

Phil 457/557: Seventeenth Century Math and Metaphysics

Fall 2009 / M 4-6:30pm / Location DSH 231

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Fall 2009 office hours: Mondays 2-3p, Wednesdays 9-10am, & by appt



GENERAL COURSE DESCRIPTION

The story of seventeenth century natural science tends to be told as a story of revolution: the natural scientists of this period overthrew the qualitative, “metaphysical” accounts of nature that were dominant in the Middle Ages, and they did so by establishing a new mathematical framework for the study of nature. This new quantitative natural science reached the pinnacle of its success with the 1687 publication of Newton’s *The Mathematical Principles of Natural Philosophy*. That, as I said, is the standard story. But is it accurate? Was the use of mathematics the real key to scientific progress in the seventeenth century? And if so, how precisely did the so-called mathematization of nature help unlock the secrets of the natural world? In this course we will examine and evaluate the standard story sketched above by taking a careful look at the philosophical and scientific work completed by three of the most important mathematically-minded philosopher-scientists of the seventeenth century: René Descartes, Isaac Newton, and Gottfried Wilhelm Leibniz. We will read texts that reveal their struggle to put mathematics to work – in both their physics and their metaphysics – and examine the relationship between their philosophical doctrines and their mathematical accounts of nature. At the end of the semester, we will consider whether the struggles of Descartes, Newton, and Leibniz should encourage us to revise or even replace the standard story of seventeenth century natural science.

REQUIREMENTS: Students enrolled in this course must 1) have already taken Phil 202: Modern Philosophy, and 2) have a high school level knowledge of mathematics (including basic geometry and some advanced algebra) but need not have any prior training in calculus.

1) REQUIRED TEXTS

The following texts should now be available at the UNM Bookstore.

- 1) *The Essential Galileo* (\$10)
 Edited by Maurice A. Finocchiaro (Hackett 2008; ISBN: 9780872209374)
- 2) *Descartes: Selected Philosophical Writings* (\$27)
 Edited by J. Cottingham, et al. (Cambridge 1988; ISBN: 9780521358125)
- 3) *Newton’s Philosophy of Nature* (\$13)
 Edited by H.S. Thayer (Dover 2005; ISBN: 0-486-44593-3)
- 4) *G.W. Leibniz: Philosophical Essays* (\$18)
 Edited by R. Ariew and D. Garber (Hackett 1989; ISBN: 9780872200623)
- 5) Supplemental texts: I may make some materials available through email or WebCT.

2) EMAIL AND INTERNET ACCESS

It is expected that you will have reliable and regular access to the internet this semester, and that you have a UNM username and password. If you do not already have a Net ID, you can obtain one by visiting the CIRT account creation page: <http://netid.unm.edu>.

3) UNM's Withdrawal Policy for semester-long courses:

- Friday 11 September is the last day to withdraw without a grade.
- If you withdraw from the course between Saturday 12 September and Friday 13 November, you will be assigned either a WP or a WF, depending on your performance on course assignments. This means that if you have an F average on all the assignments due before the date of your withdrawal, you will earn a WF for the course, and this will count as an F towards your GPA.
- If you wish to withdraw from the course between Saturday 14 November and Friday 11 December, you will need approval from the college dean. If the withdrawal is approved, you will be assigned either a WP or a WF, depending on your performance on course assignments. As in the case above, this means that if you have an F average on all the assignments due before the date of your withdrawal, you will earn a WF for the course, and this will count as an F towards your GPA.

4) Attendance and Instructor Withdrawal Policy:

Even though attendance will not count towards your grade, I will enforce the following attendance and instructor withdrawal policy for this course:

- I will drop any student who misses 2 or more classes during the first 5 weeks and any student who misses 3 or more classes during the first 7 weeks.
- Any student who misses 4 or more classes during the first 8 weeks will be withdrawn with either a WP or a WF, depending on his or her performance on class assignments. This means that if you have an F average on the assignments due within the first eight weeks, you will earn a WF for the course, and this will count as an F towards your GPA.
- Any student who misses 8 or more classes by the end of the semester will earn an F for the course regardless of performance on class assignments.

5) Appropriate Classroom Behavior

Cheating or disruptive behavior of any form will be dealt with very seriously. Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to dismissal from the University. If you are caught cheating, a report will be sent to the UNM Dean of Students office, where they will, at the very least, keep a record of the incident. UNM's Policy on Academic Dishonesty is included below:

“Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course. Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.”

(URL = <http://www.unm.edu/~sac/policies.html>)

Please be aware of the following rules of behavior for this class:

- **Cell phones must be turned off during class. In other words, phone calls and text-messaging will NOT be tolerated. If you use your phone during class, you will be asked to leave.**
- Please be respectful of your classmates.
- If you are arriving late to class, please enter the room quietly to prevent disruptions.

6a) Grading Policy (for undergraduates in the course)

Your final grade for this course will be determined based on your performance on the following tasks.

◆ *Weekly Assignments (20%)*

In order to help you better engage with the texts we'll be looking at, I will email members of the class roughly 3-5 questions that relate to the assigned readings no later than the Friday before each class session. You should try to answer all of them before coming to class the following Monday, and you will be required to answer 1-2 questions and hand in your responses at the start of class. I will indicate in my email which questions you must answer each week. While submitting correct answers is ideal, I will be grading your responses based more on effort than on accuracy, i.e., I want to see that you've attempted to engage the readings in formulating your responses.

◆ *Essays (80%)*

You will be assigned three essays (approximately 8-10 double-spaced pages in length) over the course of the semester. For each essay you will be offered a choice of topics on which you can write. More details on the expectations for these assignments will be given later in the semester. The due dates for your essays are as follows:

Essay 1 due Wednesday 30 September by 5pm (place a hard copy in my mailbox)

Essay 2 due Wednesday 4 November by 5pm (place a hard copy in my mailbox)

Essay 3 due Monday 14 December by 5pm (place a hard copy in my mailbox)

The first two essays will each be worth 25% of your final grade, and the final essay will be worth 30% of your final grade.

NOTE ON SUBMITTING ESSAYS: You are required to turn in a **hard copy** of each essay. Unless you have received permission in advance of the due date or are submitting your paper after the stated deadline, please do not email your essays as attachments.

PENALTIES FOR LATE SUBMISSIONS: You will be penalized 5 points per day late. Days late are calculated based on the 5pm deadline, and weekend days each count as a day. If you need to submit your paper over a weekend, you can email me the paper as an attachment in either Word (.doc) format or as a rich text file (.rtf).

6b) Grading Policy (for graduate students in the course)

In addition to completing weekly assignments and three papers, graduate students will be required to complete one 20 to 30 minute presentation at some point during the semester. Your goal is not to go through the text line-by-line or argument-by-argument. (If you give such a presentation, I reserve the right to snore through it.) Since all members of the class will have done the reading prior to your presentation, your goal is to highlight parts of the text that you find especially important or difficult and then motivate discussion. There are different strategies for doing this, of course, and I encourage you to speak with me before you give your presentation to get feedback. Also note that you will offer your presentation without interruption. Thus, if it helps, you can approach your presentation as you would approach giving a paper at the APA (which is a venue where you will most certainly have an audience who is familiar with the texts and topics you're covering).

Final grades for graduate students will be based on the following scale:

Weekly Assignments:	15%
Presentation	15%
Paper 1	20%
Paper 2	25%
Paper 3	25%

- **A note on reading texts in the history of philosophy**

With the fear of sounding patronizing, allow me to offer some advice on how to engage with texts written in a historical context far different than our own, and I'll preface my remarks with the following: I am working under the assumption that each of you is a smart and capable student who has already had some very intense training in philosophy. All the same, I will also assume that each of you is willing to learn something new about 17th Century philosophy and also about how to do philosophy. So even if you've read some of the texts we're reading a dozen times, I will assume that you'll read them again in full this semester and read them with a hope of seeing something you haven't seen before. With all this said, here are some pointers to help you along your journey.

First, assume that the people we're studying were geniuses. (In case you need some persuading, here's an example: Descartes lived only 53 years, and in that short time he revolutionized both philosophy and modern mathematics.)

Second, assume that the figures we're studying were careful writers and careful thinkers. Thus, if there are particular points in the texts that seem out of place, confusing, or just downright silly, look at the larger context of the text and try to figure out what the person is trying to do.

Third, assume that each assigned reading will take you at least 10 hours to complete. There are very few scholars who can read a text once and have a mastery over it. I certainly ain't one of those people, and I apologize for offering this advice if you in fact are. If you aren't (and you are in good company), then you should read the assigned texts at least two times before we meet, and ideally, you should read the texts three times. This advice was offered to me in graduate school by an eminent scholar in philosophy of science who got this same advice as a graduate student at Princeton (i.e., I am not making this up to make your life unnecessarily difficult). Why read a text three times?

On the **first reading**, you want to get a sense of what the author is trying to do. Your guiding questions should be: What is the major goal of the author in this part of the text? How does the author intend to fulfill this goal? Who is the author's intended audience, i.e., is there a certain group of people the author is trying to convince?

Now that you have a general sense of what the author *wants* to do, on the **second reading**, you want to take a more careful look at how the steps of the argument proceed and get a sense of *whether the author succeeds*. You are reading the text on the author's own terms and want to determine whether the argument is valid (to use modern logical jargon). If we grant the author his or her premises, do the conclusions he or she draws actually follow?

Finally, on the **third reading**, you want to read the text being mindful of "external" criticisms. Are premises the author relies on acceptable? Is he or she making unwarranted assumptions?

You might think all this is obvious, but I include it here as a reminder that you cannot expect to read the texts of brilliant folks just once and understand their projects on their own terms and also understand why others might not be convinced by their arguments. Very smart people dedicate their entire careers to understanding the figures we're studying, and I promise, it's not because they don't have better things to do.

If you need more encouragement (and a little chuckle), here's Descartes' account of reading philosophy as presented in the Preface to the *Principles of Philosophy*:

I should like the reader first of all to go quickly through the whole book like a novel, without straining his attention too much or stopping at the difficulties that may be encountered. The aim should be merely to ascertain in a general way which matters I have dealt with. After this, if he finds that these matters deserve to be examined and he has the curiosity to ascertain their causes, he may read the book a second time in order to observe how my arguments follow. But if he is not always to see this fully, or if he does not understand all the arguments, he should not give up at once. He should merely mark with a pen the places where he finds the difficulties and continue to read on to the end without a break. If he then takes up the book for a third time, I venture to think he will now find the solutions to most of the difficulties he marked before; and if any still remain, he will discover their solution on a final re-reading. (CSM I, 185)

Tentative Schedule of Readings and Topics

	<u>Topic</u>	<u>Readings</u>
<u>Week 1</u> Mon 24 Aug	Introductions	Syllabus
	The Standard Portrait of 17 th Century Natural Philosophy	Comte, Duhem, Koyré, Kuhn
<u>Week 2</u> Mon 31 Aug	The Galileo Affair: Science <i>versus</i> Religion?	<i>The Essential Galileo</i> Chap 4 [103-145] Chap 5 [146-168]
<u>Week 3</u> Mon 7 Sep	NO CLASS – LABOR DAY	<i>Two Chief World Systems</i> [190-233] Weekly assignment answers to be emailed by 4pm on Monday 7 Sep
<u>Week 4</u> Mon 14 Sep	Galileo’s New Science of Motion	Chap 3 [97-102] Chap 7 [179-189] Chap 10: <i>Two New Sciences</i> [334-356]
<u>Week 5</u> Mon 21 Sep	Descartes on God’s Creation	<i>Le Monde</i> (1633) [distributed electronically]
<u>Week 6</u> Mon 28 Sep	Descartes on Math and Method	<i>Descartes: Selected Phil Writings</i> <i>Discourse on Method</i> (1637) [20-56] Essay 1 Due Wed 30 Sep by 5pm
<u>Week 7</u> Mon 5 Oct	Descartes’ Math and Metaphysics I	<i>Meditations</i> (1641) [73-122] Objections and Replies [143-159]
<u>Week 8</u> Mon 12 Oct	Descartes’ Math and Metaphysics II	<i>Principles of Philosophy</i> (1644) [160-212]
<u>Week 9</u> Mon 19 Oct	Newton versus Descartes: God’s Creation	<i>De Gravitatione</i> [distributed electronically]

Week 10

Mon 26 Oct

The Math and Method of Newton's *Principia*

Newton's Phil of Nature

Preface to the *Principia*, Definitions, and
Laws of Motion [9-40]
Rules for the Study of Natural Philosophy
[3-8]

Week 11

Mon 2 Nov

Newton on God's Relationship to Nature

General Scholium [41-46]
Letters to Bentley [46-66]

Essay 2 Due Wed 4 Nov by 5pm

Week 12

Mon 9 Nov

Newton versus Leibniz: Space and God

Leibniz: Philosophical Essays

Leibniz-Clarke Correspondence [320-346]

Week 13

Mon 16 Nov

Leibniz's Early Metaphysics

Discourse on Metaphysics (1686) [33-68]

Week 14

Mon 23 Nov

Leibniz's Middle Metaphysics

Specimen of Dynamics (1695) [117-138]

New System (1695) [138-145]

On Nature Itself (1698) [155-167]

Week 15

Mon 30 Nov

Leibniz's Late Metaphysics

Letters to de Volder (1699-1706) [171-186]

On Body and Force, Against the Cartesians
(1702) [250-256]

Monadology (1714) [213-225]

Week 16

Mon 7 Dec

**Revisiting the Standard Story of 17th C
Natural Philosophy**

Location and Readings TBA

Finals Week

14-18 Dec

Essay 3 due Mon 14 Dec by 5pm