COE 1210: Scientific Revolutions Abroad
Summer 2, 2015

SYLLABUS

COURSE TITLE

COE 1210: Scientific Revolutions Abroad

INSTRUCTOR

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COURSE DESCRIPTION

This class studies two revolutions in scientific thought: the Scientific Revolution of the 17th and 18th centuries and the computational revolution of the 20th century. The Scientific Revolution gave scientists the optimism that, in principle, they could understand everything about the world around them. In contrast, the revolutions in complexity, logic, computation, mathematics and physics of the 20th century put fundamental limits on what scientists could know and understand. We seek to understand what these revolutionary scientific discoveries were, who made them, and how they changed the understanding of the world.

The class begins with an exploration of the Scientific Revolution, as exemplified by the work of Copernicus and Galileo in Italy. From our base in Florence and Rome, the heart of the Italian Renaissance, we trace the evolution of scientific thought from the 16th through 18th centuries. Lectures will be supplemented by local guest lecturers who are scientists, historians, academics, and curators with relevant expertise. We study the natural connections between the history of science taking place during the Italian Renaissance through scientific outings to local museums, observatories, universities, laboratories and archaeological sites. We then contrast this material with key results from chaos theory, computational complexity, logic, physics, quantum mechanics, and the theory of computation, all developed in the 20th century.

Taken together, these ideas make a powerful and overarching statement about about the reach and the limits of human knowledge that has profoundly affected disciplines as diverse as biology, philosophy, chemistry, mathematics, computer science, computer engineering, philosophy and religion. The seminar is self-contained and the only prerequisites are the ability to think critically, and to carefully read non-technical descriptions of the ideas being discussed. The emphasis is on the broad ideas and not on the technical details.

LEARNING OBJECTIVES

This class will trace key discoveries in six scientific disciplines from the Renaissance through the Scientific Revolution: astronomy/physics, chemistry/alchemy, anatomy, geography/exploration, mathematics/logic, and engineering/technology, and five disciplines from the 20th century: chaotic systems, mathematics, logic, computer science, and physics. For each discipline, students will learn:

- Who were the key scientists, and what were their discoveries?
• How was each topic influenced by the ancient world and middle ages?
• How did these discoveries change the world view? What assumptions were overthrown?
• What tools and instruments were used to make the discoveries?
• What role did religion play in the discoveries, and how did the discoveries affect religion?
• What role did experimentation play in the discoveries?

READINGS

Foundations/Determinism

Classical Science

Chaos and Complexity

Computational Complexity and Computability

Relativity and Quantum Mechanics

ASSIGNMENTS

In-class activities include lectures, group discussions, demonstrations, and student presentations. These activities are supplemented by trips to local museums, laboratories, observatories, and universities. There are approximately 4 homework assignments.
Each week, students write two one-page reflections on the course. The reflection should describe connections that have been observed between the course’s themes and a scientific outing.

The class’ online discussion group is a forum for the class community, including your classmates, the teaching assistants, and the instructor, to share and discuss ideas related to course material. You should post at least three entries to the discussion group every week. Your first post can be anything related to the course that the community might find interesting. It could be a question or a comment about lecture or reading material, a link to a relevant news article with your comments, a link to a relevant website with your comments, something you liked or disagree with from a recent lecture, questions about a classmate’s presentation, etc. Your second post should be a thoughtful response to one of your classmates’ postings. Your third post should be your weekly response to the reading.

Students make a short informal presentation to the class about something they have experienced during the Dialogue that relates to the course’s themes, and lead a class discussion. A section of the discussion board will be reserved for suggested activities, events, books, movies and articles that you might be relevant.

Students give a formal, non-technical presentation on a topic related to the class material. Possible topics include: a comparison of advances in a single discipline in two time periods, how a specific application area has been affected by the scientific advances, a description of how a specific discipline copes with a scientific limitation, a discussion of the philosophical implications of a limitation, or a more detailed description of the research that led to the discovery of the limitation. At the end of the semester, students submit a written project report.

There will be no tests or exams.

**GRADING CRITERIA**

Grades will be assigned as shown below. Each requirement’s contribution to the final grade is shown above in parentheses. A satisfactory score in each area is required to pass the class.

1. Attend and participate in lectures (15%),
2. Regularly do the reading, and post to the discussion board (15%),
3. Complete a series of homework assignments (35%),
4. Give an informal oral activity/book/movie report (10%),
5. Give a formal oral project presentation (10%), and
6. Write a formal written project report (15%).

**POLICY ON ACADEMIC INTEGRITY**

Northeastern University is committed to the principles of intellectual honesty and integrity. All members of the Northeastern community are expected to maintain complete honesty in all academic work, presenting only that which is their own work in tests and all other assignments. If you have any questions regarding proper attribution of the work of others, please contact me prior to submitting the work for evaluation.

Academic integrity is important for two reasons. First, independent and original scholarship ensures that students derive the most from their educational experience and the pursuit of knowledge. Second, academic dishonesty violates the most fundamental values of an intellectual community and depreciates the achievements of the entire university community.
Accordingly, Northeastern University views academic dishonesty as one of the most serious offenses that a student can commit while in college. The following is a broad overview of what constitutes academic dishonesty, but is not meant to be an all-encompassing definition.

Cheating: Intentionally using or attempting to use unauthorized materials, information or study aids in any academic exercise.

Plagiarism: Intentionally or knowingly representing the words or ideas of another as ones own in any academic exercise without providing proper documentation of source by way of a footnote, endnote, or intertextual note.

Unauthorized Collaboration: This refers to instances when students, each claiming sole authorship, submit separate reports which are substantially similar to one another. While several students may have the same source material (as in case write-ups), the analysis, interpretation, and reporting of the data must be each individuals.

All members of the Northeastern University community, students, faculty, and staff share the responsibility to bring forward known acts of apparent academic dishonesty. Any member of the academic community who witnesses an act of academic dishonesty should report it to the appropriate faculty member or to the Director of Judicial Affairs. The charge will be investigated and if sufficient evidence is presented, the case will be referred to Northeastern University Student Judicial Hearing Board. If found responsible of an academic dishonesty violation, a minimum sanction of probation will follow.

(Adapted from NU’s Academic Honesty and Integrity Policy)