Philosophy of Science: An Introduction

A sample syllabus by Tiina C Rosenqvist

[This syllabus outlines a proposed introductory course in general philosophy of science.]

1. Course Description

This course provides an introduction to foundational questions and concepts in the philosophy of science. It explores what distinguishes science from other epistemic practices, examines different types of scientific explanations, and investigates the relationship between scientific theories and evidence, as well as the nature of scientific change. We will address key issues such as the underdetermination problem, the debate between realism and anti-realism, and the influence of values on scientific practice. The course concludes with a focused exploration of climate science as a case study. No prior background in philosophy or science is required.

2. Course Objectives

Through active participation in this course, you will be able to (i) understand and articulate key concepts and debates in the philosophy of science, (ii) analyze the assumptions underlying scientific practices, (iii) engage critically with case studies from the history and practice of science and (iv) develop and refine your skills in argumentation, critical thinking, and clear communication.

3. Course Structure

In-person sessions

The in-person sessions will generally follow a format of lecture + discussion. It is expected that you complete the assigned readings before each class and actively participate in the discussions and other in-class activities. On the last day of class you will participate in a poster session.

Out-of-class activities

You are expected to complete all *required* readings before the classes for which they are assigned. You will write two short papers, take two in-person exams, and complete a group poster project.

4. Assignments & Assessment

Weights

- Attendance & Participation —15%
- Module 1 Exam — 10%
- Paper 1—10%
- Paper 2 —25%
- Cumulative Exam — 25%
- Group poster project and presentation —15%

Attendance and Participation

Attendance is mandatory. You are allowed to miss up to two class sessions without prior notice, except on the day of the poster session. If you anticipate missing more than two sessions, you must provide prior notice and complete a make-up assignment. Failure to notify will likely result in a deduction from your participation grade. Repeated lateness may also negatively impact your participation grade.

Active and considerate participation in discussions and class activities is expected. This includes completing assigned readings beforehand, coming to class prepared with ideas and questions, adhering to discussion guidelines, and demonstrating genuine engagement.

In-class participation is a critical component of the course and will be tracked throughout the term. I understand that participating in class can be challenging for various reasons. If you find in-class participation difficult, please let me know as soon as possible. We can discuss strategies to make you feel more comfortable and/or come up with alternative participation methods. Your success and comfort in this course is important to me.

Exams

You will take two in-person exams: one exam at the end of Module 1 and another (cumulative) exam at the end of the term. The first exam is worth 5% of your final grade and the second is worth 25%.

Papers

You will write two argumentative papers throughout the course. The first paper (800-1,000 words) is worth 10% of your final grade and the second paper (1,200-1,600 words) is worth 25%.

Case study project and presentation

You will work in small groups to design a poster project that critically examines the epistemic and ethical dimensions of a recent climate-related controversy. Drawing on course materials and independent research, your group will synthesize key concepts from the philosophy of science to create a comprehensive and insightful presentation that engages with central debates surrounding scientific practices, uncertainty, values, and their ethical implications in the context of climate change. The project and presentation are worth are worth 15% of your final grade.

5. Course Policies

[Omitted from this sample.]

6. Resources

[Omitted from this sample.]

7. Class & Readings Schedule

Note on terminology

- "***Required***" readings are the ones you are expected to read and engage with *before* the relevant class session.
- "***Recommended***" readings/podcasts/videos will give you a fuller understanding of the topic under discussion. They will likely be useful to you when writing papers. Some ideas in the recommended readings might also be discussed during in-class sessions.
- "***Optional***" readings/podcasts/videos are extra materials for when you are particularly interested in a topic.

Module I. Foundations

In this module, we explore foundational topics, including the demarcation problem (what separates science from non-science), falsificationism, and challenges of scientific inference, such as the problem of induction. The module concludes with an analysis of scientific explanation, examining the deductive-nomological model and its alternatives.

(1) Basics: What is an argument? How to read philosophy?

- ***Recommended***: Pryor, "Guidelines on reading Philosophy"

(2) Introduction to philosophy of science, the demarcation problem
- ***Required***: Okasha (2016): *Philosophy of Science*, Ch. 1: What is Science?
- *Optional*: Shermer (2013), "Science and Pseudoscience: The Difference in Practice and the Difference It Makes"

(3) Falsificationism
- ***Required***: Popper (1963), "Science as Falsification"
- *Optional*: Carroll (2014), "What Scientific Idea is Ready for Retirement? Falsifiability"

(4) Scientific inference, deduction, and induction
- ***Required***: Okasha (2016), *Philosophy of Science*, Ch. 2: Scientific Inference
- ***Recommended***: Ladyman (2002), *Understanding Philosophy of Science*, Ch 2: The Problem of Induction and Other Problems with Inductivism

(5) Scientific explanation
- ***Required***: Okasha (2016), *Philosophy of Science*, Ch. 3: Explanation in science
- ***Required:*** Hempel (1966), *Philosophy of Natural Science,* Chs. 2-3 (selections)

(6) Scientific explanation
- ***Required:*** Salmon, "Four Models of Explanation"

(7) Catch-up/Review + *Module Exam*

Module II. Theories, evidence, and scientific change

This module begins with the problem of underdetermination—the idea that the evidence available to us is insufficient to determine which theory is the correct one—and responses to the problem. The module also addresses scientific change, focusing on Kuhn's influential account of scientific revolutions and how disciplines evolve. Finally, through case studies in physics, biology, and psychology, we consider real-world examples of philosophical issues in science.

(8) The underdetermination problem
- ***Required***: Duhem ([1906] 1954), *The Aim and Structure of Physical Theory* (selections)
- ***Recommended***: Quine (1951), "Two Dogmas of Empiricism" (selections)

(9) Explanatory virtues
- ***Required***: Laudan (1990), "Demystifying Underdetermination"
- *Optional*: Lipton (2000),"Inference to the Best Explanation"

(10) Pessimistic induction
- ***Required***: Wray (2015), "Pessimistic Inductions: Four Varieties"

(11) Scientific change
- ***Required***: Okasha (2016), *Philosophy of Science*, Ch.5: Scientific change and scientific revolutions
- ***Required***: Kuhn (1962), *The Structure of Scientific Revolutions* (selections)

(12) Case studies
- ***Required***: Okasha (2016), *Philosophy of Science*, Ch.6: Philosophical problems in physics, biology, and psychology

(13) Workshop: How to Write a Philosophy Paper

(14) Catch-up/Review/Group work

Paper 1

Module III. Science and reality

This module explores the debate between scientific realism and anti-realism: does science uncover truths about the world, or are scientific theories simply practical tools?

(15) The debate
- ***Required***: Okasha (2016), *Philosophy of Science*, Ch.4 : Realism and anti-realism
- *Optional*: Putnam (1975), *Mathematics, Matter and Method* (selections)

(16) Scientific realism
- ***Required***: Psillos (1999), *Scientific Realism: How Science Tracks Truth*, Introduction

(17) Scientific anti-realism: instrumentalism and constructive empiricism
- ***Required***: Van Fraassen (1980), *The Scientific Image*, "Arguments Concerning Scientific Realism"

(18) Pragmatism
- ***Required***: Fine ([1986b] 1996), *The Shaky Game: Einstein, Realism and The Quantum Theory* (Selections)

(19) Catch-up / review

Module IV. Values in science

This module deals with feminist philosophy of science. We begin with the concept of situated knowledge, which challenges the idea of objective science. We then examine how values shape scientific practices and explore feminist contributions to debates about underdetermination and holism in science.

(20) Situated knowledge
- ***Required***: Haraway (1988), "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective"
- *Optional*: Okasha (2016), *Philosophy of Science*, Ch. 7: Science and its critics

(21) Value-ladenness
- ***Required***: Longino (1990), *Science as Social Knowledge*, Ch 5: Values and science

(22) Feminist philosophy of science
- ***Required***: Nelson (2022),"Underdetermination, Holism, and Feminist Philosophy of Science"

(23) Catch-up/review

Paper 2

Module V. Case study: climate science and society

This module focuses on climate science. We will critically explore the epistemic issues involved in climate predictions, the role of values and uncertainty in modeling, and the ethical implications of climate science and climate denial.

(24) Climate science: theories, data, and mathematical modeling
- ***Required*:** Internet Encyclopedia of Philosophy: "The Philosophy of Climate Science"
- ***Recommended*:** Explore Probable Futures (a non-profit climate literacy initiative)

(25) Values and uncertainty
- ***Required*:** Winsberg (2012) "Values and Uncertainties in the Predictions of Global Climate Models"
- ***Required:*** Parker (2018), "Climate Science" (SEP), Sect. 5.3
- *Optional*: Climate change: science and solutions Briefing 1: "Next generation climate models: a step change for net zero and climate adaptation"

(26) Philosophy of climate denial + group work
- ***Required***: Holsopple (2019), "The Philosophy of Climate Denial"

(27) Group work + consultations

Group Project

(28) Poster session in class

Final Exam