SYLLABUS

Course number	EES 212/412 (4 credits)
Course title	A Climate Change Perspective to Chemical Oceanography
Term	Fall 2021
Face-to-Face Meeting times and location	TR 12:30-1:45PM, Morey Hall, Room 502

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. This course also includes (1) several prerecorded learning activities and readings to be completed prior to the face-to-face classroom discussions, (2) online classroom discussions and peer review of problem sets, and (3) independent out-of-class assignments. These "outside" activities count for one academic hour per week to both review and dive deeper into topics discussed during our classroom sessions.

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 prospective 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 students 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, O_2, and silicates throughout the global ocean.

Instructor Information

Name	Professor John Kessler
Office location	Hutchison Hall, Room 210
Email address	john.kessler@rochester.edu
Office hours	Thursday from 3:30-5pm over Zoom (or by appointment) https://rochester.zoom.us/j/6605869167

Teacher's Assistant Information

Name	Madeline Every (graduate student)
Office location	Hutchison Hall, Room 107D
Email address	mevery@ur.rochester.edu
Office hours	Wednesday from 1-2:30pm over Zoom (or by appointment) https://rochester.zoom.us/j/5298591456

Face-to-Face Classroom Attendance and Participation

Face-to-face classroom sessions are scheduled on Tuesdays and Thursdays from 12:30-1:45PM in Morey Hall, Room 502. If you are unable to participate in these face-to-face sessions, they will be streamed online using the course Zoom link and recorded so that they will also be available asynchronously. The classroom zoom link is best accessed from the "Course Home Page" on Blackboard. However, I emphasize that *in real life* participation in the face-to-face class is required and attendance will be taken as part of your Participation grade. Excused absences will only be given is requests are made ahead of time.

Textbook and/or Resource Material

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

2) Recorded lectures, discussions, assignments, and additional course materials will be posted on *Blackboard* as needed. We will use *Blackboard* heavily, so please refer to it regularly.

Course Structure

This course is structured so that in a typical week you will first watch several learning activities which are prerecorded and placed on Blackboard. This will provide a solid foundation for the material covered that week. After watching those videos, you will then read sections of the textbook. The hope is that by first watching the videos, you will better understand the textbook material. After you watch the videos and complete the reading assignments, you are encouraged to post questions to the discussion board on Blackboard which we will address during the face-to-face classroom sessions on Tuesday and Thursday. In addition to providing clarifying discussion during the classroom sessions, we will also work through several problems to better understand this material. Several of these problems will be components of your "Problem Set" for that week. Weekly Problem Sets must be uploaded to Blackboard using Gradescope no later than 6:00pm on Friday. Finally, a short quiz will be given each week on Blackboard. If you have been participating all week, this quiz should take you less than 15 minutes to complete and can be completed anytime between the end of class on Thursday and 6:00pm on Saturday.

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.

Grading Policies

Grading will be based on the following structure:
Participation in discussion and classroom activities (20%)
Problem Sets (20%)
Section Quizzes (20%)
3 exams at the end of each module (10% each)
Final exam (10%)
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.

Late Assignments: Problem Sets and Quizzes turned in after the due date will be accepted with a 25% reduction if they are received less than 24 hours after the due date. Any assignment received more than 24 hours after the due date will not be accepted for credit.

Assignment of letter grades:

A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C	same breakdown as B, between 70-79
D	same breakdown as B, between 60-69
E:	below 60

Instructor Response and Feedback:
Students should expect to receive feedback and grades on their assignment within approximately one week after the due date. Grades will be posted on Blackboard.

Participation

1) Synchronous participation in the classroom sessions is strongly encouraged whenever possible either through face-to-face instruction or via Zoom. If you are participating synchronously over Zoom, please let the instructor know ahead of time or you will be considered absent.
2) Asynchronous online participation will take place through Discussion Forums on Blackboard. You will find links to different discussions within each of the Learning Modules. (You can also ask more general course questions through the "Ask a Question" discussion forum on the Course Home Page.)

These discussion platforms are places to ask questions, respond to assist your classmates, and share ideas to better understand the topics and readings under investigation. Each class member is expected to participate in these discussions by both posting original comments and subsequently replying to the posts of classmates, **with a minimum of two posts per week**. You may comment on the course readings or material, ask a question about an assignment, respond to some of your classmate's posts, or even share a link to a news article or video that is related to what we are studying. At times, the professor or TA may post a prompt and request your response.

Since the discussion board is a place to not only ask questions, but also to help your classmates by providing clarification on points of confusion, you are asked to participate in these discussions even if you don't have a specific question. As such, you should contribute to these discussions over the course of the week, not simply within one brief session. Finally, always remember the rules of online etiquette when posting and replying to classmates' posts.

Course Topics, Calendar of Activities, Major Assignment Dates

1) *Module 1 – Fundamentals of Chemical Oceanography*
   a) Week 1: August 25 – September 4
      i) Course Overview, Climate, CO_2, and Oceanic CO_2 Uptake
   b) Week 2: September 5 – 11
      i) Introduction to the Chemical Composition and Distribution in Seawater
   c) Week 3: September 12 – 18
      i) Air-Sea interface and dissolved gas exchange
   d) Week 4: September 19 – 25
      i) Ocean circulation, transport, and mixing
   e) Week 5: September 26 – October 2
      i) Review
      ii) **Module 1 Exam**

2) *Module 2 – Organic Matter Dynamics*
   a) Week 6: October 3 – 9
      i) Organic matter production and the biological pump
   b) Week 7: October 10 – 16
      i) Fall Break!
      ii) Organic matter export, remineralization, and oxygen utilization
   c) Week 8: October 17 – 23
      i) Remineralization and burial in ocean sediments
   d) Week 9: October 24 – 30
      i) Review
      ii) **Module 2 Exam**

3) *Module 3 – Global Chemical Cycles and Climate Changes*
   a) Week 10: October 31 – November 6
      i) Global Oceanic Silicate Cycle
   b) Week 11: November 7 – 13
      i) Global Oceanic Carbon Cycle
   c) Week 12: November 14 – 20
      i) Global Oceanic Calcium Carbonate Cycle
   d) Week 13: November 21 – 27
      i) Conclude the calcium carbonate cycle
      ii) Thanksgiving!
   e) Week 14: November 28 – December 4
      i) Anthropogenic CO_2, the oceanic carbon cycle, and climate
   f) Week 15: December 5 – 8
      i) **Module 3 Exam**

4) **Final Exam**
   a) Tuesday, December 14
   b) 7:15 – 9:15pm

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 strongly encourage active collaboration among students currently enrolled in this course when studying and investigating assignments; this is all part of the course policy promoting discussion. However, all individual assignments must be completed independently and must represent the work of only the specific student completing the assignment. In short, work together but write separately and independently. Verbatim copying is a violation of the course Academic Honesty policy. 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