EE 4161 -- New Course

Fri Apr 17 09:44:51 2009

Approvals Received:	Department on 04-16-09 by Kyle Dukart (kdukart@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1103 - Spring 2010
Course:	EE 4161
Institution:	UMNTC - Twin Cities
Career:	UGRD
College:	TIOT - Institute of Technology
Department:	11122 - Electrical & Computer Eng

General

Course Title Short:	Energy Conversion and Storage
Course Title Long:	Energy Conversion and Storage
Max-Min Credits for Course:	3.0 to 3.0 credit(s)
Catalog Description:	Energy issues have now reached a level of urgency that unconventional applications of existing devices and the development of new electrical devices have become necessary. In this course, we will examine the fundamental physics and chemistry of selected energy conversion and energy storage devices and connect with their electric power applications. The role of the grid and application to electric vehicles will be examined. The format of the course will consist of lectures, laboratory, and student presentations.
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>
Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Spring
Component 1:	LEC (with final exam)
Auto-Enroll Course:	No
Graded Component:	LEC
Academic Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	EE 3161 or #
Course Equivalency:	No course equivalencies

EE 4161 -- New Course

Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	000370 - IT upper div or grad student
Editor Comments:	<no text provided>
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	Phil Cohen
Faculty Sponsor E-mail Address:	picohen@umn.edu

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:

EE4940, Spring 2009

Energy Conversion and Storage Devices:
fundamentals and applications

Credits: 3
Instructors: P.I. Cohen and P. Imbertson
Lab TA: Nick Gabriel (nick.gabriel@gmail.com)
Time: 11:15 12:30 Tues and Thurs
Prerequisites: EE3161, IT, or consent of instructor

Goal: To develop an understanding of the physics and applications of devices that are key to a clean energy environment with an electrical engineering perspective.

Overview: Energy issues have now reached a level of urgency that unconventional applications of existing devices and the development of new electrical devices have become necessary. The current curriculum, however, neglects the study of many of these, partly because their understanding requires a diverse background in physics and chemistry. In this general study, we will examine the fundamental physics and chemistry of selected energy conversion and energy storage devices and connect with their electric power applications. The role of the grid and application to electric vehicles will be examined. The format of the course will consist of lectures, laboratory, and student presentations.

The course will satisfy breadth requirements in either microelectronics or power systems.

Outline:

1. Energy
2. Energy storage applications
3. Review of device physics and elementary thermodynamics
4. Photovoltaic solar cells
5. Battery storage systems
6. Super capacitors
7. Fuel Cells

8. Thermoelectric devices
9. Energy harvesting devices
10. Utility scale systems
11. Comparisons
12. Student presentations

Grading: 25% per test (3), 15% project, 10% homework (no final)‏

Tests: Feb 24, April 7, May 7

Key deadline: Project request by Jan 27

Lab Room: EECSci 6-166

EE 5251 -- New Course

Mon Apr 20 09:45:37 2009

Approvals Received:	Department on 04-17-09 by Kyle Dukart (kdukart@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1099 - Fall 2009
Course:	EE 5251
Institution:	UMNTC - Twin Cities
Career:	GRAD
College:	TIOT - Institute of Technology
Department:	11122 - Electrical & Computer Eng

General

Course Title Short:	Optimal Filtering & Estimation
Course Title Long:	Optimal Filtering & Estimation
Max-Min Credits for Course:	3.0 to 3.0 credit(s)
Catalog Description:	Basic probability theory and stochastic processes. The Gauss-Markov model. Batch/recursive least squares estimation. Filtering of linear and non-linear systems using Kalman and Extended Kalman filters. Computational aspects. Continuous-time Kalman-Bucy filter. Unscented Kalman filter and particle filters. Applications.
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>
Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Fall
Component 1:	LEC (with final exam)
Auto-Enroll Course:	No
Graded Component:	LEC

EE 5251 -- New Course

Academic Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	[Math 2243, Stat 3021] or equiv, [EE 3025, EE 4231 recommended], IT grad student or %
Course Equivalency:	No course equivalencies
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	000356 - IT grad student
Editor Comments:	<no text provided>
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	
Faculty Sponsor E-mail Address:	

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Course Syllabus

Course Syllabus:	Optimal filtering & estimation We used to offer a course on roughly the same topics as EE5712 until about 15 years ago. We discontinued due to (from what I recall) not having enough faculty in the controls area to cover all courses that we thought essential. For the past 4 years we effectively re-instituted the course (taught it as EE 8950), cross-listed it with the Department of Aerospace & Mechanics (AEM 5451), and shared responsibility by teaching it on alternate years. Course outline of our recent course offerings 1) Fundamentals of probability theory & stochastic processes, and inear dynamical systems.

2) The Gauss-Markov model, Discrete-time Kalman filtering, computational aspects (square-root filters, and fast algorithms), optimal smoothing, Levinson, & Wiener filtering.

3) Brownian motion and stochastic differential equations, Continuous-time Kalman-Bucy filter, H1-filtering.

4) Nonlinear filtering: Extended Kalman filter, Unscented Kalman filter, Particle filters, and monte carlo methods.

5) Applications.

Catalog information:

AEM 5451: Optimal Estimation, 3 credits
Prerequisites: [Math 2243, Stat 3021] or equiv, 4321

Topics:

Basic probability theory. Batch/recursive least squares estimation. Filtering of linear and non-linear systems using Kalman and Extended Kalman Filters. Applications to sensor fusion, fault detection, and system identification.

Textbook: Required: Optimal State Estimation: Kalman, H Infinity, and Nonlinear Approaches, Simon, Wiley, ISBN: 0471708585

EE 5707 -- New Course

Fri Apr 17 09:47:15 2009

Approvals Received:	Department on 04-16-09 by Kyle Dukart (kdukart@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1099 - Fall 2009
Course:	EE 5707
Institution:	UMNTC - Twin Cities
Career:	GRAD
College:	TIOT - Institute of Technology
Department:	11122 - Electrical & Computer Eng

General

Course Title Short:	Elec Drives in Renew & Veh Lab
Course Title Long:	Electric Drives in Renewables and Electric/Hybrid Vehicles Laboratory
Max-Min Credits for Course:	1.0 to 1.0 credit(s)
Catalog Description:	Laboratory to accompany EE 5705
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>
Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Other frequency
Term(s) most frequently offered:	Spring
Component 1:	LAB (no final exam)
	No

EE 5707 -- New Course

Auto-Enroll Course:

Graded Component:	LAB
Academic Progress Units:	Not allowed to bypass limits. 1.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 1.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	5705 or & 5705
Course Equivalency:	No course equivalencies
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	000356 - IT grad student
Editor Comments:	<no text provided>
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	Ned Mohan
Faculty Sponsor E-mail Address:	mohan@umn.edu

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:	Proposed syllabus for EE 5705: Proposal to Change the Title and Content of EE 5705

GEO 2202 -- New Course

Submitted by Ned Mohan
March 3, 2009

New Proposed Title: Electric Drives in Renewables and Electric/Hybrid Vehicles

Catalog Description: (3cr)

Role of electric drives in wind-electric systems, inertial storage, electric/hybrid vehicles, variable-speed drives for energy conservation, etc. Controlling ac machines for energy-efficient operation using d-q axis modeling. vector-controlled and direct-torque-controlled induction motor drives, permanent-magnet and interior-permanent magnet ac motor drives; sensor-less drives; voltage space-vector modulation techniques. Integrated simulations.

Contact Hours: 3hrs/wk

Course Coordinator:
Ned Mohan
EE/Csci 5-111
612-625-3362
mohan@umn.edu

Text:
So far in EE 5705, Advanced Electric Drives: Analysis, Control and Modeling using Simulink, (publisher website: www.mnpere.com) has been used. It has been given to students at no cost. I plan to revise this book, prior to Spring 2010, to reflect the new course emphasis.

Prerequisite by Topics:
Understanding of transformers, dc drives and ac machines and drives under balanced sinusoidal steady state.

Course Objectives:
This course teaches modern topics in sustainable technologies for optimum operation of electric drives, leading to their analysis, control and modeling using a program such as SIMULINK .

Course Outcome:
A comprehensive understanding of how electric drives operate under dynamic conditions, how they ought to be controlled for optimum performance and how they are modeled using a computer simulation program as a first step in hardware implementation of their control.

It is possible that a separate 1-credit hardware lab course can be added to complement this lecture course EE 5705. This lab can basically be an extension of the lab courses EE 4703 that uses DSP-controlled (dSPACE system) Electric Drives.

Course Outline:

1. Role of Electric Drives in Renewables, Storage, Electric/Hybrid Vehicles, variable speed drives for Energy Conservation (1 wk)

2. Review: AC Machines and Space Vector Theory (1 wk)
Brush-less DC Motor Drives
Induction Motors: Balanced Steady State Operation

3. Design and Modeling of Controllers for Torque, Speed and Position Control (1 wk)

4. Speed Control of Induction Motor Drives (1 wk)

5. Dynamic Analysis and Modeling of Induction Machines using d-q Axes Theory (2 wks)

6. Vector Control and modeling of Induction Motor Drives (2 wk)
7. Voltage Vector Pulse-Width Modulation (1 wk)

8. Direct-Torque Control and Sensor-less Drives (2 wk)

9. Permanent-Magnet and Interior Permanent Magnet Synchronous-Motor Drives (2 wks)

Relationship to Professional Component:
Aimed at graduate students; can be taken by undergraduates who have taken EE 4701

Relationship to Program Objectives:
Provides in-depth knowledge in the field of electric drives.

Prepared by: Ned Mohan, Spring 2009

GEO 2202 -- New Course

Mon Apr 20 12:33:24 2009

Approvals Received:	Department on 04-20-09 by Kathy Ohler (k-ohler@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1103 - Spring 2010
Course:	GEO 2202
Institution:	UMNTC - Twin Cities
Career:	UGRD
College:	TIOT - Institute of Technology

GEO 2202 -- New Course

Department:	11130 - Geology & Geophysics

General

Course Title Short:	Earth History
Course Title Long:	Earth History
Max-Min Credits for Course:	4.0 to 4.0 credit(s)
Catalog Description:	Major theoretical foundations (Big Bang cosmology, plate tectonics, evolution); formation of Earth and its evolution over 4.5 billion years; chemical evolution of the solid Earth, atmosphere, and ocean; origin and tectonic evolution of the continents; origin of life; patterns and processes in the history of life; long-term interactions between the geosphere, atmosphere, and biosphere.
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>
Grading Basis:	A-F only
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Spring
Component 1:	LEC (with final exam)
Component 2:	LAB (no final exam)
Auto-Enroll Course:	Yes
Graded Component:	LAB
Academic Progress Units:	Not allowed to bypass limits. 4.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 4.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	Geo 2201, 2301, or instructors permission
Course Equivalency:	No course equivalencies
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	No prerequisites
Editor Comments:	<no text provided>
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	David Fox
Faculty Sponsor E-mail Address:	dlfox@umn.edu

GEO 2202 -- New Course

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:

GEO 2202: Earth History
Spring semester, meeting time

Syllabus

Week 1: Beginnings
T 20 Jan Overview, Science, Geology, Early Earth historians
Th 22 Jan The Big Bang
ESH: Ch. 1
Lab 0: No lab

Week 2: Origin of Solar System
T 27 Jan Star formation, stellar evolution, formation of the elements
Th 29 Jan Origin of the Solar System
ESH: Ch. 2 & 5
Lab 1: Geological time and relative dating

Week 3: Differentiation of Earth
T 3 Feb Formation of the moon, differentiation of core and mantle, continental crust
Th 5 Feb Archean oceans and atmosphere
ESH: Ch. 6
Lab 2: Absolute dating

Week 4: Origin of life
T 10 Feb Origin of life
Th 12 Feb Origin of life
ESH: Ch. 8 & 9
Lab 3: Depositional environments and processes

Week 5: Biogeochemical cycling
T 17 Feb Microbial metabolisms
Th 19 Feb Whole Earth geochemical cycles: HCNOS
ESH: Ch. 3 & 7
Lab 4: Depositional environments and processes

Week 6: The more or less modern Earth System
T 24 Feb Atmospheric evolution during the Archean and Proterozoic
Th 26 Feb Continental accretion, Proterozoic tectonics and supercontinents
ESH: Ch. 10 & 11
Lab 5: Carbon cycle

Week 7: Life in the Proterozoic
T 3 Mar Earth's climate system, Snowball Earth
Th 5 Mar Origin of multicellular organisms and the Cambrian Explosion
ESH: Ch. 4 & 12
Lab 6: Phylogeny and evolution

Week 8: The Early Paleozoic
T 10 Mar Evolution of marine ecosystems during the Paleozoic
Th 12 Mar Taconic orogeny
ESH: Ch. 12 & 13
Lab 7: Phylogeny and evolution

Week 9: Spring break
T 17 Mar Spring break

Th 19 Mar Spring break
ESH: Ch. 13 & 14
No lab

Week 10: Middle and Late Paleozoic Era
T 24 Mar Origin of terrestrial ecosystems during the Devonian
Th 26 Mar Assembly of Pangea; Pennsylvanian coal swamps and glaciation
ESH: Ch. 14 & 15
Lab 8: Invertebrate life

Week 11: Late Paleozoic and early Mesozoic Era
T 31 Mar Permo-Triassic extinction and recovery
Th 2 Apr Break up of Pangea
ESH: Ch. 15
Lab 9: Invertebrate life

Week 12: The Mesozoic Era
T 7 Apr Triassic faunas and evolution of dinosaurs
Th 9 Apr Atmospheric and oceanic evolution during the Mesozoic
ESH: Ch. 16
Lab 10: Vertebrate life

Week 13: The late Mesozoic
T 14 Apr Tectonics of the Cordillera
Th 16 Apr Extinction of some dinosaurs and mammalian radiations
ESH: Ch 17 & 18
Lab 11: Stratigraphy

Week 14: The Cenozoic Era
T 21 Apr PETM and the diversification of modern mammals
Th 23 Apr Alpine-Himilayan orogeny, Basin and Range
ESH: Ch. 19 & 20
Lab 12: Evolutionary rates

Week 15: Neogene
T 28 Apr Evolution of grasslands
Th 30 Apr Human evolution
ESH: Ch 20
Lab 13: Evolutionary rates

Week 16: Global change
T 5 May The Ice Age
Th 7 May Climate change
ESH: Ch 20
Lab 14:

GEO 4403 -- New Course

Mon Apr 20 12:34:51 2009

Approvals Received:	Department on 04-15-09 by Kathy Ohler (k-ohler@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1113 - Spring 2011
Course:	GEO 4403
Institution:	UMNTC - Twin Cities
Career:	UGRD
College:	TIOT - Institute of Technology
Department:	11130 - Geology & Geophysics

General

Course Title Short:	Atmosphere, Oceans, & Climate
Course Title Long:	Atmosphere, Oceans, and the Climate System
Max-Min Credits for Course:	3.0 to 3.0 credit(s)
Catalog Description:	Dynamics and biogeochemistry of the atmosphere, oceans, and the climate system. Emphasizes modern processes that determine the transport of water, energy, and trace materials within and between the atmosphere and oceans. Examines climate models and their sensitivity to natural and anthropogenic forcings.
Print in Catalog?:	Yes

GEO 4403 -- New Course

CCE Catalog Description:	<no text provided>
Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Spring
Component 1:	LEC (with final exam)
Auto-Enroll Course:	No
Graded Component:	LEC
Academic Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	Math 1371, 1372; Chem 1021, 1022; Physics 1301, 1302
Course Equivalency:	No course equivalencies
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	No prerequisites
Editor Comments:	Course will be cross listed when ESPM course is approved
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	Katsumi Matsumoto
Faculty Sponsor E-mail Address:	katsumi@umn.edu

Student Learning Outcomes

Student Learning Outcomes:

* Student in the course:

- Can identify, define, and solve problems

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Homework questions and in-class discussions will facilitate the identification and definition of gaps in knowledge. Problem solving will be addressed by homework questions as well as midterm and final exams. Problem solving will also be addressed through the use of EdGCM, a user-friendly global climate model that can be easily installed on personal computers.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Evaluation of homework and reports using EdCGM.

- Have mastered a body of knowledge and a mode of inquiry

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Lectures are the primary means to deliver an organized body of knowledge. Mathematical derivations of dynamical features of the atmosphere and oceans will facilitate a quantitative mode of inquiry.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Assessment will be made primarily in homework and midterm and final examinations

- Have acquired skills for effective citizenship and life-long learning

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

We fill have a focus on the positive learning experience, so that students will appreciate science and be more receptive to life-long learning of science and science literacy in general.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

We will conduct critical incident questionnaire on a regular basis throughout the semester to gauge the effectiveness of our teaching methods and the learning experience of the students. Student feedbacks will help adjust our teaching and delivery methods.

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:

Atmosphere, Oceans, and the Climate System
Spring 2011 ESPM 4403/GEO4403

This course provides an introduction to atmospheric science, oceanography, and climatology at the upper undergraduate level. Emphasis will be on understanding the mechanisms and processes that determine the cycles of water, energy, and materials within and between the atmosphere and oceans. The course begins with a simple energy balance of the Earth that will give a very basic understanding of the planet s surface temperature. The inadequacy of that understanding will be the motivation to study the dynamics of the climate system. Students will learn the basic equations of motion and state and how they are applied to the atmosphere and oceans in understanding the large scale dynamics. The course will describe how physical processes largely constrain and drive biogeochemical processes in the atmosphere and oceans but also show that biogeochemical processes can in turn have a feedback on the physical processes. The course will examine the interaction and coupling between the atmosphere and oceans and between the atmosphere and land. Students will study the basics of climate dynamics and interannual and interdecadal variability of climate. Climate variability and change will be put in perspective by examining past climates and the impacts of anthropogenic climate forcings.

Prerequisites: One year each of college level physics, chemistry, and calculus.

Lecturers (alphabetical):
Katsumi Matsumoto (katsumi@umn.edu; 212 Pillsbury Hall) is a professor and oceanographer in the Department of Geology and Geophysics. His research focuses on the behavior of carbon in the global ocean and at the atmosphere-ocean interface and ocean-sediment interface.

Peter Snyder (pksnyder@umn.edu; 439 Borlaug Hall) is a professor and atmospheric scientist in the Department of Soil, Water, and Climate. His research focuses on the interactions between the atmosphere and the terrestrial biosphere using models, observations, and data analysis.

Homework: Homework will be assigned on a weekly to biweekly basis and due one week later in class. You may collaborate with your classmates to solve the problems, but each student will have to turn in a completed homework him/herself. Each day that you are late in handing in the homework, there will be a 10% penalty.

Some homework will involve the use of Matlab scripts and EdGCM on a computer. These are user-friendly tools that can be installed on a personal computer and will facilitate the understanding of key concepts in geophysical fluid dynamics and climate dynamics.

Midterm and Final Exam: A makeup exam will be given without penalty, if you missed the final because of sickness, emergency in the family, or conflict with another university activity. Otherwise, there will be a 25% penalty.

Course Objectives: This course provides a rigorous introduction to the atmospheric sciences

Grades: Homework 75%, Final Exam 25%. Depending on the class size and as a rough guide, the top third of the class will get A s, the next third B s, and the last third C s. Grades will be posted on WebVista.

Class notes: Class instruction combines the use of PowerPoint presentation and development of equations on the black board. It will be important for you to take notes in class, although most materials will come from the text. Some class notes may be posted on WebVista.

Lecture Schedule

Date	Topics	Homework	Text chapter
1	Course overview and logistics (KM, PS)		
2	Blackbody radiation and the mean temperature of 1D planet (KM)		
3	Greenhouse gases and selective radiation absorption and emission (PS)		
4	Atmospheric temperature profile (PS)		
5	Evapotranspiration and precipitation (PS)	1	
6	Oceanic temperature and salinity (KM)		
7	Oceanic density and water masses (KM)	2	
8	GFD-I: Equation of motion, real and apparent forces (PS)		
9	GFD-II: Equation of state, conservation of mass and energy (PS)		
10	GFD-III: Geostrophy and various balance of forces (PS)		
11	GFD-IV: Waves: gravity, Rossby, Kelvin (PS)	3	
12	Ekman transport and wind-driven ocean circulation (KM)		
13	Upwelling and western boundary currents (KM)		
14	Deep ocean circulation and geochemical tracers (KM)		
15	Marginal seas and interior water mass formation (KM)	4	
16	Convective adjustment and the lapse rate (PS)		
17	Atmospheric general circulation (PS)		
18	Baroclinic instabilities and eddies (PS)	5	
19	Biological production and remineralization in the ocean (KM)		
20	CO2 chemistry and air-sea gas exchange (KM)		
21	Physical and biological controls on surface ocean pCO2 (KM)		
22	Anthropogenic carbon in the ocean (KM)	6	
23	Biological production on land (PS)		
24	Atmosphere-land interaction (PS)		
25	Global climate models (PS)	7	
26	Climate feedbacks I: Clouds, albedo, aerosols, GHG (KM)		
27	Climate feedbacks II: Ocean circulation, continental weathering (KM)	8	
28	Interannual and interdecadal climate variability (PS)		
29	History and evolution of the climate system (KM)		
30	Detection and attribution of climate change (KM, PS)		

KM&PS=2
KM=14
PS= 14

GEO 4801 -- New Course

Mon Apr 20 12:35:52 2009

Approvals Received:	Department on 04-20-09 by Kathy Ohler (k-ohler@umn.edu)
Approvals Pending:	**College/Dean** > Catalog
Effective Status:	Active
Effective Term:	1113 - Spring 2011
Course:	GEO 4801
Institution:	UMNTC - Twin Cities
Career:	UGRD
College:	TIOT - Institute of Technology
Department:	11130 - Geology & Geophysics

General

Course Title Short:	Geobiology and Astrobiology
Course Title Long:	Geobiology and Astrobiology
Max-Min Credits for Course:	3.0 to 3.0 credit(s)
Catalog Description:	For more than 3 billion years, life has influenced the Earth s atmosphere, geosphere, and hydrosphere. This course examines geobiological processes with the goal of understanding their role in shaping evolution and environment. Topics include microbe-metal interactions, biogeochemical cycling, microbial paleobiology, and environmental geomicrobiology. Astrobiological discussions focus on life detection approaches and habitability of other planets.
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>

Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Spring
Component 1:	LEC (with final exam)
Auto-Enroll Course:	No
Graded Component:	LEC
Academic Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	Geo 1007
Course Equivalency:	No course equivalencies
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	No prerequisites
Editor Comments:	<no text provided>
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	Jake Bailey
Faculty Sponsor E-mail Address:	

Student Learning Outcomes

Student Learning Outcomes:	* Student in the course: **- Can identify, define, and solve problems** Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome. Lecture material will cover much of what is known (and unknown) in the biogeosciences. Upon completion of the course, students will be well-equipped to pursue their own investigations in this highly interdisciplinary field, as well as incorporate microbiological findings and techniques into their geological and environmental endeavors. Techniques and problem-solving approaches will be the focus of multiple lectures and will be integrated into classroom discussions. How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated. Exam questions will ask the students to interpret simulated data that will require an understanding of both the natural processes involved and the techniques employed to investigate them. **- Can locate and critically evaluate information** Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Students will be required to use library resources to locate, read, and evaluate articles from the peer-reviewed scientific literature.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Students will be required to produce a term paper in the form of a critical review of a scientific paper from the primary literature. Student term papers will be evaluated on the degree to which they demonstrate the ability to effectively communicate, analyze the arguments of others, and support their own arguments by citing the existing literature.

- Have mastered a body of knowledge and a mode of inquiry

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

This course will provide a comprehensive overview of the interfaces between biological, chemical, and geological phenomena and processes. Students will be exposed to a rapidly expanding body of knowledge, as well as an interdisciplinary approach to investigation that includes the integration of cutting-edge techniques and approaches from traditionally disparate fields.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Exam topics will cover the diverse range of topics in the biogeosciences presented in course lectures and readings, and ensure that the students have a thorough grasp of the course material.

- Understand diverse philosophies and cultures within and across societies

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Upon completion of this course, students will be able to understand the potential hazards and benefits of geobiological processes for society. Examples of relevant topics that influence society range from biological wastewater remediation to the hazard of acid mine drainage a growing concern in Minnesota s mining regions.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Students will have the opportunity to see first-hand the impact of microbial processes on the environment during a field trip to an acid mine drainage site. Exam questions focused on processes observed during the field trip will be used to evaluate the efficacy of this learning objective.

- Can communicate effectively

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Students will be required to produce a term paper in the form of a critical review of a scientific paper from the primary literature. Suggested papers for review will parallel subjects presented in lecture.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Student term papers will be evaluated based on the degree to which they demonstrate the ability to effectively communicate, analyze the arguments of others, and support their own arguments by citing the existing literature.

- Understand the role of creativity, innovation, discovery, and expression across disciplines

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

In this course, students will explore the rich diversity of findings in modern biology, chemistry, and geology that have been made possible through an interdisciplinary approach to science.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Exam questions and term paper topics will focus on interdisciplinary topics and methodologies.

- Have acquired skills for effective citizenship and life-long learning

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Students will be exposed to the scientific method through readings and discussion of recent discoveries and controversies in science. Upon completion of the course, will be better prepared to understand and interpret the results of scientific inquiries in the academic and popular literature.

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

As part of the term paper requirement, students will be required to critically-evaluate papers from the scientific literature and in so doing, will gain an appreciation for the peer-review process.

GEO 4801 -- New Course

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:

Sample Lecture Schedule:
Jan. 18 Introduction What is geobiology?
Jan. 20 What is life? How do we recognize it?
Jan. 22 Mini review of general biology (genes, proteins)
Jan. 25 Microbial physiology 1: Structure and function
Jan. 27 Microbial physiology 2: Structure and function, cultivation
Jan. 29 Microbial diversity: molecular tree of life, three domains
Feb. 1 Environmental distribution of microbial life
Feb. 3 Microbial metabolism 1: Thermodynamics
Feb. 5 Microbial metabolism 2: Redox, energetics
Feb. 8 Metabolism: Autotrophy, photosynthesis vs. chemosynthesis
Feb. 10 Respiration and fermentation
Feb. 12 The Carbon Cycle 1: Primary Production
Feb. 15 The Carbon Cycle 2: Heterotrophy, the microbial loop, carbon burial
Feb. 17 The Carbon Cycle 3: Methanogenesis and methanotrophy
Feb. 19 Oxygen production and consumption; The rise of oxygen
Feb. 22 The Nitrogen Cycle: N-Fixation, Nitrification/Denitrification, ANAMOX
Feb.24 The Sulfur Cycle 1: Reductive Processes
Feb. 26 The Sulfur Cycle 2: Oxidative Processes (phototrophic, chemotrophic)
Mar. 1 The Sulfur Cycle 3: Chemotrophic Ecosystems (seeps, vents, whale falls)
Mar. 3 Midterm Exam
Mar. 5 The Silicon Cycle
Mar. 8 Microbes and Metals 1: Iron and Manganese
Mar. 10 Microbes and Metals 2: Uranium, Arsenic, others
Mar. 12 Microbially-mediated geochemical profiles
Mar. 15-19 Spring Break
Mar. 22 Ecology and geobiology: Symbioses (microbe/microbe, microbe/animal)
Mar. 24 Biofilms and mats vs. planktonic life modes
Mar. 26 Spatial and temporal variations in community structure
Mar. 29 Microbial evolution, Horizontal gene transfer
Mar. 31 Instruments and Techniques in Geobiology 1: Rocks and chemistry
Apr. 2 Instruments and Techniques in Geobiology 2: Cells and genes
Apr. 5 Geological effects of microbial activity 1: sedimentary processes
Apr. 7 Geological effects of microbial activity 2: carbonates
Apr. 9 Geological effects of microbial activity 3: phosphorites
Apr. 12 Geological effects of microbial activity 4: mineral dissolution, clays

Apr. 14 Paleomicrobiology 1: microfossils, stromatolites
Apr. 16 Paleomicrobiology 2: stable isotopes
Apr. 19 Paleomicrobiology 3: lipid and pigment biomarkers
Apr. 21 Biomineralization: geobiology of eukaryotes
Apr. 23 Geobiology and the environment 1: microbes and climate change
Apr. 26 Geobiology and the environment 2: acid mine drainage (w/field trip)
Apr. 28 Geobiology and the environment 3: environmental remediation
Apr. 30 Astrobiology 1: Planetary Habitability
May 3 Astrobiology 2: Life Detection Strategies
May 5 Final Exam

GEO 5402 -- New Course

Mon Apr 20 12:36:47 2009

Approvals Received:	Department on 04-17-09 by Kathy Ohler (k-ohler@umn.edu)
Approvals Pending:	**College/Dean** > Catalog > PeopleSoft Manual Entry
Effective Status:	Active
Effective Term:	1103 - Spring 2010
Course:	GEO 5402
Institution:	UMNTC - Twin Cities
Career:	UGRD
College:	TIOT - Institute of Technology
Department:	11130 - Geology & Geophysics

General

Course Title Short:	Sci & Politics Global Warming
Course Title Long:	Science and Politics of Global Warming
Max-Min Credits for Course:	3.0 to 3.0 credit(s)
Catalog Description:	Global warming viewed from physical sciences and political-social aspects. Science emphasizes detection and attribution of global warming using concepts of radiation, climate system, and carbon cycle. Politics emphasizes effects on society and biodiversity, and national and global efforts and controversy over possible responses and consequences.
Print in Catalog?:	Yes
CCE Catalog Description:	<no text provided>
Grading Basis:	Stdnt Opt
Topics Course:	No
Honors Course:	No
Delivery Mode(s):	Classroom
Instructor Contact Hours:	3.0 hours per week
Years most frequently offered:	Every academic year
Term(s) most frequently offered:	Spring
Component 1:	LEC (with final exam)
Auto-Enroll Course:	No
Graded Component:	LEC
Academic Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Financial Aid Progress Units:	Not allowed to bypass limits. 3.0 credit(s)
Repetition of Course:	Repetition not allowed.
Course Prerequisites	<no text provided>

GEO 5402 -- New Course

for Catalog:

Course Equivalency:	Geo 3402/Geo 5402
Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based)	No prerequisites
Editor Comments:	Statement on how GEO5402 will be different from its undergraduate version GEO3402 Graduate students taking GEO5402 will listen to the same lectures as undergraduate students taking GEO3402. They will use the same primary text, which is David Archer s Global Warming: Understanding the Forecast. Graduate students will be treated differently in three respects: 1) Graduate students will have additional required readings from the most recent Intergovernmental Panel on Climate Change (IPCC) science report. This is a very dense, detailed, and technical report prepared by and for scientists. The report would be too much for undergraduates; it will be challenging but manageable for graduate students. 2) Graduate students will do different homework problems and exam questions that are more quantitative and difficult. Some questions will relate directly to the IPCC science report noted in (1). 3) The course will have greater expectations in graduate students than undergraduates in terms of class discussion and debate and performance.
Proposal Changes:	<no text provided>
History Information:	<no text provided>

Faculty Sponsor Name:	Katsumi Matsumoto
Faculty Sponsor E-mail Address:	katsumi@umn.edu

Liberal Education

Requirement this course fulfills:	None
Other requirement this course fulfills:	None
Criteria for Core Courses:	<no text provided>
Criteria for Theme Courses:	<no text provided>

Writing Intensive

Propose this course as Writing Intensive curriculum:	No
Question 1:	<no text provided>
Question 2:	<no text provided>
Question 3:	<no text provided>
Question 4:	<no text provided>
Question 5:	<no text provided>
Question 6:	<no text provided>
Question 7:	<no text provided>

Readme link. Course Syllabus requirement section begins below

Course Syllabus

Course Syllabus:	Science and Politics of Global Warming GEO 3402 and GEO 5402 Spring 2010 Course Syllabus Time and Place: 8:15 9:30 am in Pillsbury Hall Room 110 Instructor: Katsumi Matsumoto 212 Pillsbury Hall

katsumi@umn.edu

Matsumoto is a professor and oceanographer in the Department of Geology and Geophysics. His research focuses on climate change and carbon cycle change and uses numerical models of global climate. He is a contributing author of the 2007 IPCC science report on global climate change.

Office Hours: By appointment but feel free to stop by during regular working hours

Course website: WebVista via MyU Portal (http://myu.umn.edu)

Reading Materials:
(1) David Archer, Global warming: Understanding the forecast, Blackwell Publishing, 2007
(2) Additional readings on E-Reserve and WebVista

Grading: Homework 50%, Report 10%, Class Attendance and Participation 20%, Final Exam 20%

Final Exam: 8:00am-10:00am Wednesday, May 13 (regular classroom)

Welcome to the Science and Politics of Global Warming! Today media often carry headlines warning the public of the dangers of human-induced global climate change. New signs of global warming, such as retreating mountain glaciers and shrinking Arctic Ocean ice cover, are reported. At the same time there are claims and accusations that global warming is just a hoax. On the political front too, there are conflicting positions about what needs to be done if anything about global climate change. Even amongst those who accept that global warming is occurring, there is little consensus about how to mitigate the human impacts and at what cost. In this course, we will examine global warming from both the natural science and social science perspectives. The goal of the natural science portion, taught by Matsumoto, is to clarify what we know and how well we know about global warming: the physics of greenhouse effect (why Earth is habitable compared to Mars and Venus?), the global carbon cycle (what is the consequence of burning oil?), and future global climate forecasts (what awaits us). The goal of the politics portion of the course, taught by a number guest lecturers and Matsumoto, is to explain the goals and means to put the science into action. We will identify the policies, technologies and forms of social reorganization needed to produce carbon-neutral national and world society, as well as legal, social and cultural factors helping or impeding our attainment of that goal.

Guest lectures:
This course will feature a number of guest lectures from different departments (Ecology, Evolution and Behavior, Humphrey Institute, Law, Political Science, Soil, Water and Climate) on the politics aspect of the course. These lectures will provide perspectives by experts on topics such as environmental law, resource management, environmental economics, energy, public policy, American and international politics, technology, and social organizations.

The CLE Environment Theme (Geo 3402 only)
This course meets the Environment Theme of the University of Minnesota Council on Liberal Education. A CLE theme course engages students in difficult debates about moral, legal, and ethical issues that require critical inquiry from a variety of perspectives and independent thinking. The Environment theme in particular requires an in-depth examination of a significant environmental problem from various perspectives. This course takes scientific and sociological approaches to examine global warming, which is arguably one of the most significant environmental problems facing the global society today. Climate change cuts into society from various dimensions: sustainability, energy provision, environmental justice, technology, population dynamics, the organization of production and consumption, and national security. By approaching from the perspectives of both natural and social sciences, this course gives explicit attention to interrelationships between the natural environment and human society.

Learning outcomes:
At the end of this course successful students will be able to:
- Explain the basics of atmospheric structure, greenhouse effect, and global carbon cycle
- Explain detection and attribution of global warming
- Discuss climate modeling and future climate forecasts
- Understand national and international policy options for dealing with global climate change
- Understand the relationship between global climate change and energy production and usage.
- Discuss the feasibility of alternative energy technologies and conservation as solutions.
- Understand the projected impacts of climate change on global prosperity, health, migration, conflict, biodiversity and other social issues.
- Envision the organizational requirements of a carbon-neutral society and planet.
- Understand the actions needed to overcome barriers and create a carbon-neutral society

Homework:
Homework will be due one week after it is assigned. Some homework will require you to use numerical models noted in Archer s book and accessible by a web browser. Other homework will require access to web-based interactive modules. Homework will lose 10% of grade per day late.

Report:
During the semester, you are to collect articles on global climate change. They can be in various forms and from a variety of sources (e.g., newspapers, news magazines, etc.) but have to be reasonably credible (e.g., no supermarket tabloids). The articles can be on any aspect of climate change. You should find relevant articles on a regular basis. At the end of the course, you will submit a report, providing a general discussion of your collection of articles. You should relate these articles to the course content. In addition, choose one article in particular, and discuss it in more detail. Your entire report should be 3 pages or less, plus your collection of articles (organized scrap books would earn extra credits).

Quiz and Exams:
If there is a conflict in time with another university activity, the student needs to notify the instructor before the quiz/exam is administered in order to be allowed to make it up without penalty. Sickness and family emergency are also acceptable reasons for penalty-free makeups, but this will need to be communicated without delay. Otherwise, a makeup can be given within a week of the missed quiz/exam with a 25% penalty.

Class Participation:
There will be an effort made to have a short in-class discussion on a selected topic every lecture. There will also be student group presentation. Each group will make one group presentation during the semester. The topic will be Climate Change in the Media. Your job is to evaluate and critique how the media is handling some issue related to climate change. Each group will select some current news media article or news broadcast (video clip) and develop an analysis and critique of the content of and position taken by it. Circulate the article or video to class beforehand and your analysis to the class. About 20 minutes total.

Academic integrity:
Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty, which includes plagiarizing; cheating on assignments or examinations. A student responsible for scholastic dishonesty can be assigned a penalty including an "F" or "N" for the course.

Disabilities statement:
It is university policy to provide, on a flexible and individual 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 are encouraged to contact the professor.

Grades:
Final course grades will be curved (i.e., not based on absolute scores). As a rough guide, the top third of the class will get A s, the next third B s, and the last third C s. Students with scores significantly lower than the bulk of the last third may receive D s or F s.

Class notes:
Some class lectures will be posted on the web.

Class Schedule:
Week Dates Topics Events
1 1/20
1/22 Introduction and course logistics
Impacts of climate change
2 1/27
1/29 The looming risks of global climate change

The greenhouse effect
HW 1
3 2/3
2/5 Greenhouse gases and radiative forcing
The temperature structure of the atmosphere
GP 1
4 2/10
2/12 Potential solutions--technology, policy or social change?
Slow march--international and national responses
HW 2
5 2/17
2/19 Essentials of climate physics
Feedbacks in the climate system
GP 2
6 2/24
2/26 What s holding us back?-social factors retarding effective response .
Embedded in energy: energy and civilization
HW 3
7 3/3
3/5 Fossil fuels and energy consumption the Kaya identity
Population, affluence and technology: the STIRPAT formula
GP 3
8 3/10
3/12 Divergent rationalities: Economic costs, interests and public goods
The social construction and politics of climate change
HW 4
9 Spring Break
10 3/24
3/26 Scientific consensus and climate change skeptics
Climate change science: acceptance or rejection?
GP 4
11 3/31
4/2 Natural carbon cycle
Anthropogenic carbon cycle
HW 5
12 4/7
4/9 The responses of developed nations (US , Germany, Japan, Sweden)
The responses of developing nations (Brazil, India and China)
GP 5
13 4/14
416 Detection and attribution of global warming
Future climate projections
HW 6
14 4/21
4/23 Past climates and abrupt climate change
Sub-national diffusion of climate change solutions
GP 6
15 4/28
4/30 US politics of global warming 1
US politics of global warming 2
HW 7
16 5/5
5/7 Mobilizing to fight climate change
Envisioning a sustainable world
Exams 5/12-16 Final Exam: 8:00am-10:00am Wednesday, May 13 Final
HW=Homework assigned. Due one week later in class. GP=Group Presentation.

Lecture topics and reading materials

1.1) Introduction and course logistics
Is global climate change occurring now and is it caused by human activity? What is the time scale of climate response and how would it impact our decision-making? How did we get to this point? What is the social? (economics, politics, relational patterns, culture). What are the relationships between society and nature? What are the roles of social institutions and social organization in generating global climate change and in solving it? Why is it important to approach global climate change from both the natural and social scientific perspectives?
Reading: Archer Chapter 1

1.2) Impacts of climate change
What impacts are anticipated? A look at health, sea level, ocean acidification, and biodiversity.
Readings:
Doney, S.C., The dangers of ocean acidification , Scientific American, Mar., 58-65, 2006.
Epstein, P.R., Is global warming harmful to health? , Scientific American, Aug., 50-57, 2000.
Schneider, D., The rising seas , Scientific American, Mar. 112-117, 1997.
Recommended: Kolbert, E., Butterfly lessons , New Yorker, Jan. 9, 32-39, 2006.

2.1) The looming risks of global climate change
Predicted effects on human society and other life from different scenarios of climate change. Adaptation versus mitigation as responses.
Reading: Intergovernmental Panel on Climate Change, 2007 Synthesis Report (pp. 2-22).

2.2) The greenhouse effect
Basic physical concepts and terminology needed to discuss the greenhouse effect: electromagnetic radiation, wave number, frequency, Stefan Boltzman equation, and blackbody spectra. A simple radiation balance of the planetary surface that will allow us to understand the first order difference in the climatologies of Venus (hothouse), Earth (just right), and Mars (icehouse).
Reading: Archer Chapters 2 and 3

3.1) Greenhouse gases and radiative forcing
The nature of optically opaque atmosphere. What are the chemical composition of the atmosphere, radiative properties of greenhouse gases, selective absorption of infrared light, and saturation band width?
Reading: Archer Chapter 4

3.2) The temperature structure of atmosphere
How do the vertical motion of air masses, cooling of temperature with altitude, and air compressibility impact Earth s surface temperature (and the layer model of atmosphere).
Reading: Archer Chapter 5

4.1) Potential solutions--technology, policy or social change?
In order to fully mitigate global climate change, the currently wealthy societies will have to reduce carbon emissions by 80% and the entire world by an average of 50% by the year 2050. A range of technologies, policy agreements and ideas of conservation-inducing social reorganization and value change have been proposed to help attain these goals. What mixture of these (or other) approaches will do the trick? How do global inequalities affect the possibilities? Will a carbon-neutral world increase privation and suffering, or inspire finding happiness even with conservation of energy, and for whom?
Reading:
Hansen, 2007, How Can We Avert Dangerous Climate Change? (pp 2-17). Testimony to Select Committee on Energy Independence and Global Warming, US House of Representatives, April 26, 2007.

Stern, Nicholas, Executive Summary, pp. vi-ix. The Economics of Climate Change, (2007)

4.2) Slow march--international and national responses
Overview, history and analysis of global climate change politics, negotiations and agreements. UNFCCC, IPCC, Kyoto Protocol, Bali roadmap. Comparison of national reactions to Kyoto. Proposals for the emerging global agreements.
Readings:
Daniel Bodansky History of the Global Climate Change Regime Chp. 2 (23-41) in Urs Luterbacher and Detlef Sprinz,2001 International Relations and Global Climate Change (MIT Press).
S. Bastianoni, et al. The Problem of Assigning Responsibility for Greenhouse Gas Emissions Ecological Economics 49 (2004) 253-257

5.1) Essentials of climate physics
What drives the winds and ocean currents? What determines the temperature and precipitation distributions around the globe? Touch on the great importance of the effect of Earth s rotation on the motion of winds and currents.
Reading: Archer Chapter 6
Recommended: Kump, Kastings, Crane, Ch. 4 + 5, The Earth Systems (2nd Ed), Prentice Hall, 2004.

5.2) Climate feedbacks
Understanding climate feedbacks and self regulation through the Gaia hypothesis and Daisyworld. These concepts and simple models like the layer model of the atmosphere are great tools to help facilitate understanding but are unfit for realistic predictions. Realistic predictions require climate modeling.
Reading: Archer Chapter 7
Recommended: Kump, Kastings, Crane, Ch. 2 + 6, The Earth Systems (2nd Ed), Prentice Hall, 2004.

6.1) What s holding us back?-The range of factors retarding effective response
Many different factors affect the speed and effectiveness of national response to global climate change. At the most basic level, modern civilization depends upon extremely high inputs of energy to maintain the division of labor, systems of production, and social order. A society s energy (and carbon) intensity is a function of its population, affluence and technology. Even if reducing energy intensity will serve the public good (mitigate climate change), individuals and interest groups oppose it due to projected personal losses, disparage the technology, and stress the social problems. Climate change, with its call for global cooperation, poses a universal culture shock, increasing denial. International agreements are hard pressed to take national variation into full account. .
Readings:
Broadbent, Jeffrey, Social Learning and National Response to Global Climate Change: Hypotheses for a New Comparative Project using Policy Network Analysis forthcoming in Sumi et al. title unknown (eds.) Springer-Verlag, 2009 (1-20).
Recommended:
McCright, Aaron and Riley Dunlap , Challenging Global Warming as a Social Problem Social Problems 47, 4. 499-522.
Gould et al, Chp. 1 (3-17) The Treadmill of Production as an Outcome of Scientific Methods, The Treadmill of Production, Paradigm Publishers.

6.2) Embedded in Energy: Energy and social evolution Energy use and the stages of social evolution: hunting and gathering, agricultural revolution, industrial revolution. Energy, industrial revolutions (coal, oil, electronics) and social change. Energy budgets, lifestyle and social routines in developed, transitional and developing countries. Concept of embodied energy. Concept of carbon neutral society. Can we cut energy use by 50% but maintain quality of life? Introduction to other factors affecting national response rates to climate change.

Reading:
Fischer-Kowalski, M., Haberl, H. (1997) Modes of Production and their Sustainability Problems Society and Natural Resources 10 (1) 61-85.

7.1) Fossil fuels and energy consumption the Kaya identity
Type and availability of fossil fuels. How long are fossil fuels predicted to last (Hubbert curve and Kaya identity) and what do the predictions depend on?
Reading: Archer Chapter 9

7.2) Population, affluence and technology: the STIRPAT formula
IPAT/STIRPAT. Effect of population size, level of consumption, and efficiency of technology upon national greenhouse gas emissions in different civilizations and countries.
Reading:
York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "A Rift in Modernity? Assessing the Anthropogenic Sources of Global Climate Change with the Stirpat Model." The International Journal of Sociology and Social Policy 23 (31-47).
Recommended:
Rosa et al, Tracking the Anthropogenic Drivers of Ecological Impacts, Ambio, 33, 8 Dec 2004 (509-512)
Pimentel, D. et al. 2005. Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems . BioScience 55: 573-582.

8.1) Divergent rationalities: Economic costs, interests and public goods
Reducing GHG emissions may not cause serious declines in national prosperity, but will cause some corporate sectors (like oil and highways) to lose out, creating powerful resistance to the transition. In any case, it is hard to get individuals and groups to cooperate for the common good. How can we calculate and assign the costs and burdens of transition to a carbon-neutral society and bring about cooperation?
Readings:
Hardin, Garrett, The Tragedy of the Commons., Science 162 (1968): 1243-1248
Fisher, Dana R. 2006. "Bringing the Material Back In: Understanding the U.S. Position on Climate Change," Sociological Forum 21:467-494.
Recommended:
Dietz et al, 2002, The Drama of the Commons, introduction pp. 3-35.
Pulver, Simone. Making Sense of Corporate Environmentalism Organization and Environment 20:1 March 2007 44-75.

8.2) The social construction and politics of climate change .
Public opinion and leadership assessments about climate change is not a direct reflection of scientific knowledge, nor even of powerful economic interests. These judgments arise under the influence of many social and cultural factors, including education, news, religion, political ideologies and legitimacy of science, as well as denial and apathy. For any set of beliefs to gain political power, it must be carried by movements and advocacy coalitions. Stakeholder participation may help spread belief in climate change science. Cross-national variation in the strength of advocacy coalitions and opportunities for stakeholder participation may be very influential in determining the comparative effectiveness of national reactions to climate change.
Readings:
McCright, Aaron M. and Riley E. Dunlap. 2000. "Challenging Global Warming as a Social Problem: An Analysis of the Conservative Movement's Counter-Claims." Social Problems 47:499-522.

9. SPRING BREAK

10.1) Natural carbon cycle
Carbon storage and exchange under natural circumstances or prior to industrialization. Where is carbon in the absence of human activities and how does it move around? A look at the roles the terrestrial biosphere, oceans, rocks, and atmosphere.
Reading: Archer Chapter 8

10.2) Anthropogenic carbon cycle
Human perturbations to the carbon cycle: emissions of methane, carbon dioxide, deforestation, etc. How have these activities modified the natural carbon cycle and the atmospheric chemistry?
Reading: Archer Chapter 10
Recommended: Sarmiento, J. and N. Gruber, Sinks for anthropogenic carbon , Physics Today, Aug., p. 30-36, 2002.

11.1) Scientific consensus and climate change skeptics
Is science just a special interest? Peer review process. Who are the skeptics and what are their arguments?
Reading: Oreskes, N. The scientific consensus on climate change Science, 306, 1686, 2004.

11.2) Climate change science: Legitimate or suspect?
Climate change science plays the central role in our knowledge of global climate change. However the dominant scientific consensus is not always accepted. Ultimately, how a given society understands and evaluates climate change is socially constructed by many factors, including pressures from interest groups and the culture of the society. Will opportunities for participation and dialogue among stakeholders help strengthen societal belief in global climate change and willingness to take action against it?
Readings:
Demeritt, David, The Construction of Global Warming and the Politics of Science Annals of the Association of American Geographers (92) 2, 2001, 307-337.

12.1) The responses of developed nations (US , Germany, Japan) .

Developed nations have responded in many different ways to climate change, but none adequately. Differences in their GHG reductions and policies may be explained by their climate vulnerability, economic interests, social constructions and political institutions and processes. Among the developed nations, Japan, the United States and Germany serve as instructive comparative cases.
Reading: Schreurs, Miranda. Chp. 9 Domestic politics and the global environment: Japan, Germany and the US compared in Schreurs, Environmental Politics in the US, Japan and Germany (Cambridge U Press 2002) (pp. 241-261).

12.2) The responses of transitional and developing nations (Brazil, India and China) .
Developing (and transition) nations have responded in many different ways to climate change, but none adequately. Differences in their concern with climate change may be explained by their climate vulnerability, economic interests, social constructions and political institutions and processes. Among the developing nations, Brazil, India and China serve as instructive comparative cases.
Readings:
Roberts, J. T. Climate Change: Why the Old Approaches Aren t Working pp 191-208, in K. Gould and T. Lewis, Twenty Lessons in Environmental Sociology, Oxford University Press, 2009.
Richerzhagen and Scholz, China s Capacities for Mitigating Climate Change, World Development, 36:2 pp. 308-324, 2008.

13.1) Detection and attribution of global warming
How do we know that global warming is actually happening? Focus on empirical evidences, including instrumental measurements as well as proxy data. How do we know that global warming is caused by humans? The role of global climate models.
Reading: Archer Chapter 11
Recommended: Kolbert, E., The climate of man-I , New Yorker, April, 25, 56-71, 2005.

13.2) Future climate change and projections
What are the future climate projections? How global climate models are used to make predictions using greenhouse gas emissions as inputs. What about for the Midwest?
Reading: Archer Chapter 12
Recommended: IPCC AR 4 Working Group I Summary for Policy Makers, 2007.

14.1) Past climates and abrupt climate change
How bad is the forecast relative to climate changes in the past? A look at past climates and abrupt climate changes to get a point to reference to understand the magnitude of current climate change. How have ancient civilizations been impacted by past climate change?
Readings:
Alley, R.B., Abrupt climate change , Scientific American, Nov., 62-69, 2004.
Kolbert, E., The climate of man-II , New Yorker, May 2, 56-63, 2005.
Recommended:
Alley, R.B. and Bender, M., Greenland ice cores: Frozen in time , Scientific American, Feb., 80-85, 1998.

14.2) Sub-national diffusion of climate change solutions
Frustrated by insufficient national and international response, local actors (states, cities, firms) have been setting up smaller-scale emissions reductions agreements. Under what conditions do states, cities and countries adopt global climate change policies?
Readings: Vasi, B. Thinking Globally, Planning Nationally and Acting Locally, Social Forces 86:1 September 2007 (1-17)

15.1) US politics of environmental protection and global warming 1
Reading: McKinsey & Company. 2007. "Reducing Greenhouse Gas Emissions. How Much at What Cost?" U.S. Greenhouse Gas Mapping Initiative, Executive Summary. (Full Report on WebVista)

15.2) US politics of environmental protection and global warming 2
Reading: Stern, N. "Stern Review executive summary" New Economics Foundation, 2006.

16.1) Mobilizing to fight climate change
A successful transition will require large scale popular mobilization to push for new rules, habits and attitudes. Such mobilization will depend upon the strength of civil society, openness of political institutions and other factors.
Readings:
Hawken, Paul. A Declaration of Sustainability Chp. 21 pp. 379-388 in R. Scott Frey, The Environment and Society Reader, Allyn and Bacon 2001.
Brown, Lester, Chp. 13 The Great Mobilization (265-287) in Brown, Lester, Plan B 3.0 Mobilizing to Save Civilization W.W. Norton and Co.

16.2) Envisioning a sustainable world
A vision of a sustainable society will help guide efforts for reform. What will a sustainable, carbon-neutral society and world look like? How can we organize society to reduce GHG emissions? What mixture of technical fix and social reorganization will we need? Geoengineering and wedges.
Readings:
Goodwin, Neva. March 2008. An Overview of Climate Change: What does it mean for our way of life? What is the best future we can hope for? Working Paper No. 08-01 Global Development and Environment Institute, Tufts University (pp 1-30).
Socolow, R.H. and Pacala, S.W., A plan to keep carbon in check , Scientific American, Sept, 50-57, 2006.
Kolbert, E., The climate of man-III , New Yorker, May 9, 52-63, 2005.
Recommended:
Socolow, R.H., Can we bury global warming? Scientific American, Jul, 49-55, 2005.
Herzog, H. Eliasson, B., Kaarstad, O., Capturing greenhouse gases , Scientific American, Feb, 72-79, 2000.