

Clark Atlanta

SU/197  
CAU Intro to ESS

**ATTACHMENT A**

**CLARK ATLANTA UNIVERSITY  
PHY 104:-INTRODUCTION TO EARTH SYSTEM SCIENCE**

**INSTRUCTION: DR. DENISE STEPHENSON-HAWK  
Spring 1997**

**Course Title:** Introduction to Earth Systems Science

**Instructors:** Denise Stephenson-Hawk, Ph.D.  
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**Department:** Physics

**Course Code:** Phy 104- Clement Hall Room 207

**Level:** /x/ Basic // Intermediate // Advanced

**Prerequisite:** /x/ None

**Credit Hours:** 4 Semester Hours (3 hours lecture/ 2 hours laboratory)

**Days/ Time:** Monday/ Wednesday/ Friday 2:00-2:50 P.M.

**Audience:** Targets Non-Science majors

**Office Hours:** M/W/F Noon- 2P.M.  
T-TH 11-12A.M.  
Other by Appointments

**Duration:** 14 Weeks

**Textbook:** **Earth Science: A Holistic Approach**  
Conte, D.J.; Thompson, D.J.; and Moses, L.L.

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### GENERAL REMARKS

1. Students are expected to attend class regularly and on time. **It is the students' responsibility to obtain class lecture notes and assignments when absent.** Frequent absence will adversely affect your grade, particularly, recitation absences.
2. Students should expect to spend approximately 2 hours studying outside of class for each hour spent in class. Homework will be assigned regularly. Late assignments will adversely affect your grade.
3. **If quizzes or exams are missed, make-ups will not be given.** Students that desire to make-up missed assignments must take a cumulative examination at the end of the semester.
4. Cheating on quizzes or exams will be dealt with in accordance to the policy provided in the college catalog.
5. Group study is encouraged, however, exams are individual efforts.

### COURSE SYLLABUS

**Course Objective:** An overview of the Earth Sciences from a systems perspective will be provided. Students will learn to view the Earth as a complex system of interacting components including the geosphere, biosphere, hydrosphere, atmosphere, and cryosphere. Course content will emphasize the mass and energy transfers between subsystems, including discussion of the social, economic, and ecological implications of global climate change. Relevant issues include global warming, stratospheric ozone depletion, deforestation, desertification, acid rain biodiversity, human population growth and food-water-energy resources. This course will meet general education requirement in the physical sciences in the College of Liberal Arts and Sciences.

#### Introduction      Overview of Earth System Sciences

1. Origins of the Universe
2. What is a system? Feedback stability, regulation, and homeostasis
3. The Earth's Vital Statistics: Shape, size, rotation, position in space.
4. Viewing the Earth From Space: How we can study global change from remote sensing. NASA's mission to Planet Earth.

#### Components of the Earth's Systems

##### 5). The Atmosphere

Origin, composition, and structure of the atmosphere  
Solar energy and the Earth's heat engine.  
Atmospheric circulation and winds  
Clouds, moisture, and precipitation  
Weather and Climate  
Global Warming and Ozone depletion  
Desertification

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- 6). Chemistry of Atmosphere and Oceans
  - Origin of Life
  - Acid Rain
  - Ozone Hole
  - Sources and sinks/pollution
  
- 7). The Biosphere
  - Primary Production and the Food Chain .The photosynthesis-respiration cycle
  - Cycles of Carbon, Nitrogen, and Phosphorous
  - Soil and Vegetation Classification
  - Deforestation
  - Geological Evolution of Life, the Oceans, and Atmosphere
  - Loss of Biodiversity - Health Effects of Air Pollution
  
- 8). The Geosphere
  - Igneous, Metamorphic, and Sedimentary Rocks
  - The Rock Cycle
  - Weathering and the Geochemical Cycling of Elements
  - The Earth's Interior and Plate Tectonics
  - Geologic Perspectives on Climate Change
  - Geologic Evolution of Life, the Oceans, and Atmosphere
  
- 9). The Hydrosphere
  - The Hydrologic Cycle
  - Mechanical and Chemical loads of Streams
  - Groundwater, Aquifers, Water supply and quality
  - The Cryosphere: Glaciers and Ice Ages
  - The Ocean-Atmosphere Connection
  - Marine Geochemical Cycle
  - El Nino and the Southern Oscillation
  
- 10). The Integrated Earth System: A Miracle of Design
  - An overview of systems interactions
  - Understanding the Earth's system diagram
  - Introduction to modeling the Earth's system's
  - Geoengineering
  
- 11). Policy and Socio-Economic Implication of Global Change
  - Human Population Growth
  - Food, water, and energy resources in the future
  - A Global Marshall Plan: Can it Work?

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### GRADING POLICY

Class Participation/Attendance	10%
Quizzes (10)	40%
Exams (3)	30%
Reports	15%
Homework Notebooks	5%

A	90-100
B	80-89
C	70-79
D	60-69
F	below 60

#### Homework Assignments

Homework assignments, in the form of applied problems in physics, will be given throughout the semester to assist in developing your skills of interdisciplinary critical thinking. Some of the problems are not designed with the intent of your providing a numerical solution, but rather to see how well you can assimilate the concepts that you have learned in physics, mathematics, computer science, English, etc. The assignment is also intended to assist you in developing your technical writing style. Keep in mind that great ideas are only as good as your ability to communicate them either orally or verbally.

#### FOR EACH HOMEWORK ASSIGNMENT YOU SHOULD:

1. Clearly delineate all assumptions
2. State and define all laws of physics you believe to be applicable to the assignment.
3. Convey your logical thought process in words.
4. Outline, if possible, a method to solve the problem to ascertain a numeric solution.
5. Seek assistance from your fellow classmates.

“...Minds grow through academic challenge. Challenge comes from teachers, curriculum, peers, and from within individual students as they have learned to strive for excellence. Much of the emphasis in our American culture is on how to get by easily and how to avoid hard work. Too often shoddy performance and products are considered acceptable. However, for those who will become leaders in the sciences, arts, literature, medicine, research, business and the disciplines, and early inculcation of the pursuit of excellence, and a willingness to work very hard and to persist, seem to be essential ingredients of personal achievement...”

Paraphrased from GSG Newsletter  
Summer 1992

Clark Atlanta

Senior  
CAU Integrative + Systemic

**ATTACHMENT B**

**PHYSICS/BIOLOGY/CHEMISTRY  
INTEGRATIVE AND SYSTEMIC APPROACHES TO UNDERSTANDING EARTH SCIENCES**

**Description:**

PHY 420(?) INTEGRATIVE AND SYSTEMATIC APPROACHES TO UNDERSTANDING EARTH SCIENCE..

Credit hours: 3 lecture hours. Prerequisites: Completion of first semester junior (level) courses in biology, physics, chemistry, political science, mathematics, or computer sciences. The course will explore methods of problem solutions that integrate working knowledge of various subdisciplines comprising Earth System Sciences. Students will be required to assimilate theory and principles across ESS subdisciplines, as well as the mathematical and computational subdisciplines. Case studies of three natural disasters will be the focus of this interdisciplinary course, thereby allowing students working in multidisciplinary teams to address real world problems through the application of academic knowledge; *in situ*, hands-on, real time scientific data; and use of novel, computer-based techniques. This combination of academic, research and practical, hands-on approach is expected to significantly enhance students ability to think critically across various disciplines.

**Enrollment:** Class will be limited to 15 students. Students will be divided into three groups (5 students each) for discussions and completion of group projects/assignments.

**Lead Course Instructors:**

**Textbook:** Given the interdisciplinary and multidisciplinary nature of the course, no single text book will be utilized for the course. Instead, a carefully prepared set of selected readings from various sub-disciplines will be placed upon reserve in Library East for student use.

COURSE CONTENT

This capstone Earth System Science course will be compartmentalized into two (2) main parts. Part I of the course will include reviews and overviews of

1. the cosmic/macro scale view of Earth Science and ESS (Introduction)

Representative topics:

- atmospheric physics (temperature, humidity, winds, rainfalls radiation balance)
- atmospheric chemistry (ozone, greenhouse gases, chemical reactions in the atmosphere)
- oceans (sea surface temperature, circulation and heat transport, marine biosphere, topography and roughness)
- land (land biosphere, vegetation structure and functions, ice and snow cover, water cycle, radiative properties, soil moisture)
- solid Earth (crustal movements, gravity and magnetic fields)

2. the scientific components related to each of the three natural disasters identified for case studies in the course (definition, cause, manifestation, etc. of each natural disaster)

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3. philosophy of science; scientific method; scientific critique; scientific writing
4. critical thinking: definition, how to ... ; tips for ... ; etc.
5. use of the Internet and WWW to access information and data
6. modeling: what is it; components of modeling; constructing models
7. computer programs and modules for use in constructing appropriate models for each case study

Part II of the course will include student participation in discussions, data collection/manipulation, library searches/data acquisition and hands-on approaches to completing group assignments/projects relative to the three case studies on natural disasters. In this portion of the course, students will;

- (a) use computer and applicable software to simulate initiation, development, tracking, impact and aftermath of each of the three natural disaster case studies. It is anticipated that various computer program, software packages and modules will be utilized here, including but not limited to, COMET, STELLA, PATHFINDER, and EARTNET.
- (b) collect, and if necessary, generate data/measurements (remote sensing, *in situ* or archived) from applicable sources for use in completing assignments.

The Spring 1997 piloted course will focus on three natural disasters (I.e., three case studies):

- a. floods
- b. hurricanes
- c. earthquakes

Components and points which students must address as part of their projects and assignments to gain an holistic view of these three natural disasters include:

1. impact of each case study on natural resources
2. economic impacts
3. possible threats to national security
4. human impacts: health related issues; individual to population levels
5. environmental impacts: individual organismal to population levels; biodiversity and changes in habitat-, species composition; migrations; evolutionary process; restoration; pollution; etc.
6. policy issues: possible modifications; changes; implementation of new ones; awareness and education; and,
7. technology: from the perspective of usage, current practices and new advances.