Professional Education Unit
Department of Earth and Space Sciences

ESS 108 – Physical Geology

A FACE-TO-FACE, LECTURE- AND LABORATORY-BASED COURSE

ESS 108-001, ESS 108L-001
Spring 2010

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Office Hours: 12:00pm - 3:00pm M; 11:30pm – 12:30pm T, TH; or by appointment

Course Description: Earth materials, structures, and processes for geology majors and others who wish to take upper division ESS classes. Lab provides hands-on experience in rock and mineral identification and the use and interpretation of topographic and geologic maps. *This course satisfies area studies-natural and mathematical sciences for general education*.

Required Field Experience Hours: NONE

"Community Engagement: A Light to and from the Mountains"

The Professional Education Unit at Morehead State University delivers rigorous, high quality programs that prepare professionals informed by best national and international scholarship, plus research, literature, and experiences specific to Appalachia- preparing professionals to improve the schools, quality of life, and the communities in which they live and serve. This statement is not only the strategic mission for the College, but it also incorporates the conceptual framework that guides all our activities.

Conceptual Framework Outcomes (CFOs):

The Unit and the faculty within individual programs assess the degree to which its teaching option graduates:

1) Master the content knowledge, professional and the 21st century skills need to make an optimal contribution to "whole" student learning in education settings.

2) Are competent in the collection and use of data to inform decision-making and to demonstrate accountability for student learning.

3) Demonstrate professional dispositions

4) Are culturally competent and understand the regions from which they have come utilizing knowledge and experiences to effectively "bridge the gaps" (economic, achievement, and geographic) so that they will be able to ensure optimal learning for all students.

5) Engage in authentic field experiences in collaboration with committed school-based partners and are empowered to improve the quality of education throughout this region and beyond.

Student Learning Outcomes (SLOs): By the end of this course, the candidate will be able to:

1. Explain methods of scientific problem solving.
2. Explain major geologic concepts and principles, such as uniformitarianism.
3. Explain what is meant by the "Earth System."
4. Explain basic principles of chemistry.
5. Identify minerals and explain their characteristics; list the common elements in minerals and in the earth's crust; list the important classes or groups of minerals; and write chemical formulae for selected minerals.
6. Identify common igneous rocks and explain their origin; describe magma composition, type, and their impact on igneous rock composition; describe magma formation including partial melting and magma evolution; differentiate between magma and lava; describe and recognize igneous textures and the origins of these textures; classify igneous rocks according to texture and composition.
7. Recognize and classify extrusive igneous activity in terms of types of lava flows, types of volcanoes, lava domes, and fissure eruptions.
8. Recognize and classify intrusive igneous activity in terms of discordant plutons and concordant plutons; describe the general mechanism for the emplacement of batholiths and stocks.
9. Define and explain the processes of weathering and erosion in terms of mechanical weathering, chemical weathering, oxidation, and hydrolysis; explain the controls on the rate of weathering.
10. Explain soil formation in terms of regolith, soil profiles and horizons, and the controls on soil development and resulting problems with soils.
11. Define sediment and explain how it is transported and what media it is transported in.
12. Recognize and explain siliciclastic sediments in terms of their source, common minerals, and textures.
13. Recognize and explain biogenic sediments in terms of organism parts, composition, external sources, and where, in general, they form.
14. Recognize and explain chemical sediments in terms of their mineralogy and, where applicable, morphology.
15. Explain lithification in terms of compaction, pressure solution, and cementation.

16. Identify siliciclastic sedimentary rocks using grain size and composition; explain their possible depositional environments.
17. Identify biogenic sedimentary rocks; explain their possible depositional environments.
18. Identify chemical sedimentary rocks using their mineralogy; explain their possible depositional environments.
19. Use sedimentary structures and fossils to describe and interpret sedimentary rocks.
20. Explain sedimentary facies in terms of submergence and transgression and emergence and regression.
21. Explain the hydrologic cycle.
22. Describe rivers and streams in terms of drainage basins and drainage patterns.
23. Describe channelized flow in terms of gradients, channel shape, sinuosity, and discharge.
24. Explain erosion and sediment transport through hydraulic action, abrasion, and sediment load.
25. Explain fluvial deposition in terms of stream types and their characteristic deposits.
26. Explain deltaic deposition and the characteristics of the deposits of each of the major types of delta.
27. Explain rock/sediment porosity and the types of porosity.
28. Explain permeability and hydraulic conductivity; differentiate these from porosity.
29. Use Darcy's Law to explain groundwater movement.
30. Explain aquifers in terms of their parts, the major types, recharge, and discharge.
31. Explain water well design and function in terms of aquifer impacts.
32. Explain waste disposal in landfills, septic systems, lagoons, and constructed wetlands in terms of ground water impacts and concerns.
33. Explain the basic principles of geology that resulted in the development of the geologic time scale.
34. Explain and recognize unconformities.
35. Explain absolute dating leading to the dates on the geologic time scale, practical applications, and sources of error.
36. Explain the structure and composition of the earth's interior in layers and general chemical composition.
37. Explain isostasy.
38. Explain the generation and properties of Earth's magnetic field and the record of these properties contained in the rock record.
39. Be able to read topographic maps and use the information contained therein.
40. Explain evidence for continental drift and the formulation of the general theory of plate tectonics.
41. Explain plate boundaries in terms of plate movements and crustal types involved.
42. Use average spreading rates and hotspots to determine general plate movements.
43. Explain the driving forces of plate tectonics, including mantle convection, ridge-push, and slab-pull.
44. Explain crustal deformation in terms of rock mechanics (stress and strain) and the resultant rock types.
45. Use strike and dip to identify geologic structures.

46. Describe fold, fault, and joint morphology, types, and occurrences.
47. Explain orogenesis in terms of volcanic, plutonic, faulting, and fold and thrust belt contributions.
48. Explain the causes of metamporphism and the resultant rock types.
49. Identify metamorphic rocks using texture and metamorphic minerals.
50. Explain the occurrence of metamorphic rocks and resultant grades.
51. Explain earthquakes in terms of tectonic movements; use appropriate tools and techniques to locate the epicenter, magnitude, and intensity of earthquakes.
52. Read geologic maps.

NCATE/ EPSB Accreditation Alignment of CFOs and SLOs:

Program:	**Earth and Space Science Teaching, 8-12** **Middle Grades Science Teaching, 5-9**		**ESS 108: Physical Geology**		
Aligned with ▶ **Assessment ▼** **(point values)**	**Kentucky Teacher Standards (KYS)**	**Kentucky Education Reform Act (KERA)**	**Education Professional Standards Board (EPSB)**	**National Science Teacher Association Standards for Science Teacher Preparation (NSTA)**	**NCATE**
Physical Properties of Minerals (100 pts) CFO: 1 SLO: 5	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Mineral ID (100 pts) CFO:1 SLO: 5	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Igneous Rocks (100 pts) CFO: 1 SLO: 6	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Sedimentary Rocks (100 pts) CFO: 1 SLO: 16, 17, 18	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Metamorphic Rocks and Metamorphic Minerals (100 pts) CFO: 1 SLO: 49	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Lab Exam 1 (100 pts) CFO: 1 SLO: 5, 6, 16-18, 49	1.1	2	Closing the achievement gap	1.A.4.25 1.C.4.a.2	1
Lecture Exam 1 (100 pts) CFO: 1 SLO: 1- 20	1.1	2	Closing the achievement gap	1.A.1.2, 1.A.1.3, 1.A.4.25, 1.A.5.29, 1.A.5.30, 1.C.4.a.1, 1.C.4.a.2, 1.C.4.a.10	1

Topographic Maps; Distances, Scales, Grids (100 pts) CFO: 1 SLO: 39	1.1	1, 2	Closing the achievement gap	1.B.4.33, 1.C.4.a.1	1
Topographic Maps; Elevations (100 pts) CFO: 1 SLO: 39	1.1	1, 2	Closing the achievement gap	1.C.4.a.1	1
Topographic Maps; Bearings (100 pts) CFO: 1 SLO: 39	1.1	1, 2	Closing the achievement gap	1.B.4.33	1
Surface Hydrogeology (100 pts) CFO: 1 SLO: 21 – 26	1.1	1, 2	Closing the achievement gap	1.B.3.22, 1.B.4.33, 1.C.4.a.6, 1.C.4.b.15	1
Ground Water (100 pts) CFO: 1 SLO: 27 – 32	1.1	1, 2	Closing the achievement gap	1.B.3.22, 1.B.4.33, 1.C.4.a.6, 1.C.4.b.15	1
Lab Exam 2 (100 pts) CFO: 1 SLO: 21-32, 39	1.1	1, 2	Closing the achievement gap	1.B.3.22, 1.B.4.33, 1.C.4.a.1, 1.C.4.a.6, 1.C.4.b.15	1
Lecture Exam 2 (100 pts) CFO: 1 SLO: 21 - 38	1.1	2	Closing the achievement gap	1.A.1.5, 1.A.4.24, 1.A.4.25, 1.B.3.21, 1.B.3.22, 1.B.3.24, 1.C.4.a.1, 1.C.4.a.2, 1.C.4.a.6, 1.C.4.b.15, 1.C.4.b.16	1
Earthquakes/Tectonics (100 pts) CFO: 1 SLO: 51	1.1	1, 2	Closing the achievement gap	1.B.3.25, 1.C.4.a.1, 1.C.4.b.13	1
Structural Geology CFO: 1 SLO: 45 - 46	1.1	2	Closing the achievement gap	1.A.4.24, 1.C.4.a.1, 1.C.4.a.3, 1.C.4.b.17	1
Geologic Maps (100 pts) CFO: 1 SLO: 52	1.1	2	Closing the achievement gap	1.C.4.a.1	1
Final Exam (100 pts) CFO: 1 SLO: 1 - 52	1.1	2	Closing the achievement gap	1.A.1.2, 1.A.1.3, 1.A.1.5, 1.A.4.24, 1.A.4.25, 1.A.5.29, 1.A.5.30, 1.B.3.21, 1.B.3.22, 1.B.3.24, 1.C.4.a.1, 1.C.4.a.2, 1.C.4.a.6, 1.C.4.a.10,	1

				1.C.4.b.13, 1.C.4.b.15, 1.C.4.b.16	
Quiz 1: igneous textures (100 pts) CFO: 1 SLO: 6	1.1	2	Closing the achievement gap	1.A.4.25, 1.C.4.a.2	1
Quiz 2: multiple chapters (100 pts) CFO: 1 SLO: 9-20	1.1	2	Closing the achievement gap	1.A.4.25, 1.C.4.a.2	1
Quiz 3: spreading rates (100 pts) CFO: 1 SLO: 42	1.1	1, 2	Closing the achievement gap	1.B.3.24, 1.B.4.33, 1.C.4.a.1, 1.C.4.a.3	1
Quiz 4: structural geology (100 pts) CFO: 1 SLO: 44 – 47	1.1	2	Closing the achievement gap	1.A.4.24, 1.C.4.a.1, 1.C.4.a.3, 1.C.4.b.17	1
Homework 1: Units 1 (100 pts) CFO: 1 SLO:	1.1	1	Closing the achievement gap	1.A.1.3, 1.A.5.30, 1.B.4.33	1
Homework 2: Units 2 (100 pts) CFO: 1 SLO:	1.1	1	Closing the achievement gap	1.A.1.3, 1.A.5.30, 1.B.4.33	1
Homework 3: Q (100 pts) CFO: 1 SLO: 23	1.1	1, 2	Closing the achievement gap	1.B.3.22, 1.B.4.33, 1.C.4.b.15	1
Homework 4: seep v (100 pts) CFO: 1 SLO: 30 – 32	1.1	1, 2	Closing the achievement gap	1.B.3.22, 1.B.4.33, 1.C.4.b.15	1
Homework 5: Relative and Absolute dating (100 pts) CFO: 1 SLO: 33 - 35	1.1	1, 2	Closing the achievement gap	1.B.3.21, 1.C.4.b.16	1

<u>Assignment Descriptions</u>:

Program: **Earth and Space Science Teaching, 8-12** **Middle Grades Science Teaching, 5-9**	**ESS 108: Physical Geology**
Assessment (point value)	**Description**
Physical Properties of	Students will learn how to use appropriate tools (hand lens,

Minerals (100 pts)	streak plates, glass plates, pennies, nails, dilute hydrochloric acid, etc.) and their senses to describe the physical properties of minerals.
Mineral ID (100 pts)	Students will use mineral properties to identify minerals.
Igneous Rocks (100 pts)	Students will use igneous rock properties to identify igneous rocks.
Sedimentary Rocks (100 pts)	Students will use sedimentary rock properties to identify sedimentary rocks.
Metamorphic Rocks and Metamorphic Minerals (100 pts)	Students will use their mineral identification skills to identify metamorphic minerals. Students will use metamorphic rock properties to identify metamorphic rocks.
Lab Exam 1 (100 pts)	Students will answer questions about rocks and minerals and apply their knowledge to identify a variety of rocks and minerals.
Lecture Exam 1 (100 pts)	Students will answer a variety of questions about the earth system, scientific method, basic chemistry, minerals, magma, rocks, volcanoes and plutons, weathering and erosion, soils, and sedimentary geology.
Topographic Maps; Distances, Scales, Grids (100 pts)	Students will begin to learn how to read topographic maps. This lab will concentrate on determining distances, using scales, and using grids.
Topographic Maps; Elevations (100 pts)	Students will continue to learn how to read topographic maps. This lab will concentrate on being able to determine the elevation of various points and objects.
Topographic Maps; Bearings (100 pts)	Students will continue to learn how to read topographic maps. This lab will concentrate on using bearings to navigate with topographic maps.
Surface Hydrogeology (100 pts)	Students will study the properties of rivers and streams.
Ground Water (100 pts	Students will examine how ground water moves through rocks and sediments.
Lab Exam 2 (100 pts)	Students will be tested over their understanding of Topographic maps, surface hydrogeology, and ground water principles and applications.
Lecture Exam 2 (100 pts)	Students will answer a variety of questions about the hydrologic cycle, rivers and streams, groundwater and waste disposal, geologic time, and Earth's interior and basic geophysics.
Earthquakes/Tectonics (100 pts)	Students will determine earthquake location through triangulation, richter magnitude, and mercalli intensity.

Structural Geology	Students will examine strike, dip, folds, faults, and joints in laboratory settings.
Geologic Maps (100 pts)	Students will use their knowledge of rock types and structural geology to learn how to read and interpret geologic maps.
Final Exam (100 pts)	Students will answer questions about plate tectonics, crustal deformation, orogenesis, metamorphism, and all prior topics.
Quiz 1: igneous textures (100 pts)	Students will demonstrate their understanding of igneous textures
Quiz 2: multiple chapters (100 pts)	Students will demonstrate their understanding of multiple aspects of geology.
Quiz 3: spreading rates (100 pts)	Students will demonstrate their understanding of spreading rates.
Quiz 4: structural geology (100 pts)	Students will demonstrate their understanding of structural geology.
Homework 1: Units 1 (100 pts)	Students will demonstrate their understanding of units and conversions.
Homework 2: Units 2 (100 pts)	Students will demonstrate their understanding of units and conversions.
Homework 3: Q (100 pts)	Students will demonstrate their understanding of stream discharge.
Homework 4: seep v (100 pts)	Students will demonstrate their understanding of seep velocity.
Homework 5: Relative and Absolute dating (100 pts)	Students will demonstrate their understanding of relative and absolute dating.

<u>Grading Scale</u>:

Your semester grade will be based on:

Quizzes and Homework	20%
Exam 1	15%
Exam 2	15%
Final Exam (cumulative)	20%
Lab Numerical Score	30%

Your laboratory numerical score will be calculated as follows:

Lab Exercises	60%
Lab Exam 1	20%
Lab Exam 2	20%

Letter Grade	Percentage Required
A	90-100
B	80-89
C	70-79
D	60-69

E	< 60
U	Failure to attend the last three or more weeks of class

Course Evaluation:

You will have the opportunity to evaluate this course using a Department of Earth and Space Science Instrument.

Required Textbooks:

Marshak, S., 2008, Earth: Portrait of a planet: New York, W.W. Norton & Co., 832 p.

Attendance Policy:

There is no formal attendance policy for the lecture portion of this class. Understand, however, that students with poor attendance almost always get lower grades. So be careful; the consequences for missing class can be severe. **Making up a lab is *very* difficult, however. DON'T MISS LAB!** Read the next three policies carefully.

Rescheduling of Exams

You must contact me 24 hours in advance to reschedule an exam. Permission will be granted if you present me with an official document (e.g., on letterhead from a doctor, coach, or judge) that justifies your need for special consideration. *No exceptions!*

Make-ups

Make-ups of missed quizzes or homework assignments will not be granted unless you present me with an official document (e.g., on letterhead from a doctor, coach, or judge) that justifies your need for special consideration. Make-ups for missed exams will be granted for true emergencies only and then only if you contact me within 24 hours of the scheduled exam time and present me with documentation as described above. *No exceptions!*

Late Assignments

Late work will not be accepted unless you meet the same conditions as described for make-ups.

Quizzes and Homework

Quizzes and homework assignments will be given weekly. Each quiz or homework assignment will be graded satisfactory (S) or unsatisfactory (U). *Incomplete work is an automatic U*. Your semester quiz grade will be calculated by dividing the number of S's earned by the total number of quizzes and homework assignments (e.g., 6 S's out of 8 = 6/8 = 75%).

Academic Honesty

I will not tolerate any form of academic dishonesty. *If I even see a laptop, cell phone or iPod during an exam or quiz, I will assume you are cheating.* The same goes if I see open notes or books during exams or quizzes. At the very least, I will assign a failing grade for the exam or quiz. See Appendix A of the Student Handbook for more information about my and your options in the event I accuse you of academic dishonesty. The pdf for the handbook is at http://www.moreheadstate.edu/dsl/eaglehandbook/?id=1028.

Laptops, Cell Phones, PDAs, Pagers, iPods, Mp3 players, etc.

The ONLY electronic device you need for this class is a calculator (*not* your cell phone). Turn your cell phone off or set it to vibrate. See me at the beginning of class if you expect an EXTREMELY important call (e.g., your wife is about to give birth). See my policy on academic dishonesty for more information about electronic devices.

Americans with Disabilities Act (ADA)

In compliance with the ADA, all students with a documented disability are entitled to reasonable accommodations and services to support their academic success and safety. Though a request for services may be made at any time, services are best applied when they are requested at or before the start of the semester. To receive accommodations and services the student should immediately contact the Disability Services Coordinator in the Office of Academic and Career Services, 223 Allie Young Hall, 606-783-5188, www.moreheadstate.edu/acs/

Campus Safety Statement

Emergency response information will be discussed on the first day of class. Know the location of the nearest exit routes in the event evacuation becomes necessary. You should notify me at the beginning of the semester if you have special needs or think you might require assistance during an emergency evacuation. Review emergency response protocols at http://www.moreheadstate.edu/emergency.

In the event of a fire alarm, ESS 108 evacuates down the 2nd St. stairwell and exits Lappin Hall on the ground floor. We walk immediately toward ADUC and cross the street to re-convene near the ADUC Loading Dock.

In the event of a tornado warning, ESS 108 proceeds to the 4th floor interior hallway connecting the A and B wings for shelter.

Course Calendar:

ESS 108: Physical Geology*

*subject to change with or without notice

Week	Lecture Topic	Readings	Laboratory
1	Science; Geology; Overview of	PRELUDE, CH 3, 4	Physical Properties of Minerals; Mineral ID

	Tectonics		
2	Minerals; Igneous Rocks	CH 5, 6	Mineral ID
3	Intrusive and Extrusive Igneous Processes	CH 6, 9	Igneous Rocks
4	Weathering, Erosion, Soils	CH 7	Sedimentary Rocks
5	Sediment	CH 7	Metamorphic Rocks and Metamorphic Minerals
6	Sedimentary Environments	CH 7	**LAB EXAM 1: Wednesday, February 17, 2010**
7	**LECTURE EXAM 1, Monday February 22**		Topographic Maps; Distances, Scales, Grids
8	Flooding and Basic Surface Hydrogeology	CH 17	Topographic Maps; Elevations
9	Groundwater and Waste Disposal	CH 19	Topographic Maps; Bearings
10	**SPRING BREAK**		**NO LAB**
11	Geologic Time	CH 12	Surface Hydrogeology
12	**LECTURE EXAM 2, Friday April 2, 2010**		Ground Water
13	Earth's Interior	CH 2	**LAB EXAM 2: Wednesday, April 7, 2010**
14	Plate Tectonics in Detail	CH 3, 4	Earthquakes/Tectonics
15	Plate Tectonics in Detail	CH 3,4	Structural Geology
16	Crustal Deformation; Metamorphism	CH 11, 8	Geologic Maps
17	**FINAL EXAM: Thursday, May 6, 2010; 10:15 am – 12:15 pm**		