

STS-UY.2274 Space and Spacetime

Department of Technology, Culture and Society, NYU-Tandon

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Off. Hr: Zoom, Tues 12:30-1:30pm remote
Office: 2 MetroTech, 9th Fl., Rm929

6 MetroTech Rm207
M/W 12:00-1:50pm
Spring 2025

I. Instructional Format: Instruction will be conducted in-class, unless circumstances require otherwise. Please be aware of the NYU policy on face masks at nyu.edu/life/safety-health-wellness/coronavirus-information/covid-related-guidance/protective-equipment.html. Masks are not required but welcome. As a reminder, if you are ill or are exhibiting symptoms of illness (coughing, sneezing, runny nose, etc.), you should stay home until you feel better and your symptoms are gone. It's ok to miss one or two lectures in this class: these can be easily made up by discussing any missed content with me. On the other hand, if you find yourself in a situation in which you will have to miss more than a week of lectures, please see Section VII.3.ii below. I will periodically remind the class of these policies over the course of the semester.

II. Description: What is the nature of space? Is it an independently existing substance or does it consist in the relations between physical objects? Can motion be described in terms of the relational properties of objects, or must we always define motion with respect to an absolute motionless substratum? Does the existence of left-handed gloves entail the existence of absolute space? In this course, we will consider these and other questions about the nature of space and time as they appear in the writings of philosophers ranging from Plato and Aristotle, through Descartes and Newton, and culminating in Einstein and 20th-century conceptions of space and time.

This is a 4-credit course that meets over a 15 week semester. You should thus expect to devote 6.6 hours per week of supplemental time for this course. Supplemental time is time outside of classroom instruction that involves reading assignments, writing, exam preparation, homework assignments, and study time. For additional information on NYU policies related to this, please see: www.nyu.edu/academics/accreditation-authorization-assessment/resources-faqs/required-weekly-minutes.html

III. Objectives

HuSS (Humanities and Social Sciences) General Education Objectives

Think critically, creatively and independently; demonstrate information literacy; demonstrate skills in inquiry and analysis; demonstrate effective oral communication skills; demonstrate effective writing skills; bring the perspectives of HuSS to bear on technical discourse; demonstrate ethical reasoning.

STS (Science, Technology and Society) Cluster Objectives

- Demonstrate a basic understanding of the following:
 - How sci & tech shape society (in historical, philosophical, sociological, cultural, and technical ways).
 - How social processes frame sci and tech enterprises, including theory construction, invention, and innovation.
 - The relation between the content of sci/tech knowledge, and the social context in which it is created.
- Demonstrate technical proficiency in a field in the natural sciences or engineering.
- Demonstrate ability to critically analyze and communicate issues involving interactions among sci, tech, & society.

IV. Reading

A. At Bookstore or on reserve at Dibner:

1. [H] Huggett, N. (ed.) (1999), *Space from Zeno to Einstein*, Cambridge: MIT Press.

B. Online at course website:

2. [N] Norton, J. (2019), 'The Hole Argument', *The Stanford Encyclopedia of Philosophy*, E. Zalta (ed.). plato.stanford.edu/entries/spacetime-holearg.

3. [R] Rynasiewicz, R. (2011), 'Newton's Views on Space, Time, and Motion', *The Stanford Encyclopedia of Philosophy*, E. Zalta (ed.). plato.stanford.edu/entries/newton-stm.
4. [S] Slowik, E. (2021) 'Descartes' Physics', *The Stanford Encyclopedia of Philosophy*, E. Zalta (ed.), plato.stanford.edu/entries/descartes-physics.

V. Requirements: This course has two websites: A Brightspace website, brightspace.nyu.edu, accessible only to enrolled students, and a public website, <https://research.engineering.nyu.edu/~jbain/spacetime/>.

1. **Seven homework assignments.** These are posted in the Contents section in Brightspace. Please submit them by their due dates to links in the Brightspace Assignments folder. One optional extra credit assignment may also be submitted and will count towards your final homework grade.

Submission format: The preferred file type is .pdf. Please label the file you submit using the following format:

<assignment number>.<last name>_<first initial>.<file type>

Example: Jon Bain's .pdf submission for homework #7 should be labeled:

07.Bain_J.pdf

2. **One paper** of 5–7 pages. Suggested topics are posted in the Contents section in Brightspace.
 (a) The paper must conform to writing guidelines posted in the Contents section of Brightspace.
 (b) The paper should be submitted to the relevant link in the Assignments folder in Brightspace.

Submission format: The preferred file type is .pdf. Please label the file you submit using the following format:

Paper_<last name>_<first initial>.<file type>

(c) *Late paper policy:* There are no extensions on the due date. Late papers will be accepted but will be given a penalty of a third of a grade point for every period of 7 days after the due date. *Example:* An A paper turned in 1-7 days late will receive an A-; an A paper turned in 8-14 days late will receive a B+; an A paper turned in 15-21 days late will receive a B; *etc. Late papers cannot be accepted after the due date of the final.*

3. One **midterm** and one **final**. Each exam will consist of 8 short answer questions, of which you will be asked to pick 6 to respond to; and 3 short essay questions, of which you will be asked to pick 2 to respond to. A response to a short answer question should be no more than 1 paragraph in length (~3-4 sentences), and a response to a short essay question should be no more than 1 page in length (~3-4 paragraphs). For the policy on makeup exams, please see Section VII.3.ii below.

VI. Grade Distribution: Homework: 25% total Midterm: 25% Paper: 25% Final: 25%

VII. Reminders on University Policies

1. **Inclusion Statement.** NYU values an inclusive and equitable environment for all students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. If this standard is not being upheld, please feel free to speak with me.

2. **Moses Statement.** If you would like to request accommodations, please contact the Moses Center for Students with Disabilities (CSD) at 212-998-4980, mosescsd@nyu.edu, nyu.edu/csd, 726 Broadway, 2nd Flr. You must be registered with CSD to receive accommodations.
3. **Standards and Procedures.** The NYU-Tandon Office of Student Affairs maintains a Community Standards and Procedures website at engineering.nyu.edu/life/student-affairs/community-standards-procedures. It contains information relevant to:
- (i) **Incompletes.** It is NYU-Tandon policy that incompletes can be given only in extenuating circumstances (medical emergencies, accidents, *etc.*). An incomplete cannot be given because of a heavy course load, job commitments, or because you've simply fallen behind. For this reason, you should attend every lecture and make sure you're aware of assignment deadlines and exam dates. If you find yourself falling behind during the semester, do not hesitate to contact me. If you think you qualify for an incomplete grade at the end of the semester, see the procedure in (ii) below.
 - (ii) **Excuses due to illness or circumstances.** If you are experiencing an illness or any other situation, emotional or physical, that might affect your academic performance in a class (for instance, if you have to miss more than a week of lectures, or you think you qualify for an incomplete grade at the end of the semester), please email or schedule a visit with Deanna Rayment, Coordinator of Student Advocacy, Compliance and Student Affairs, Dibner Hall Room LC 240C, eng.studentadvocate@nyu.edu. Deanna is your official advocate at NYU-Tandon. (No other NYU school offers a similar service to its students!) She can reach out to your professor on your behalf when warranted. She can also advise you on all issues related to Health and Wellness. For legal and privacy reasons, you should not directly contact your professor with requests and concerns of this nature.
 - (iii) **University Honor System.** Please be aware of the university policy on cheating and plagiarism in the Student Code of Conduct. Cheating on an exam, or plagiarizing on an essay assignment, are sufficient reasons for receiving an F in the course. The Code of Conduct can be downloaded from the Office of Student Affairs website listed above.
4. **Grading Policy.** The following is NYU-Tandon's grading policy for all undergrad classes:
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|----|-------------------------------|-----|---|
| A | Excellent (4.000) | S | Satisfactory |
| A- | Excellent (3.667) | U | Unsatisfactory Progress |
| B+ | Good (3.333) | W | Withdrew Officially |
| B | Good (3.000) | I | Incomplete (converts to F after 180 days) |
| B- | Good (2.667) | AUD | Auditor Status |
| C+ | Satisfactory (2.333) | NR | No record |
| C | Satisfactory (2.000) | P | Passing |
| C- | Satisfactory (1.667) | | |
| D+ | Minimum Passing Grade (1.333) | | |
| D | Minimum Passing Grade (1.000) | | |
| F | Failure (0.000) | | |

VIII. Schedule The following schedule may need to be revised over the course of the semester. The reading assignments should be completed by the date on which they appear.

1		Weds 1/22. Introduction
2	Mon 1/27. Plato [H] Chap 1.	1/29. Euclid [H] Chap 2. hw1 due
3	2/3. Euclid, cont.	2/5. Zeno [H] Chap 3.
4	2/10. Zeno, cont.	2/12. Aristotle [H] Chap 4. hw2 due
5	2/18 (Tues). <i>Note:</i> No Class on Mon 2/17 (Presidents' Day) <i>Aristotle, cont.</i>	2/19. The Aristotelian Tradition [H] Chap 5.
6	2/24. Descartes [H] Chap 6.	2/26. Descartes, cont. [S]. hw3 due
7	3/3. Newton [H] Chap 7.	3/5. Newton, cont.
8	3/10. Midterm	3/12. Leibniz & Clark. [H] Chap 8.
9	3/17. Berkeley & Mach [H] Chap 9.	3/19. Berkeley & Mach, cont. hw4 due
10	3/24. Spring Break	3/26. Spring Break
11	3/31. Spacetime [H] Chap 10.	4/2. Spacetime, cont. hw5 due
12	4/7. Kant and Handedness [H] Chap 11.	4/9. Kant and Handedness, cont.
13	4/14. Kant and Geometry [H] Chap 12.	4/16. Kant and Geometry, cont. hw6 due
14	4/21. Poincaré [H] Chap 13.	4/23. Einstein & Special Relativity [H] Chap 14. Paper due
15	4/28. Special Relativity, cont.	4/30. General Relativity. [N]. hw7 due
16	5/5. Quantum Gravity. extra cred due; Final date to be announced by registrar	