

Intermediate Logic I

Instructor

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Course description and learning goals

This course will explore some of the main results in the metatheory of classical first-order logic up through the soundness and completeness theorems and results in the neighborhood. We will also explore several philosophical questions regarding the nature of logic and the foundations of mathematics, and develop some of the mathematical tools and proof methods needed for further work in the subject. This course is a prerequisite for 730:408 ("Intermediate Logic II"), which covers more advanced topics in the metatheory of classical first-order logic such as computability, undecidability, and the incompleteness theorems.

Course prerequisites

The only formal requirement is completion of 730:201 ("Introduction to Logic"). However, the course is substantially different, and much more difficult. You will not only be tackling formal proofs that are much harder to construct than those you would find in an introductory course; in addition, most of our time will be spent proving results *about* various proof systems themselves, which will require you to become comfortable with abstract mathematical reasoning. If you have questions about whether this course is suitable for you, please do not hesitate to talk with me.

Course assessments

There will be three types of assessment in this course.

One component of your grade will be based on **your attendance during the in-person sessions (Thursdays at 1pm to 2:20pm in 101 Scott Hall)**. This will be worth **5 points**; each session that you do not attend from start to finish without an official excuse will result in a deduction of 1 point.

Another component of your grade will be your performance on **weekly problem sets**. These will be worth **45 points of your final grade**.

The last component of your grade will be a **take-home midterm exam** (worth **20 points**) and a comprehensive **take-home final exam** (worth **30 points**).

Online content

At the beginning of each week, I will be posting a number of documents to help you work through the course readings: sometimes these will be detailed handouts, sometimes these will be narrated slides, and sometimes both.

I will also be regularly conducting *optional* synchronous lectures on Zoom, which I will record and post to the Canvas website. To help facilitate your attendance, I will do my best to schedule these at the beginning of the week based on your availabilities, which I will poll the week before. To help entice your attendance, I will offer bonus points for those who attend (though these cannot be used towards your attendance grade).

Course texts

Nearly all of the readings for the course will come from the following textbook, which you *must* acquire a physical copy of. (This is important because there are .pdf files of it floating around about on the Internet that have a different pagination than the one I will be using.)

- Theodore Sider, *Logic for Philosophy* (2010, Oxford University Press)

I will also be assigning some material from the following open-source, free, and online textbook, which is also a good supplement to the reading from Sider's textbook:

- Michael Hallett and Richard Zach, *Intermediate Logic: An Open Introduction*, Fall 2021 α edition, <https://builds.openlogicproject.org/courses/intermediate-logic/il-screen.pdf>

I will suggest and post additional resources as the course progresses.

Provisional course reading schedule

I will likely shorten or lengthen how much time we spend on certain sections depending on how we are progressing through the course. But this will give you an idea of what we will be covering, in what order. The dates in blue are when the Thursday in-person sessions will occur. Readings must be finished by the in-person session, although ideally you will read them along with when I conduct the optional synchronous sessions and/or post asynchronous material earlier in the week. Occasionally, you will be assigned course notes written by yours truly; these will be found in the relevant modules and in the "Files" section on the Canvas course website.

Week 1	Basic set theory
2 September	Sider, "What is Logic?", pp. 1–24

Week 2 9 September	The syntax and semantics of PL Sider, “Propositional Logic”, pp. <u>25–37</u>
Week 3 16 September	Fitch-style, sequent, and axiomatic proofs in PL Sider, “Propositional Logic”, pp. <u>37–46</u>
Week 4 23 September	Fitch-style, sequent, and axiomatic proofs in PL Sider, “Propositional Logic”, pp. <u>46–49</u>
Week 5 30 September	Proof by induction and the soundness of PL Sider, “Propositional Logic”, pp. <u>50–56</u>
Week 6 7 October	Proof schemas and the deduction theorem for PL Sider, “Propositional Logic”, pp. <u>56–62</u>
Week 7 14 October	The completeness of PL Sider, “Propositional Logic”, pp. <u>62–66</u>
Week 8 21 October	The syntax and semantics of PC Sider, “Predicate Logic”, pp. <u>90–98</u>
Week 9 28 October	Adding identity and function symbols to PC Sider, “Beyond Standard Predicate Logic”, pp. <u>107–113</u>
Week 10 4 November	First-order theories in PC Hallett and Zach, “Theories and Their Models”, pp. <u>123–138</u>
Week 11 11 November	Axiomatic proofs in PC Sider, “Predicate Logic”, pp. <u>99–104</u> Skiles, “Axiomatic Proofs in PC with Identity”, pp. <u>##–##</u>
Week 12 18 November	The soundness of PC Skiles, “The Soundness of PC”, pp. <u>##–##</u>
THANKSGIVING BREAK 22 - 26 November	
Week 13 2 December	The completeness of PC and neighboring results Skiles, “The Completeness of PC”, pp. <u>##–##</u>
Week 14 9 December	The completeness of PC and neighboring results Skiles, “The Completeness of PC”, pp. <u>##–##</u>

Academic integrity policy

Cheating, plagiarism, and other forms of academic malfeasance come in many forms—if you haven't already, I would recommend familiarizing yourself with the Academic Integrity Policy (<http://academicintegrity.rutgers.edu/academic-integrity-policy/>) for a list of examples. Any suspected violation—and I am quite talented at detecting these—will be automatically referred to the Office of Judicial Affairs, and can carry penalties up to and including a failing grade in the course or expulsion from the university. Note: ignorance about what counts as academic malfeasance, or carelessness in acting in accordance with this policy, is *not* a defense. Thus, if you have any questions about whether you are toeing the line, please do not hesitate to consult with me *before* you submit your work.

University disability statement

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation. For more info, please visit <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please register by following this link: <https://webapps.rutgers.edu/student-ods/forms/registration>.