Course Syllabus

Course Name: History and Philosophy of Science
First Year Available: Year 2 (Sophomore)
Course Code: PHIL260
Subject Area: Philosophy & Religious Studies
Class Style: Lecture
Number of Credits: 3
Term(s) Offered: Fall Semesters
Prerequisites: None
Instructor: Richard Dietz

Course Description
This course provides an introduction to key ideas and approaches proposed in philosophy as ways of understanding the aims, practices, and limits of science. We survey several approaches which have been proposed, with special attention to those from the late 19th Century to the present: positivism and Reichenbach’s logical empiricism; Popper’s critical rationalism; Kuhn’s account of scientific revolutions; van Fraassen’s constructive empiricism; Giere’s perspectivism and several approaches in the sociology of science will be included. In order to assess the adequacy of these accounts of science, we will investigate key developments in the history of science. Following the approach of DeWitt’s Worldviews, (2nd edition, 2010), we follow the path from Aristotle’s science through Galileo and Newton to Einstein, with special reference to changing theories in astronomy and cosmology. But we also follow the route in biology from Aristotle through Darwin to the discovery of the structure of DNA, as well as a host of other episodes in the history of scientific thought. We ask what strengths and weaknesses we can discover in the various alternative approaches to understanding science which are mentioned above, by reference to case studies from the history of science. We consider the role of logics (deductive and inductive) in science. And we end the term by investigating what the limits of science are, and what relevance scientific knowledge may have to ethical or social issues today.

Course Objectives
At the end of this course, students should be able to: (i.) Show an understanding of several major questions central to philosophy of science today; (ii.) Present several of the main approaches used in the past century to interpret science and its history, and several strengths and weakness of each approach; (iii.) Give examples from the history of science which illustrate some of the strengths and weaknesses of the main approaches studied; (iv.) Coherently discuss how theories of the motion of the heavenly bodies were improved from the ancient views of Aristotle and his predecessors to Newton and also to Einstein; (v.) Coherently discuss the transition from Aristotle’s ideas in biology to Darwin’s theory of evolution and to outline several common misunderstandings of Darwinian evolution; (vi.) Show acquaintance with key concepts and terminology of formal logic; (vii.) Comment in an informed way on whether, and in what ways if any, science can be applied to ethical issues.

Grading Criteria
Grading is as follows: participation in discussion (20%); assignments (20%); midterm (20%); paper/presentation (20%); final examination (20%). Late assignments will be penalized.

Organization
Classes will start with a 20-minute discussion followed by a 55-minute lecture. Each student will lead at least one discussion and prepare a summary and review of the readings in advance of the class meeting. Students are required to write one essay (8–10 typed pages, double-spaced), which is due by the end of Week 12. Students find it is ideal to define their own topic and central questions in consultation with their professor. Your essay should be based on course readings and at least one additional book or set of essays which deal with your topic. Late papers will be penalized, and e-mailed papers will not be accepted.
Required Materials and Textbooks
One primary general history of science text we will use is available free on line: John Avery - Science and Society (Copenhagen, Denmark : H. C. Orsted Institute, 2nd Edition, 2005.)
Additional readings will be distributed in class and/or posted to a class website by the instructor. Some other materials (videos, etc.) may also be posted through class web site or available at library reserve.

Lectures and Activities
Week 1
(Day 1): Introduction: What is philosophy, and what is philosophy of science? What is a Worldview?
• Reading: DeWitt- Chap. 1, 2, 3; pp.54-62; Gorham- Chap. 2.

WEEK 2: From Origins to Greek Science and Philosophical Basis
(Day 2): Greek Scientific Thought: the Pre-Socratics & Plato’s Science
• Reading: Gorham- Chap. 1; Notes on logic.

WEEK 3: The Scientific Contributions of Aristotle
(Day 1): Aristotle I: His Biology and Ideas on Causality
(Day 2): Aristotle II: His Physics, Astronomy and Cosmology
• Reading: DeWitt- Chap. 9.

WEEK 4: From Alexandria to the Renaissance
(Day 2): Leonardo da Vinci as Artist, Scientist and Thinker.
Anatomy from Leonardo to Vesalius to W'm. Harvey and the Circulation of the Blood
• Reading: DeWitt- Chap. 10, 11, 12, 13.

WEEK 5: The Scientific Revolution
(Day 1): Thomas Kuhn and the Structure of Scientific Revolutions: Paradigms and the Copernican Revolution.
How did Copernicus find the “nerve” to challenge Aristotle?
• Reading: DeWitt- Chap. 14; Gorham pp. 15-20.
(Day 2): Galileo, the Telescope, and the new Role for Observation.
• Reading: DeWitt- Chap. 17.

WEEK 6: Alternative Ways in Philosophy of Science
(Day 1): Interpreting Scientific Revolution by Logical Empiricism: by K. Popper; by T. Kuhn; by sociology of science; by R. Giere.
(Day 2): Considering the Application of History of Science to examples. A. Wegener & Continental Drift Theory as example.
• Reading: DeWitt- Chap. 6 & 7; Gorham- Chap. 5.

WEEK 7: New Models of the Cosmos
(Day 2): Tycho Brahe and J. Kepler.
• Reading: DeWitt- Chap. 15 & 16.
WEEK 8: Newtonian Synthesis
• Reading: DeWitt- Chap. 18, 19, 20.
(Day 2): The Newtonian Synthesis and its elaboration.
• Reading: DeWitt- Chap. 22.

WEEK 9: Evolution and Biology
(Day 1): Mid-term Summary of Weeks 1-8
(Day 2): From Aristotle to Darwin to Mendel: Key Ideas
• Reading: DeWitt- Chap. 27.

Week 10: Darwin’s Theory of Evolution and Its Interpretation
• Reading: DeWitt- Chap. 28; Galileo -letters and essay.
(Day 2): From Darwin to the Discovery of DNA. Molecular Biology, Genetic Markers and Early Human Migration.
• Reading: DeWitt- Chap. 28.

Week 11: The Journey of Man / The Aims of Science
(Day 1): “The Journey of Man” video and discussion.
(Day 2): The Aims of Science. Realism, Instrumentalism, & Anti-realism.
• Reading: Video / Gorham- Chap. 4; DeWitt- Chap. 8.

Week 12: Einstein’s Revolution
(Day 1): Einstein and Special Relativity Theory.
(Day 2): Einstein and General Relativity Theory.
• Reading: DeWitt- Chap. 23 & 24; Popper essay.

Week 13: Development’s in Contemporary Physics
(Day 1): Big Bang Cosmology and alternatives.
(Day 2): Understanding Quantum Theory.
• Reading: L. Randall essays.

Week 14: The Aims of Science
(Day 1): Scientific Realism and Anti-realism
(Day 2): van Fraassen’s Constructive Empiricism
• Reading: re-read Gorham- Chap. 4; DeWitt- Chap. 8.

Week 15: Science and Human Values
(Day 1): Science and Human Values
(Day 2): Science and Human Futures
• Reading: Gorham- Chap. 5 & 6.