University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Environmental Geochemistry II

3 Credits

MEES 627
Spring 2019

Course Objectives / Overview

Prequequisites: MEES 640 Interconnected Earth Systems: Land, Ocean, and Estuary, or permission of instructor.

This course is a detailed examination of Earth's geochemical cycles, with an emphasis on macronutrient and carbon cycling through globally important biomes. The course employs a textbook, which is supplemented with weekly readings that include foundational review papers, and original scientific works. Topics include biogeochemical cycles of organic carbon and nutrients in terrestrial, lacustrine, wetland, and marine systems. Emphasis is placed on understanding how global rates of geochemical transformations are estimated and how these rates may be changing during the anthropocene.

Expected Learning Outcomes

1. By the end of the course, students will be able to compare the composition of Earth to that of other planets and the solar system and explain the processes that led to the unique composition of Earth.
2. Through course readings, and with an emphasis on recent primary literature, students will become familiar with the major biogeochemical processes that occur in the atmosphere, on land, in fresh waters ecosystems, and the world's oceans.
3. Students will acquire skills in quantitative approaches to environmental geochemistry. These skills will be demonstrated through analytical problem sets emphasizing quantitative mass balances and stoichiometries of a variety of Earth System processes, and a synthesis paper that will put to use quantitative approaches learned in class.
4. Students will be able to summarize multiple ways humans alter biogeochemical processes.
5. Students will demonstrate a mastery of course material by leading class discussions of primary literature, participation in class discussions, an exam, and preparation of a synthesis paper in which a biogeochemical cycle will be traced globally.

INSTRUCTOR DETAILS:

Hali Kilbourne
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410-326-7205

Sairah Malkin
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410-221-8418

Jeff Cornwell
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CLASS MEETING DETAILS:

Days: Monday and Wednesday
Times: 8:30-9:50
Originating Site: CBL & HPL
IVN bridge number:
(*******)
Phone call in number:
(***)
Room phone number:
(*****)

CURRICULUM FULLFILMENT:

MEES *** fulfills a *** (PD, ISG, etc) MEES requirement. OR elective etc

Prerequisites
Insert here or state N/A

Teaching Assistant
TBD or N/A

Course Assessment / Grading

Course grading is based on 2 exams during the semester, problem sets, paper discussions, and final exam.

Points:

Lead Paper Discussion	20 Points
Discussion Participation	10 Points
5 Problem Sets (6 assigned; 4 pts each)	20 Points
Exam 1 (1st half-material; Kilbourne)	25 Points
Term Assignment (2nd half material; Malkin)	25 Points
TOTAL	**100 percent**

Tentative Weekly Course Schedule

1st half – Kilbourne; 2nd half -- Malkin

Week	Topic	Date	Reading	Activities/Due Dates
1	Course Introduction	Wed		
2	Origins	Mon	Chapter 2	
		Wed	Discussion paper	problem set 1 due (from chapter 2)
3	The Atmosphere	Mon	Chapter 3	
		Wed	Discussion paper	
4	The Lithosphere	Mon	Chapter 4	
		Wed	Discussion paper	problem set 2 due (from chapter 4)
5	Carbon Cycle of Terrestrial Ecosystems	Mon	Chapter 5	
		Wed	Discussion paper	
6	Biogeochemical Cycling on Land		Chapter 6	problem set 3 due (from chapter 5)
			Discussion paper	
7				
8	review and mid-term			Mid-term exam
9		Spring break – Mar		
10	Inland waters -- lakes	Mon	Supplemental reading	
		Wed	Discussion paper	
11	Inland waters -- rivers	Mon	Chapter 8	Problem set 4 due
		Wed	Discussion paper	term paper topics selected
12	Wetlands, anaerobic processes, and blue carbon burial	Mon	Chapter 7	Problem set 5 due
		Wed	Gibb's Free energy yield calculations	
13	Estuaries, nutrient transformations, export, and early sediment diagenesis	Mon	Chapter 8	Problem set 6 due
		Wed	Discussion paper	
14	Temperature and thermodynamic constraints on biogeochemical processes	Mon	Supplemental reading	
		Wed	Discussion paper	
15	Linking Carbon and Oxygen cycles	Mon	Chapter 11	Term Papers due
		Wed	Discussion paper	
16	Summary and Review	Mon		Term Paper Presentations
		Wed		

Required textbooks, reading and/or software or computer needs

Schlesinger and Bernhardt's *Biogeochemistry: An analysis of global change* is the main text for this course. Other textbooks you might find as handy references include *Biogeochemistry of Estuaries* by Thomas S. Bianchi and the textbook used in Environmental Geochemistry 1 (*Water Chemistry – An introduction to the chemistry of natural and engineered aquatic systems* by P. L. Brezonik and W. A. Arnold. The textbook readings will be supplemented with readings from recent journal articles available as electronic copies via Moodle.

Course Communication

We use Moodle as our course administration software. All materials, including this syllabus, will be posted on the Moodle site for this course. Lectures will be made available on Moodle after they are given. Research shows that the synthesis and writing required by note-taking is an important component of learning, thus to encourage deeper learning, lectures will be made available on Moodle after they are given and not before. If you have questions or need to discuss anything with your professors outside of class, we encourage you to email or call us via the contact information provided on the first page of this syllabus. Please allow 24hrs for a response to email and realize that over the weekend, there will be no communication. Your professors have other work and personal obligations besides this class for which we need to make time. A lack of planning on your part does not constitute an emergency on our part.

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved of various academic and research-related policies by which all students and faculty must abide.

Please visit http://www.umces.edu/consolidated-usm-and-umces-policies-and-procedures for a full list of campus-wide academic policies.

Course-Specific Policies and Expectations

Science is a quantitative endeavor. The homeworks provide practice for students to quantify concepts learned in class. Homeworks are intended to provide practice for assessment of quantitative skills via exams and will not be graded for correctness but for completeness. The answers will be provided with the expectation that students will go over their answers and learn from their mistakes. Nine homeworks will be assigned and only eight are counted towards the grade. The worst grade will be dropped. Generally no late work will be accepted unless pre-approved by the instructor because of extenuating circumstances. We understand that research activities are a high priority for graduate students and we are committed to working with our students to balance the ability to take courses with research obligations.