Advanced Environmental Systems

Geographical Sciences 301

Spring 2016

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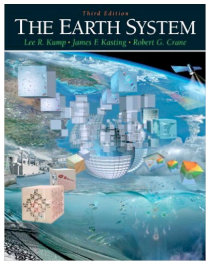
I. Course Text



We are using *The Earth System*, 3rd edition, by Kump, Kasting & Crane (**ISBN:** 9780321597793). The 2nd edition will work as well (especially if you can find it cheaper). Students may also find it useful to have a copy of an introductory physical geography text, such as the one used in GEOG201 by Christopherson (you can use virtually any edition you can find, no matter how old, or any one of countless texts in this area).

II. Course Description

GEOG301 is an advanced course in Environmental Systems, with emphasis in physical geography and Earth System Science. The major goal of this class is to provide a fundamental understanding of physical aspects and dynamics of the Earth as a system. GEOG301 builds on the material covered in GEOG201, and focuses on the climate and biosphere, and their interactions. The class explores how the Earth as a system is changing, both in the past and the future. Recent case studies integrate research in physical geography, remote sensing, and modeling in important applications to real world phenomena.

Learning Outcomes

1. To understand the fundamental laws and principles underlying the physical environment, how these control processes that occur on the land surface, in the oceans and in the atmosphere, and how these systems interact.
2. To understand the mechanisms that lead to variability in important physical characteristics such as air temperature, weather, climate, plants and other elements of the environment
3. To describe the key components, interactions and concepts that characterize the modern Earth system.
4. To understand the causes of change in the Earth System across temporal and spatial scales.
5. To understand human impacts Earth systems, and to have a quantitative comprehension of the role of these impacts on climate and biological resources.
6. To understand approaches for monitoring and modeling the Earth system using remote sensing, computer models, and other data.
7. To understand contemporary issues surrounding climate change and loss of biodiversity

III. Course Organization

The course is organized around five major topics: (1) Global Energy Balance and the Greenhouse Effect, which covers how the atmosphere and solar radiation interact; (2) Atmospheric and Oceanic Circulation- Water, Weather and Climate, which covers how the energy balance of the Earth interacts with the atmosphere and hydrosphere to produce climate and weather, and how the atmosphere and oceans interact; (3) Ecosystems, including carbon and nutrient cycling, biodiversity, and the interaction of biosphere with other Earth systems; (4) Global warming, past and present; (5) Monitoring and Modeling Earth Systems, where we present examples from our own research that illustrate the integrative approaches scientists use to explore systems and the impacts of humans on these systems.

Lectures

Lectures consist of material written by hand, accompanied by projected graphics. The instructors do not make their lecture notes available, but slides of the graphics will be available on Canvas. The text is meant to provide background to the lectures. While lectures cover some key concepts in the text, many new concepts are also presented only through lecture material. Supplemental reading material may also be assigned throughout the course.

Collaboration

GEOG301 is taught in a tiered-collaborative classroom. Throughout the semester, students will be asked to interact in collaborative fashion during lecture. No laptops, notebooks (IPad type devices) or phone use is allowed during lecture without special permission from the instructors, except during the collaborative segments and as directed. Please be considerate of your classmates and do not try to skirt this rule.

Assigned Seating

Students will be given assigned seats in the lecture hall. Please use your assigned seat and try to be early to class to avoid disruption. If you do get delayed, please find an appropriate time to go to your assigned seat. We will rotate the seating every few weeks.

IV. Course Requirements

Attendance is not required for this course. However, in class participation, activities, assessments and collaborative exercises are required and graded. We strongly suggest that students attend every lecture. There is no mechanism to make-up missed in-class activities and exercises and these will negatively effect your grade except as governed under University regulations.

We will assign approximately 8 homework assignments. The schedule for these assignments will be released during the semester and will generally be due about a week after they are assigned. Students may work together on these assignments, but the final work must be your own (i.e. in your own words, or using your own calculations). Presenting anyone else's work as your own, even if conducted collaboratively, will be considered academic dishonesty. No late assignments will be accepted, except as allowed under University regulations and with prior permission.

We will have two midterms and a comprehensive final exam. Exams may be a mix of multiple-choice, fill in the blank, short answer/diagram, and longer answer formats. We do not give early exams and please note the first mid-term is scheduled the week before Spring Break.

V. Course Grading

Course grades will be determined as the sum of the weighted scores of in-class activities and assessments, homework, the two midterms and final. We curve the final, cumulative points earned (not individual elements of the grade). We will use the plus/minus grading system.

Class participation, activities and assessments	20%
Assigned Problem Sets	30%
Midterm Exams (2)	30%
Final Exam	20%

VI. Course Prerequisites

Students must have completed GEOG201 and GEO211, or their equivalent (with permission of the instructors), before taking GEOG301. Concurrent enrollment in GEOG201/211 and GEOG301 is not allowed. Students will not receive credit for GEOG301 if they have taken GEOG398B. Students are also expected to know simple high school algebra, and how to use a scientific calculator (either as a device or in software emulation).

VII. Course Related Policies

The University expects each student to take full responsibility for their academic work and academic progress. GEOG301 follows all University of Maryland course related polices for undergraduate students with regards to areas such as academic integrity, classroom conduct, attendance, absences, missed assignments, and complaints about grading, among others. The complete list of these policies governing our course is located here: Course Related Polices.

VIII. Course Schedule[†]

Lecture	Reading	Date	
			Introduction: Global Change & System Models
1	1	26-Jan	**Class Introduction**
			Section I: Global Energy Balance and Greenhouse Effect
2	3	31-Jan	**Radiation and Radiation Laws**
3	3	2-Feb	**Planetary Energy Balance Models**
4	3	7-Feb	**Atmospheric Composition and Structure:**
5	3	9-Feb	**Greenhouse Gases**
6	3	14-Feb	**Global Energy Budget**
			Section II: Atmospheric/Ocean/Cryospheric Circulation
7	4	16-Feb	**Hydrologic Cycle, Atmospheric Moisture & Humidity**
8	4	21-Feb	**Adiabatic Processes**
9	4	23-Feb	**Winds & General Circulation of the Atmosphere**
10	4	28-Feb	**Upper Level Flow and Vorticity**
11	5	2-Mar	**Ocean Circulation & El Nino**
12	6	7-Mar	**Cryospheric Processes**
13		9-Mar	**Catch-up & Review**
14		14-Mar	**Midterm I (Kump Chps 1,3-6)**
15	2	16-Mar	**Modeling Systems: Daisy World**
		21-Mar	***Spring Break***
			Section IV: The Biosphere
16	8	28-Mar	**Nutrient Cycles**
17	8	30-Mar	**Nutrient Cycles**
18	9	4-Apr	**Ecosystems & Biodiversity**
19	9	6-Apr	**Ecosystems & Biodiversity**
20	13	11-Apr	**Biodiversity Through Time**
21	10	13-Apr	**Origins of Life**
22	11	18-Apr	**Effects of Life on the Atmosphere**
23		20-Apr	**Midterm II (Kump Chps 2, 8-11)**
			Section V: Global Warming & Mitigation
24	15	25-Apr	**Global Warming: Present and Future**
25	16	27-Apr	**Global Warming: Mitigations**
			Section VI: Putting it all Together
26		2-May	**Synthesis: The GEDI Mission**
27		4-May	**Synthesis: The Carbon Monitoring System**
28		9-May	**Course Summary & Review**
		18-May	**Final Exam 1:30 - 3:30**

[†]Course schedule may be revised in class and via Canvas by instructors during the semester