PHIL 311: Philosophy of Science

Term:	Spring 2018	**Instructor:**	Robert Smithson
Time:	TR 11am-12:15pm	**Email:**	rsmithson@rollins.edu
Room:	BUSH 102	**Office:**	French House, Room 104
		Office Hours:	TR 10-11am and by appointment

Course Description

Scientific discoveries and scientific practice itself raise a number of interesting philosophical questions. Why should we think that our best scientific theories are true? Are we justified in making predictions about the future on the basis of observations made in the past? What are laws of nature, and in what sense do they govern physical events? What is the proper interpretation of fundamental physical theories like relativity and quantum mechanics? How do we distinguish science from pseudo-science? What are the distinctive aspects of the scientific method? In this introductory course, we will consider how philosophical arguments might be used to assess these and other questions.

Course Goals

1. To provide students with a systematic overview of the types of reasoning involved in scientific inquiry.
2. To assess the various philosophical challenges to and defenses of scientific knowledge.
3. To provide students with an overview of how philosophy can help us better understand the content of specific scientific theories (physics, biology, etc.).

Course Texts

All texts for the course will be posted to the course's Blackboard site.

Grading

Short papers (2 pages each): 30%
Final: 20%
Homework: 25%
Quizzes: 15%
Participation: 10%

The participation grade takes into account both attendance and discussion in class. Class attendance is mandatory. If you have an excused absence (such as a medical absence). please bring me a note or send me an email.

Papers
There will be a series of writing assignments throughout the term, each 2 pages long (double-spaced). To facilitate anonymous grading, only include your identification number (and not your name) at the top of the document. For helpful advice on writing philosophy papers, see Jim Pryor's helpful introduction: www.jimpryor.net/teaching/guidelines/writing.html.

Homework
The homework assignments for the course may include short problem sets, reading responses, etc. These assignments will be announced throughout the term.

Quizzes
Throughout the term, there will be quizzes on readings and on recently presented material. These quizzes will sometimes be announced, and sometimes unannounced.

Participation
The participation grade takes into account both attendance and discussion in class. Class attendance is mandatory. Students arriving late will receive reduced credit for attendance that day. Students leaving class early will also receive reduced credit.

The professor will accommodate a reasonable number of excused absences for religious holidays and official off-campus college business such as academic conference presentations and athletic competitions. However, per the College's policy on excused absences (http://www.rollins.edu/catalogue/academic_regulations.html#class-attendance), students must discuss with the professor the dates of the anticipated absences no later than the last day of the drop period. Students must present to their professor written evidence of the anticipated absences and discuss with him/her how and when make-up work should be completed prior to missing the class. Students should not expect to receive allowance for excused absences if they do not meet with the professor beforehand and clarify the dates as necessary.

Absences will be addressed by the professor in accordance with his attendance policy. The professor retains the right to determine what would be considered to be a reasonable number of absences (excused or otherwise) for the course. A student will not fail a course because the number of religious observances and/or college business absences exceed the number of absences allowed, except if excessive absences make it impossible to fulfill the expectations of the course. The student's class participation grade in the course, though, may still be affected.

Honor Code
Membership in the student body of Rollins College carries with it an obligation, and requires a commitment, to act with honor in all things. The student commitment to uphold the values of honor—honesty, trust, respect, fairness, and responsibility—particularly manifests itself in two public aspects of student life. First, as part of the admission process to the College, students agree to commit themselves to the Honor Code. Then, as part of the matriculation process during Orientation, students sign a more detailed pledge to uphold the Honor Code and to conduct themselves honorably in all their ac-

tivities, both academic and social, as a Rollins student. A student signature on the following pledge is a binding commitment by the student that lasts for his or her entire tenure at Rollins College:

> The development of the virtues of Honor and Integrity are integral to a Rollins College education and to membership in the Rollins College community. Therefore, I, a student of Rollins College, pledge to show my commitment to these virtues by abstaining from any lying, cheating, or plagiarism in my academic endeavors and by behaving responsibly, respectfully and honorably in my social life and in my relationships with others.

This pledge is reinforced every time a student submits work for academic credit as his/her own. Students shall add to the paper, quiz, test, lab report, etc., the handwritten signed statement:

> *"On my honor, I have not given, nor received, nor witnessed any unauthorized assistance on this work"*

Material submitted electronically should contain the pledge; submission implies signing the pledge.

Credit Hour Statement for Rollins Courses
This course is a four-credit-hour course that meets three hours per week. The value of four credit hours results, in part, from work expected of enrolled students both inside and outside the classroom. Rollins faculty require that students average at least 2.5 hours of outside work for every hour of scheduled class time. In this course, the additional outside-of-class expectations include the careful study of (i) the assigned readings, (ii) the class handouts posted to Blackboard, and (iii) the student's notes from class.

Accessibility Services
Rollins College is committed to equal access and inclusion for all students, faculty and staff. The Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 create a foundation of legal obligations to provide an accessible educational environment that does not discriminate against persons with disabilities. It is the spirit of these laws which guides the college toward expanding access in all courses and programs, utilizing innovative instructional design, and identifying and removing barriers whenever possible.

If you are a person with a disability and anticipate needing any type of academic accommodations in order to fully participate in your classes, please contact the Office of Accessibility Services, located on the first floor of the Olin Library, as soon as possible. You are encouraged to schedule a Welcome Meeting by filling out the "First Time Users" form on the website: http://www.rollins.edu/accessibilityservices/ and/or reach out by phone or email: 407-975-6463 or Access@Rollins.edu.

All test-taking accommodations requested for this course must first be approved through the Office of Accessibility Services (OAS) and scheduled online through Accommodate **at least 72 hours before the exam**. Official accommodation letters must be received by and discussed with the faculty in advance. There will be no exceptions given unless previously approved by the OAS with documentation of the emergency situation. We highly recommend making all testing accommodations at the beginning of the semester. OAS staff is available to assist with this process.

Title IX Statement
Rollins College is committed to making its campus a safe place for students. If you tell any of your faculty about sexual misconduct involving members of the campus community, your professors are required to report this information to the Title IX Coordinator. Your faculty member can help connect you with the Coordinator, Oriana Jiménez (TitleIX@rollins.edu or 407-691-1773). She will provide you with information, resources and support. If you would prefer to speak to someone on campus confidentially, please call the Wellness Center at 407-628-6340. They are not required to report any information you share with the Office of Title IX.

Sexual misconduct includes sexual harassment, stalking, intimate partner violence (such as dating or domestic abuse), sexual assault, and any discrimination based on your sex, gender, gender identity, gender expression or sexual orientation that creates a hostile environment. For information, visit http://www.rollins.edu/titleix/.

Electronic Device Policy
In order to promote classroom discussion, no laptops, tablets, phones, etc. are permitted during class except by instructor permission.

In order to protect the integrity of the classroom experience, the use of recording devices is limited to either the expressed permission of the faculty member or with proper documentation from the Office of Accessibility Services. Information about accommodations through Accessibility Services can be found at http://www.rollins.edu/accessibility-services/. Recording without the proper authorization is considered a violation of the Rollins Code of Community Standards.

Course Schedule
This schedule is subject to change, depending on the progress of the discussion in the class. If there are changes, I will make note of them in class and will send out an email about the changes. Next to each class period, there is an assigned reading. The readings for 1/23 should be completed before class on 1/23, etc.

Date	Topic
	THE DEMARCATION PROBLEM: WHAT IS SCIENCE?
R 1/18	Syllabus.
	Reading: Carl Hempel (1966). *Philosophy of Natural Science* (excerpt 1).
	Blackboard handout.

T 1/23	*Reading*: Larry Laudan (1982) Science at the Bar.
	Background reading:
	Carl Hempel (1966). *Philosophy of Natural Science* (ch. 3).
	Pierre Duhem (1954) The Aim and Structure of Physical Theory (ch. 3).
R 1/25	NO CLASS (interview) (makeup class TBA)

REALISM: WHY BELIEVE SCIENTIFIC THEORIES?

T 1/30	Indispensability arguments, alternative explanations of scientific success.
	Reading: Excerpts from Anjan Chakravartty (2011). "Scientific Realism."
	Kyle Stanford (2000). "An Antirealist Explanation of the Success of Science."
R 2/1	The pessimistic meta-induction, underdetermination arguments
	Reading: Larry Laudan (1981). "A Confutation of Convergent Realism."
T 2/6	NO CLASS (interview) (makeup class TBA)
R 2/8	Alternatives to realism.
	Reading: John Worrall (1989). "Structural Realism: The Best of Both Worlds?" (excerpts).
	Bradley Monton & Chad Mohler (2017). "Constructive Empiricism." (excerpts).

INDUCTION AND CONFIRMATION: HOW ARE THEORIES CHOSEN?

T 2/13	Confirmation and acceptability.
	Reading: Carl Hempel (1966). *Philosophy of Natural Science* (ch. 4).
	Background reading: Bryan Skyrms (2000). *Choice and Chance* (ch. 8).
R 2/15	The probability calculus.
	Reading: Bryan Skyrms (2000). *Choice and Chance* (ch. 6).
T 2/20	Scientific inductive logic.
	Reading: Bryan Skyrms (2000). *Choice and Chance* (ch. 8).
R 2/22	The traditional problem of induction.
	Reading: Wesley Salmon, (1974). "An Encounter with David Hume."
T 2/27	The new problem of induction.
	Reading: Bryan Skyrms (2000). *Choice and Chance* (ch. 4).

LAWS AND GENERALIZATIONS: HOW DO THEORIES EXPLAIN?

R 3/1	Types of scientific explanation.
	Reading: James Woodward (2014). "Scientific Explanation." (excerpts)
T 3/6	*Reading*: Carl Hempel (1966). *Philosophy of Natural Science* (ch. 5).
R 3/8	Motivations for non-Humeanism.
	Reading: Helen Beebee (2000). "The Non-Governing Conception of Laws of Nature."
TBD	Humean Supervenience.
	Reading: Ned Hall (manuscript). "Humeanism about laws of nature." (excerpts)

SPRING BREAK

SCIENCE AND VALUES

T 3/20   Theory-ladenness of observation.
Reading: homas Kuhn (1962). *The Structure of Scientific Revolutions.* (excerpts)

R 3/22   Social construction, paradigms.
Reading: Thomas Kuhn (1962). *The Structure of Scientific Revolutions.* (excerpts)

T 3/27   Feminist philosophy of science, standpoint theory.
Reading: Elizabeth Anderson (2015). "Feminist Epistemology and Philosophy of Science." (excerpts)

R 3/29   Scientific objectivity
Reading: Helen Longino (1991). Multiplying subjects and the diffusion of power.

T 4/3   Science and ethics.
Reading: Heather Douglas (2003) The moral responsibilities of scientists. Kristen Intemann (2001). "Science and Values: Are Value Judgments Always Irrelevant to the Justification of Scientific Claims?"

PHILOSOPHY OF PHYSICS

R 4/5   Absolutism vs. relationism, geometric structure, historical background
Reading: Tim Maudlin (2010). *Space and Time.* Chs. 1-2. (excerpts)
Sakai handout.

T 4/10   Arguments for absolutism, arguments for relationism.
Reading: Tim Maudlin (2010). *Space and Time.* Ch. 2.
Sakai handout.
Optional background: Barry Dainton (2010). Chs. 10-11. (excerpts)

R 4/12   Minkowski geometry, spacetime in special relativity, the Lorentz Invariant Interval
Reading: Sakai handout.
Optional background: Edward Taylor and John Wheeler (1992). *Spacetime Physics.* (excerpts).

T 4/17   Geometric laws in special relativity, the twins paradox
Reading: Sakai handout.
Optional background: Edward Taylor and John Wheeler (1992). *Spacetime Physics.* (excerpts).

R 4/19   Constructing Lorentz coordinates, time dilation, Lorentz contraction, The "constancy of the speed of light,
Reading: Sakai handout.
Optional background: Edward Taylor and John Wheeler (1992). *Spacetime Physics.* (excerpts).

T 4/24   Locality, polarization, entangled states, Bell's Theorem, Aspect's Experiment
Reading: Sakai handout.

R 4/26	Bell's Theorem, Aspect's Experiment *Reading*: Sakai handout.
T 5/1	Quantum formalism, wave collapse, reconciling QM with SR *Reading*: Sakai handout.
TBA	Review Session.
05/03 11am-1pm	**EXAM**