; **please see the course schedule for the specific days when recitations will be conducted**. These sessions will review lecture material, work through problems, and provide the opportunity to discuss specific questions you may have. While your participation in these review sessions is not required, it is highly recommended.

Grading Policies

Grading will be based on the following structure: homework and class participation (20%), 3 exams (20% each), and a final exam (20%). Note: Graduate students registered for EES 412 should expect assignments and exams that will have additional (and more challenging) problems which will be graded more strictly.

Course Topics, Calendar of Activities, Major Assignment Dates

In Class	At Home
Week 1 <i>Composition and Distribution of Chemicals in the Ocean</i> Thursday, August 29: Introduction & Descriptive Lecture	Read Preface & Ch. 1
Week 2 <i>Composition and Distribution of Chemicals in the Ocean</i> Tuesday, September 3: Descriptive Lecture Thursday, September 5: Quantitative Lecture Friday: September 6: Recitation (1-1:50pm, Hutchison Hall, room 205)	Read Preface & Ch. 1
Week 3 <i>Tracer Conservation and Ocean Transport</i> Tuesday, September 10: Descriptive Lecture (HW #1 Due) Wednesday: September 11: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, September 12: Quantitative Lecture	Read Ch. 2
Week 4 <i>Air-Sea Interface</i> Tuesday, September 17: Descriptive Lecture (HW #2 Due) Wednesday: September 18: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, September 19: Quantitative Lecture	Read Ch. 3
Week 5 <i>Organic Matter Production</i> Tuesday, September 24: Descriptive Lecture (HW #3 Due) Thursday, September 26: Quantitative Lecture Friday: September 27: Exam Review (1-1:50pm, Hutchison Hall, room 205)	Read Ch. 4
Week 6 <i>Organic Matter Production</i> Tuesday, October 1: In Class Exam 1 on Ch. 1 – 3 Thursday, October 3: Quantitative Lecture Friday: October 4: Recitation (1-1:50pm, Hutchison Hall, room 205)	Read Ch. 4
Week 7 <i>Organic Matter Export and Remineralization</i> Tuesday, October 8: Descriptive Lecture (HW #4 Due) Wednesday: October 9: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, October 10: Quantitative Lecture	Read Ch. 5
Week 8 <i>Remineralization and Burial in Sediments</i> Tuesday, October 15: No Class – Fall Break Thursday, October 17: Descriptive Lecture (HW #5 Due) Friday: October 18: Recitation (1-1:50pm, Hutchison Hall, room 205)	
Week 9 <i>Remineralization and Burial in Sediments / Silicate Cycle</i> Tuesday, October 22: Quantitative Lecture Wednesday: October 23: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, October 24: Descriptive Lecture (HW #6 Due)	Read Ch. 6
Week 10 <i>Silicate Cycle</i> Tuesday, October 29: Quantitative Lecture Thursday, October 31: Quantitative Lecture Friday: November 1: Exam Review (1-1:50pm, Hutchison Hall, room 205)	Read Ch. 7
Week 11 <i>Carbon Cycle</i> Tuesday, November 5: In Class Exam 2 on Ch. 4 – 6 Thursday, November 7: Descriptive Lecture Friday: November 8: Recitation (1-1:50pm, Hutchison Hall, room 205)	Read Ch. 8

Course Topics, Calendar of Activities, Major Assignment Dates

In Class	At Home
Week 12 <i>Carbon Cycle & Calcium Carbonate Cycle</i> Tuesday, November 12: Quantitative Lecture (HW #7 Due) Wednesday: November 13: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, November 14: Descriptive Lecture	Read Ch. 8 & 9
Week 13 <i>Calcium Carbonate Cycle</i> Tuesday, November 19: Quantitative Lecture (HW #8 Due) Wednesday: November 20: Recitation (1-1:50pm, Hutchison Hall, room 205) Thursday, November 21: Descriptive Lecture	Read Ch. 9
Week 14 <i>Carbon Cycle, CO₂, and Climate</i> Tuesday, November 26: Quantitative Lecture (HW #9 Due) Thursday, November 28: No Class – Thanksgiving	Read Ch. 10
Week 15 <i>Carbon Cycle, CO₂, and Climate</i> Tuesday, December 3: Quantitative Lecture (HW #10 Due) Wednesday: December 4: Exam Review (1-1:50pm, Hutchison Hall, room 205) Thursday, December 5: In Class Exam 3 on Ch. 7 – 10	Read Ch. 10 STUDY!
Week 16 Tuesday, December 10: Review for Final Exam Friday, December 13: Final Exam Review (1-1:50PM, Hutchison Hall, room 205) Tuesday, December 17: Final Exam (Comprehensive) 7:15 – 9:15PM	STUDY!

Americans with Disabilities Act (ADA)

Center for Excellence in Teaching and Learning (CETL), 107 Lattimore Hall, 585-275-9049
<http://www.rochester.edu/college/cetl/>

The Center for Excellence in Teaching and Learning (CETL) offers a variety of disability services for undergraduates and graduate students in Arts, Sciences & Engineering. These services aim to provide an inclusive experience and equal access to academic content and program requirements. Their approach relies on collaboration among students, CETL staff, and instructors. Students are invited to make an appointment to meet with a disability support coordinator to get acquainted and talk about classroom accommodations. CETL also provides transition support and self-advocacy skill development.

In addition, students can find information on other University accommodations and services, including transportation and campus accessibility at: <http://www.rochester.edu/eoc/>

Academic Honesty

All assignments and activities associated with this course must be performed in accordance with the University of Rochester's Academic Honesty Policy. Unless otherwise noted, I encourage collaboration among students currently enrolled in this course when studying and investigating assignments. However, all individual assignments must be completed independently and must represent the work of only the specific student completing the assignment. In short, study together but write separately and independently. In addition, collaborating with students who have previously taken EES 212/412 is prohibited, including the sharing of assignments, exams, notes, and lecture materials from past semesters, unless permission to do so is granted from the instructor prior to such collaboration. A comprehensive description of the University of Rochester's Academic Honesty Policy is available at: www.rochester.edu/College/Honesty