Syllabus: Introduction to Environmental Sciences, ESci 100A

Instructor: Mathis Hain, EMS 308A, mhain@ucsc.edu
TA: Adrienne Ricker, EMS A35 or D206, aricker@ucsc.edu
Lectures: MWF 2:40-3:45pm, EMS D236
Discussion: Thursdays 6-8pm, EMS D236
Canvas course website: https://canvas.ucsc.edu/courses/19732

Problem sets: 8 weekly problem sets, not in exam weeks, due Mondays
Exams: Midterm (2:40-3:45pm, 2/8/2019), Final (4-7pm, 3/19/2019)
Requirements: You will need a computer for this class. No textbook.

Learning goals:

#1 Systems approach to the environment: You will learn a powerful way of describing the global environment as set of distinct components that interact to give rise to complex behaviors such as climate and the global cycles of carbon and nutrients.

#2 Quantifying the environment: You will learn how to translate environmental questions into equations that provide insights and understanding.

#3 Environmental change: You will build mathematical models of the natural environment, and you will use these models to analyze how humans are changing the environment.

Course description: The main purpose of this course is for you to develop a quantitative understanding of critical environmental problems our civilization is currently confronted with. To address and understand these problems requires not only knowledge of the relevant processes but also a set of concepts and tools that provide the framework to ask questions and calculate answers.

Environmental problems covered in this course: The course is centered around four main topics: (a) Earth's energy budget and climate change, (b) the global carbon cycle and ocean acidification, (c) land-use change, soil degradation and eutrophication, and (d) long-lasting pollution.

Exams: There will be two exams, a Midterm (2:40-3:45pm, 2/8/2019) and a Final (4-7pm, 3/19/2019). The Midterm exam counts for 20% and the final exam counts for 40% of your final grade.

Problem sets: There will be eight weekly assignments that together count for 40% of your final grade. We will discuss the assignments in class on each Monday afternoon, so you need to hand in your answers when class begins to earn points. Each problem set typically contains some multiple-choices questions, reading, calculations, and feedback.

Expectations: This course is designed to balance between the theory and the reality of global change, and you are expected to engage with both these aspects. There will be room for discussion during lectures and you are encouraged to participate based on the assigned reading, course content and your own experiences. This is important because learning how to articulate environmental questions and provide quantitative answers is the main purpose of this course.

Grading scale: >85% As, 85-70% Bs, 70-60% Cs, 60-50% Ds
If this scale results in too few As, Bs, and Cs, then a curve will be used to assign at least 10% As, 20% Bs, and 30% Cs.

Website: All course materials will be posted to the course Canvas page (https://canvas.ucsc.edu/courses/19732). The lecture slides will be posted after each lecture. The problem sets will be posted before the relevant information is covered in class.

Insight Maker: We will use www.insightmaker.com to build models of Earth's climate and of the global cycles of carbon and nutrients. Insight Maker is free and does not require you to install any software. For this course you will simply need to sign up for an account, which allows you to access your work using the web browser on any computer.

Inclusivity: Everyone is welcome to this class, and we can all expect to be treated with respect. Diverse opinions on environmental issues can and should be discussed in a civil and considerate manner.

Discussion sessions: There is a weekly Discussion session led by TA Adrienne Ricker, every Thursday 6-8pm. These sessions give you the opportunity to discuss any question you might have on the lectures, the problem sets, or the models you are building with Insight Maker.

Group work: You are allowed and even encouraged to work in groups. If you have an interesting discussion please bring it to class. You are trusted to be honest and that each of you hands in your own work.

Lecture calendar: There are ten weeks of class and three lectures per week. Because of MLK day and Presidents day there will be only 28 lectures in total, which will include review sessions and the Midterm.

Part 1:
Climate Change

Week 1
1: Introduction to ESci
2: Spheres of Earth
3: Reservoir Models I

Week 2
4: Energy
5: Black body radiation
6: Reservoir Models II

Week 3
X: ===MLK day===
7: Reflection/Albedo
8: The greenhouse effect

Week 4
9: Greenhouse model
10: Earth Climate
11: Climate models

Week 5
12: Ongoing climate change
13: Review: Climate
14: === MID-TERM EXAM ===

Part 2:
Environmental change

Week 6
15: The biological carbon cycle
16: The geologic carbon cycle
17: The history of the carbon cycle

Week 7
X: === Presidents day ===
18: Human carbon emissions
19: Ocean acidification

Week 8
20: The future carbon cycle
21: Nutrients
22: Agriculture

Week 9
23: Ocean productivity
24: Ocean biogeochemistry
25: Earth System models

Week 10
26: Review of reservoir models
27: Review of biogeochemistry
28: Discussion: Changing Earth