Fall 2019

HIST 373-001: The Rise of Modern Science

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Course Description: The term “Scientific Revolution” signifying a discrete object of historical analysis was initially coined by Alexandre Koyré in 1939 and first became a book title in Rupert Hall’s The Scientific Revolution (1954). Implicit in this “traditional” scholarship was the notion of a cataclysmic if not climatic event, a conceptual revolution involving far-reaching changes in ways of thinking about nature. Here scientific advances were viewed in terms of autonomous ideas—disembodied mentalities—divorced from their wider geo-cultural contexts; if there was a geography of thought it was imprinted on maps that were metaphysical, metaphorical.

Revisionist scholarship in recent years has challenged this viewpoint, tending to be skeptical of both the novelty and coherence of what had previously been understood as a “revolution” and questioning if there ever was a single cultural entity called “science” in the 17th century to experience revolutionary change. There was rather, it is contended, a complex array of cultural practices aimed at understanding, explaining and controlling the natural world, each with different characteristics and each experiencing different modes of change. Such work has also given attention to new frameworks of intellectual production, extra scientific influences, the concrete human practices by which ideas are fashioned, as well as agencies and personalities hitherto marginalized in the historiography of early modern science.

This course consists of four components. The first examines the historical dimension of science: specifically how history illuminates the role of science in human cultural development. The second focuses on the nature of scientific inquiry: its genesis, defining characteristics, varieties and place in the modern world. It will also examine the conditioning factors outside science itself that played a pivotal role in the production of new knowledge as well as the development of key reasoning processes in cultural historical context. The third looks at the achievements of major scientists in relation to the visionary displacement underlying their creative enterprise and in relation to the societies in which they lived. Venturing outside the structures of Aristotelian physics, and other conventional paradigms, scientists during this period produced innovations not so much by new observations or additional evidence but by new, challenging ways of looking at old problems adopting a psycho-biographical over purely disciplinary perspective. In both celestial and terrestrial physics, change was brought about by transpositions that were taking place inside minds of the scientists themselves. This course seeks to explain why. The fourth component examines how changes in engineering and technology during the 20th and 21st centuries have affected the balance among various modes of scientific rationality (or styles of science) and how scientific knowledge has become power to be used not merely to contemplate nature but to alter and improve it.

Course Goals: The course aims to demonstrate that science is not a hermetically sealed, isolated activity of the mind but one intrinsically related to the overall historical process: the history of civilization. By viewing scientific development as part of the wider story of human thought and endeavor during the period, the course will provide a necessarily wider context for understanding science and technology. In addition to treating science as a unique cultural...
phenomenon, the course and its requirements, also seeks to improve students’ abilities to think, read, and write in a critical and analytical fashion. Finally, the course aims to determine whether there exists an overall pattern of scientific development and if so, is it one of creative displacement (i.e. the Kuhnian approach) or are there diverse forms of rupture, discontinuity or rapid change in science?

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<th>Assignments and Marks:</th>
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<tbody>
<tr>
<td>First Book Review (Biography)       20%       Due Wed., Oct. 2</td>
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<tr>
<td>Mid Term                               30%           Mon., Oct. 7</td>
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<tr>
<td>Second Book Review                   20%           Due Mon., Nov. 11</td>
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<tr>
<td>Wrap-up Quiz                          20%           Wed., Dec. 11</td>
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<td>Class Participation                  10%</td>
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Grading Scale for Assignments and Participation:

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<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>85 – 100</td>
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<tr>
<td>B+</td>
<td>80 – 84.5</td>
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<tr>
<td>B</td>
<td>75 – 79.5</td>
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<tr>
<td>C+</td>
<td>69.5 – 74.5</td>
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<tr>
<td>C</td>
<td>65 – 69.5</td>
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<tr>
<td>D</td>
<td>50 – 64.9</td>
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<tr>
<td>F</td>
<td>49.9 - 0</td>
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Texts: (required readings)
Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago, 1970)

Semester Schedule:

**Sept. 4:** Introduction

**Sept. 9 and Sept. 11:** The History of Science: Contexts, Definitions and Key Issues.
*Readings:* Butterfield, Intro.; Kuhn, ch. 1

**Sept. 16 and Sept. 18:** Science and its Historical Roots.
*Readings:* Butterfield, ch. 2; Kuhn, ch. 3; Westfall, ch. 1

**Sept. 23 and Sept. 25:** Paradigms, Anomalies and Scientific Discovery.
*Readings:* Kuhn, ch. 5, ch. 6; Butterfield, ch. 7

**Sept. 30 and Oct. 2:** The Scientific Revolution in the History of Thought.
*Readings:* Butterfield, “The Scientific Revolution” (class handout); Kuhn, ch. 9; Westfall, ch. 2 *Book review is due Wednesday, October 2.*

**Oct. 7:** Midterm Quiz.

**Oct. 9 and Oct. 14:** Tradition and Innovation in Scientific Research.
*Readings:* Kuhn, “Essential Tension” (to be supplied), ch. 9; Butterfield, ch. 5.
Readings: Kuhn, ch. 10; Butterfield, ch. 7

Readings: Butterfield, ch. 5; Westfall, ch. 6; Mason, ch. 8

Nov. 4 and Nov. 6: The Newtonian Revolution.
Readings: Kuhn, ch. 11; Westfall, ch. 6; Butterfield, ch. 7

Nov. 11 and Nov. 13: The Scientific Revolution in the History of Western Civilization.
Readings: Butterfield, ch. 10
Second book review due Monday, November 11.

Nov. 18 and Nov. 20: The Application of Science in the 18th Century.
Readings: Mason, chs. 23, 24

Nov. 25 and Dec. 2: Evolution and the Great Chain of Being.
Readings: Mason, chs. 27, 28; Butterfield, ch. 7

Dec. 4: Geology, Chemistry and Theories of Light During the 19th Century.
Readings: Mason, chs. 33, 36, 38

Dec. 9: Review for Wrap-up Quiz

Dec. 11: Wrap-up Quiz.

Biographies:

W. Isaaco, Einstein: His Life and Universe (NY, 2007).
B. Barnes, Thomas Kuhn and Social Science (NY, 1982).
S. Fuller, Thomas Kuhn: A Philosophical History for Our Times (Chicago, 2000).
H. Kesten, Copernicus and His World (NY, 1945).
P. Sears, Charles Darwin (NY, 1950).
E. Curie, Madame Curie (London, 1938).
A. Pais, Subtle is the Lord: The Science and Life of Albert Einstein (NY, 1982).
P. Schilpp, Albert Einstein Philosopher-Scientist (NY, 1949).
R. Clarke, Einstein: The Life and Times (NY, 1971).

**Suggested Books for Second Book Review:**

B. Barnes, *Thomas Kuhn and Social Science* (NY, 1982).
Course Requirements:

- Hist 373 requires two book reviews (approximately 5-6 pages) based on a book relating to themes of the course, chosen by the student (with Professor’s approval) but not one of the course texts.
- The first book review will be a review of a scientist’s biography and is due on Wednesday, October 2. This will count as 20% of the final grade.
- The second book review will be of a work on any scientific subject covering the course chronology and this is due on Monday, November 11. This review will also count for 20% of the final grade.
- Book review guidelines will be provided. Autobiographies, memoirs, and novels are not acceptable.
- Both book reviews are to be handed in at the beginning of class—hard copy, not email.
- There will be a midterm quiz and a wrap up quiz. The midterm counts for 30% and the wrap up will count for 20% of the final grade.

Policies:

- This is an intellectually demanding course and all students will be expected to do all the readings listed in the syllabus and start work on their written assignments before the submission date, ideally as soon as the book and/or subject has been approved.
- A sign-up sheet will be circulated in class weeks prior to book reviews due. After choosing your book be sure to check the sign-up sheet to make sure that your choice has been approved by the Professor.
- Once your book and later your second book have been approved it is the student’s responsibility to bring these to completion using the guidelines in the handouts without further professorial input.
- Attendance will be taken during each class and it is the student’s responsibility to sign the attendance book. Absences will be excused only with documentation from the Dean of Students.
- Assignments MUST be submitted on time. Excuses for work submitted late will not be accepted (medical reasons, death in family apart). There are no exceptions (except as noted above). Late submissions will have grades deducted (one grade per day of lateness) unless a valid reason given (i.e. illness, supported documentation from the Dean of Students). This point must be clearly understood before students agree to take this class. Last minute pleas based on undocumented reasons will be rejected.
- It is the student’s responsibility to ascertain that all assignments have been duly submitted and all required term work completed prior to termination of the semester. By signing the attendance book, students explicitly acknowledge their understanding and acceptance of this condition.
- Plagiarism in any written assignment will result in an automatic failure and will be reported to the Dean of Students.
- Students must not put assignments under the professor’s office door. They should be submitted on the due date at the beginning of the class or taken to the History office where the office administrator will date stamp them.
• Assignments are to be submitted as hard copy. Email attachments will not be accepted.

• There will be no “make-up” exam. If you miss the midterm quiz or wrap-up quiz for any reasons other than those applying to written assignments listed above, you will receive an F.

• There will be no “re-writing” of book reviews. Students having problems with written English must consult the Humanities Dept. Writing Center (Cullimore, 4th floor), Professor Janet Bodner.

• All submitted work must contain the following signed statement: I have fully complied with the NJIT Honor Code. Signed: Your Name.