

Course Description

This course will introduce students to the interdisciplinary study of time. Readings will be drawn from historical and contemporary work in the sciences, philosophy, and literature. The assignments will be a mixture of problem sets and short writing pieces. The problem sets will ask students to apply a number of the mathematical tools introduced in the course. The writing assignments will ask students to explain and assess various paradoxes concerning time, some depicted in philosophical writings, others depicted in works of fiction.

Time-Measurement: We begin by discussing the history of time-measurement, focusing on both water clocks and sun dials. Problem sets will focus on calculations required to make and use each, e.g., students will be asked to calculate the volume of water required to measure 1 hour of time with a simple outflow water-clock.

Zeno's Paradoxes: We will discuss Aristotle's presentation in his *Physics* of Zeno's paradoxes of motion, paying close attention to the Arrow Paradox since it focuses on the nature of time, but also briefly touching on the other paradoxes to explain Zeno's overall project. The Arrow Paradox rests on the assumption that an object occupying a region of space at an instant cannot be in motion at that instant. Newton's and Leibniz's development of calculus was supposed to offer us a means of understanding how an object can be in motion at an instant, thereby solving the paradox. Students will be introduced to those basic concepts of calculus needed to understand and evaluate this response. Problem sets will focus on some basic calculus.

Ontology of time: In 1908, J.M.E McTaggart argued that time cannot exist. Temporal passage, according to him, is essential to time, but he argues that temporal passage is impossible. This is the foundational, cornerstone work in the philosophy of time. Students will be introduced to the argument by first reading Kurt Vonnegut's 'Slaughterhouse-Five', which accurately depicts two different views of temporal passage.

Topology of time: Here our focus will be on the direction of time. Why does temporal passage unfold in the particular direction that it does? Could it flow backwards? We will look at a number of theories that claim that time's topological features depend on facts about those

things existing in time. Special attention will be given to the view that the direction of time depends on the universe's increasing state of entropy. To evaluate this response, students will be introduced to some basics of thermodynamics.

Time-travel: Our final section will focus on two paradoxes of time-travel, the twin paradox and the grandfather paradox. The twin paradox arises because special relativity seems to predict that if two twins travel at very different speeds, then the one traveling faster will age at a slower rate. The grandfather paradox arises because a time traveler would seem able to kill his ancestors, thereby preventing his own birth. While this paradox seems to undermine the possibility of time-travel, we will look at a number of defenses of time-travel that rest on particular conceptions of space-time and how humans exist in space-time.