Term Information

Effective Term	Autumn 2023
Previous Value	*Autumn 2018*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Adding Nature, Number, Mind GE theme to the course

What is the rationale for the proposed change(s)?

This course is an excellent fit for this theme.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

N/A

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	History
Fiscal Unit/Academic Org	History - D0557
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	3711
Course Title	Science and Society in Europe, from Copernicus to Newton
Transcript Abbreviation	Sci&SocEarlyEuro
Course Description	A survey of the history of science and its place and relationship to European society in the early modern period. Students will understand the various strands that constitute the scientific revolution in early modern Europe, modern intellectual history, how revolutions in thought occur, and will practice analytical and communications skills in working with both secondary and primary sources.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week, 6 Week, 4 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster
Previous Value	*Columbus, Lima, Mansfield, Marion, Newark*

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq or concur: English 1110.xx, or permission of instructor.
Exclusions	
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	54.0104
Subsidy Level	Baccalaureate Course
Intended Rank	Sophomore, Junior, Senior

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors
General Education course:
Historical Study; Number, Nature, Mind
The course is an elective (for this or other units) or is a service course for other units

Previous Value

Required for this unit's degrees, majors, and/or minors
General Education course:
Historical Study
The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will learn about early modern intellectual history; understand the various strands that constitute the scientific revolution in early modern Europe; and practice analytical and communications skills with primary and secondary sources.

Content Topic List

- Science
- Science and religion
- Science and society
- Scientific revolution
- Early physics
- Early chemistry
- Early astronomy
- Early optics
- Scientific instruments
- Technology
- European thought
- Intellectual history
- History of ideas

Sought Concurrence No

Attachments

- 3711 GE form NNM 2022.docx: GE Form

  (Other Supporting Documentation. Owner: Getson,Jennifer L.)

- 3711 Syllabus GE NNM 2022 - Goldish.docx: Syllabus

  (Syllabus. Owner: Getson,Jennifer L.)

Comments

- Please see feedback sent to department 1-13-2023 RLS *(by Steele,Rachel Lea on 01/13/2023 02:34 PM)*
- Deleted the old versions and replaced them with new versions. *(by Getson,Jennifer L. on 07/29/2022 12:23 PM)*
- Please make sure that only one set of answers for Goals 1 and 2 & their ELOs is provided. As such, by adding them again later in the form & providing slightly different answers, it's rather confusing. The panel should only see one set of answers for 1.1, 1.2, 2.1, and 2.2 *(by Vankeerbergen,Bernadette Chantal on 07/29/2022 11:31 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Getson,Jennifer L.	07/29/2022 10:06 AM	Submitted for Approval
Approved	Soland,Birgitte	07/29/2022 10:45 AM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	07/29/2022 11:32 AM	College Approval
Submitted	Getson,Jennifer L.	07/29/2022 12:23 PM	Submitted for Approval
Approved	Soland,Birgitte	07/29/2022 01:25 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	11/29/2022 03:27 PM	College Approval
Revision Requested	Steele,Rachel Lea	01/13/2023 02:34 PM	ASCCAO Approval
Submitted	Getson,Jennifer L.	01/27/2023 03:51 PM	Submitted for Approval
Approved	Soland,Birgitte	01/27/2023 09:32 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/30/2023 03:52 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	01/30/2023 03:52 PM	ASCCAO Approval

HISTORY 3711: SCIENCE & SOCIETY IN EARLY MODERN EUROPE

(University Hall 38, Mondays 2:20-3:40)

Format: Lecture, in-person, 3 hours per week, 3 credit hours

Instructor: Matt Goldish 148 Dulles Hall goldish.1@osu.edu

Office Hours: 3:40 to 4:40 Mondays and by appointment. E-mail to set a time.

Description and Purposes of the Course

The scientific revolution is a term used to describe the huge changes in European conceptions of nature which occurred from around 1450 to 1750. These changes did not occur in some isolated ivory-tower laboratory, but within a cultural and intellectual framework. New discoveries were made through analysis of older scientific and philosophical ideas in conversation with rapidly changing conceptions about how to apprehend Truth (epistemology), new geographical and technical discoveries, and shifting economic, social, and political conditions. As natural philosophers increasingly realized that mathematics was the key to describing nature accurately (like musical notes for describing a melody), radical new mathematical techniques were formulated to quantify and describe new scientific discoveries. We will be examining the new discoveries, the new mathematics, and their cultural context, which is why the course is called "Science and Society". The purposes of this course are: to give students some sense of the various strands that constitute the scientific revolution in early modern Europe; to consider changing views about mathematics as a way to understand how it ended up at the center of science and technology; to think about how revolutions in thought occur; to learn about early modern intellectual history more generally; to practice the analytical and communications skills called for in working with both secondary and primary sources.

GE Theme: Number, Nature and Mind

This course fulfills the requirements for the GE Theme: Number, Nature, and Mind.

Goal 1: Successful students will analyze the nature of mathematics and/or mathematical reasoning at a more advanced and in-depth level than in the Foundations component.

ELOs: 1.1 Engage in critical and logical thinking about the nature and/or application of mathematical reasoning.

1.2 Engage in an advanced, in-depth, scholarly exploration of the philosophical and/or cognitive foundations of mathematics and/or the application of mathematics in understanding the natural world or human cognition.

How we will achieve these Goals and Outcomes in this course:

(See reading and discussion for 3, 10, 15 September, 1, 6 22 October, 24 November) The rise of modern science is heavily based on the recognition that mathematics is the "language" of nature, and the tremendous development of the mathematical tools needed to decode the "book" of natural knowledge. We will examine the revival of Pythagoras, Euclid and Archimedes in the Renaissance and see how their philosophical as well as practical understanding of relations between mathematics and the physical world inspired the birth of modern science. This outcome will be achieved in particular by reading about and discussing the place of mathematics in Copernicus's heliocentric argument; the geometric reasoning of Johannes Kepler; the huge strides in geometry and mathematics made by Descartes and the Cartesians trying to understand motion in space; and the invention of calculus simultaneously by Newton and Leibniz. Other related topics will also come up along the way.

Goal 2: Successful students will integrate approaches to number, nature, and mind by making connections to their own experience of mathematical thinking and its application in the world, and by making connections to work they have done in previous classes and/or anticipate doing in the future.

ELOs: 2.1 Identify, describe, and synthesize approaches to or experiences of the role of mathematics and mathematical reasoning in different academic and non-academic contexts.

2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.

How we will achieve these Goals and Outcomes in this course:

(See reading and discussion for 10 and 22 September, 6 and 13 October, 8 December.) Throughout the course, we will be reading and talking about how life looked to Europeans before, during, and after the scientific revolution (yes, I will still use that term), up to our own day. We will, for example, consider the ability of mathematics to describe everyday experiences such as the geometry of flowers, the harmonics of music, the patterns of tides, and of course the movements of the earth and other planets. The thinkers of the scientific revolution showed us the necessity of understanding the world in mathematical terms, and we will regularly encounter this phenomenon in all kinds of life experiences, relevant then and now. Students will have the opportunity to reflect on this growing realization of the early modern natural philosophers in class readings, discussions, and written assignments, such as their papers and exams.

Goal 3: Successful students will experience and examine mathematics as an abstract formal system accessible to mental manipulation and/or mathematics as a tool for describing and understanding the natural world or human cognition.

ELOs: 3.1 Analyze and describe how mathematics functions as an idealized system that enables logical proof and/or as a tool for describing and understanding the natural world or human cognition.

How we will achieve these Goals and Outcomes in this course:

(See reading and discussion for 3, 10, 15, and 22 September, 1, 6 and 22 October, and 1 December.) This goal and ELO are at the very heart of our studies in the scientific revolution. Ancient philosophers and medieval Scholastics had developed mathematical studies in some very sophisticated ways. The early modern natural philosophers revived the ancient reverence for mathematics as a set of tools for understanding the operations of the physical world. Their studies raised new and practical mathematical problems in navigation, optics, ballistics, mechanics, astronomy, acoustics, probability, and architecture. In response the natural philosophers (what we would call scientists) of that age invented new mathematical methods, including logarithms, analytical geometry, decimal fractions, probability theory, and fluxions (calculus). And, unlike medieval Scholastic logical debates, mathematics offered proofs which could be demonstrated in the physical world. In this way, mathematics shifted during the early modern period from the realm of the theoretical to the center of practical application. These are among the topics which will come up in our readings, discussions, and assignments for this course.

<u>Required Reading</u>

> James R. Jacob, *The Scientific Revolution: Aspirations and Achievements, 1500-1700* (on CARMEN)

> Betty Jo Teeter Dobbs and Margaret C. Jacob, *Newton and the Culture of Newtonianism* (buy online or through campus bookstore)

> Articles, documents and supplemental readings through our CARMEN website or online

<u>Attendance</u>

I do not take attendance but if you miss a class it is likely that you will miss a quiz, and you will certainly miss important material which may be on the final exam. If you have to miss class because of an emergency, do not worry, even if there is a quiz. The two lowest quiz grades are dropped, and you can

get notes from one of your classmates. If you do miss a class*, be sure to get excellent notes from someone who was here*! Please do not ask me, "Did I miss anything important?" If you didn't miss something important, I was not doing my job. I will not, however, repeat the class to you or give you a missed quiz.

Enrollment

All students must be officially enrolled in the course by the end of the second full week of the quarter. No requests to add the course will be approved by the Chair after that time. Enrolling officially and on time is solely the responsibility of the student.

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct **http://studentlife.osu.edu/csc/**.

Disability Services

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue.

Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Sexual Misconduct and Relationship Violence

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Diversity

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

HOW TO GET AN **A** IN HISTORY 3711

- Give it all you've got. Don't think of this as your easy course which you can work on in your spare time. Enjoy the reading and discussions, but treat it with the seriousness with which you would treat a Chemistry or Political Science course.
- Do each reading carefully, not in a rush. *Take notes on names, terms and topics* which are discussed at any length. *Use chapter or article titles and sub-chapter headings* to guide you about the main topics. *Look up any terms* with which you are not familiar and/or ask about them in class.
- Participate in class discussions in a meaningful, informed way and take notes in class.
- Do not miss classes unless there is an emergency. If you need to miss, get excellent notes from classmates who were present.
- Answer the quiz questions accurately. If you have read carefully and taken some notes this should be fairly easy.
- Write well structured, grammatical, sophisticated essays. Follow the template. Proofread carefully. Do not throw in filler material just to make your paper longer—I deeply dislike that. Don't use all your space on biography. *Proofread* very carefully to eliminate errors which I will catch.
- Think about the larger themes we discuss in class and readings in order to do great on the final exam.

Getting a **B**

Do all the same things you would need to do to receive an A, but: perhaps you miss one or two classes, or you do not take such careful notes on the reading. Your papers are still tightly organized but not quite as sharp or the writing not as carefully proofread as an A paper.

Getting a **C**

Do the same things you would need to do to receive a B, but: your reading is not sufficiently careful to receive full credit on the quizzes, your papers have a few grammatical or structural issues, and your grasp of the material is not as sophisticated as it should be in a college course.

Getting a **D** or **E**

You miss several class periods, your reading is not careful and your grasp of the ideas from the readings is not sufficient to show you are following the course. You miss turning in papers or you write them so poorly that I am unable to give them a passing grade.

If you are concerned during the semester that you are not receiving the quiz or essay grades you want, look carefully at the criteria above and consider seriously whether you are doing what it takes to receive those better grades. Evaluate your reading habits in particular. At the university level it is not enough to just "do" the reading—you need to really understand and remember what is there.

Reading and Lecture

Please be aware that, while we will discuss the readings in lecture, the main part of the lecture and discussion will often cover topics entirely different from the day's reading as well.

Writing Ability

If you are concerned that your writing is not proficient enough, both technically and conceptually, to succeed in a 3000-level history course, contact the Writing Center: http://cstw.osu.edu. I will grade down for poor grammar and other technical errors as well as content problems.

Grading

I may consider improvement when determining final grades. The usual breakdown is: A: 92 and above; A-: 89-92; B+: 87-88; B: 82-86; B-: 79-82; C+: 77-78; C: 72-76 C-: 69-72; D+: 67-68 D: 62-66; E: below 62.

Your grade will be based on the following assignments. I may adjust someone's grade slightly if the person has shown strong indications of improvement. Each grade is expressed as a number of points. Each point equals 1% of your grade in the class. So, for example, a quiz is worth five points. 5/5 is an A; 4/5 is a B, etc.

Pop quizzes	12 @ 5 points each; lowest 2 dropped	=50%
Paper		=25%
Final exam		=25%

Weekly Topical Outline

These readings are to be done *before* you get to class on each day listed

Wed 27 Aug Syllabus review; introductions; the scientific revolution; ancient & medieval background
Reading: None
Topics: The scientific revolution; its period, nature, and achievements; the relationship between people, institutions, and fields; relationship of science to society; science and technology; Why then?

Mon 1 Sept Labor Day; no class

Wed 3 Sept Ancient and medieval science
Reading: Jacob, *Sci Rev*, Ch. 1; Pythagoras, Plato, Aristotle, and other ancient authors (Carmen)
Topics: The philosophical, scientific, technological and mathematical legacy of the ancients; Thales of Miletus; Pythagoras; Aristarchus of Samos; Plato and Neoplatonism; Aristotle and Scholasticism; Euclid; Archimedes; Ptolemy.

Mon 8 Sept How the medieval legacy prepared the way for the scientific revolution
Reading: Grant, "When Did Modern Science Begin?" (Carmen)
Topics: The establishment of universities in Europe; the division of faculties; "priest-

philosophers"; the scholastic method of debate; mathematics and mixed mathematical sciences.

Wed 10 Sept Renaissance philosophy, magic, skepticism and science
Reading: Jacob, *Sci Rev*, Ch. 2; David Wooton, *Invention of Science*, Ch 5, "Mathematization of the World," (on CARMEN)
Topics: Neoplatonism, magic and science; *gematria*, *notrikon* and *temurah*—letter and number magic; revival of Pythagoreanism, Stoicism, skepticism, atomism; *plus ultra*; John Dee and Euclid; mathematics as the language of nature; Hermes Trismegistus.

Mon 15 Sept The "New Science" and the spread of Copernicanism
Reading: Jacob, *Sci Rev*, Ch. 3; Copernicus, Brahe, Kepler, etc. (Carmen)
Topics: Copernicus and Aristarchus of Samos; mathematics of planetary movement; equants and epicycles; the problem of circular motion; the problem of comets in the superlunary spheres; Kepler's divine geometry; Kepler's ellipse; Kepler's Laws.

Wed 17 Sept The question of scientific revolutions and the Kuhn Thesis
Reading: Kuhn, *Structure of Scientific Revolutions* (Carmen)
Topics: What is a scientific revolution? How can we tell when one occurs? Normal science; paradigms and paradigm shifts; the invisibility of scientific revolutions; examples.

Mon 22 Sept Galileo, Religion, and science
Reading: *Science in Europe*, Ch. 4 (Carmen)
Topics: Kepler and Galileo; experiment and observation; telescopes and other instruments; the problems of infinity and infinitesimals; the concerns of the Church; why the Galileo trial was not a symptom of a war between science and theology.

Wed 24 Sept Sir Francis Bacon and the conceptualization of modern science
Reading: Henry, *Knowledge is Power*, Part 1 (Carmen)
Topics: Bacon's life and legacy; the betterment of mankind; his interest in natural philosophy; his role in the scientific revolution; Bacon vs. Fludd and the Paracelsians; Bensalem.

Mon 29 Sept Bacon's life and method
Reading: Henry, *Knowledge is Power*, Part 2 (Carmen)
Topics: Experimental method; ancients vs. moderns; inductive reasoning; science and the Apocalypse; public life and science.

Wed 1 Oct Mathematics takes center stage
Reading: Gaukroder, *Emergence of a Scientific Culture*, Ch 10, "The Quantitative Transformation of Natural Philosophy"
Topics: Hydrostatics and kinematics; quantification of motion; mechanics; cosmic disorder; science and technology; mathematical laws of nature.

Mon 6 Oct The ontology and geometry of space; absolute space and time
Reading: Koyré, *Closed World to Infinite Universe*, Ch 5 ("Indefinite Extension or Infinite Space"), Ch. 7 ("Absolute Space, Absolute Time and Their Relations to God")
Topics: Infinite vs. finite space and the problems with each; the physical and mathematical problems of infinite space; the relation of time to space; God's role; occasionalism.

Wed 8 Oct France; Descartes, Mersenne, Gassendi; mechanical philosophy; skepticism
Reading: Jacob, *Sci Rev*, Ch. 4; Descartes selections (Carmen)
Topics: Descartes's contributions to philosophy and mathematics; his skeptical experiment; Cartesian dualism and its implications; Cartesian physics; Mersenne and Gassendi as atomists; their mitigated skepticism.

Mon 13 Oct Science in England; Hobbes, Boyle, Newton
Reading: Jacob, *Sci Rev*, Ch. 5
Topics: English Paracelsians; Hobbes and Boyle experiment with the air pump; Boyle and the shift from alchemy to chemistry; the "sceptical chymist"; measuring the elasticity of air; quick overview of Newton.

Wed 15 Oct Gilbert, Harvey, Boyle, Newton texts
Reading: *Science in Europe*, Ch. 8 (excluding Bacon excerpts) (Carmen)
Topics: Gilbert and magnetism; Harvey and the circulation of blood; new methods of measurement and calculation; Newton and God.

Mon 20 Oct Newton and the Newtonian revolution
Reading: Dobbs and Jacob, *Newton and the Culture*, 1-37
Topics: Newton's life and legacy; Newton's "miraculous year", 1665-6; from Kepler to Newton; his methods; his early discoveries in physics, mathematics, optics.

Wed 22 Oct Newton's *Principia* and *Opticks*; culture of Newtonianism
Reading: Dobbs and Jacob, *Newton and the Culture*, 38-78
Topics: Newton's *Principia Mathematica* (1687), its contents and impact; how careful calculations of planetary motion saved Newton from erring about a plenum and leading him instead to the theory of gravity; discovery and use of the calculus; dispute with Leibniz; nature of light and optical experiments.

Mon 27 Oct The spread on Newtonianism and its impact
Reading: Dobbs and Jacob, *Newton and the Culture*, 78-123
Topics: Newtonianism in England; Desaguliers, Hooke, Hauksbee, Grey; the industrial application of Newtonian principles; Continental Newtonians; Voltaire and Mme. Du Chatelet.

Wed 29 Oct The revolution in medicine
Reading : Harold Cook, "The New Philosophy and Medicine" (Carmen)
Topics: Was medicine part of the scientific revolution? physics vs. empirics—their differing goals, methods, and training; professionalization; Galenic vs. Paracelsian medicine.

Mon 3 Nov Science and magic: the Yates thesis
Reading: Frances Yates, "The Hermetic Tradition" (Carmen)
Topics: The Yates Thesis about magic and science; the evidence from Neoplatonic, kabbalistic and Hermetic sources; the weight of optimism.

Wed 5 Nov Critics of the Yates thesis
Reading: Copenhaver, "Natural Magic" (Carmen)

Topics: Copenhaver's focus on distinguishing Neoplatonic from Hermetic and kabbalistic sources; what is and is not left of Yates's thesis; alternatives.

Mon 10 Nov Science and religion: the Merton thesis
Reading: Merton, *Science, Technology & Society* selections (Carmen)
Topics: Merton's case for the receptivity of Calvinism toward new science; background: the Weber thesis; Merton's case and proofs; mathematical and technical training schools.

Wed 12 Nov Critics of the Merton thesis
Reading: Webster, "Puritanism" (Carmen)
Topics: What is Webster's essential critique of Merton? Are there others? Catholics vs. Lutherans vs. Calvinists; Jews; educational issues; chronology of development.

Mon 17 Nov Heresy, skepticism, and the New Science
Reading: Deason, "Reformation Theology" (Carmen**)**
Topics: Relationship of Bacon and Renaissance philosophers' attitudes toward the world and that of the Puritans; contradictions and failures of expected outcomes; different kinds of Protestants.

Wed 19 Nov More on heresy and the New Science
Reading: Hunter, "Science & Heterodoxy"(Carmen)
Topics: What is Hunter's main argument about why scientists feared being accused of atheism? The theological problems of mechanism and Cartesian dualism; the role of mathematical and experimental proof.

Mon 24 Nov Infinitesimals, space and motion
Reading: Mahoney, "Infinitesimals and Transcendent Relations: The Mathematics of Motion" (Carmen)
Topics: Changes in the conception of mathematics over the 17th c.; its aims; necessity of logarithms, exponential functions, sines, cosines and tangents to describe the mechanics of nature and spatial relations; structural analysis of equations; solvability vs. solution; Leibniz and the calculation of curved areas; mathematics and physical problems.

Wed 26 Nov Thanksgiving break; no class

Mon 1 Dec Curators of Experiments for the Royal Society **PAPERS DUE**
Reading: *Philosophical Transactions of the Royal Society, selections* (CARMEN)
Topics: Hooke, Desaguliers, Hauksbee, etc.; their goals in demonstrating scientific principles within the RS; public experiments; applicability; courses on Newtonian mathematics, physics, and applications.

Wed 3 Dec Popular scientific thinking in the Enlightenment: Fontenelle's *Conversations* (Web)
Reading: Fontenelle, *Conversations*, first and second evenings (3-36)
Topics: Fontenelle's views—Cartesian, not Newtonian; the setting; purpose of the *Conversations*; women and science; principles discussed.

Mon 8 Dec Fontenelle's *Conversations*; review
Reading: Fontenelle, *Conversations*, third to fifth evenings (37-73) (Web)

Topics: Further principles discussed; the problem of vortices and motion in Cartesianism; Newtonian solutions; significance of popularizing new science.

FINAL EXAM: Thursday Dec 11 4:00pm-5:45pm

Samples of Possible Final Exam Questions Concerning Mathematics

>Why did Kepler have such a difficult time abandoning his picture of planetary motion based on the geometric solids? Where did that view originate? Why would he think that the world is constructed around particular geometric principles?

>Why did the ideas of Pythagoras have such a large impact on the scientific revolution? What had he discovered about the relationship between mathematics and nature? How was that discovery advanced in the sixteenth and seventeenth centuries?

>What does Mahoney mean when he says (461) that Descartes's geometry would hardly have been comprehensible to ancient geometers, and that Descartes, in turn, would have found the standard mathematics a single generation after him incomprehensible? What is Mahoney's point? Why was the very nature of mathematical practice changing so rapidly in the seventeenth century?

PAPER ASSIGNMENT, HISTORY 3711

Select *two* articles from the *Philosophical Transactions of the Royal Society* from between 1665 and 1730. The links are long so I will send them in a message.

Look through the tables of contents to find articles that are of interest to you and are of an appropriate length—between about two and twenty pages. Read the articles and write an essay of about 4-5 double-spaced pages (about 1000 to 1250 words) *on each*; i.e. you are writing two short essays. Give each essay a title but do not use a title page or bibliography.

Your essay should open with a paragraph or two explaining the *topic* and *aim* of the article from the *Philosophical Transactions*. It should have a paragraph or two about the author, if that information is available. If other people are mentioned you can put in a paragraph or a few sentences about each of them. The best source for this is the Oxford Dictionary of National Biography, which you can find online through the OSU Library page at:

https://library.ohio-state.edu/record=b5849565

You may also want to use a work on scientists' biographies. In another paragraph or two explain the branch of science on which the article touches and its stage of development at the time. Use the library and the Web of Science or other databases to find scholarly books and articles about your subjects in order to clarify these questions. *Please do not skip this step! And do not fill the paper with biography!*

At this point should come a paragraph or two on what the article can teach a historian of science and

anything else noteworthy you find there. Use the sample paper below as a general guideline for the type of thing you might do.

Use endnotes or footnotes in Chicago Manual of Style format (you will find examples in my paper, on the Library website, and numerous places on the web.) Be sure to footnote all of the following: 1.) Direct quotations from other people; 2.) Paraphrases of other people's work; 3.) Ideas, statistics, or anything else you take from elsewhere.

I will not require a minimum number of references because this will depend on the paper. I do expect you to use appropriate reference works (especially the *Dictionary of National Biography*), books, and journal articles (which you will find by use of the periodicals databases on the Library website.) Do not use Wikipedia, People Magazine, Astrology Weekly, or other inappropriate sources. I advise that if you use web resources, you only go to sites operated by universities (xxxx.edu) or major educational institutions. Be very careful of all the garbage out there because I hold you responsible for the quality of your sources. Do not depend only on web resources because you will almost certainly miss the major books and articles on your subject, for which I will remove points.

In most cases, I will know whether you have done thorough research because I will recognize whether you have found the major books and articles on your subjects. If not, you will lose points. I also care very much about proper writing, so if you are concerned about your writing level, go to the Writing Center (see information above). If you need help doing research, please contact me by e-mail.
I will place a sample paper below as a model. I care very much about all aspects of the paper, including article choice, adherence to the template, paragraph breaks, word usage, sentence structure, grammar, syntax, and footnoting.

Write in short declarative sentences; avoid long, convoluted ones!! Use active voice (e.g. Bob went to the laboratory) rather than passive voice (The laboratory was visited by Bob.) Also avoid these constructions: "Bob was wanting to know about telescopes" and "Bob's telescope needed fixed".

All quotations, paraphrases, information and ideas you learn from any source require a footnote or endnote.

Please use block quotations (i.e. set the long quotation in its own paragraph, all of which is indented) in any situation where you are quoting more than 3 or 4 lines from a source. The whole paragraph is indented and there are no quotation marks around it. A reference note is needed at the end.

GRADING CRITERIA FOR HISTORY 3711 PAPERS
(each paper is worth 10 points, for a total of 20; each point is 1% of your class grade)

From past 1730 (unless you consulted me)	-1 to -2
Too short or too long by more than about half a page	-1 to -2
Chaotic organization, not following guidelines	-.5 to -3
Failure to use Chicago Manual style footnotes (+/-)	-.5 to -2
Bad writing (spelling, punctuation, usage, etc.)	-.5 to -2
Missing major books and articles on the topic	-1 to -3
Missing major important aspects of the article	-1 to -3
Plagiarism	-5 to -20

SAMPLE PAPER FOR HISTORY 3711

(ignore non-standard formatting; yours will be 11-12 point font double-spaced)

_____ _____

An Aspect of the Spontaneous Generation Controversy in England

Johannes Genius, History 3711, Autumn 2021

An article appeared in the *Philosophical Transactions of the Royal Society* in 1699 relating an aspect of the spontaneous generation controversy then occurring in Italy.[i] The article, apparently inserted by the editor (no author is mentioned), is an extract from a letter written by an anonymous author in Leghorn (Livorno), Italy to Dr. Martin Lister in England, concerning two related matters: the manuscripts left behind by the famous experimentalist Francesco Redi after his death; and a recent experiment performed in Italy concerning the spontaneous generation of fleas.

Redi and Lister were well known scientists in the period, but D'iacinto Cestone of Leghorn is unknown from other sources.

Francesco Redi (1626-1698) became famous for an experiment he performed in 1668 which disproved the doctrine of spontaneous generation. Spontaneous generation was the idea that fleas, maggots, and other creatures were born directly from rotting organic matter.[ii] Redi began his study with the example of maggots which appear in rotting meat. He believed that they did not generate themselves spontaneously from the meat but were the larvae of flies which laid eggs in the meat. He performed an experiment in which he placed pieces of fresh meat in an open jar, a jar covered with cheesecloth, and a sealed jar. As the meat rotted, the sealed jar produced no maggots, the covered jar produced maggots which did not hatch, and the open jar was full of maggots which soon metamorphosed into flies.[iii]

Redi had died shortly before this letter was written. It appears that Martin Lister had asked his correspondent in Italy whether Redi had left behind a manuscript continuation of his book, *Animali Dentro gli animali*,[iv] among his papers.

Martin Lister (1638-1712), was an English physician and experimentalist. Lister came from a famous family of physicians, and was educated in medicine at St. John's College, Cambridge. In 1671 he was inducted into the Royal Society. He went on to receive an M.D. degree from Oxford and write numerous articles on medicine, natural history, and antiquities for the *Philosophical Transactions*. He was especially known for studies of sea animals and fossils, and for pioneering the idea of the geological survey.[v]

The unknown Italian author of the letter first explains to Lister that he requested Redi's servant, a young physician, to search for the manuscript Lister had presumably requested among Redi's papers. The manuscript was not found, but the author goes on to tell Lister about a young naturalist, Signior D'iacinto Cestone, in Leghorn, who has made important discoveries about the generation of fleas. While the author never explicitly connects the question

about Redi's papers with the experimental results of Cestone, the relationship is obvious. Cestone's research is precisely the type for which Redi was famous. It may be that Cestone was a student or follower of Redi.

The letter does not describe Cestone's method for his discoveries, but some hints to this method arise later. At the very end, the author mentions the plates which accompany the letter, which he says are "maginified by the Microscope". In addition, the detailed description of the flea, worm, eggs, and pouches, are given in such detail that they must have been observed with a microscope. Finally, at one point (43) the author refers to how something looks "to the Natural Eye," again suggesting that the other observations were made under a microscope.[vi]

This paper is interesting for several reasons. First, it shows how scientific ideas were communicated by personal correspondence between scholars in different countries, and how the Royal Society might take advantage of such letters to enlighten its whole audience on scientific news. Second, it indicates that even after Redi's famous experiments, there were still debates about spontaneous generation. Scientists, or "naturalists", seemed to believe that fleas, like maggots in meat, did not appear by themselves; but they could not figure out how. Cestone explained the entire process, including drawings of what he saw under a microscope, to show the details of the generational process. Third, the letter shows how use of the microscope changed scientific practice in the seventeenth century. In 1668, when Redi performed his famous maggot experiment, he apparently relied on unassisted vision. He simply showed people whether maggots did or did not appear. At the end of the century, Cestone used a microscope to actually allow people to see what was going on in the case of fleas. Finally, the appearance of images helped readers of the *Philosophical Transactions* really visualize the process, and it gave them a reference to compare eggs, nits, or fleas which they might encounter.

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i. N/a, "An Extract of a Letter from Leghorn to Dr. Martin Lister, November 24, 1698. concerning Seignior Redi's Manuscripts, and the Generation of Fleas," in *Philosophical Transactions of the Royal Society* 21:249 (1699): 42-43 (illustrations on the previous page).

ii. Russell Levine and Chris Evers, "The Slow Death of Spontaneous Generation (1668-1859)," in *Journal of the American Health Museum* 16:3 (1988): 24.

iii. Paula Findlen, "Controlling the Experiment: Rhetoric, Court Patronage, and the Experimental Method of Francesco Redi," in *History of Science* 31:91 (March 1993): 35-64.

iv. No work of Redi by this name is known. Presumably the author means Redi's *De animalculis vivis quæ in corporibus animalium vivorum reperiuntur*.

v. *Dictionary of National Biography*, s.v. "Lister, Martin".

vi. On the use of microscopes in seventeenth century science, see Marian Fournier, *The Fabric of Life: Microscopy in the Seventeenth Century* (Baltimore: Johns Hopkins University Press, 1996), esp. 44-47 and 114-123.

GE Theme course submission worksheet: Number, Nature, Mind

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Number, Nature, Mind)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

(enter text here)

This is a course on the scientific revolution, whose very core is the development of mathematical tools to describe observed phenomena in nature. Many of our standard mathematical tools were developed during the sixteenth- to early eighteenth centuries for just this purpose.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking.	The rise of modern science is heavily based on the recognition that mathematics is the "language" of nature, and the tremendous development of the mathematical tools needed to decode the "book" of natural knowledge. We will examine the revival of Pythagoras, Euclid and Archimedes in the Renaissance and see how their philosophical as well as practical understanding of relations between mathematics and the physical world inspired the birth of modern science.
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or ideas within this theme.	This outcome will be achieved in particular by reading about and discussing the place of mathematics in Copernicus's heliocentric argument; the geometric reasoning of Johannes Kepler; the huge strides in geometry and mathematics made by Descartes and the Cartesians trying to understand motion in space; and the invention of calculus simultaneously by Newton and Leibniz. Other related topics will also come up along the way.
ELO 2.1 Identify, describe, and synthesize approaches or experiences.	Throughout the course, we will be reading and talking about how life looked to Europeans before, during, and after the scientific revolution (yes, I will still use that term), up to our own day. We will, for example, consider the ability of mathematics to describe everyday experiences such as the geometry of flowers, the harmonics of music, the patterns of tides, and of course the movements of the earth and other planets.
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	The thinkers of the scientific revolution showed us the necessity of understanding the world in mathematical terms, and we will regularly encounter this phenomenon in all kinds of life experiences, relevant then and now. Students will have the opportunity to reflect on this growing realization of the early modern natural philosophers in class readings, discussions, and written assignments, such as their papers and exams.

Example responses for proposals within "Citizenship" (from Sociology 3200, Comm 2850, French 2803):

***ELO 1.1** Engage in critical and logical thinking.*	*This course will build skills needed to engage in critical and logical thinking about immigration and immigration related policy through:* *Weekly reading response papers which require the students to synthesize and critically evaluate cutting-edge scholarship on immigration;* *Engagement in class-based discussion and debates on immigration-related topics using evidence-based logical reasoning to evaluate policy positions;* *Completion of an assignment which build skills in analyzing empirical data on immigration (Assignment #1)*
	Completion 3 assignments which build skills in connecting individual experiences with broader population-based patterns (Assignments #1, #2, #3) *Completion of 3 quizzes in which students demonstrate comprehension of the course readings and materials.*

ELO 2.1 *Identify, describe, and synthesize approaches or experiences.*	*Students engage in advanced exploration of each module topic through a combination of lectures, readings, and discussions.* *<u>Lecture</u>* *Course materials come from a variety of sources to help students engage in the relationship between media and citizenship at an advanced level. Each of the 12 modules has 3-4 lectures that contain information from both peer-reviewed and popular sources. Additionally, each module has at least one guest lecture from an expert in that topic to increase students' access to people with expertise in a variety of areas.* *<u>Reading</u>* *The textbook for this course provides background information on each topic and corresponds to the lectures. Students also take some control over their own learning by choosing at least one peer-reviewed article and at least one newspaper article from outside the class materials to read and include in their weekly discussion posts.* *<u>Discussions</u>* *Students do weekly discussions and are given flexibility in their topic choices in order to allow them to take some control over their education. They are also asked to provide* *information from sources they've found outside the lecture materials. In this way, they are able to* *explore areas of particular interest to them and practice the skills they will need to gather information* *about current events, analyze this information, and communicate it with others.* *Activity Example: Civility impacts citizenship behaviors in many ways. Students are asked to choose a TED talk from a provided list (or choose another speech of their interest) and summarize and evaluate what it says about the relationship between civility and citizenship. Examples of Ted Talks on the list include Steven Petrow on the difference between being polite and being civil, Chimamanda Ngozi Adichie's talk on how a single story can perpetuate stereotypes, and Claire Wardle's talk on how diversity can enhance citizenship.*
ELO 2.2 *Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.*	*Students will conduct research on a specific event or site in Paris not already discussed in depth in class. Students will submit a 300-word abstract of their topic and a bibliography of at least five reputable academic and mainstream sources. At the end of the semester they will submit a 5-page research paper and present their findings in a 10-minute oral and visual presentation in a small-group setting in Zoom.* *Some examples of events and sites:* *The Paris Commune, an 1871 socialist uprising violently squelched by conservative forces*
	Jazz-Age Montmartre, where a small community of African-Americans–including actress and singer Josephine Baker, who was just inducted into the French Pantheon–settled and worked after World War I. *The Vélodrome d'hiver Roundup, 16-17 July 1942, when 13,000 Jews were rounded up by Paris police before being sent to concentration camps* *The Marais, a vibrant Paris neighborhood inhabited over the centuries by aristocrats, then Jews, then the LGBTQ+ community, among other groups.*

Goals and ELOs unique to Number, Nature, Mind

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Successful students will experience and examine mathematics as an abstract formal system accessible to mental manipulation and/or mathematics as a tool for describing and understanding the natural world.

	Course activities and assignments to meet these ELOs
ELO 3.1 ELO 1.1 Analyze and describe how mathematics functions as an idealized system that enables logical proof and/or as a tool for describing and understanding the natural world.	See e.g. reading and discussion in sample syllabus for Sept. 10 and 15, Oct. 1, 6, 8, 22, and Nov. 24. These topics are, however, treated in many other class sessions as well. See also sample final exam questions on syllabus p. 9. Overall: This goal and ELO are at the very heart of our studies in the scientific revolution. Ancient philosophers and medieval Scholastics had developed mathematical studies in some very sophisticated ways. The early modern natural philosophers revived the ancient reverence for mathematics as a set of tools for understanding the operations of the physical world. Their studies raised new and practical mathematical problems in navigation, optics, ballistics, mechanics, astronomy, acoustics, probability, and architecture. In response the natural philosophers (what we would call scientists) of that age invented new mathematical methods, including logarithms, analytical geometry, decimal fractions, probability theory, and fluxions (calculus). And, unlike medieval Scholastic logical debates, mathematics offered proofs which could be demonstrated in the physical world. In this way, mathematics shifted during the early modern period from the realm of the theoretical to the center of practical application. These are among the topics which will come up in our readings, discussions, and assignments for this course.