

## **GEOL 167 – History & Philosophy of the Geosciences**

### **Course Information**

Spring 2007

Tuesday-Thursday, 9:30-10:45 AM

Room 7115 Memorial Hall

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### **Course Description and Goals**

As an introductory experience in the Bachelor of Arts in Earth Science, students will be inculcated in the philosophy of geosciences as an interdisciplinary medium for extending classical science viewpoints to complex Earth systems. The history, traditions, and conventions of the geosciences, from antecedents in classical philosophies to contemporary models of the geosciences as a way of knowing, will be represented as a part of learning experiences. Students will grasp the geosciences as unique within the sciences, establishing relevance and value of Earth science literacy in professional and personal settings. Class activities will consist of seminar discussions, lecture, and analysis/synthesis activities. Course goals include:

1. Articulate the nature of the geosciences and the activity of geoscientists;
2. Introduce the concepts of Earth-based and anthropocentric frameworks for understanding Earth phenomena;
3. Define meaningful questions, appropriate methods, and representative solutions in the geosciences;
4. Describe significant paradigms that have emerged in the geosciences in the transition from mythological/religious views of discrete Earth phenomena to a complex Earth Systems view;
5. Introduce major research thrusts that have existed or are underway, to better represent the geosciences to non-scientific audiences.

### **Requirements and Policies**

#### **Required Text:**

There is no set textbook for this class. Instead, class discussions, lectures, and seminars will be supported by primary scientific papers and essays, web resources, and other assigned readings and instructional materials. The primary sources of these will be found at either the course Blackboard site or at <http://csmres.jmu.edu/geollab/pyle/geol167> or at <http://csmres.jmu.edu/geollab/fichter/geol167>. Please add these sites as bookmarks to your favorite browser.

#### **Academic Honesty:**

Making references to the work of others strengthens your own work by granting you greater authority and by showing that you are part of a discussion located within an intellectual community. When you make references to the ideas of others, it is essential to provide proper attribution and citation. Failing to do so is considered academically dishonest, as is copying or paraphrasing someone else's work. The consequences of such behavior will lead to consequences ranging from failure on an assignment to failure in the course to dismissal from the university. Because the disciplines of the sciences value collaborative work, you will be encouraged to share ideas and to include the ideas of others in our papers. Please ask if you are in doubt about the use of a citation. Honest mistakes can always be corrected or prevented."

## **Disability Statement**

If you are a student with a documented disability who will be requesting accommodations in my class, please make sure you are registered with the Office of Disability Services, Wilson Hall, Room 107, 568-6705 and provide me with an Access Plan letter outlining your accommodations. I will be glad to meet with you privately during my office hours to discuss your special needs."

## **Policy on Adding Courses**

Students are responsible for registering for classes and for verifying their class schedules on e-campus. The deadline for adding a Fall Semester class without instructor and academic unit head signatures is **January 16, 2007**. Instructor and academic unit head signatures are required to add a Spring Semester 2007 class between **January 17 and January 25, 2007**. No student will be allowed to register for a Spring Semester class after **January 25, 2007**. No exceptions will be made to these deadlines.

## **Assignments**

Assignments in this course will be primarily authentic, rather than performance-based in nature. Therefore, your grade on individual assignments will be based not on a binary scale of "right" or "wrong," but rather on the basis of your level of understanding relative to course goals. Detailed scoring rubrics for each assignment will be provided as the course progresses. Each assignment is due on the due date defined, and make-ups will not be provided except in the case of a bona-fide and documented medical or family emergency. Generalized descriptions of these assignments are provided below:

***(A) Section Synthesis Exercises (50% of final grade; due one week after the completion of content sections)*** The content of this course has been carefully considered and organized in such a way as to first lay a philosophical foundation in the traditions of science, followed by the expression (or antithesis) of these elements in the Earth sciences. At the end of each content section, you will be asked to produce a brief synthesis of the section, centered on a particular case or Earth phenomenon. Each synthesis paper should be 2-3 typed, 1.5-spaced pages, not inclusive of any figures or illustrations that may be used. The specific parameters of each exercise will be shared in class at the end of each content section.

***(B) Field Trip Summary (10% of final grade; due one week after field trip)*** One of the fundamental aspects of the Earth sciences that distinguishes it from other sciences is the need for field-based investigations. But such investigations are interpreted through the mental frameworks of the observer and dialogue with others. In order to provide participation in this process, a required field trip will be scheduled for a Saturday in April. During this field trip, each student will be required to observe both the geologic features of each stop as well as the interactions of the instructors with each other and other students. A brief reflective paper (2-3 typed, 1.5 spaced pages) will be expected of each student after completion of the trip.

***(C) Summative Analysis (40% of final grade; presentation on the last day of class, final paper due on Wednesday of Finals Week)***  
In lieu of a final examination, each student will work in partnership with another student, analyzing a specific situation in the geosciences. Multiple and varied thought frameworks will be presented in class, as either philosophical descriptors or as historical examples.

The task is therefore to analyze the situation presented, utilizing these descriptors and examples to best describe the situation at hand. The analysis will consist of both a verbal presentation as well as a written paper. The oral presentation will take place on the last scheduled class, and should support the verbal component with visual, metaphorical, or analogic representations. The final paper should be informed by reflection on the verbal presentation, and be submitted no later than noon on the Wednesday of finals week. A rubric will be provided in class.

### Grading

Grading will be on a 10 point scale, with 100-90% = A, 80-89%=B, 70-79%=C, 60-69%=D, and <60=F, drawn on a basis of the total number of points available.

### Attendance

Class attendance is vital to your learning, as missing class can adversely affect your overall learning. Missing class is punitive in itself, but missing more than 3 classes, except in the case of bona fide illness or emergency, will result in a 10% reduction of your overall grade.

### Tentative Schedule of Topics

Class	Section	Topic
Jan 9	I. Overview of the Human Need and Search for Truth	What is your starting point for thinking in science?
Jan 11		Origins of mythical, analytical, and empirical Truth
Jan 16		The search for Truth in Western History;
	II. Critical Skepticism and Science	Augustine, Aquinas, and the scholastic tradition
Jan 18		Renaissance thinking; Bacon and the development of inferences
Jan 23		Popper and the falsification of deductions as represented in the geosciences
Jan 25		Classical reductionist views; Linear, bounded systems
Jan 30	III. Three Phases of Science	Two Body Problem
Feb 1		Disorganized Complexity
Feb 6		Complex Systems
Feb 8	IV. Science vs. Pseudoscience vs. Nonscience	Rejection or acceptance of ideas for the lack of evidence; Non-Scientific Argument marketing, persuasion, and the truth
Feb 13		<b>Assessment Day</b>
Feb 15		Pseudoscience Arguments truth is what we say it is, regardless of the existence or non-existence of evidence; Discrete solutions with apparent objectivity
Feb 20	V. Geology as a Historical Science	The Age of the Earth, the Scientific Argument; Kelvin physics versus geology
Feb 22		The Catastrophist vs. Uniformitarian debate
Feb 27		Search for Minerals and Georg Bauer; Predictive capacity & William Smith
Mar 1		Gilbert, Chamberlin, and multiple working hypotheses
Mar 6,8		<b>Spring Break</b>
Mar 13		Psychology of Time
Mar 15	VI. The Nature of Authority	Perry and schemes of intellectual and ethical development
Mar 20		Schwab, the rhetoric of conclusions vs. the narrative of enquiry; Kuhn and the resolution of crises of thought
Mar 22	VII. A Unifying theory in the geosciences-crisis case study	Wegener, DuToit, Holmes, and the need for a mechanism; Rejection of Continental Drift
Mar 27		Lateral versus Vertical Movement drift versus isostasy; Geophysics (gravity and magnetics) and the development of Physical Oceanography
Mar 29	VIII. Non-classical views of Earth science	From classical reductionist views of the Earth sciences to complex Earth systems; Non-linear, diffuse systems
Apr 3		Universality elements of complex systems as applied to the Earth

Apr 5	VIII. Non-classical views of Earth science	Tentative Nature of Earth Systems explanations, in the historical context of explanations in the Earth sciences
Apr 10		Holistic solutions concentrating on interrelationships; Earth Systems Science: using geology, oceanography, meteorology, and biology to understand the Earth as a whole system (GAIA).
Apr 12	IX. The practice vs. instruction in the geosciences	Pedagogy as a way of transmitting and thinking; Pedagogy of the geosciences ideals of instruction versus actual practice
Apr 17		Artifacts of instruction in the geosciences instructional materials and texts
Apr 19	X. Social commentaries on the Earth sciences and Earth systems	Representation of the Earth Sciences by Earth Scientists; Representation of the Earth Sciences by non-Earth Scientists; Representation of the Earth Sciences by non-Scientists
Apr 24		Utopian vs. dystopian views on the nature of scientific knowledge
Apr 26		Final Project Draft presentation
May 2		Final Project submission