WESTERN UNIVERSITY
DEPARTMENT OF PHILOSOPHY
Undergraduate Course Outline 2022-23

PHILOSOP 2032G
Einstein for Everyone

Winter Term	Instructor: **Chris Smeenk**
Online	**WIRB 7180 Office Hours: Thursday 10 – 11am**
Classroom (if applicable)	csmeenk2@uwo.ca

DESCRIPTION

This course considers the work of Albert Einstein and its impact, focusing mainly on the theories of relativity and cosmology. Mathematics will be kept to a minimum, and no physics background will be assumed. The course starts with special relativity, as formulated by Einstein in 1905. We will discuss Einstein's two postulates and explore their strange consequences for the behavior of measuring rods and clocks, and explain the meaning and importance of the relativity of simultaneity. How did Einstein discover special relativity? We will look at the historical context of his work, showing how it related to 19th century physics. We will also consider various consequences of the theory, such as $E = mc^2$, and alleged paradoxes (such as the twin paradox). We then turn to Einstein's most striking achievement, the general theory of relativity (1915). This theory is based on the remarkable idea that spacetime is curved. We will develop the background needed to understand this concept and the other basic ideas of the theory, and consider consequences of the theory related to cosmology and black hole physics. We will also consider Einstein's innovative path to general relativity as exemplifying an effective critical analysis of a physical theory.

TEXTS

The primary textbook for the course is an online book by John D. Norton, *Einstein for Everyone*. We will also read parts of the following papers, all posted to the OWL website:

Readings

The primary textbook for the course is an online book by John D. Norton, *Einstein for Everyone*. We will also read parts of the following papers, all posted to the OWL website:

1. Einstein (1905), "On the Electrodynamics of Moving Bodies'' (translation by John Walker).
2. Appendix on special relativity, by Michel Janssen (from the *Cambridge Companion to Einstein* (2014)).
3. Selection from I. B. Cohen, *The Birth of a New Physics*.
4. Selections from Einstein, "On the Relativity Problem" (1914)
5. "Einstein's Role in the Creation of Relativistic Cosmology,'' by Chris Smeenk (from the *Cambridge Companion to Einstein*).
6. Selections from the correspondence between Einstein and De Sitter (from the *Collected Papers of Albert Einstein, Volume 8*).

7. Selections from *The First Three Minutes*, by Steven Weinberg (1977)
8. Selections from *Cosmology for the Curious*, by Delia Perlov and Alex Vilenkin (2017).

OBJECTIVES

By the end of the course students will be able to:

1. Demonstrate they understand the physical concepts introduced by Einstein and how these concepts apply to the world.
2. Characterize the problems Einstein confronted, and how he resolved them by rethinking basic concepts with his distinctively "philosophical" approach to science.
3. Perform critical reflection on how modern physics impacts our understanding of the universe and our place in it.
4. Improve analytical skills to critically assess science (in different senses), and to present these ideas in writing.
5. Apply critical reflection on the development of science and the impact of dramatic changes in our understanding, based on Einstein's work as a case study.

METHOD OF EVALUATION

1. Regular formative assessments (10 %). These formative assessments will help give you and me a sense of how well you are understanding key concepts as they are introduced. They include: (i) short questions and polls (3 %). Marks will be based on participation. (ii) Short mini-quizzes (4 %), including multiple choice questions or short problems. You will be able to take the quizzes at the end of the week, and they cover material discussed in the assigned readings and lectures. Marks will be based on performance. (iii) Discussion forum posts (3 %). You will be asked to reflect, assess, and engage with your peers and TAs in discussion.
2. Short writing assignments (20 %): (i) peer-reviewed short essay writing (Compair, 10 %), assigned roughly bi-weekly according to the schedule above. Compair assignments will focus on developing writing skills for the final paper. (ii) Critical reflections (10 %): each week you will write a brief response to the material we have covered, answering three questions: "what," "so what," and "now what"?.
3. Exams (35 %): midterm (15 %) and final exam (20 %), both administered online, consisting of multiple choice, true / false, and short essay questions. A more detailed description of the exams, and sample questions, will be distributed two weeks prior to each exam.
4. Final Essay (35 %): roughly 2000 word final essay, due at the end of the term. The grading rubric and guidelines will be posted well in advance of the essay due date.

Late submissions: Because of the interactive and integrated nature of much of the course work, it is essential to continue to keep pace and meet deadlines. Please do not ask for extensions on these deadlines. We will not accept late submissions. We will, however, automatically drop the lowest score for each type of assessment (for example, the mark for critical reflections will be based on the top 9 out of 10).

Course Schedule

Week	Topic	Applications
	Module 1: It's about time	
Jan. 9	Relativity and Light	Discussion Forum Critical Reflection
Jan. 16	Simultaneity for Distant Events	Compair 1 Mini-quiz Critical Reflection
Jan. 23	Spacetime	Discussion Forum Mini-quiz Critical Reflection
Jan. 30	Implications of Relativity	Compair 2 Critical Reflection
	Module 2: Gravity as Curved Spacetime	
Feb. 6	Gravity and Geometry	Discussion Forum Mini-Quiz Critical Reflection
Feb. 13	Einstein's Path to a New Theory	Midterm Exam
Feb. 20	Reading week	
Feb. 27	General Relativity 101	Compair 3 Critical Reflection
March 6	Was Einstein Right?	Discussion Forum Mini-Quiz Critical Reflection
	Module 3: Einstein's Cosmos	
March 13	Rough and Winding Road to Cosmology	Compair 4 Mini-Quiz Critical Reflection
March 20	The Big Bang Theory and Black Holes	Discussion Forum Mini-Quiz Critical Reflection
March 27	Cosmology's Dark Materials	Compair 5 Critical Reflection
April 3	Concluding Reflections: Einstein as a Philosopher	Final Essay, due April 10
April, date TBD		Final Exam

AUDIT

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

DEPARTMENT OF PHILOSOPHY POLICIES

The Department of Philosophy policies that govern the conduct, standards, and expectations for student participation in Philosophy courses are available in the Undergraduate section of the Department of Philosophy website http://uwo.ca/philosophy/undergraduate/policies.html.
It is your responsibility to understand the policies set out by the Senate and the Department of

Philosophy, and thus ignorance of these policies cannot be used as grounds of appeal.

ACCOMMODATION

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department. Documentation shall be submitted, as soon as possible, to the Office of the Dean of the student's Faculty of registration, together with a request for relief specifying the nature of the accommodation being requested. The UWO Policy on Accommodation for Medical Illness and further information regarding this policy can be found at
http://uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

EVALUATION OF ACADEMIC PERFORMANCE

At least three days prior to the deadline for withdrawal from a course without academic penalty, students will receive an assessment of work accounting for at least 15% of their final grade. For 3000- or 4000-level courses in which such a graded assessment is impracticable, the instructor(s) must obtain an exemption from this policy from the Dean and this exemption must be noted on the corresponding course syllabus. In rare instances and at the Dean's discretion, other courses could receive a similar exemption, which also must be noted in the course syllabus.

COURSE ASSIGNMENT

The last day of scheduled classes in any course will be the last day on which course assignments will be accepted for credit in a course. Instructors will be required to return assignments to students as promptly as possible with reasonable explanations of the instructor's assessment of the assignment.

ACADEMIC OFFENCES

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

PLAGIARISM CHECKING

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com http://www.turnitin.com.

SUPPORT SERVICES

Registrarial Services http://www.registrar.uwo.ca
Student Support Services https://student.uwo.ca/psp/heprdweb/?cmd=login
Services provided by the USC http://westernusc.ca/services/
Student Development Centre http://www.sdc.uwo.ca/

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help. Immediate help in the event of a crisis can be had by phoning 519.661.3030 (during class hours) or 519.433.2023 after class hours and on weekends.