

Spring 2021

## **PHYS 421-002: General Relativity**

Slawomir Piatek

Follow this and additional works at: <https://digitalcommons.njit.edu/phys-syllabi>

---

### **Recommended Citation**

Piatek, Slawomir, "PHYS 421-002: General Relativity" (2021). *Physics Syllabi*. 318.  
<https://digitalcommons.njit.edu/phys-syllabi/318>

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in Physics Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact [digitalcommons@njit.edu](mailto:digitalcommons@njit.edu).

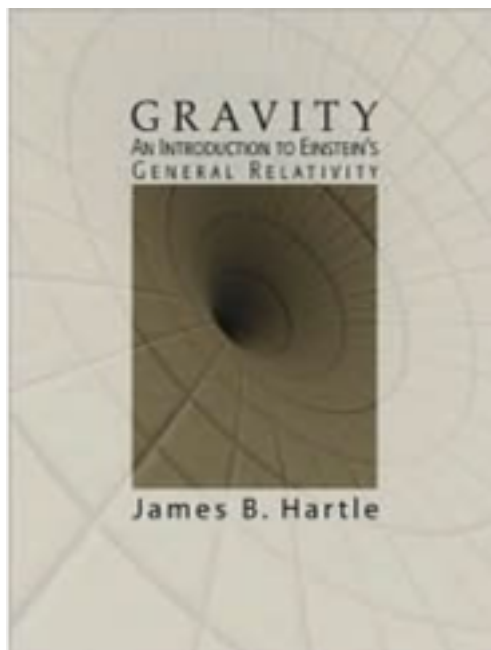
**Course Outline**  
Phys 421-002, General Relativity  
Spring 2021

Slawomir Piatek  
423F Tiernan Hall  
973-596-3551 (office)  
piatek@njit.edu

**Lecture:** Tuesday & Thursday, 12:30 PM – 1:50 PM, KUPF 106  
And online at  
<https://njit.webex.com/meet/piateknjit.edu>

**Office Hour:** T & R, 2:30 PM – 3:30 PM, other times by appointment

**Textbook:** *Gravity An Introduction to Einstein's General Relativity*, by James B. Hartle, published by Addison Wesley, ISBN 0-8053-8662-9



**Lecture Quizzes:** Starting on January 28, a lecture quiz will be given by the end of every Thursday class. The quiz will contain 1 – 5 problems depending on the level of difficulty. The quiz will be graded and discussed in the following lecture. The quizzes will be “open textbook” but “closed notes.”

**Midterm:** There will be a midterm exam on Thursday, March 9, covering chapters 1– 7. The exam will contain six open-ended problems.

**Homework:** No formal homework will be assigned; however, the syllabus lists suggested practice problems that a student should attempt to solve. Problems for the lecture quizzes, midterm, and final may be (but do not have to be) selected from the suggested problems.

**Grading:**

Lecture quizzes 40%  
Midterm 30%  
Final 30%

**Cutoffs for letter grades:**

85% – A  
80% – B+  
70% – B  
65% – C+  
50% – C  
40% – D  
Below 40% – F

**Students with disabilities:**

If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

**Honor Code and Etiquette:**

NJIT has a zero-tolerance policy for cheating of any kind and for student behavior that disrupts learning by others. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable. **Students are required to agree to the NJIT Honor Code on each exam, assignment, quiz, etc. for the course.**

Turn off all cellular phones, wireless devices, computers, and messaging devices of all kinds during classes and exams. Please do not eat, drink, or create noise in class that interferes with the work of other students or instructors. Creating noise or otherwise interfering with the work of the class will not be tolerated.

## Class Calendar

Lecture	Topic	Reading Material	Suggested Problems
1. T, 1/19	Gravitational Physics and Geometry as Physics	Ch. 1 & 2	Ch. 2: 1, 3, 4, 5
2. R, 1/21	Gravitational Physics and Geometry as Physics	Ch. 1 & 2	Ch. 2: 6, 7, 9
3. T, 1/26	Space, Time, and Gravity in Newtonian Physics	Ch. 3	Ch. 3: 1, 2, 4, 5, 6
4. R, 1/28	Principles of Special Relativity	Ch. 4.1–3	Ch. 4: 2, 3, 4, 6, 8, 9
5. T, 2/2	Principles of Special Relativity	Ch. 4.4–6	Ch. 4: 11, 12, 13, 15, 16, 18
6. R, 2/4	Special Relativistic Mechanics	Ch. 5.1–2	Ch. 5: 1, 2, 3, 4, 6
7. T, 2/9	Special Relativistic Mechanics	Ch. 5.3–4	Ch. 5: 7, 8, 11, 13
8. R, 2/11	Special Relativistic Mechanics	Ch. 5.5–6	Ch. 5: 16, 17, 18, 21
9. T, 2/16	Gravity as Geometry	Ch. 6.1–4	Ch. 6: 3, 4, 5, 6
10. R, 2/18	Gravity as Geometry	Ch. 6.5–6	Ch. 6: 10, 11, 12, 13
11. T, 2/23	The Description of Curved Spacetime	Ch. 7.1–4	Ch. 7: 1, 2, 5
12. R, 2/25	The Description of Curved Spacetime	Ch. 7.5–7	Ch. 7: 7, 8, 10, 13
13. T, 3/2	The Description of Curved Spacetime	Ch. 7.8–9	Ch. 7: 14, 17, 18, 19, 20
14. R, 3/4	Geodesics	Ch. 8.1–2	Ch. 8: 2, 3, 4
15. T, 3/9	<b>Midterm (Chapters 1-7)</b>		
16. R, 3/11	Geodesics	Ch. 8.3–4	Ch. 8: 12, 13
17. T, 3/23	The Geometry Outside a Spherical Star	Ch. 9.1–3	Ch. 9: 1, 2, 3, 4
18. R, 3/25	The Geometry Outside a Spherical Star	Ch. 9.3	Ch. 9: 5, 6, 7, 8, 10
19. T, 3/30	The Geometry Outside a Spherical Star	Ch. 9.4	Ch. 9: 12, 13, 14, 16, 17, 18
20. R, 4/1	Gravitational Collapse and Black Holes	Ch. 12.1–4	Ch. 12: 1, 5, 6, 8, 10
21. T, 4/6	Gravitational Collapse and Black Holes	Ch. 12.1–4	Ch. 12: 11, 12, 13, 14, 15
22. R, 4/8	Astrophysical Black Holes	Ch. 13.1–3	Ch. 13: 1, 2, 3, 4, 5
23. T, 4/13	Gravitational waves	Ch. 16.1–5	
24. R, 4/15	The Universe Observed	Ch. 17.1–3	Ch. 17: 1, 2, 4, 7, 8, 9
25. T, 4/20	Cosmological Models	Ch. 18.1–2	Ch. 18: 2, 3, 4, 5, 6, 7
26. R, 4/22	Cosmological Models	Ch. 18.3–4	Ch. 18: 9, 10, 13, 15
27. T, 4/27	Cosmological Models	Ch. 18.5–6	Ch. 18: 18, 19, 21, 22, 24
28. R, 4/29	Which Universe and Why?	Ch. 19.1–2	