"If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in."
Rachel Carson

UNIVERSITY OF TEXAS AT SAN ANTONIO
College of Education and Human Development
Department of Interdisciplinary Learning and Teaching

IDS 2413/3211
Earth Systems Science/Advanced Earth Systems Science Lab
Spring 2008

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COURSE DESCRIPTION

IDS 2413 – (3-0) 3 hours credit
This course provides a look at the Earth system as a whole. Emphasis will be on the interrelationships between biological, geological, hydrological, climatological, and human systems on local, continental and global scales. The interactions between the hydrosphere, atmosphere, biosphere, cryosphere, and lithosphere that together make up the earth system will be studied. This interdisciplinary view of our planet highlights the manner in which all systems of the earth control or influence each other. **Prerequisite: Completion of Mathematics and Science Core Curriculum requirements.**

IDS 3211 – (0-3) 1 hour credit
Familiarizes students with laboratory tools, techniques, and safety issues and allows them to form a better understanding of topics in earth systems science. **Prerequisite: Completion of Mathematics and Science Core Curriculum requirements**

KNOWLEDGE BASE

The basis for this course is the *National Science Education Standards (NSES)* for science content. These standards are designed to guide the nation toward a scientifically literate society. Founded in exemplary practice and research, the Standards describe a vision of the scientifically literate person and present criteria for science education that will allow that vision to become reality. Teachers must have theoretical and practical knowledge and abilities about science, learning, and science teaching. General science competencies for EC-4 and 4-8 in Texas (TEKS *Standards*) are correlated to the NSES and will also be addressed in the course. Lecture topics**,** laboratory activities and assignments are chosen to enhance and model course topics and reflect an understanding of the *National Science Content Standards* and the *Texas Essential Knowledge and Skills* for elementary and middle school science curricula. The *National Science Education*

Standards can be downloaded from **http://books.nap.edu/html/nses/** . The *TEKS* can be found at **http://www.tea.state.tx.us/teks/.**

COURSE OBJECTIVES

As caring, responsible and scientifically literate persons, students enrolled in this course will be able to:

1. exhibit a holistic understanding of Planet Earth, recognizing that it is a system comprised of changing and interacting subsystems;
2. demonstrate an aesthetic appreciation of, and respect for, the beauty and value of the Earth, its grand cycles and its life;
3. exhibit a holistic understanding of individual organisms, recognizing that each is a system comprised of changing and interacting subsystems, and that each is also a part of environmental processes;
4. demonstrate an awareness that humans are unique, that our activities may seriously impact Planet Earth, and that individually and collectively we have the responsibility to make informed decisions on issues affecting the future of our planet and its inhabitants;
5. demonstrate wise use of Earth's limited resources;
6. access, sort, interpret, analyze, evaluate and apply information from a wide variety of sources;
7. use current technologies as tools to access and process information;
8. demonstrate skills for engaging in individual and collaborative scientific and social endeavors;
9. demonstrate effective communication skills within the context of science;
10. show an understanding of the basic concepts and principles of science, and apply them to identify issues, solve problems, make decisions and understand the world;
11. participate in "hands on" and inquiry-based activities in classroom and field settings;
12. participate in classroom and outside experiences, assignments, and activities that promote the *National Science Education Standards* and the *TEKS*;
13. acquire skills needed to collect and interpret data and,
14. use the Internet for research.

CONCEPTUAL FRAMEWORK

(Excerpts from Dr. Art's Guide to Planet Earth by Art Sussman)

Earth is Whole

"One of our civilization's major discoveries is that we live on a round planet. Today we are in the middle of a more awesome discovery about the nature of our home. Earth is not flat. Earth is not round. Earth is whole."

"Earth is Whole" means that all the planet's physical features and living organisms are interconnected. They work together in important and meaningful ways. The clouds, oceans, mountains, volcanoes, plants, bacteria and animals are all functioning parts of Earth's Operating System.

Systems within Systems within Systems

"We use the word "system" when we want to describe something that is made up of different kinds of parts that join together to form an interconnected whole. Learning to think in terms of systems is very useful because we are surrounded by all sorts of systems. In fact, each of us is our own little system."

The Earth System

*"In examining Earth as a whole, we use systems thinking to focus on **Earth's matter, Earth's energy and Earth's life**. In other words, we are going to examine from a systems point of view the stuff (matter) that exists on planet Earth, the energy that makes things happen on planet Earth, and the organisms that make our planet unique in the solar system."*

COURSE CONVENTIONS

Taking a course online is very different than attending a course on campus. Although the course is designed to support your learning, you must be prepared to learn in a different way. **The VARK Learning Style Evaluation** is a good starting point for you to find out what your learning preferences and strengths are. Once you have completed the questionnaire and received feedback, take a little time to think about incorporating some of the suggested activities in your learning patterns.

Some critical issues in whether you will enjoy this course and will successfully master the content are the following:

1. You must have access to a computer and the Internet, and you must know how to use both.
2. You need to be a motivated and disciplined learner with good time management skills - it is easy to fall behind.
    - Be an active participant in your own learning
    - Self-direct your learning through self-discipline and metacognition
3. You are open to communication with the instructor and your classmates through e-mail and online discussions.
4. You are willing to
    - Ask questions when you are unsure of what to do
    - Report problems with either technology or assignments
    - Turn in assignments on time

REQUIRED COURSE MATERIALS

(1) *Dynamic Earth: An Introduction to Physical Geology*, fifth edition, by Skinner, Porter, and Park (publisher: John Wiley and Sons; ISBN 0-471-15228-5) – If you are near the University of Texas at San Antonio (UTSA), you can purchase the textbook at the bookstore. However, if you are not located closely to UTSA, you can purchase the book directly from the publisher through this link: **http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471152285.html**.

(2) WebCT Student Learning Guide

Both course materials can be purchased from the UTSA bookstore as a package (ISBN 0-471-66276-3). You can purchase the package directly from the bookstore or through this link: http://www.bkstr.com/webapp/wcs/stores/servlet/StoreCatalogDisplay?storeId=15178&langId=-1&catalogId=10001.

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COURSE DESIGN

Assignments: These include inquiry-based activities, reports on virtual and hands-on labs, and a web-based project.

Readings: Readings consist of online and textbook assignments. Expect a minimum of 40 pages per week.

Tests: The midterm and final exam will consist of short-answer essays and will be open book and open notes.

ASSESSMENT

Varied formative and summative assessment components are collected throughout the semester. Each chapter module will be accompanied by a hands-on exploration and an inquiry-based, interactive activity. If an assignment is turned in late, 10 points will be deducted for every day that it is late, regardless of the reason. In addition, there will be a final project that focuses on a particular science topic. The midterm and final exam will allow students to apply understanding they gained in solving problems based on the topics explored in the course of the semester.

GRADING SCALE

>90	A
89-80	B
79-70	C
69-60	D
<60	F

GRADE DISTRIBUTION

Lab Reports:	25%
Midterm:	15%
Final Exam:	15%
Project:	15%
Assignments:	30%

PROFESSIONALISM

An important part of this course is the growth students make toward becoming professional educators. Students are expected to submit work that represents their best effort. All assignments must conform to university policies governing academic dishonesty. If you are not sure what constitutes plagiarism, please visit **http://www.indiana.edu/~wts/wts/plagiarism.html**. All work submitted must be edited for grammar, spelling and correct sentence structure. **The instructor reserves the right to deduct points from any assignment that does not conform to professional writing standards.**

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UNIVERSITY POLICIES

The University expects every student to maintain a high standard of individual integrity for work done. In cases of scholastic dishonesty, the faculty member responsible for the class may initiate disciplinary proceedings against the student. In this class all UTSA procedures will be followed and the necessary paperwork will be filed with the Office of Student life and the College of Education. The course instructor will recommend a penalty to the Office of Student Life, which may impose an additional university penalty. Students are expected to be above reproach in scholastic activities. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. "Scholastic dishonesty includes, but is not limited to cheating, plagiarism, collusion; the submission for credit any work or materials that are attributable in whole or in part to another person; taking an exam for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts" (Regent's Rules and Regulations, Part One, Chapter VI, Section 3, subsection 3.2, subdivision 3.22). Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. See **http://www.utsa.edu/infoguide/appendices/b.cfm** for the Student Code of Conduct.

ACCOMODATIONS FOR STUDENTS WITH SPECIAL NEEDS

If any member of this class feels that he/she has a disability and needs special accommodations of any nature whatsoever, the instructor will work with you and the Office of Disability Services to perform in this class. Students with disabilities must be registered with the Office of Disability Services located in MS 2.03.18 (Main Campus, 458-4157) or BV 1.302 (Downtown, 458-2838). If a student requires accommodations related to a disability, he or she should make an appointment with the course instructor to discuss these special needs. See **Disabled Student Services.**

FLEXIBILITY CLAUSE

Flexibility is one key to learning. The instructor reserves the right to modify or change the assignments, sequence of assignments, or weight of assignments as necessary and as reflected by the needs of individuals or the group during the semester. This course outline represents a tentative listing of information and modifications may be assigned as necessary and appropriate.

GENERAL STATEMENTS

For technical support on this WebCT course, please visit **http://www.webct.com/students** or **https://webct.utsa.edu/contact.htm**.

UTSA Diversity Statement

The University of Texas at San Antonio (UTSA) is committed to the success of every student, staff and faculty member – on campus, at work and in life. For all members of our university community to excel, we must preserve freedom of thought and expression and promote a climate of respect that honors the rights, safety, dignity and worth of every individual. We choose to be members of this community and pledge our respect for the well-being of all its members.

To further strengthen our wonderful UTSA community, we affirm the following values:

- **RESPECT**. We respect the dignity, worth and contribution of all individuals.
- **INCLUSIVENESS**. We include people of every race, culture, ethnicity, ability, religion, gender, sexual orientation and socio-economic status, and we include a diversity of ideas and points of view.
- **RESPONSIBILITY**. We take responsibility for struggling against and eliminating hate, injustice, discrimination, harassment, bigotry, violence or intimidation of any kind.
- **SELF-EXAMINATION**. We examine our own biases and struggle against racism, sexism, homophobia and other forms of oppression.
- **CIVILITY**. We recognize differences among people as a natural thing and see each new experience working with diverse groups as an opportunity to be better than we were before. We listen, and when we disagree, we work to resolve all disagreements with integrity.
- **INTEGRITY**. We practice personal and academic integrity and value service, citizenship and leadership.
- **CELEBRATION**. We celebrate all of the many backgrounds, experiences, similarities and differences among members of the university community.

For all our differences, we share one world.
To embrace diversity is to welcome the differences and delight in the sharing.

Department of Interdisciplinary Learning and Teaching Mission and Goal Statements:

MISSION

The mission of the department of ILT is to foster the intellectual and professional growth and integrity of students and faculty through critical reflection and dialogue, civic responsibility, and leadership. This mission will be accomplished by nurturing a community of interdisciplinary learners who:

- Promote excellence in academic and pedagogical knowledge and research
- Engage in reflective practice
- Embody a strong professional identity and can articulate their philosophies and values
- Value diversity and multiple perspectives
- Promote equality and social justice
- Care about their students and their profession

- Advocate for educational change and reform

GOALS
The department of ILT will create a context that nurtures interdisciplinary learners who:

- Acquire and demonstrate content and discipline knowledge
- Demonstrate an awareness and acknowledgement of and engagement in research-based, reflective, culturally responsive practices
- Are producers, disseminators, and critical consumers of research
- Demonstrate an awareness and acknowledgment of and engagement in social justice and equitable practices
- Articulate their professional philosophy and demonstrate a strong professional identity

"Must we always teach our children with books? Let them look at the mountains and the stars up above. Let them look at the beauty of the waters and the trees and flowers on earth. They will then begin to think, and to think is the beginning of a real education."

David Potis

SBEC SCIENCE STANDARDS
Grades EC-4 and 4-8

Standard VI. **The science teacher understands the history and nature of science.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
6.1k the limitations of the scope of science and the use and limitations of physical, mathematical, and conceptual models to describe and analyze scientific ideas about the natural world;
6.2k that science is a human endeavor influence d by societal, cultural, and personal views of the world;
6.3k that scientific ideas and explanations must be consistent with observational and experimental evidence;
6.4k how logical reasoning is used in the process of developing, evaluating, and validating scientific hypotheses and theories;
6.5k the roles that publishing and peer review play in developing and validating scientific knowledge;
6.6k principles of scientific ethics in reporting data and in experimenting with living organisms, including human subjects;
6.7k that scientific theories have predictive power;
6.8k that scientific theories are constantly being modified to conform more closely to new observational and experimental evidence about the natural world;
6.9k the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge; and
6.10k the relationship between science and technology.

Application: What Teachers Can Do
The beginning teacher is able to:
6.1s provide students with opportunities to examine the types of questions that science can and cannot answer;
6.2s design and conduct scientific investigations to answer questions;
6.3s analyze, review, and critique the strengths and weaknesses of scientific explanations, hypotheses, and theories using scientific evidence and information;
6.4s analyze ways in which personal or societal bias can affect the direction, support, and use of scientific research;
6.5s use key events and knowledge of individuals from throughout the history of science to illustrate scientific concepts;
6.6s design instruction that accounts for the contributions to science of individuals from a variety of cultures; and
6.7s use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge.

Standard VII. **The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.**

Teacher Knowledge: What Teachers Know

The beginning teacher knows and understands:

7.1k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;

7.2k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;

7.3k concepts related to changes in populations and to characteristics of human population growth;

7.4k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;

7.5k the properties of natural ecosystems and how natural and human processes can influence changes in environments;

7.6k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and

7.7k the role science can play in helping resolve personal, societal, and global challenges.

Application: What Teachers Can Do

The beginning teacher is able to:

7.1s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;

7.2s apply scientific principles and processes to analyze factors that influence personal choices concerning fitness and health;

7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;

7.4s analyze how factors such as population growth, resource use, population distribution, over consumption, technological capacity, poverty, and societal views can influence changes in environments;

7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and

7.6s demonstrate how science can be used to help make informed decisions about societal and global issues.

Standard IX. **The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.**

Teacher Knowledge: What Teachers Know

The beginning teacher knows and understands:
9.1k that living systems have different structures to perform different functions;
9.2k that organisms have basic needs;
9.3k that organisms respond to internal or external stimuli;
9.4k the relationship between organisms and the environment;
9.5k the life cycles of organisms; and
9.6k how populations or species evolve through time.
9.7k all content specified for teachers in grades EC–4;
9.8k the structure and function of living systems;
9.9k reproduction and the mechanisms of heredity;
9.10k adaptations of organisms and the theory of evolution;
9.11k regulatory mechanisms and behavior; and
9.12k the relationships between organisms and the environment.

Application: What Teachers Can Do
The beginning teacher is able to:
9.1s describe stages in the life cycle of common plants and animals;
9.2s identify characteristics of plants and animals;
9.3s identify adaptive characteristics and explain how adaptations influence the survival of populations or species;
9.4s describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next;
9.5s analyze the role of internal and external stimuli in the behavior of organisms;
9.6s compare and contrast inherited traits and learned characteristics;
9.7s describe ways living organisms depend on each other and their environment for basic needs;
9.7s describe ways living organisms depend on each other and their environment for basic needs;
9.8s analyze the characteristics of habitats within an ecosystem; and
9.9s identify organisms, populations, or species with similar needs and analyze how they compete with one another for resources.
9.10s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;
9.11s analyze how structure complements function in cells, organs, organ systems, organisms, and populations;
9.12s identify human body systems and describe their functions;
9.13s distinguish between dominant and recessive traits and predict the probable outcomes of genetic combinations;
9.14s explain that every organism requires a set of instructions for specifying its traits;
9.15s describe how an inherited trait can be determined by one or by many genes and how more than one trait can be influenced by a single gene;
9.16s compare and contrast sexual and asexual reproduction;
9.17s compare traits in a population or species that enhance its survival and reproduction;
9.18s describe how populations and species change through time;
9.19s analyze responses in organisms that result from internal and external stimuli;

9.20s describe feedback mechanisms that allow organisms to maintain stable internal conditions;
9.21s identify the abiotic and biotic components of an ecosystem;
9.22s describe the interrelationships among producers, consumers, and decomposers in an ecosystem; and
9.23s analyze and describe adaptive characteristics that result in a population's or species' unique niche in an ecosystem.

Standard X. **The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in Earth and space science.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
10.1k properties of Earth materials;
10.2k changes in Earth systems; and
10.3k characteristics of the Sun, moon, and stars.
10.4k all content specified for teachers in grades EC–4;
10.5k the structure and function of Earth systems;
10.6k cycles in Earth systems;
10.7k the role of energy in weather and climate;
10.8k characteristics of the solar system and the universe;
10.9k the history of Earth; and
10.10k the history of the universe

Application: What Teachers Can Do
The beginning teacher is able to:
10.1s describe properties and uses of rocks, soils, water, atmospheric gases, and other Earth materials;
10.2s describe characteristics of weather, tools for making weather measurements, and changes in weather;
10.3s describe forces and processes that change the surface of Earth (e.g., glaciers, earthquakes, weathering);
10.4s identify objects in the sky and describe their characteristics (e.g., Sun as Earth's major energy source, position of the planets in relation to the Sun); and
10.5s describe the basic characteristics of the Sun and other stars; analyze the consequence of the moon's orbit around Earth (e.g., phases of the moon) and Earth's orientation and movement around the Sun (e.g., day and night, the seasons).
10.6s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;
10.7s analyze and describe characteristics of the geosphere, the hydrosphere, the atmosphere, and the biosphere;

10.8s analyze a variety of Earth cycles (e.g., rock cycle, water cycle, carbon cycle, nitrogen cycle);
10.9s analyze and describe how human activity and natural processes, both gradual and catastrophic, can alter Earth systems;
10.10s identify properties of and analyze interactions among the components of the solar system;
10.11s explain weather measurements and analyze weather processes;
10.12s analyze how the Earth's position, orientation, and surface features affect weather and climate; and
10.13s examine characteristics of the universe, such as distances, stars, and galaxies, and describe scientific theories of the origin of the universe.

Standard XI. **The science teacher knows unifying concepts and processes that are common to all sciences.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
11.1k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;
11.2k how patterns in observations and data which explain natural phenomena allow predictions to be made;
11.3k how the concepts and processes listed below provide a unifying framework across the science disciplines:
- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium; and
- form and function;

11.4k properties and patterns of systems can be described in terms of space, time, energy, and matter;
11.5k how change and constancy occur in systems;
11.6k the complementary nature of form and function in a given system; and
11.7k how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

Application: What Teachers Can Do
The beginning teacher is able to:
11.1s apply the systems model to identify and analyze common themes that occur in physical science, life science, and Earth and space science;
11.2s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;
11.3s analyze the general features of systems (e.g., input, process, output, feedback);

11.4s analyze the interactions that occur between the components of a given system or subsystem;
11.5s analyze the interactions and interrelationships between various systems and subsystems; and
11.6s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change (e.g., evolution).