Center for Professional Development
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Independent Study Course Syllabus

Course Number: SOC 967

Course Title: The Scientific Revolution, 1500-1800

☐ Online X Distance Learning

Instructor: Allen Carden, Ph.D. **Phone number:** (559) 903-0648 **Email:** ACarden@aol.com	**Units: 3** **Grade Level: All**

Course Description

An exploration of the key discoveries, theories, personalities, and impact of the scientific revolution in Europe in the 16th through the 18th centuries, including the conflict between scientific advances and traditional religious and cultural views of the period. Comparisons with the current revolution in science and technology will be examined.

Course Dates

This is a self-paced independent study course; students may enroll at any time and take up to one year to complete all assignments. The course may be completed no less than three weeks from the date of registration, and no more than one year from the date of registration. A time extension may be possible; the Center for Professional Development must be contacted for information and instructions.

Course Materials

Learning materials used in this course include a book by John Gribbin, *The Scientists: A History of Science Told through the Lives of its Greatest Inventors* (2004) and a NOVA/Public Television DVD: *Galileo's Battle for the Heavens*, which includes printable materials for educators. **It is the student's responsibility to obtain these materials.** The assignment workbook, which includes a select bibliography and a web site evaluation form, is provided.

Course Requirements

Students will demonstrate mastery of stated learning objectives for this course by successful completion of a series of required assignments aligned with those learning objectives. Complete

assignment details will be provided upon registration for the course. The following assignments are all required, and contain the maximum point values indicated below:

1. Watch DVD, "Galileo's Battle for the Heavens" and respond to questions (50 points)
2. Evaluate the educational materials available from the DVD (5 points)
3. Assigned readings from John Gribbin's book, *The Scientists*, and create a chart of 20 scientists per instructions, as well as completing a review of the book (50 points)
4. Biographical report (1-2 pages each) on three selected scientists (20 points)
5. Develop an annotated Internet bibliography of eight websites useful for teachers (15 points)
6. Report on the Scientific Method (may be written report, power point, or poster format) (15 points)
7. Essay (1-2 pages) on the influence of scientific thinking on the Enlightenment (10 points)
8. Report (1-2 pages) on a pre-1500 non-European scientific discovery helpful to the advance of science in the West (10 points)
9. Personal opinion essay (1-2 pages) on the relationship between science and religious faith (10 points)
10. Develop and teach a lesson dealing with the history of science (or submit two lesson plans if unable to teach a lesson) (30 points)
11. Essay (1-2 pages) on what can be gained from a study of the history of science (10 points)
12. Evaluation and application (1 page) describing your reaction to the course and how you might find it useful in your teaching (5 points)

Completed assignments are to be submitted all together at the conclusion of the course. Assignments have been designed to promote learning outcomes that are aligned with the national content standards (see below).

National Content / Common Core Standards

Based on national history standards developed by NCHS (National Center for History in Schools at UCLA), this course will help prepare teachers to address the following:

History Standards for Grades 5-12, World History

Era 6: The Emergence of the First Global Age Standard 6A: The student understands major global trends from 1450 to 1770.

- Assess how the acceleration of scientific and technological innovations in this era affected social, economic, and cultural life in various parts of the world.
- Identify patterns of social and cultural continuity and various societies and analyze ways in which peoples maintained traditions and resisted external challenges in the context of a rapidly changing world.

Additional curriculum standards for social studies, addressed by this course, are described by the National Council for the Social Studies for grades 1-12 as found in Strand 8, "Science, Technology, and Society."

Lower Grades: a) identify and describe examples in which science and technology have changed the lives of people. . . b) identify and describe examples in which science and technology have led to changes in the physical environment. . . c) describe instances in which values, beliefs, and attitudes have resulted from new scientific and technological knowledge.

Middle Grades: a) examine and describe the influence of culture on scientific and technological choices and advancement. . . b) show through specific examples how science and technology have changed people's perceptions of the social and natural world. . . c) describe examples in which values, beliefs, and attitudes have been influenced by new scientific and technological knowledge, such as . . . conceptions of the universe. . .e) seek reasonable and ethical solutions to problems that arise when scientific advancements and social norms or values come into conflict.

High School: a) identify and describe both current and historical examples of the interaction and interdependence of science, technology, and society in a variety of cultural settings. b) make judgments about how science and technology have transformed the physical world and human society and our understanding of time, space, place, and human-environment interactions. c) analyze how science and technology influence the core values, beliefs, and attitudes of society, and how core values, beliefs, and attitudes of society shape scientific and technological change. e) recognize and interpret varied perspectives about human societies and the physical world using scientific knowledge, ethical standards, and technologies from diverse world cultures.

California History Standards

Students analyze the historical developments of the Scientific Revolution and its lasting effect on religious, political, and cultural institutions.
7.10.1: Discuss the roots of the Scientific Revolution (e.g. Greek rationalism; Jewish, Christian, and Muslim science; Renaissance humanism; new knowledge from global exploration).
7.10.2: Understand the significance of the new scientific theories (e.g. those of Copernicus, Galileo, Kepler, Newton) and the significance of new inventions (e.g. the telescope, microscope, thermometer, barometer).
7.10.3: Understand the scientific method advanced by Bacon and Descartes, the influence of new scientific rationalism on the growth of democratic ideas, and the coexistence of science with traditional religious beliefs.

Learning Objectives

It is intended that students who complete this course will be able to:

- Describe the religious/cultural environment within which the growth of science developed in Europe in the 16th and 17th centuries (Assignments #1,3,4,9)

- Understand the importance of key individuals and inventions to the Scientific Revolution of the period (Assignments #1,3,4,7,11)
- Explain key theories developed by thinkers and researchers during the Scientific Revolution (Assignments #1,2,3,4,6,7)
- Define the nature of conflicts that arose between the new scientific theories and the Roman Catholic Church, and the reasons for resistance to change (Assignments #1,9)
- Grasp the implications of changes in core values and worldviews as a result of scientific observation and experimentation (Assignments #1,3,4,6,7)
- Trace the development of the "scientific method" (Assignments #3,6)
- Analyze the growth and expansion of scientific thinking as a result of early discoveries and its impact on Western Civilization (Assignment #8)
- Analyze the relationship between scientific discoveries of the era and changes in technology and society, including the Age of Discovery and Colonization (Assignments #1,3,4,7)
- Demonstrate awareness of ethical considerations in science (Assignments #7,9)
- Demonstrate ability to take material from this course and develop a meaningful lesson for students (Assignments #5,10,11)

Schedule of Topics and Assignments

See "Course Requirements" section above. Assignment details will be given after course registration is completed.

Evidence of Learning

In evaluating your work, the instructor will look for

- evidence of mastery of learning objectives through students' reflective writing assignments
- evidence of thoughtful analysis of learning objectives through ability to make practical application of the material in lesson plans
- evidence of "scientific literacy" in analysis of issues
- evidence of the ability to synthesize large amounts of material in written and video forms and distill the essence of the material using critical thinking skills demonstrated in student's written assignments
- evidence of growth in historical understanding of the development of the Scientific Revolution

Grading Policies and Rubrics

The final grade will be calculated as follows:
205-230 points = A
180-204 points = B

Below 180 points is not considered acceptable passing work. Students requesting a letter grade must earn a grade of "A" or "B" to receive credit for the course. Students selecting a pass/no pass option must earn at least 180 points to pass.

- The discernment between an A or a B is at the discretion of the instructor based on the quality of work submitted (see assignment rubrics).
- Coursework falling short of a quality equaling a B or a Credit Grade will be returned with further instructions.
- All assignments must be completed in order to receive a grade. In addition, all assignments are expected to reflect the quality that teacher-training institutions require of professional educators. If completed assignments do not meet this standard, students will be notified with further instructions from the instructor.

Instructor/Student Contact

A minimum of three contacts between the instructor and student is required as part of the course assignments. Email (see instructor contact information above) is the preferred means of contact. Contact #1 should be made when the student receives and has looked over the course materials. Instructor prompt for contact #1: **Have you received all of the course materials, and do you understand what is expected for successful completion of the course?** Contact #2 should be made when the student has completed assignment #5. Instructor prompt for contact #2: **Are there any questions or concerns you have about the course material and assignments so far? What has been of most benefit to you in the course to this point?** Contact #3 should be made when the student has completed all assignments and is ready to send them to the instructor for grading. Instructor prompt for contact #3: **Have you completed all assignments, and requested online grading? Are there any questions or concerns you have at this point?**

References/ Resources

Select Bibliography of Books related to the Scientific Revolution

David Berlinski, *Newton's Gift*, New York, 2000.

Mario Biagioli, *Galileo, Courtier*, Chicago, 1993

Leonard C. Bruno, *The Landmarks of Science*, New York, 1989.

John R. Christianson, *On Tycho's Island*, London, 2000.

J. G. Crowther, *Founders of British Science*, London, 1960.

Richard Dawkins, *The Blind Watchmaker*, *New Yo*rk, 1986.

Stillman Drake, *Galileo*, Oxford, 1980

Anthony Flew, *Malthus*, London, 1970.

Rupert Hall, *Isaac Newton*, Oxford, 1992.

Hermann Kesten, *Copernicus and His World*, London, 1945.

Frank Manuel, *Portrait of Isaac Newton*, Cambridge, MA, 1968.

C.D. O'Malley, *Andreas Vesalius of Brussesl 1514-1564*, Berkeley, 1964.

James Reston, *Galileo*, London, 1994.

Stephen Shapin, *The Scientific Revolution*, London, 1966.

Richard Westfall, *The Life of Isaac Newton*, London, 1997.

Arthur Zajonc, *Catching the Light*, London, 1993.

Websites related to the Scientific Revolution

http://trackstar4teachers.org/trackstar/ts/themes/ss9-12/index_ss9.html

http://www.madera.k12.ca.us/webquest/scientificrevolution.htm

National and State Content Standards Websites

www.education-world.com/standards

www.academicbernchmarks.com/search/

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Center for Professional Development website (http://ce.fresno.edu/cpd) to "Submit Grade Form". Once the instructor fills out the grade form online, students may log back in to request their Grade Report as well as order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information see the Independent Studies Policies and Procedures that were sent to you when you received your course materials, or in your online course. They are available, also at http://ce.fresno.edu/cpd - under General Information > CPD Policies.

Plagiarism and Academic Honesty

All people participating in the educational process at Fresno Pacific University are expected to pursue honesty and integrity in all aspects of their academic work. Academic dishonesty, including plagiarism, will be handled according to the procedures set forth in the Fresno Pacific University Catalogue. URL http://www.fresno.edu.

CONTINUING EDUCATION PROGRAM STUDENT LEARNING OUTCOMES:

CE 1. Demonstrate proficient written communication by articulating a clear focus, synthesizing arguments, and utilizing standard formats in order to inform and persuade others, and present information applicable to targeted use.
CE 2. Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
CE 3. Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement.
CE 4. Apply critical thinking competencies by generating probing questions, recognizing underlying assumptions, interpreting and evaluating relevant information, and applying their understandings to the professional setting.
CE 5. Reflect on values that inspire high standards of professional and ethical behavior as they pursue excellence in applying new learning to their chosen field.
CE 6. Identify information needed in order to fully understand a topic or task, organize that information, identify the best sources of information for a given enquiry, locate and critically evaluate sources, and accurately and effectively share that information.

FRESNO PACIFIC UNIVERSITY STUDENT LEARNING OUTCOMES

Student Learning Outcomes Oral Communication: Students will *exhibit* clear, engaging, and confident oral communication – in both individual and group settings – and will critically *evaluate* content and delivery components.
Written Communication: Students will *demonstrate* proficient written communication by *articulating* a clear focus, *synthesizing* arguments, and utilizing standard formats in order to *inform* and *persuade* others.
Content Knowledge: Students will *demonstrate* comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
Reflection: Students will *reflect* on their personal and professional growth and *provide evidence* of how such reflection is utilized to manage personal and vocational improvement.
Critical Thinking: Students will *apply* critical thinking competencies by *generating* probing questions, *recognizing* underlying assumptions, *interpreting* and *evaluating* relevant information,

and *applying* their understandings to new situations.
Moral Reasoning: Students will *identify* and *apply* moral reasoning and ethical decision-making skills, and *articulate* the norms and principles underlying a Christian world-view.
Service: Students will *demonstrate* service and reconciliation as a way of leadership.
Cultural and Global Perspective: Students will *identify* personal, cultural, and global perspectives and will employ these perspectives to *evaluate* complex systems.
Quantitative Reasoning: Students will accurately *compute* calculations and symbolic operations and *explain* their use in a field of study.
Information Literacy: Students will *identify* information needed in order to fully understand a topic or task, *explain* how that information is organized, *identify* the best sources of information for a given enquiry, *locate* and critically *evaluate* sources, and accurately and effectively *share* that information.