

# PHIL 371 Philosophy of the Natural Sciences

Spring 2024

**Instructor:** Dr. Daniel J. Nicholson ([dnicho@gmu.edu](mailto:dnicho@gmu.edu))

**Teaching Assistant:** Lee Thielemier (they/them) ([athielem@gmu.edu](mailto:athielem@gmu.edu))

**Modality:** In person (face coverings are optional)

• **When?** Mondays & Wednesdays, 12:00 – 1:15 pm.

• **Where?** [Krug Hall](#) 5.

• **Office Hours:** Wednesdays, 1:30 – 2:30 pm. My office is on the 6<sup>th</sup> floor of [Horizon Hall](#), room 6275. We can also meet via Zoom. If you are not available at this time, email me to schedule an appointment.

• **Where to find information about this course:** all course information, including announcements, assignments, and any changes to the schedule will be posted on the [Blackboard](#) site for this course.

• **Course Description:**

This course examines a range of questions and contested issues in modern philosophy of science. It takes as its starting point Thomas Kuhn's ***The Structure of Scientific Revolutions (SSR)***, which is one of the most important and influential scholarly works of the twentieth century. This book, first published in 1962, transformed the philosophy of science (and many other areas as well) to such an extent that it is difficult to understand the current debates in the field without it.

The first half of the course will be devoted to a close reading and in-depth analysis of *SSR*, as well as to a consideration of the subsequent revisions that Kuhn made to his ideas later in his life. The second half of the course will examine a wide range of responses to Kuhn's work by some of the most distinguished philosophers of science of the last seventy years.

Some of the topics we will address in this course include the problem of demarcating science from pseudoscience, the rationality of scientific change, the role of values and objectivity in theory choice, the feminist critique of science, the relationship between scientific knowledge and truth, and the question of scientific progress. We will do all of this by engaging directly with the primary literature. Our emphasis will be on depth rather than breadth; we will focus on a relatively small number of problems and closely examine them over numerous classes.

• **Course Objectives:**

Students who take this course can expect to learn to:

- Familiarize themselves with core problems in the philosophy of science.
- Evaluate arguments about the nature of science and develop and defend their own views on them.
- Critically assess philosophical views about science in a balanced, open-minded, and rigorous way.
- Recognize the importance of the historical, sociological, and political dimensions to science.

Students will achieve these objectives by means of individual and collaborative work, as well as by the guidance I provide throughout the semester. They will be evaluated by means of journal entries, a presentation, a critical review, and a final essay—an outline of which will be presented in class.

#### • Required Readings:

The entire course is organized around the content and impact of the following book:

Kuhn, Thomas S. (2012 [1962]). [\*The Structure of Scientific Revolutions \(50<sup>th</sup> anniversary edition\)\*](#). Chicago: Chicago University Press.

***You are required to buy a paper copy of this book***, and make sure that you get the 50<sup>th</sup> anniversary edition, as the pagination differs from older editions. This edition also includes a fantastic introductory essay by Ian Hacking that is well worth reading. You can find it at the GMU bookstore as well as online for very reasonable prices (you can buy a copy on [Amazon](#) for less than \$10). ***Please bring the book with you to class along with a pen and a notebook (to keep track of class discussions)***.

I have provided you will PDF versions of all other readings in this course. You can find these on Blackboard, and they can also be downloaded by clicking on the hyperlinks in the course schedule at the end of this syllabus. ***I strongly encourage you to print off all the readings, as it is far easier to annotate paper copies of philosophical texts***. If you do end up working with the texts electronically, find out how to annotate and markup PDF files (e.g., by using Adobe Reader).

To avoid copyright issues, please note that you remain subject to all the rights and restrictions of the publishers, and you are expected to honor those. Your copies of all the works I provide are to be used solely for purposes of this class; they are not to be distributed, sold, or employed for any other commercial purpose. Your participation in this class indicates your explicit agreement to be bound by these limitations.

As we will be going through each text in detail, ***it is essential that you bring the assigned reading with you to class***, and that you have it in front of you during class discussions. Failing to bring the reading to class will negatively impact your participation grade.

#### • Course Reading Expectations:

The assigned reading for each class is listed in the course schedule. ***Please make sure that you do the assigned reading before coming to class***. If you do not, you will not be able to follow the lectures or meaningfully participate in group activities and discussions, and your grades will suffer as a result.

#### • A Note About Reading Philosophy:

Reading philosophy demands a different kind of attention compared to other sorts of reading. This is because philosophical texts typically aim to present rationally persuasive arguments, rather than to merely report facts, tell stories, evoke emotions, or offer opinions. These arguments are often subtle, and they tend to deal with ideas in ways with which you may not be familiar. To fully understand them requires time and patience. Give yourself enough time to work through the texts without rushing, taking notes in the margins or in a notebook and highlighting key passages as you go along. If you do this, you will find it much easier to understand the reading and critically engage with it during class. And remember: ***if no questions come to your mind as you read, then you are not reading properly***.

## • Questions, Contact, and Email Etiquette:

If you have a question about the course, or a problem with an assignment, feel free to ask it at the start of class; often others will have the same concern, so doing this will help everyone. Alternatively, come to speak to me after class or send me an email. As I teach numerous classes, ***please start the subject of any emails you send me with 'PHIL371:'***. If you fail to do this, I cannot guarantee your email will be read. I respond to emails as soon as I can, though as a rule I do not answer emails during weekends.

## • Assignments and Grading:

<b>Attendance and Participation</b> (expected in every class)	10 %
<b>Twenty-Three Journal Entries</b> (about the assigned readings; at least 100 words each)	25 %
<b>Presentation</b> (of the assigned reading for one class; 15 minutes)	15 %
<b>SSR Review</b> (1,500–2,000 words)	20 %
<b>Infographic &amp; 'Flash Talk' of Final Essay</b> (1 slide; 5 minutes)	5 %
<b>Final Essay</b> (on a topic of your choice [approved by me]; 2,000 words)	25 %
<b>TOTAL</b>	<b>100 %</b>

- **Attendance and Participation (10%)**: One of the central goals of this course is to help you learn how to fruitfully engage with philosophical ideas about science. As with most things, the best way to learn how to do this is with practice. That is one of the primary purposes of our time together in class: for you to practice critically engaging with a philosophical argument. To incentivize this important part of the learning process, a tenth of your final grade will depend upon your participation in class.

Merely showing up to class will not earn you full marks for participation. It is not enough to attend. Class discussion is an essential component of this course, and I will regularly invite participation. ***Please come prepared to discuss the assigned reading.*** Your oral contributions in class should show that you have not only done the reading but have also made a serious effort to understand it. Note, however, that ***you will never be penalized for asking questions or for making thoughtful comments.***

To facilitate class interactions, we will use nameplates so that we can address each other by name. (I will also use the nameplates to take attendance.) I will sometimes ask you to form small groups and work together on a particular question or task. In such cases, you will be expected to act as a team and assist one another (for example by helping each other understand the ideas under discussion). In general, you should demonstrate a willingness to engage in lively but respectful debates with others. Your participation should come with the understanding that those who disagree with you are not adversaries to be defeated, but rather valuable resources; people from whom you have much to learn.

***You are expected to attend every class.*** You will not do well if you miss classes. If you cannot attend a particular class, you must let me know in advance. A justified absence requires proper documentation (e.g., a doctor's note or written proof of participation in a university or work-related event). After the first week of term, ***every unjustified absence after the second will result in a 10% penalty in your participation grade.*** Hence 12 absences will result in a 100% deduction of your participation grade (or 10% of your overall grade). Moreover, you must attend at least 14 classes overall to pass this course. Finally, if you are more than 15 minutes late for class, your lateness will be considered an absence.

- **Twenty-Three Journal Entries (23 x 1% = 23% + 2% = 25%)**: To incentivize you to read and think about the readings before class, ***you must submit a journal entry of at least 100 words (roughly 5–6 sentences) for the assigned reading for each class.*** Your journal entries should ***summarize*** the main points of the reading and offer a ***critical reaction*** to it. For example, you might identify a point you found particularly interesting, provocative, or puzzling, and explain why. Or you may wish to relate the reading to something else we have covered in the course. In addition, ***your entry should include a question about the reading,*** which can be: (a) a request for ***clarification*** (something you did not understand) or (b) a suggestion for ***discussion*** (something you would like to discuss further in class). Writing these journal entries twice a week will allow you to stay on top of the readings, and it will allow me to keep track of your progress in your understanding of the material. On the day of each class, I will pick out for group discussion a few of your individual journal entries, which I will ask you to read out in class.

***Journal entries are due no later than 11:59 pm on the day before class.*** Entries will be graded as either '1' or '0'. All late entries will be '0'. You must submit an entry in preparation for **23** out of the 28 classes in this course: all except the first class, the last three, and the class you are presenting the reading for. Each journal entry is worth **1%** of your final grade, so fulfilling this requirement will earn you 23% of your final grade. **You will obtain an additional 2% as a bonus if you submit all your journal entries on time.** Conversely, if you fail to submit any journal entries, you will automatically disqualify yourself from obtaining a final grade higher than a C (even if you get an A+ in all other assignments!).

- **Presentation (15%)**: On the first week of term, each of you will sign up to ***present the assigned reading for one class in the course*** (and remember that you do not need to submit a journal entry for the reading you are presenting). You will deliver a ***15-minute presentation*** of the reading (or, if you are doing it together with a partner, a 30-minute presentation), which must be accompanied by some sort of visual aid. Examples of possible formats include (but are not limited to) Power Point slides, copies of a handout (which I am happy to print out for you), or notes you write on the whiteboard. Regardless of the format you choose, ***you must submit your presentation material no later than two hours before class,*** so that I have time to review everything beforehand.

To do well in this assignment, make sure that you address the following questions in your presentation:

- (a) What is the author's objective? What topic or problem is the author addressing in the reading?
- (b) How does the author proceed? How is the text organized and what path does the author take?
- (c) What is the outcome of the author's analysis? What novel insights does the author provide?
- (d) What are the implications of the reading? What connections can you identify with earlier readings?

After you present, I will ask you a few questions before opening the discussion to the rest of the class. ***Note that if you do not attend class on the day you agreed to present, you will get fail this assignment.***

- **SSR Review (20%)**: After we complete our examination of SSR, you will write a review of it. Your review should be ***between 1,500 and 2,000 words*** and it must be divided evenly into two parts. In ***Part I***, you will apply the four presentation questions to SSR as a whole. In ***Part II***, you must analyze one of Kuhn's key concepts (e.g., paradigm, normal science, puzzle-solving, anomaly, crisis, incommensurability, revolution, etc.) and show how he uses it to support his views. To do well in this assignment, ***it is not enough to summarize Kuhn's views***; you must also ***interpret*** and ***evaluate*** them. Explain not just what Kuhn says, but ***how he justifies*** what he says. And do not just say you agree or disagree with Kuhn; ***give reasons*** for your opinions. ***The SSR review is due no later than 11:59 pm on Wednesday, March 6.***

- **Final Essay (25%)**: At the end of the semester, you will write an essay on one of the themes covered during the second half of the course. You should aim to compare or connect two or more of the readings discussed in class, or examine a problem or issue addressed by several of the readings. First, think of a topic covered in class that you would like to write about. Then, come up with an **essay prompt**, which should be concrete, specific, and preferably articulated in the form of a **question** (that you will attempt to answer). Lee and I are happy to offer suggestions if you cannot decide what to write about.

Once you have an essay question, you must draft a **rough outline of the structure of your planned essay**. This should be about half a page of bullet points that specify the different subsections of your essay, and which indicate what ground you are going to cover and how you are going to proceed. In addition, your outline should include a **thesis**; the claim you are ultimately going to be arguing for in your essay. **You must submit your final essay outline no later than 11:59 pm on Wednesday, April 10**. Lee and I will review your outline and let you know if it is appropriate. **You must receive my approval before you can start working on your essay**, so it is in your interest to submit your outline as soon as possible.

When writing your final essay, you should not just present the views of the authors you are discussing, but also take a stand yourself and justify the position you defend (i.e., your thesis). You should identify the weaknesses in the views you oppose, as well as anticipate and deal with potential objections that may be raised against your thesis. The essay should be **2,000 words** and include a bibliography and a word count. I will provide you with additional guidelines on how to for write, structure, and format the essay. **Your final essay is due no later than 11:59 pm on Friday, May 3**.

- **Infographic & 'Flash Talk' of Final Essay (5%)**: In preparation for the submission of the final essay, you will use **one Google Slide** to schematically represent your essay's argumentative structure in the form of a detailed infographic, and you will give a very short, **5-minute 'flash talk' presentation** of your infographic to the rest of the class. You are expected to act on any feedback you receive on this assignment when preparing the written version of your essay for submission. The flash talk sessions will take place during the last two classes of the semester, on **Wednesday, April 24** and on **Monday, April 29**. You will be evaluated on the content of your infographic as well as on the delivery of your flash talk.

#### • **Submission of Written Work and Lateness Penalties:**

All graded written work must be drafted in Word document format and uploaded on **Blackboard** via the pertinent link (a link will be provided for each assignment). Work must be submitted by the designated deadline. Deadlines are non-negotiable. Extensions will only be granted due to appropriate extenuating circumstances, and only if these are communicated to me in advance of the deadline. If you do not have a good reason for a late submission, **your assignment will lose one letter grade for each day it is late**, including weekends (i.e., Saturday and Sunday count as two days). These penalties are to ensure fairness, so that everyone has the same amount of time to work on each assignment.

#### • **Grading Scale:**

The grading scale for all assignments in this course is as follows:

97-100% = <b>A+</b>	87-89% = <b>B+</b>	77-79% = <b>C+</b>	60-69% = <b>D</b>
93-96% = <b>A</b>	83-86% = <b>B</b>	73-76% = <b>C</b>	59% or below = <b>F</b>
90-92% = <b>A-</b>	80-82% = <b>B-</b>	70-72% = <b>C-</b>	

Final averages will be rounded up or down to the nearest whole number.

### • **Student Use of Electronic Devices:**

Cell phones are not to be used during class. Please keep them stowed away, in silent mode, and out of sight. I prefer that you take notes by hand, but I will allow the use of laptops and tablets. I only ask that you are respectful of your peers and your instructor, and that you do not engage in activities that are unrelated to class (e.g., gaming, email, chat, surfing the web, etc.). Such disruptions show a lack of professionalism and will result in a reduction of your participation grade. If you are repeatedly found to be engaging in non-class activities on your electronic device, I will ask you to leave the classroom.

### • **Academic Integrity and the Honor Code:**

This course is conducted in accordance with the [GMU Honor Code](#). You are expected to abide by this code; any violation will be reported to the Honor Committee for adjudication. As members of the academic community, you are expected to be attentive to issues of academic integrity, particularly as they relate to the acknowledgement of sources. Passive plagiarism (e.g., failing to cite sources) is as bad as active plagiarism (e.g., downloading an essay off the internet). Always cite and reference your sources. Please note that any text generated by an artificial intelligence text-generation tool cannot be accepted as your own work, and its use in this class will be considered a serious violation of academic integrity.

### • **Disability Accommodations:**

Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding laws that ensure equal treatment of people with disabilities. If you require accommodations for this course, visit <http://ds.gmu.edu/> for information about the Disability Services registration process. Then please discuss your approved accommodations with me.

### • **Commitment to Diversity and Inclusion:**

The Department of Philosophy seeks to create an inclusive learning environment that fosters respect for people across differences. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, and age. We encourage everyone to engage with philosophical ideas personally, but to also be open to exploring and learning from experiences different than their own.

Please note that this does not mean not being critical. Respecting others' views means taking them seriously; and taking them seriously means thinking about their strengths and weaknesses, asking questions, and offering constructive criticisms or alternative viewpoints where appropriate. It also means thinking about where the views of others challenge our own, and being open to what they can teach us. Valuing diversity is not just an attitude—it is a matter of developing a practice that involves:

- learning to listen to other perspectives and to hear criticism of our own views;
- expressing criticisms and differences of opinion in ways that are not personal or hurtful and that leave space for other voices (as well as for the possibility that we are wrong);
- being generous in our interpretation of what others say, forgiving of missteps as moments for learning, and holding ourselves and others accountable for where we can do better;
- having good reasons for one's views, but being willing to change one's mind;
- not rushing to judgment; learning to assess different positions while being unsure where we stand; *and* being willing to accept that there will always be things one cannot see or understand.

# COURSE SCHEDULE

(subject to change; please check Blackboard for updates)

W	Date	#	Reading / Topic	Presenter
W	Mon., January 15	NO CLASS (MLK Day)		
1	Wed., January 17	1	Introduction to the Course	
W	Mon., January 22	2	Hacking: 'Introduction: Rationality'	.
UNIT I: KUHN'S STRUCTURE OF SCIENTIFIC REVOLUTIONS (SSR)				
2	Wed., January 24	3	SSR, Preface & I: 'A Role for History'	.
W	Mon., January 29	4	SSR, II–III: 'The Route & Nature of Normal Science'	.
3	Wed., January 31	5	SSR, IV–V: 'Puzzle Solving' & 'Priority of Paradigms'	.
W	Mon., February 5	6	SSR, VI–VII: 'Anomaly' & 'Crisis'	.
4	Wed., February 7	7	SSR, VIII: 'The Response to Crisis'	.
W	Mon., February 12	8	SSR, IX: 'The Nature & Necessity of Revolutions'	.
5	Wed., February 14	9	SSR, X: 'Revolutions as Changes of World View'	.
W	Mon., February 19	10	SSR, XI–XII: 'Invisibility & Resolution of Revolutions'	.
6	Wed., February 21	11	SSR, XIII: 'Progress Through Revolutions'	.
W	Mon., February 26	12	SSR: 'Postscript – 1969'	.
7	Wed., February 28	13	Kuhn: 'Objectivity, Value Judgment, & Theory Choice' *	.
W	Mon., March 4	NO CLASS		
8	Wed., March 6	(Spring Break)		
UNIT II: PHILOSOPHY OF SCIENCE AFTER SSR				
W	Mon., March 11	14	Popper: 'Science: Conjectures & Refutations'	.
9	Wed., March 13	15	Kuhn: 'Logic of Discovery or Psychology of Research?'	.
W	Mon., March 18	16	Watkins & Popper: 'Against Normal Science'	.
10	Wed., March 20	17	Lakatos: 'Science & Pseudoscience'	.
W	Mon., March 25	18	Feyerabend: 'Consolations for the Specialist'	.
11	Wed., March 27	19	Laudan: 'From Theories to Research Traditions'	.
W	Mon., April 1	20	Longino: 'Values & Objectivity'	.
12	Wed., April 3	21	Longino: 'Does SSR Permit a Feminist Revolution?'	.
W	Mon., April 8	22	McMullin: 'A Case for Scientific Realism'	.
13	Wed., April 10	23	Kukkanen: 'Truth, Incoherence, & Evolution of Science'	.
W	Mon., April 15	24	Daston: 'History of Science Without Structure'	.
14	Wed., April 17	25	Kitcher: 'After Kuhn' [ONLINE]	.
W	Mon., April 22	26	Review, Essay Planning Workshop, & Wrap-Up	
15	Wed., April 24	27	'FLASH' TALKS OF FINAL ESSAYS I	
W	Mon., April 29	28	'FLASH' TALKS OF FINAL ESSAYS II	
16	Fri., May 3	FINAL ESSAY DUE		

Final Essay Outline Due

Final Essay Outline Due