

## Earth Science (w/Lab) Syllabus

**EAS K102, Four sem. hrs. credits**  
**CRN#/Sec. - # 30032 /T1 & # 30035 /T1A**  
**Fall 2011**

**Three Rivers Community College**  
**Norwich, CT 06360**

### Office Hrs.

**M:** 12-1pm; **T:** 2-3pm  
**R:** 2-3pm (Or by appointment)

**Instructor:** Associate Professor William J. Dopirak, Jr.

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**Phone:** 860.892.5758

**Office location:** C-130

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### Recommended Text:

Lutgens, F.K. (2011). Foundations of Earth Science, 6<sup>th</sup> ed. Pearson /Prentice Hall. 476p.

### Supplementary Materials (NOT REQUIRED)

Pough, H. F. 1991. *Peterson First Guide to Rocks and Minerals*. Houghton Mifflin Co.

### Catalog Description:

A study of the earth as a planet including a study of the new geology and physiography of Connecticut. Emphasis is placed on Connecticut's earthquakes, dinosaurs, and rock identification. This course is designed for liberal arts and business students desiring to meet a science requirement for a degree and for prospective teachers. Some fieldwork is involved. Three lecture hours, three laboratory hours.

### Primary Objectives:

In addition to developing an understanding of earth science processes as they relate to other scientific disciplines, the student will be aided to obtain an awareness of the interdependence of physical processes and natural laws governing the earth to ensure their continuation and stability. An understanding of geosystems and the interrelationship between humans and other life forms will be developed. The student also will be encouraged to gain intuition about the earth sciences: **Astronomy;** measurements of the universe, the solar system, and light. **Meteorology;** weather & climate, temperature, humidity, pressure, and wind. **Geology;** the rock cycle, earth's substance, mineral identification, erosion, and geomorphology. **Oceanography;** hydrologic cycle, wind, waves, water circulation, and tides.

### Attendance Policy:

Students are expected to attend class and laboratory sessions regularly. If a class or lab is missed due to circumstances beyond your control, **please**, be sure to notify your instructor and make the necessary arrangements for obtaining the lecture notes. **You will be responsible** for the material. **If 3-4 classes (and/or 3-4 labs) are missed, a deduction of 5 POINTS will be taking from your final grade. TEN POINTS will be deducted from your final grade if 5 or more classes (and/or labs) are missed. If 100% attendance is noted, 5 points will be added to your grade.**

**Field Excursions** – Approximately 13 field excursions are planned during lab times, if you do not wish to attend the field excursions you must report to sign in, the campus lab (A-221) for activity assignments.

## **Grade Evaluation:**

There will be three examinations, and the final examination. Although the subject matter does tend to build on itself, the final examination is not cumulative. There will be eleven **weekly** quizzes. The lowest quiz grade will be dropped. **There will be no makeup quizzes!** Exam and quiz questions will consist of multiple choice and/or short answers. Two-laboratory practicals may also be included.

A systematic research paper on **ONE** of four **research projects** is also required:

- 1) Astronomical Observation Project: this project includes daily-weekly observations of lunar and solar activity.
- 2) Geologic Survey of Global Seismic & Volcanic Activity Project (via the Internet): this project incorporates the use of the 'World Wide Web' to monitor (current) global seismic and volcanic activity.
- 3) Atmospheric Monitoring & Weather Forecasting Project (via the Internet or, newspaper): this project will include tracking storms as jet streams and fronts influence them. Collect, display, and analyze accumulated data for precipitation, temperature, dew point, and interactions between high & low-pressure systems. Predict approaching disturbances of local weather.
- 4) A Formal 5-7 page Research Paper: Selections for your paper could be taken from a list of topics found within this syllabus or from your own interests.

More will be said pertaining to your paper/project through the semester. Oral presentations may also accompany research project.

**\*\*\*\*Research Project Due Date (30 November 2011) \*\*\*\***

## **Suggestions for the course:**

To gain a better understanding is sure to read the required reading sections **before** coming to class. Also, be prepared to participate in classroom discussions.

## **Grading:**

Final grade will based on the following:

Semester Grade*	-----50%
Laboratory Grade <sup>£</sup>	-----25%
Research Project	-----20%
<u>Class participation</u>	-----05%
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\*Semester grade = 40% Unit tests + 10% quizzes

<sup>£</sup>Laboratory grade = 20% Lab practicals + 5% Lab reports

## **Final Grade:**

100.0-99.0= A	79.4-77.5= C+
98.9-93.5= A	77.4-72.5= C
93.4-90.5= A-	72.4-69.5= C-
90.4-87.5= B+	69.4-63.5= D+
87.4-84.5= B	63.4-59.5= D
84.4-79.5= B-	59.4-00.0= F

### **College Withdrawal Policy:**

A student who finds it necessary to discontinue a course once class has met must provide written notice to the registrar. Withdrawal forms are available at the Registrar's office on both campuses and the office at the Subase. Nonpunitive "W" grades are assigned to any withdrawal requested before the various unrestricted withdrawal deadline. After that period, a student wishing to withdraw must obtain **written** authorization of the instructor to receive a "W" grade on their academic record, non-punitive grade indicating termination of class participation. **The day to withdraw, *EVEN WITH INSTRUCTOR SIGNATURE*.** Students who do not withdraw, but stop attending **will receive** a grade of "F" for the final grade. Students are advised that withdrawal from 50% or more of their classes will result in being placed on **Progress Probation** for the following semester Eligibility for refund of tuition is based upon date of withdrawal when received by the Registrar. **Verbal withdrawals cannot be accepted.**

### **Disabilities Statement:**

If you have a hidden or visible disability, which may require classroom or test-taking modifications, please see me as soon as possible. If you have not already done so, please be sure to register with disability counselors by contacting Student Services Office.

### **Academic and Classroom Misconduct:**

The instructor has the primary responsibility for control over classroom behavior and maintenance of academic integrity, and can order the temporary removal or exclusion from the classroom, and/or laboratory, of any student engaged in conduct violative of the general rules and regulation of the institution. Extended or permanent exclusion from classroom, and/or laboratory, or further disciplinary action can be effected only through appropriate college procedure. Plagiarism, cheating, or any form of academic dishonesty is **prohibited**. Students guilty of academic dishonesty directly or indirectly will receive a **zero** for an exercise or exam and may receive an **F** for the course in addition to other possible disciplinary sanctions, which maybe imposed through the regular institutional procedures. Any student that believes he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected.

### **Informative Earth Science Web Sites**

Hourly, local star charts: <http://www.formilab.ch/yoursky/>

Compute local sidereal time: <http://tycho.usno.navy.mil/sidereal.html>

Earth and moon viewer: <http://www.fourmilab.ch/earthview/vplanet.html>

National earthquake information center: <http://wwwneic.cr.usgs.gov/neis/current/world.html>

Global volcanic activity: <http://www.nmnh.si.edu/gvp/gvn> and <http://volcano.und.nodak.edu>

SeaWiFS Project home page: <http://seawifs.gsfc.nasa.gov/SEAWIFS.html>

Earth & Environmental Science: <http://info.er.gov/network/science/earth/earth.html>

Rockhounds informative page: <http://www.rahul.net/infodyn/rockhounds/rockhounds.html>

Windows to the universe: <http://www.windows.umich.edu/>

NASA TV Home Page: <http://www.nasa.gov/ntv>

**\*\*MANY MORE\*\***

## Tentative Fall 2011 EAS K102 Laboratory Activities

- 1) Planetary system replication
- 2) Earth-Moon-Sun interactions
- 3) Astronomical observations
- 4) Global time zones: International date line & prime meridian
- 5) Dew point & Relative humidity: Use of a sling psychrometer
- 6) Heat transfers: Conduction and Convection
- 7) Mineral formation
- 8) Mineral identification
- 9) Rock identification
- 10) The dynamic ocean floor
- 11) Plate tectonics
- 12) Effects of glaciers & morainal formation
- 13) Expressing topography on a map
- 14) Reading geologic maps & Integrating geological concepts
- 15) Geologic Time Scale & Fossil lab

## Possible Field Excursions

- 1) Mystic Seaport Planetarium (Mystic, CT)
- 2) Cochegan Rock (Montville, CT)
- 3) Rt.#11 Road-cut (Salem, CT)
- 4) Glacier Park (Ledyard, CT)
- 5) Lantern Hill (North Stonington, CT)
- 6) Bailey's Ravine (North Franklin, CT)
- 7) Yantic Falls (Norwich, CT)
- 8) Dinosaur Park (Rocky Hill, CT)
- 9) Gungywamp (Groton, CT)
- 10) Mashatucket Museum (North Stonington, CT)
- 11) Hartman Park (Lyme, CT)
- 12) Mamacoke Island (New London, CT)
- 13) Devil's Den Cave (North Franklin, CT)
- 14) Devil's Hopyard (Salem, CT)
- 15) Bluff Point (Groton, CT)

## Tentative Fall 2011 EAS K102 Lecture Schedule

<u>Week</u>	<u>Topic</u>	<u>Chapter(s)</u>
1	Introduction/ Properties of earth	
2	<b>Quiz 1-</b> Mineralogy/ Rock Cycle & Rock types	<b>1-2</b>
3	<b>Quiz 2-</b> Metamorphism/ Glaciation	<b>4</b>
4	<b>Quiz 3-</b> Plate tectonics/ Orogeny	<b>5-6</b>
5	<b>Quiz 4-</b> Volcanism	<b>7</b>
6	<b>Review &amp; UNIT EXAM I</b>	
7	<b>Quiz 5-</b> Paleontology/ Geologic timetable & periods	<b>8</b>
8	<b>Quiz 6- LAB PRACTICAL I /</b> Marine environments/ Tides	<b>9-10</b>
9	<b>Quiz 7 -</b> Atmospheric influences on weather	<b>11</b>
10	<b>Quiz 8 -</b> Meteorology/Pressure systems	<b>12-14</b>
11	<b>Review &amp; UNIT EXAM II</b>	
12	<b>Quiz 9 -</b> Earth-Moon-Sun interactions/Lunation cycle	<b>15</b>
13	<b>Quiz 10 -</b> Solar system/Eclipses	<b>16</b>
14	<b>Quiz 11/LAB PRACTICAL II</b> Connecticut Geology	
15	<b>Review</b>	
16	<b>Final Exam</b>	

**\*\*\*\*\*IMPORTANT DATES\*\*\*\*\***

**\*(28 April)\* Research Projects due**

**\*(14 Dec.)\* Oral presentations**

**\*(19 Dec.)\* Final Exam**

**Syllabus Revisions:**

This schedule may be subject to change as the instructor sees fit. The instructor will announce any changes in advance.

**Research Topic Ideas:**

- 1) Planetary beginnings
- 2) Cosmology
- 3) Earth materials
- 4) Earth's dynamic crust
- 5) Development of earth's major features
- 6) Time and Geology
- 7) Air, climate and weather
- 8) Structural Geology
- 9) Plate tectonics
- 10) Volcanic activity
- 11) Hydrothermal systems
- 12) Fault lines
- 13) Connecticut's geology
- 14) Connecticut's minerals
- 15) Mineralogy
- 16) Orogeny and mountain formation
- 17) Earthquakes
- 18) Earth's magnetic field
- 19) Energy resources from the earth
- 20) Mineral resources from the earth
- 21) Igneous rocks
- 22) Sedimentary rocks
- 23) Metamorphic rocks
- 24) The rock cycle
- 25) Glaciation
- 26) Geological timescale
- 27) Weathering and erosion
- 28) Sediments and sedimentation
- 29) Folds and other rock deformations
- 30) Dikes, sills, and magma
- 31) Glacial erratics
- 32) The hydrological cycle
- 33) Hydrology and weather
- 34) Aquifers
- 35) Glacial landscapes
- 36) Regional metamorphism
- 37) Landscape evolution
- 38) Interpreting the Grand Canyon sequence
- 39) Geology of mineral deposits
- 40) Sedimentation in the sea

### **Research Topic Ideas (cont.)**

- 41) Earth's interior heat
- 42) Exploring earth's interior
- 43) Seismic waves
- 44) Geological differences between oceans and continents
- 45) Continental margins
- 46) Topographic terranes of Connecticut
- 47) Paleontology
- 48) Fossils in Connecticut
- 49) Dinosaur epochs
- 50) Unraveling geological history

### **Learning Outcomes– EAS K102:**

- 1) The student will develop 'critical thinking skills' through the analysis of scientific data.
- 2) The student will be able to describe the scientific methods through examples.
- 3) The student will be able to describe the characteristics of planet earth.
- 4) The student will be able to identify the principle elements that make up geological formations.
- 5) The student will demonstrate knowledge of ionic, covalent, and hydrogen bonding.
- 6) The student will demonstrate knowledge of lunar & solar eclipses, as well as, total, partial, & angular forms of eclipses.
- 7) The student will be able to identify igneous, metamorphic, & sedimentary rocks.
- 8) The student will be demonstrating knowledge of the rock cycle.
- 9) The student will demonstrate knowledge of plate tectonics.
- 10) The student will be able to list the various geological time scales.
- 11) The student will be able to explain the difference between particle sorting.
- 12) The student will be able to identify minerals.
- 13) The student will demonstrate knowledge of the various earth sciences.
- 14) The student will demonstrate knowledge of the processes involved in the earth's formation.
- 15) The student will provide an overall perspective of the earth as part of the universe.
- 16) The student will be able to define energy and state the laws of energy conservation.
- 17) The student will be able to explain geomagnetic processes.
- 18) The student will be able to define the term's geomorphology & topography.
- 19) The student will be able to define the term's paleontology & glaciation.
- 20) The student will demonstrate knowledge of the chemical composition of the earth's crust.
- 21) The student will be able to explain the role of earthquakes & volcanoes.
- 22) The student will be able to understand the relationship between humans & their planet.
- 23) The student will demonstrate knowledge of the geological succession.
- 24) The student will demonstrate knowledge of the various earth science interactions.
- 25) The student will be able to discuss some common theories pertaining to the origin of the earth and our solar system.
- 26) The student will demonstrate knowledge of modern mapping techniques.
- 27) The student will demonstrate knowledge of hydrothermal vent systems.
- 28) The student will be able to illustrate the immensity of the solar system.
- 29) The student will be able to list the types of bodies found in the solar system.

## **Learning Outcomes– EAS K102 (cont.)**

- 30)** The student will demonstrate knowledge of meteorology.
- 31)** The student will be able to construct and read weather maps.
- 32)** The student will demonstrate knowledge of pressure systems and weather fronts.
- 33)** The student will be able to define convection and conduction and apply the two to winds and heat exchange.
- 34)** The student will be familiar with cloud types and able to recognize basic types.
- 35)** The student will gain working knowledge of relative humidity and dew point values.

## **Detailed Course Outline – EAS K102**

### **I Introduction**

#### **A) Aspects of earth science**

- 1.** Astronomy
- 2.** Meteorology
- 3.** Oceanography
- 4.** Geology

#### **B) Elements of earth**

- 1.** Atoms
  - a)** Atomic number & mass
  - b)** Behavior of electrons
  - c)** Energy & stability of atoms
    - 1)** Ions
    - 2)** Isotopes
- 2.** Matter
  - a)** Phases of matter
  - b)** Influencing factors
    - 1)** Temperature
    - 2)** Pressure

#### **C) Properties of earth**

- 1.** Age of earth
- 2.** Age of universe
- 3.** Hydrosphere
- 4.** Biosphere

### **II Astronomy**

#### **A) Planetary system**

- 1.** Solar system
  - a)** four inner terrestrial planets
  - b)** four outer gaseous planets
  - c)** one smallest, furthest planet
- 2.** Electromagnetic radiation
- 3.** Solar day
- 4.** Sidereal time
- 5.** Lunar day

## II Astronomy (cont.)

### B) Planetary motion

1. Rotation
2. Revolution
3. Galactic rotation
4. Eccentricity
5. Aphelion
6. Perihelion
7. Precession
8. Inclination
  - a) seasonal fluctuations
    - 1) solstices
    - 2) equinoxes

### C) Earth – Moon system

1. Leading theories of origin of moon
2. Phases of moon
  - a) new moon
  - b) waxing crescent
  - c) first quarter
  - d) waxing gibbous
  - e) full moon
  - f) waning gibbous
  - g) third quarter
  - h) waning crescent
3. Tides
  - a) Spring tides
  - b) Neap tides
  - c) Apogee
  - d) Perigee

### D) Eclipses

1. Ecliptical seasons
  - a) umbra
  - b) penumbra
2. Solar eclipses
3. Lunar eclipses
  - a) Lunar nodes
4. Partial
5. Total
6. Angular

### E) Earth's atmosphere

1. Troposphere
2. Stratosphere
  - a) Ozone layer
3. Mesosphere
4. Thermosphere
  - a) Ionosphere



### **III Meteorology**

#### **A) Climatology**

1. Biomes

#### **B) Weather influences**

1. Sun
2. Ocean
3. Topography
4. Rotation & revolution of earth
5. Climate

#### **C) Air masses & Air pressure**

1. High pressure systems
2. Low pressure systems
3. Wind
4. Jet Streams
5. Cloud formations
  - a) Condensation nuclei
  - b) Water vapor
  - c) Low atmospheric pressure
  - d) Three basic cloud forms
    - 1) Cirrus
    - 2) Strata
    - 3) Cumulus
  - e) Four families of clouds
    - 1) Development
    - 2) Height

#### **D) Air masses & Fronts**

1. Aspects of air masses
  - a) Saturation value
  - b) Absolute Humidity
  - c) Relative Humidity
  - d) Dew Point
2. Fronts & Cloud formation
  - a) Warm front
  - b) Cold front
  - c) Stationary front
  - d) Occluded fronts

#### **E) Weather Mapping**

#### **F) Weather Symbols**

#### **G) Weather Forecasting**

### **IV Geology**

#### **A) Divisions of solid earth**

#### **B) Earth's crustal composition**

1. Oceanic crust
2. Continental crust

#### **C) Mineralogy**

1. Crystal & crystallization
2. Physical properties of minerals

## IV Geology (cont.)

### D) **Rock Cycle**

1. Igneous
2. Sedimentary
3. Metamorphic

### E) **Crystallization of magma**

1. Bowen's series of reactions
  - a) Granitic rocks
  - b) Andesitic rocks
  - c) Basaltic rocks
  - d) Pyroclastic rocks
2. Igneous textures
  - a) Aphanitic
  - b) Phaneritic
  - c) Porphyritic
  - d) Glassy

### F) **Plate tectonics**

1. Divergent boundaries
  - a) Spreading center
2. Convergent boundaries
  - a) Subduction zones
3. Transform boundaries

### G) **Igneous activity**

1. Intrusive
2. Extrusive
3. Plutons
4. Volcanism
  - a) Types of volcanoes
    - 1) Shield
    - 2) Cinder cones
    - 3) Composite
    - 4) Calderas
    - 5) Volcanic pipes & necks
    - 6) Fumaroles
    - 7) Fissure eruptions
    - 8) Intraplate volcanism
  - b) Volcanoes & climate

### H) **Seismic activity**

1. Types of seismic waves
  - a) Body Waves
    - 1) P waves
    - 2) S waves
  - b) Surface Waves
    - 1) Raleigh waves
    - 2) Love waves
2. Epicenter
3. Focus
4. Earthquake Magnitude & Intensity
  - a) Richter scale
  - b) Mercalli scale
5. Tsunami

**I) Plate Tectonics & Paleomagnetism**

1. Curie point
2. Magnetic reversals

**J) Geological Time Scale**

1. Relative dating
2. Radiometric dating

**V Mountain Building**

**A) Orogenesis**

**B) Isostasy & Isostatic adjustment**

**C) Mountain Systems**

1. Folded Mountains
2. Fault-Block Mountains
3. Upwarped Mountains
4. Volcanic Mountains

**D) Rock Deformation**

1. Elastic deformation
2. Plastic deformation

**E) Folds**

1. Anticlines
2. Synclines
3. Domes
4. Basins

**F) Joints & Faults**

1. Reverse fault
2. Normal fault
3. Lateral fault
4. Thrust fault
5. Transform fault
6. Grabens
7. Horsts

**VI Oceanography**

**A) Oceanic Zonation**

1. Vertical zonation
  - a) Photic zone
  - b) Bathyl zone
  - c) Abyssal zone
  - d) Hadal zone
2. Horizontal zonation
  - a) Littoral zone
  - b) Neretic zone
  - c) Pelagic zone

**B) Ocean floor**

1. Seamounts
2. Guyots
3. Atolls
4. Reefs
5. Rises & Rifts
6. Canyons
7. Continental shelf
8. Hydrothermal vent systems

- C) Oceanic Circulation**
1. Wind & Currents
  2. Pycnoclines
    - a) Halocline
    - b) Thermocline
  3. Coriolus Effect
  4. Tides
  5. Land Masses
    - a) Upwelling
    - b) Downwelling
  6. Tides

**VII Glaciation**

- A) Types of Glaciers**
1. Valley glaciers
  2. Continental glaciers
  3. Ice Caps
  4. Piedmont glaciers
- B) Glaciers & the hydrological cycle**
- C) Glacial movement**
- D) Glacial erosion**
- E) Glacial deposits**
1. Moraines
  2. Outwashed plains
  3. Kettleholes
  4. Striate
- F) Causes of glaciation**
- G) Glaciers in the geologic past**
- K) Plate Tectonics & Paleomagnetism**
3. Curie point
  4. Magnetic reversals
- L) Geological Time Scale**
3. Relative dating
  4. Radiometric dating

**VIII Connecticut Geology**

- A) Physiographic regions of CT**
- B) Connecticut's geological history**
- C) Connecticut's terranes**
1. Newark terrane
  2. Avalonian terrane
  3. Iapetos terrane
  4. Proto-North American terrane