CEE 501.014: Greenhouse Gas Control
Fall 2015

Course Information

Instructor: Prof. Christian Lastoskie, Ph.D., Dept. of Civil & Environmental Engineering
180 EWRE phone: (734) 647-7940 email: cmlasto@umich.edu

Lectures: Mondays and Wednesdays noon – 1:30 p.m. @ 151 Chrysler

Office Hours: To be determined; will be scheduled after receiving input from students.

Principal Text: *Carbon Capture*, Jennifer Wilcox: Springer, 2012; ISBN 978-1-4614-2214-3.*

Reading List: *Carbon Capture and Storage*, Steve Rackley: Butterworth-Heinemann Elsevier, 2010; ISBN 978-1856176361.

Introduction to Carbon Capture and Sequestration, Berend Smit, Jeffrey R. Reimer, Curtis M. Oldenburg, Ian C. Bourg: Imperial College Press, 2014; ISBN 978-1783263271.

Materials and the Environment: Eco-Informed Material Choice, Michael F. Ashby: Butterworth-Heinemann Elsevier, 2013; ISBN 978-0123859716.

Sustainable Energy Systems and Applications, Ibrahim Dincer and Calin Zamfirescu, Springer, 2012; ISBN 978-0387958606. *

Introduction to Environmental Engineering and Science, 3rd edition, Gilbert M. Masters and Wendell P. Ela: Pearson Education, 2008; ISBN 0-13-148193-2. *

Capturing Carbon: the New Weapon in the War Against Climate Change, Robin Mills: Hurst, 2011; ISBN 978-1849040334.

Caching the Carbon: the Politics and Policy of Carbon Capture and Storage, James Meadowcraft and Oluf Langhelle: Edward Elgar, 2009; ISBN 978-1848444126.

* The University of Michigan library offers online access to this textbook for authenticated users

Course Description

This course presents a review of strategies for the reduction of greenhouse gas emissions in power generation, transportation, and the built environment. The sources, discharges, and physical properties of greenhouse gases are surveyed, and technologies for greenhouse gas elimination or sequestration are discussed in depth. Policy options for greenhouse gas control and carbon footprint reduction are also considered.

Course Outcomes. After completing this course, students should be able to do the following:

1. Recognize the major sources of greenhouse gas emissions and their radiative forcing effects on the global climate.
2. Use physical property data to calculate the energy requirements for the compression, transport, and geologic sequestration of carbon dioxide.
3. Perform engineering design calculations for the separation of carbon dioxide from pre- or post-combustion gas mixtures using absorption solvents, adsorbents, or membranes.
4. Carry out an eco-audit of a product or a process carbon footprint to guide the selection of low carbon intensity materials for buildings and manufactured goods.
5. Understand strategies for transportation sector greenhouse gas emission reductions using fuel economy improvements or onboard vehicle carbon capture.
6. Be familiar with the economic and regulatory policy options for controlling greenhouse gas emissions, and the political and societal challenges of implementing these policies.

Grading Policy

The course grade will be weighted as follows:

Homework sets (5 total @ 5%)	25%
Midterm exam	25%
Final exam	25%
Term paper	20%
Attendance	5%
Total	100%

Grading Scale:								
	> 98%	A+	93-98%	A	90-93%	A-	87-90%	B+
	83-87%	B	80-83%	B-	77-80%	C+	70-77%	C

Homework and Exam Policy: You may work with and have discussions with other students in solving the homework problems. However, each student must electronically submit his or her own solution. Per ISD policy, distance students have two extra days beyond the on-campus student homework deadline to submit homework solutions.

Exams are to be solved individually and no collaboration is permitted. The midterm and final exams are given in take-home format and are also submitted electronically. You will have five days, including a weekend, to complete each exam.

Attendance Policy: It is expected that students enrolled in the on-campus section (001) will regularly attend lectures. For excused absences related to illness, work or conference travel, course conflicts, or other reasons for which the instructor has been given advance notice, on-campus students can view the missed lecture when it is posted online.

For distance students (section 881), it is expected that all lectures will be viewed online in tape-delayed format. Students in section 881 are invited to attend live lectures if circumstances allow.

Make-up Policy: Accommodation will be made for students (both on-campus and distance) who need to make up homework or exams due to travel, illness, or other reasons. Notify Prof. Lastoskie as far as possible in advance so a plan can be agreed upon for completion of the work.

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Course Syllabus

Week	Dates	Topic
1	9/9	Introduction and course overview
2	9/14, 9/16	Greenhouse gases and climate forcing
3	9/21, 9/23	Inventory and properties of greenhouse gases
4	9/28, 9/30	CO_2 compression, transport and storage
5	10/5, 10/7	Absorption column CO_2 separation
6	10/12, 10/14	Adsorbent bed CO_2 separation
7	10/21	Membrane separation technology / midterm exam
8	10/26, 10/28	Cryogenic distillation / algal-based capture
9	11/2, 11/4	CO_2 reduction catalysts / mineral carbonation
10	11/9, 11/11	Methane and nitrous oxide emissions control
11	11/16, 11/18	Carbon eco-audits and materials selection
12	11/23, 11/25	Transportation CO_2 emissions and fuel economy
13	11/30, 12/2	Onboard carbon capture in vehicles
14	12/7, 12/9	Greenhouse gas regulations and policymaking
15	12/14	Retrospective and final exam