# PHILOSOPHY 3330G: PHILOSOPHICAL FOUNDATIONS OF SPACETIME THEORIES

*Instructor* N/A

*Course Description*

In this course we will study the nature of space and time. We will begin with disputes regarding the nature of space, time, and motion waged in the seventeenth century by the likes of Galileo, Descartes, Newton, and Leibniz. After briefly reviewing the Aristotelian doctrines that these thinkers responded to, we will study the debate between "aboslute" and "relational" accounts of space and time. Relationalists treat space as consisting of nothing but the spatial relationships between objects, whereas proponents of "absolute" space assert that space exists as a substance in its own right. We then turn to the development of non-Euclidean geometry in the $19^{th}$ century and debates regarding the epistemology of geometry. Kant argued that Euclidean geometry must hold, but the study of non-Euclidean geometries led Poincare´ and others to conclude that spatial geometry is to some degree conventional. The final section of the course turns to the development of modern spacetime theories. We will consider Einstien's special and general theories of relativity, the new conceptions of space and time they introduce, and the impact of these new ideas on the traditional debates.

*Texts*

Barry Dainton, *Time and Space*, McGill - Queen's University Press.
Robert Geroch, *General Relativity from A to B*, University of Chicago Press.
*Online Readings*. Collection of articles, posted on the course website.

*Requirements*

1. Participation (10 %): Discussion will be an important part of the course, and students will be expected to keep up with the reading and participate in discussions in person or online.
2. Informal Writing (10 %): Students will be asked to submit short writing assignments (~ 250 words), roughly bi-weekly (5 or 6 sets of questions total). Late assignments will not be accepted, but one of these assignments can be missed without penalty.
3. Two papers (50 %): one short (4-5 pages, 20 %) and one longer (6-8 pages, 30 %) papers; suggested topics and guidelines will be distributed. The late penalty is 3 % per work day and 5 % for the weekend, with a maximum penalty of 20 %.
4. Final Exam (30 %): cumulative essay exam, with choice regarding which questions to answer (e.g., answer 4 out of 6 essay questions).

*Objectives*

The course has two main objectives. The first is to introduce students to different views regarding the nature of space and time and how these have developed historically. The second objective is to help students develop the ability to read and appreciate philosophical arguments related to technical subjects. In particular, the course will highlight the role philosophical analysis has played in assessing the adequacy of different views of space and time.

## TENTATIVE SCHEDULE

| Date | Topic | Assigned Reading |
|---|---|---|
| Jan. 8 | Introduction and Overview | |
| | Classical Debate and the New Science of Motion | |
| Jan. 10 - 15 | Galileo and Descartes: Relativity, Inertia, and Motion | R 1; D 10.1-10.3; G 2 |
| Jan. 17 - 24 | Newton: Absolute Space and Time | R 2; R 3; D 11.1-11.4, 12; G 3 |
| Jan. 29 - Feb. 5 | Leibnizian and Machian Relationalism | R 4; D 10.4-10.7, 11.5-11.7 |
| | Geometry and Conventionality | |
| Feb. 7 - 12 | Kant on Geometry | R 6 |
| Feb. 14 - 26 | Euclidean and Non-Euclidean Geometry | R 8; D 13 |
| Feb. 28 - March 4 | Conventionality of Geometry | R 7 |
| March 6 -11 | Incongruent Counterparts and Absolute Space | D 14 |
| | Theory of Relativity | |
| March 13 - 20 | Special Relativity | G 4-6; D 16-17 |
| March 25 - April 10 | General Relativity | R 9; D 18-19; G 7-8 |

*Note*: R refers to articles posted online, listed below; G = Geroch, D = Dainton (numbers refer to chapters or section numbers).

*Course Webpage*: I will adjust this schedule and the reading assignments as the quarter progresses. Check the course webpage for regular updates on the schedule and other class announcements. Any handouts or other materials distributed in class (including reading questions) will be posted on the webpage, along with supplemental readings and links to other useful websites.

## READINGS POSTED ONLINE

1. Descartes, *Principles of Philosophy*, translated by Miller and Miller, pp. 39-69.
2. Newton on space and time: selections from "De Gravitatione," from *Newton: Philosophical Writings*, edited by Janiak, pp. 12-40; Scholium to the Definitions, *Principia*, trans. by Cohen and Whitman, pp. 408-415.
3. "Newton's Philosophical Analysis of Space and Time," by Robert Di Salle. In *Cambridge Companion to Newton*, ed. by G. E. Smith and I. B. Cohen.
4. *Space from Zeno to Einstein*, by Nick Huggett. Selections from chapters 8-9, pp. 143-158, 169-180.
5. "Philosophy of Space and Time," by John Norton. In *Introduction to the Philosophy of Science*, by Salmon et al., pp. 179-231.
6. Kant, Transcendental Aesthetic, Section I: Space, from *Critique of Pure Reason*, trans. by Kemp Smith, pp. 67-74.

7. Poincaré, "Space and Geometry," in *Science and Hypothesis*, pp. 51-71.
8. Hans Reichenbach, *Philosophy of Space and Time*, pp. 1-37.
9. Einstein on General Relativity: *The Meaning of Relativity*, pp. 55-61; 2§ of "The foundation of the general theory of relativity"; *Relativity: the special and the general theory*, pp. 66-73.

**Audit**: Students wishing to audit the course should consult with the instructor prior to or during the first week of classes.

The Department of Philosophy Policies which govern the conduct, standards, and expectations for student participation in Philosophy courses is available in the Undergraduate section of the Department of Philosophy website at http://uwo.ca/philosophy/undergraduate/proceduresappeals.html. It is your responsibility to understand the policies set out by the Senate and the Department of Philosophy, and thus cannot be used as grounds of appeal.