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Earth Science (ESCI) 1520 Introduction to Earth Science Lecture and Laboratory (4 Units) CSU:UC
[formerly Earth Science 1]

Advisory: Successful completion of Mathematics 1060 with a grade of "C" or better and eligibility for English 1500 strongly recommended.

Total Hours: 48 hours lecture; 48 hours lab (96 total hours)

Catalog Description: This course is an introduction to the essentials of Earth Science with a laboratory. The sciences that collectively make up Earth science include geology, oceanography, meteorology, and astronomy. This course focuses on the interactions between physical and chemical systems of the Earth such as the tectonic cycle, rock cycle, and hydrologic cycle. This course covers the distinction between weather and climate and an understanding of Earth's place in the larger universe.

Type of Class/Course: Degree Credit

Texts: Tarbuck, Edward J., Frederick K. Lutgens, Dennis Tasa. *Earth Science*. 14th ed. San Francisco: Pearson, 2015. Print.

Fagin, Dan. *Toms River*. 2nd. Washington: Island P, 2015. Print.

Additional Required Materials: none

Course Objectives:

By the end of the course, a successful student will be able to:

- 1 Explain and practically apply the principles of the scientific method
- 2 Demonstrate a fundamental understanding of and be able to practically apply concepts, principles and interactions of Earth's systems including:
 - a) Hydrologic Cycle
 - b) Rock Cycle
 - c) Plate Tectonics Cycle
 - d) Solar System
 - e) Geologic Time
 - f) Weather and Climate
- 3 Be able to explain basic properties of minerals and rocks and to identify representative samples, and
- 4 Explain the processes that shape the Earth and how they change over geologic time
Communicate complex course concepts effectively in writing and diagrams

Course Scope and Content (Lecture):

Unit I Introduction to Earth Science

- A. The sciences that collectively make up Earth science
- B. The nature of scientific inquiry
- C. The stages in the formation of solar system
- D. Earth's four major spheres
- E. Earth's internal structure
- F. Major features of continental and oceanic basins
- G. Earth system science

Unit II Earth Materials

- A. Matter including atoms and elements
- B. Minerals: Building blocks of rocks
- C. Properties of minerals
- D. Mineral resources
- E. The rock cycle
- F. Igneous rocks
- G. Sedimentary rocks
- H. Metamorphic rocks

Unit III Sculpturing Earth's Surface

- A. Mechanical and chemical weathering
- B. Soil and soil profiles
- C. Mass wasting – the work of gravity
- D. The hydrologic cycle
- E. Running Water
- F. Groundwater
- G. Glaciers, glacial erosion and glacial deposition
- H. Deserts
- I. Wind, wind erosion and wind deposition

Unit IV Forces Within the Earth

- A. Plate Tectonics: A scientific revolution unfolds
- B. The Plate Tectonics model
- C. What drives plate tectonics
- D. Earthquakes and seismology
- E. Earthquake destruction
- F. Earth's interior
- G. Volcanoes and volcanic hazards
- H. Plate tectonics and volcanic activity
- I. Crustal deformation
- J. Mountain building

Unit V Deciphering Earth's History

- A. A brief history of geology
- B. Relative dating principles
- C. Dating with radioactivity
- D. The geologic time scale
- E. Is Earth unique?

- F. Precambrian history
- G. Life explodes in the Paleozoic Era
- H. Age of the dinosaurs in the Mesozoic Era
- I. Age of mammals in the Cenozoic Era

Unit VI The Global Ocean - Oceanography

- A. The ocean floor
- B. Geography of the oceans
- C. Comparing the oceans to the continents
- D. Composition of seawater
- E. The diversity of ocean life
- F. The ocean's surface circulation
- G. Ocean waves
- H. Shoreline features
- I. Tides

Unit VII Earth's Dynamic Atmosphere (Meteorology)

- A. Weather and climate
- B. Composition of the Atmosphere
- C. Earth – Sun relationship
- D. Principles and factors affecting atmospheric change
- E. Formation and classification of clouds
- F. Formation and classification of precipitation
- G. Air pressure and winds
- H. Weather patterns and severe storms
- I. World climates
- J. Climate-feedback mechanism
- K. Some possible consequences of global warming

Unit VIII Origins of Modern Astronomy

- A. Ancient astronomy
- B. The birth of modern astronomy
- C. The motions of Earth
- D. Touring our solar system
- E. Earth's moon
- F. Terrestrial and Jovian planets
- G. Small solar system bodies
- H. Light
- I. Spectroscopy
- J. The active sun
- K. The Universe
- L. Stellar evolution
- M. Galaxies and galactic clusters
- N. The Big Bang Theory

Course Scope and Content (Lab):

Unit I SI and Metric System

- A. Understanding the Metric System (prefixes)

- B. Conversions (Dimensional Analysis)
 - C. Measuring Density of Materials
 - D. Comparing Density of Important Rock Types
 - E. Scientific Method
- Unit II Study of Minerals
- A. Mineral Properties
 - B. Classification of Minerals
 - C. Identification of 24 Unknown Minerals
 - D. Important Mineral Uses
- Unit III Igneous, Sedimentary, Metamorphic Rocks and the Rock Cycle
- A. Properties of Igneous Rocks
 - B. Identification of 12 Unknown Igneous Rocks
 - C. Properties of Sedimentary Rocks
 - D. Identification of 12 Unknown Sedimentary Rocks
 - E. Properties of Metamorphic Rocks
 - F. Identification of 12 Unknown Metamorphic Rocks
 - G. The Rock Cycle
- Unit IV Introduction to Aerial Photographs and Topographic Maps
- A. Recognition of Scale on Topographic Maps
 - B. Calculation of Gradient on Topographic Maps
 - C. Recognition of Geologic Landforms
 - D. Construction of Geologic Cross Sections
 - E. Aerial Photographs
- Unit V Running Water and Groundwater
- A. Streamflow and Changes to Stream Downstream
 - B. Erosion, Transportation, and Deposition in Streams
 - C. Shaping Stream Valleys
 - D. Drainage Patterns
 - E. Surface Processes
 - F. The Importance of Groundwater
 - G. Porosity and Permeability
 - H. Wells
 - I. Subsidence
- Unit VI Understand the Plate Tectonic Model
- A. Earth's Major Lithospheric Plates
 - B. Plate Boundaries
 - C. Divergent Boundaries
 - D. Convergent Boundaries
 - E. Transform Boundaries
 - F. What Drives Plate Motions
 - G. Students Build Their Own Tectonic Plate Boundary

- H. Faults and Folds

- Unit VII Earthquake and Earthquake Epicenter Location
 - A. What is an Earthquake?
 - B. Instruments Used to Measure Earthquakes
 - C. Locating an Earthquake Epicenter
 - D. Measuring the Size of an Earthquake
 - E. Rock Deformation

- Unit VIII Volcanoes and Volcanic Hazards
 - A. Nature of Volcanic Eruptions
 - B. High versus Low Viscosity Magma and Lava
 - C. What is Extruded During Eruptions
 - D. Shield Volcanoes
 - E. Cinder Cones
 - F. Composite Cones
 - G. Volcanic Hazards Mapping

- Unit IX Geologic Time (Relative and Radioactive Dating)
 - A. Dating Rock Layers Using Relative Age Principles
 - B. Correlation of Rock Layers
 - C. Identification of Fossils and Fossil Types
 - D. Dating Rock with Radioactivity
 - E. Construction of Sequence of Rock Using Both Relative and Radioactive Dating
 - F. Recognition of Division on Geologic Time Scale

- Unit X Oceanography
 - A. Geography of the Oceans
 - B. Salinity and Sources of Sea Salts
 - C. Passive Continental Margins
 - D. Active Continental Margins
 - E. Mapping of Hawaiian Island and Emperor Seamount Chains

- Unit XI Waves, Currents, and Tides
 - A. Wave Characteristics
 - B. Waves when they Approach the Surf Zone
 - C. Describing Motion of waves using the Wave Table
 - D. Currents
 - E. Causes of Tides
 - F. Tidal Patterns and Reading Monthly Tidal Cycle

- Unit XII Earth-Sun Relations
 - A. Earth's Motions – Rotation versus Revolution
 - B. Cause of Seasons based on Earth's Orientation
 - C. Solstices and Equinoxes
 - D. The Fate of Incoming Solar Radiation

- Unit XIII Atmosphere
 - A. Measuring Air Pressure

- B. Factors Affecting Wind
- C. General Circulation of the Atmosphere
- D. Measuring Wind
- E. Mapping Idealized Global Circulation Patterns

Unit XIV Weather and Climates

- A. Recognition of Weather Associated with Air Masses
- B. Thunderstorms
- C. Tornadoes
- D. Hurricanes
- E. Long range Climate Patterns
- F. Climate Associated with Tectonics

Unit XV Modern Astronomy and the objects in the Solar System

- A. The Birth of Modern Astronomy
- B. An Overview of the Planets
- C. Earth's Moon
- D. Minor members of the Solar System
- E. Understanding Scale in the Solar System

Unit XVI The Universe and Stellar Evolution

- A. Measuring Distance to the Stars
- B. Stellar Color and Temperature
- C. Plotting Stars on the Hertzsprung-Russell Diagram
- D. Stellar Evolution
- E. Types of Galaxies
- F. The Big Bang

Learning Activities Required Outside of Class:

The students in this class will spend a minimum of 6 hours per week outside of the regular class time doing the following:

1. Studying text, chapter handouts and students learning objectives
2. Answering questions at end of chapter
3. Skill practice
4. Completing required reading
5. Problem solving activity or exercise
6. Written work
7. Field trips

Methods of Instruction:

1. Assign reading topics in the text book and selected references
2. Class lectures will be used to clarify and extend the theoretical and factual concepts present in the text
3. Class discussions and problem solving sessions
4. Audiovisual materials, relative to some unit of study will be shown to supplement lecture materials

5. Problem sets and questions from the text will be assigned
5. Selected experiments will be assigned in the laboratory for individual student learning
6. Demonstration experiments and lecture demonstrations will be used in the classroom and laboratory

Methods of Evaluation:

1. Substantial writing assignments including:
 - a. Essay exams
 - b. Laboratory reports
 - c. Research reports
 - d. Computer video analysis presentation
2. Computational or non-computational problem-solving demonstrations including:
 - a. Exams
 - b. Homework problems
 - c. Quizzes
 - d. Laboratory reports
3. Other examinations, including:
 - a. Multiple choice
 - b. Matching items
 - c. True/false items
 - d. Completion
 - e. Essay
 - f. Demonstrations of laboratory techniques

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.

1. Curriculum development for each lab
2. Published schedule of individual laboratory activities
3. Published laboratory activity objectives
4. Published methods of evaluation
5. Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies

During laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is physically present in lab when students are performing lab activities.
2. Instructor is responsible for active facilitation of laboratory learning.
3. Instructor is responsible for active delivery of curriculum.
4. Instructor is required for safety and mentoring of lab activities.
5. Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practicals, notebooks, portfolios, etc.) that become a component of the student grade that

- cover the majority of lab exercises performed during the course.
- Instructor is responsible for supervision of laboratory clean up of equipment and materials.

Supplemental Data:

TOP Code:	193000 Earth Science
SAM Priority Code:	E: Non-Occupational
Funding Agency:	Y: Not Applicable
Program Status:	I: Program Applicable
Noncredit Category:	Y: Not Applicable
Special Class Status:	N: Course is not a special class
Basic Skills Status:	N: Not Applicable
Prior to College Level:	Y: Not Applicable
Cooperative Work Experience:	N: Course is not a part of a cooperative education program
Eligible for Credit by Exam:	No
Eligible for Pass/No Pass:	Yes