

Lafayette College

Department of Physics

September 2, 2011

FYS 067: Simple Rules and Complex Behavior

Course Description

Fall Semester - 2011

Mon-Wed-Fri: 11:00 PM to 11:50 AM

Mon: 12:00-1:00 PM (Selected Weeks Only)

Room 17, Hugel Science Center.

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Scientists seek to explain the complex nature of the world around us in terms of simple rules that can explain a wide range of complex behaviors. Sometimes these rules take the form of fundamental principles that attempt to explain a vast array of diverse and complex phenomena. This is often referred to as the “reductionist approach” to science, and the most successful examples of this are the fundamental conservation laws of physics such as conservation of energy or conservation of momentum. However, at times the scientific approach takes the form of simple models that supposedly contain the essence of numerous, related phenomena; but are not necessarily related to basic principles. For example, such simple models have been used to relate the behavior of avalanches, weather, earthquakes, fire storms, and erosion. Similar attempts have been made to understand the nature of the evolution of biological species at all levels, and to evaluate various strategies of survival. We will seek to understand these approaches to knowing; and attempt to evaluate their successes, their failures, and what lessons can be learned from this style of investigation.

Required Books and Texts

Copenhagen, by **Michael Frayn**.

The Pleasure of Finding Things Out, by **Richard P. Feynman**.

Voodoo Science, by **Robert Park**

Beyond Oil, by **Kenneth S. Deffeyes**

Carbon Shift, **Thomas Homer-Dixon (ed.)**.

Collapse, by **Jared Diamond**

Questioning Collapse, **Patricia A. McAnany (ed.) and Norman Yoffee (ed.)**.

The St. Martin's Handbook, by **Andrea Lunsford**

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Course Structure

This FYS will be a seminar style, discussion oriented course structured around the concepts discussed in the books listed in the above reading list. These books are somewhat personalized stories of the attempts by the authors and other scientists to understand the nature of the physical universe by what is termed the “scientific method”. These authors explore the connections between fundamental physical principles (simple rules) and the complexity of the diverse environment in which we live (complex behavior). We will seek to understand and evaluate these ideas, and test them against our own sense of reality. In order to accomplish our goals, we will need to explore and examine the nature of reality as scientists understand the term. We will also examine how these ideas are presented to the public, as well as to the general community of scientists. To this end, we will also be using reading from other books and articles; as well as an occasional video.

In addition to the regular meetings, there will be required meetings at noon on selected days. These will be scheduled with one (or more) weeks notice, and lunch will be provided. Please keep this in mind when making other commitments.

Course Objectives

We will pose questions about the nature of science, about the difference between scientific views and the views of scientists, and about the ability of the non-scientist (but educated reader) to tell the difference. Simply put, are the conclusions presented by these books (and other sources we will encounter) based on hard evidence, or are they simply a reflection of the attitudes of the scientists and not scientific conclusions? In addition, we will examine some simple models found in the current literature, and explore the structure and implicit assumptions behind these models. Our goal will be to ascertain if these models are useful exercises that lead to an improved understanding of the physical phenomena studied, or are they just sophisticated video games played on computers.

Improving and honing your writing skills is one of the important goals of this course, and it is important for you to realize that your writing, no matter how good, can always be improved. The use of multiple drafts, critiqued by colleagues, can greatly aid in this endeavor. To help you accomplish this objective, this course is associated with the College’s Comprehensive Writing Program. The purpose of this program is to provide, with the aid of writing associates, individualized writing instruction that will help you head off writing problems before your papers are evaluated by me. The writing associate for this class is Margaret Abelkop. You will be required to meet with him at least four times during the semester, once for the initial essay, once for the first of the assigned papers, and twice for the middle paper. A meeting with the WA for the last essay is optional.

At these 30 minute conferences you will discuss the drafts of your writing assignments. These conferences will give you an excellent opportunity to ask questions and to discuss your

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writing in detail. It is important for you to realize that the writing associate does not edit your writing, but rather will offer suggestions on the form and structure of the paper. I would encourage you to meet with Margaret more often than the minimum required for the course. You must get your papers to me at the requested time so that both of us can have time to read them before he meets with you. It is therefore critical that you not miss scheduled conferences. **I consider this activity an important and required part of your writing assignments.**

Evaluation of Your Performance

Since this is a discussion oriented course, active participation by all students will be expected and required. For each discussion class, you will e-mail a question to me which can be used for the basis of a discussion in class. The subject line of the e-mail should contain only the author's last name (or that of the first editor), and the chapter numbers or other designation of the reading assignment. If there is a problem with your e-mail, bring your question on a 3 by 5 card with your name and a question for the class on the assigned reading. You will give these to me at the beginning of the class period. These questions will form the basis for that class discussion. Although there may be some necessity for me to set the stage for this discussion, the quality of the discussion will depend upon each and every student coming to class fully prepared to discuss the reading assignments for the day. The goal is to have the instructor function as a facilitator of the discussion not as a lecturer. You should be prepared to be called upon by me to address the topics under consideration. Lack of preparation for the discussion will affect the your grade.

There will be four writing assignments which will account for 70% of the final grade. Class participation will account for 30% of the final grade, 15% associated with the quality of the questions you submit and 15% associated with the quality of your participation in the in-class discussions. The first writing assignment will be a two page essay that will act as a warm-up exercise and will serve as the basis for your last writing assignment. The others will all involve multiple drafts, the first of which will be a 5 page paper. That is followed by a 10 page paper having two drafts. The last assignment is another 2-3 page essay which is based upon your first assignment, so you must save all your drafts from that assignment. These assignments will be spaced uniformly throughout the semester.

Learning Goals and Student Learning Outcomes

After your have taken this course, I expect you to be able to distinguish being scientific and non-scientific arguments. You should be able to characterize the basic foundations of a scientific argument and be able to critique such arguments. You should be able to recognize the difference between good and weak scientific arguments and distinguish between scientific claims and pseudoscience. You should also be able to evaluate the use and misuse of scientific arguments in public discourse.