



# SYLLABUS

# PHILOS/5500

Symbolic Logic

Spring 2022 (full term)

3 credit hours

Distance learning with synchronous class meetings

Tuesdays and Thursdays 11:10-12:30pm on Zoom

## COURSE OVERVIEW

### Instructor

Instructor: **Neil Tennant**

Email address: [tennant.9@osu.edu](mailto:tennant.9@osu.edu) (preferred contact method)

Website: [u.osu.edu/tennant9/](http://u.osu.edu/tennant9/)

Student hours: Wednesdays and Fridays, 1:30 p.m. to 3:30 p.m.

### Teaching Assistant

Instructor: **TBA**

Email address: TBA

Student hours: TBA

### Prerequisites

PHILOS 2500 or equivalent. Not open to students with credit for 650.

### Course description

We introduce the student to the metatheory of first-order logics and languages; natural deduction for propositional and predicate logic; model theory; soundness, completeness, and Löwenheim-Skolem theorems.

### Advice for prospective students

A prerequisite for this course is PHIL2500: Introduction to Symbolic Logic. We shall be making important use of techniques of logical analysis and regimentation, at both the object- and the meta-level. We shall revise relevant introductory material as necessary. Graduate students in Philosophy, however, need to take this course in order to fulfill their program requirements. For this reason, it is especially important to take advantage of the instructor's student hours when the need arises.

## HOW THIS ONLINE COURSE WORKS

**Mode of delivery:** This course is 100% online. You will find a sequence of materials and activities each week in Carmen, and we will meet for two weekly Zoom sessions during our scheduled class meeting times. To connect to our Zoom, see the meeting link in the menu of our course's Carmen page.

**Pace of online activities:** This course is divided into **weekly modules** that are released one week ahead of time. You may schedule your efforts freely throughout the week as you keep pace with due dates.

**Credit hours and work expectations:** This is a **3-credit-hour course**. According to Ohio State policy ([go.osu.edu/credithours](http://go.osu.edu/credithours)), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

**Attendance and participation requirements:** Research shows regular participation is one of the highest predictors of success. With that in mind, I have the following expectations for everyone's participation:

- **Participating in online activities: AT LEAST ONCE PER WEEK**  
You are expected to log in to the course in Carmen every week. (During most weeks you will probably log in many times.)
- **Twice Weekly Zoom sessions: REQUIRED.** Students should plan to attend all synchronous class sessions for the course. Recordings of synchronous class sessions will be made available on Carmen for students who have a good reason to have to miss class. The recordings are not meant to be a substitute for the class sessions themselves.
- **Zoom instructor office hours: OPTIONAL.**  
You are encouraged to note my office hours in your weekly schedule and attend as you have questions, but these sessions are optional.

## COURSE MATERIALS AND TECHNOLOGIES

### Textbooks

#### Required

- Neil Tennant, *Natural Logic*, Edinburgh University Press, 2nd revised edition, 1991. A PDF will be made available for free on Carmen

# Course technology

## Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at [ocio.osu.edu/help/hours](https://ocio.osu.edu/help/hours), and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** [ocio.osu.edu/help](https://ocio.osu.edu/help)
- **Phone:** 614-688-4357(HELP)
- **Email:** [servicedesk@osu.edu](mailto:servicedesk@osu.edu)
- **TDD:** 614-688-8743

## Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen ([go.osu.edu/canvasstudent](https://go.osu.edu/canvasstudent))
- CarmenZoom virtual meetings ([go.osu.edu/zoom-meetings](https://go.osu.edu/zoom-meetings))
- You are welcome [to use the free, Ohio State-themed virtual backgrounds](https://go.osu.edu/zoom-backgrounds) ([go.osu.edu/zoom-backgrounds](https://go.osu.edu/zoom-backgrounds)) during CarmenZoom meetings.

## Required equipment

- **Computer:** current Mac (MacOs) or PC (Windows 10) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access at [go.osu.edu/student-tech-access](https://go.osu.edu/student-tech-access).

## Required software

- **Microsoft Office 365:** All Ohio State students are now eligible for free Microsoft Office 365. Visit [the installing Office 365](https://go.osu.edu/office365help) ([go.osu.edu/office365help](https://go.osu.edu/office365help)) help article for full instructions.

## Carmen access

You will need to use BuckeyePass ([buckeyepass.osu.edu](https://buckeyepass.osu.edu)) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions ([go.osu.edu/add-device](https://go.osu.edu/add-device)).

- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Install the Duo Mobile application ([go.osu.edu/install-duo](https://go.osu.edu/install-duo)) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

## GRADING AND FACULTY RESPONSE

### How your grade is calculated

ASSIGNMENT CATEGORY	POINTS
Mid-Semester Exam	40
Final Exam	60
Zoom attendance and participation	Extra credit opportunity up to 10% (curved for the class) for above-average attendance; asking good questions; and making useful contributions to class discussions.
<b>Total</b>	<b>100</b>

*See course schedule below for due dates.*

## Descriptions of major course assignments

### Mid-Semester and Final Exams

**Description:** These exams will require that you demonstrate understanding of core concepts and the skills covered in each section of the course. Exams will involve giving written answers to questions (or answering multiple-choice questions) that will probe more deeply your understanding of central concepts and the skills that involve them. Some exam questions may be of multiple-choice type; but others will be more probing than the easier questions in the low-stakes quizzes. The point values of exam questions will be clearly indicated. They will not necessarily all be equal. Exams are not available asynchronously. The Midsemester Exam will be taken during a scheduled class period. The Final Exam will be taken during the official exam period in Finals Week. They will be accessible online under "Quizzes" on Carmen/Canvas.

**Academic integrity and collaboration:** You are not permitted to collaborate with others on these exams, but you may refer to your course materials. The work that you turn in must be entirely your own.

## Missing an Exam

If (and only if) you are able to provide a genuine excuse for missing a scheduled exam, please let the Instructor know as soon as possible if this is the case, so that an accommodation can be made within Carmen/Canvas for you to take the exam that you have missed at a later time. Please refer to the Course Schedule for due dates.

## Grading scale

93–100:	A
90–92.9:	A-
87–89.9:	B+
83–86.9:	B
80–82.9:	B-
77–79.9:	C+
73–76.9:	C
70–72.9:	C-
67–69.9:	D+
60–66.9:	D
Below 60:	E

## Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-4357(HELP)** at any time if you have a technical problem.)

- Preferred contact method: If you have a question, please contact me first through my Ohio State email address. I will reply to emails within 24 hours on days when class is in session at the university.
- Class announcements: I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences ([go.osu.edu/canvas-notifications](http://go.osu.edu/canvas-notifications)) to ensure you receive these messages.
- Grading and feedback: Students will receive their scores on exams within ten days of submission, and students will receive feedback on any informal assignments that they have arranged with the Instructor, in order to help them practice their skills.

## OTHER COURSE POLICIES

## Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.
- **Synchronous sessions:** During our Zoom sessions I ask you to use your real name and a clear photo of your face in your Carmen profile. During our full-group lecture time, you may turn your camera off if you choose. When in breakout rooms or other small-group discussions, having cameras and mics on as often as possible will help you get the most out of activities. You are always welcome [to use the free, Ohio State-themed virtual backgrounds](https://go.osu.edu/zoom-backgrounds) (go.osu.edu/zoom-backgrounds). Remember that Zoom and the Zoom chat are our classroom space where respectful interactions are expected.

## Policy on attendance at Zoom meetings

**Attendance and participation requirements:** Research shows regular participation is one of the highest predictors of success. With that in mind, I have the following expectations for everyone's participation:

- **Participating in online activities: AT LEAST ONCE PER WEEK**  
You are expected to log in to the course in Carmen every week. (During most weeks you will probably log in many times.)
- **Twice Weekly Zoom sessions: STRONGLY RECOMMENDED.** Students should plan to attend all synchronous class sessions for the course. Recordings of synchronous class sessions will be made available on Carmen for students who miss class for some good reason. The recordings are *not* intended to enable students to habitually avoid attending the synchronous class sessions. The synchronous class sessions are very important. They afford all students the opportunity to raise questions about the material.
- **Zoom instructor office hours: OPTIONAL.**  
You are encouraged to note my office hours in your weekly schedule and attend as you have questions, but these sessions are optional.
- **Participating in discussion forums: OPTIONAL**  
A Course Q&A discussion forum will be available on Carmen to ask direct questions about the course material and assignments asynchronously.

Carmen/Canvas records your log-in times, thereby enabling the instructor to keep an accurate check on the extent to which you meet these attendance and participation requirements. That record will contribute significantly to the final calculation of your overall letter grade. You should ensure that the instructor is made aware of any circumstances that would excuse your missing any of the expected occasions of attendance and participation.

## Academic integrity policy

See **Descriptions of major course assignments**, above, for my specific guidelines about collaboration and academic integrity in the context of this online class.

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's [Code of Student Conduct](http://studentconduct.osu.edu) (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's Code of Student Conduct and this syllabus may constitute "Academic Misconduct."

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

**If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page ([go.osu.edu/coam](http://go.osu.edu/coam))
- Ten Suggestions for Preserving Academic Integrity ([go.osu.edu/ten-suggestions](http://go.osu.edu/ten-suggestions))
- Eight Cardinal Rules of Academic Integrity ([go.osu.edu/cardinal-rules](http://go.osu.edu/cardinal-rules))

## Student Services and Advising

University Student Services can be accessed through BuckeyeLink. More information is available here: <https://contactbuckeyelink.osu.edu/>

For undergraduates, advising resources are available here: <http://advising.osu.edu>

For graduate students in Philosophy, Declan Smithies *qua* Director of Graduate Studies is available for advising questions and concerns: smithies.2@osu.edu.

For graduate students in departments other than Philosophy, please consult the Chair of your program.

## Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

## Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at [equity.osu.edu](http://equity.osu.edu),
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or email [equity@osu.edu](mailto:equity@osu.edu)

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

## Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide



opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

## Land Acknowledgement

We would like to acknowledge the land that The Ohio State University occupies is the ancestral and contemporary territory of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. Specifically, the university resides on land ceded in the 1795 Treaty of Greenville and the forced removal of tribes through the Indian Removal Act of 1830. I/We want to honor the resiliency of these tribal nations and recognize the historical contexts that has and continues to affect the Indigenous peoples of this land.

More information on OSU's land acknowledgement can be found here:

<https://mcc.osu.edu/about-us/land-acknowledgement>

## Your mental health

As a student you may experience a range of issues that can cause barriers to learn, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at [go.osu.edu/ccsondemand](https://go.osu.edu/ccsondemand). You can reach an on-call counselor when CCS is closed at 614- 292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at [suicidepreventionlifeline.org](https://suicidepreventionlifeline.org). The Ohio State Wellness app is also a great resource available at [go.osu.edu/wellnessapp](https://go.osu.edu/wellnessapp).

## ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

### Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To

establish reasonable accommodations, I may request that you register with [Student Life Disability Services](#). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services.

## Disability Services Contact Information

- Phone: 614-292-3307
- Website: [slds.osu.edu](http://slds.osu.edu)
- Email: [slds@osu.edu](mailto:slds@osu.edu)
- In person: [Baker Hall 098, 113 W. 12th Avenue](#)

## Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility ([go.osu.edu/canvas-accessibility](http://go.osu.edu/canvas-accessibility))
- Streaming audio and video
- CarmenZoom accessibility ([go.osu.edu/zoom-accessibility](http://go.osu.edu/zoom-accessibility))
- Collaborative course tools
- You are welcome [to use the free, Ohio State-themed virtual backgrounds](#) ([go.osu.edu/zoom-backgrounds](http://go.osu.edu/zoom-backgrounds)) during CarmenZoom meetings.

## COURSE SCHEDULE

Refer to the Carmen course for up-to-date assignment due dates. The student will be presumed to have read Chapters 1-4 of the textbook, since these chapters cover the material of PHIL 2500. The material to be covered in this course includes, at the outset, some revision of the '2500 basics'. It then proceeds to deal with certain topics covered by the later chapters of the textbook, and by other material available only in the Instructor's Beamer presentations that will be posted on Carmen. All of the Instructor's postings will be downloadable. It is imperative the students keep track of what postings by the Instructor are relevant to the material being covered each week. The order of presentation may have to be altered as the course progresses, in order to accommodate students' questions in class, and whatever problems of understanding that the Instructor may discern from students' performance in Quizzes and the Midsemester Exam.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Jan 11 and 13	<p>Formal languages v. natural languages. Deductive logic as the study of validity of arguments. Applications of deductive logic, in both mathematics and empirical science. The philosophical importance of logic for the study of language and rationality.</p> <p>Read: Chapter 1</p>
2	Jan 18 and 20	<p>Eliminating syntactic ambiguity. Categorizing linguistic expressions: names, function signs, predicates, connectives, quantifiers, variable-binding term-forming operators. Formal grammars as involving precise inductive definitions of <i>term</i> and of <i>well-formed formula</i>.</p> <p>Read: Chapter 2</p>
3	Jan 25 and 27	<p>Interpretation of the connectives by means of truth-tables. Calculating the truth-value of a sentence of propositional logic under an assignment of truth-values to its constituent atoms. Showing that any sentence with no repetitions of atoms is contingent.</p> <p>Read: Section 3.2</p>
4	Feb 1 and 3	<p>Determining the truth-value of a complex first-order sentence under an interpretation/model. Evaluating a first-order sentence as true (or as false) in a finite model, using the 'model-relative' rules for introducing the universal quantifier and eliminating the existential quantifier.</p> <p>Categorically describing finite models.</p> <p>Expressing finitude and infinity in a first-order language.</p> <p>Read: Sections 3.3 to 3.5, and selections posted to Carmen.</p>
5	Feb 8 and 10	<p>The primitive Introduction and Elimination Rules of <i>Natural Deduction</i> for the connectives <math>\neg</math> (not), <math>\wedge</math> (and), <math>\vee</math> (or), <math>\rightarrow</math> (if... then...); the quantifiers <math>\exists</math> (some) and <math>\forall</math> (all); and the identity predicate <math>=</math> (with particular attention paid to restrictions on parameters, and to possibilities of discharge of assumptions in subordinate proofs).</p> <p>The Absurdity Rule for the absurdity symbol <math>\perp</math>.</p> <p>Explaining why it is necessary to obey the <i>restrictions on parameters</i> in applications of the rules of existential elimination and universal introduction.</p> <p>Validity of argument. Logical consequence and logical truth ('tautologousness'). Compactness of logical consequence. Counterexamples to invalid arguments.</p> <p>Read: Sections 3.6, 3.8</p>

Week	Dates	Topics, Readings, Assignments, Deadlines
6	Feb 15 and 17	<p>The primitive Left and Right rules of the <i>Sequent Calculus</i> for the connectives <math>\neg</math> (not), <math>\wedge</math> (and), <math>\vee</math> (or), <math>\rightarrow</math> (if. . . then__); the quantifiers <math>\exists</math> (some) and <math>\forall</math> (all); and the identity predicate <math>=</math>. The Structural Rules of the Sequent Calculus.</p> <p>The relationship between natural deductions and sequent proofs.</p> <p>Read: Chapter 4 and selections posted to Carmen.</p>
7	Feb 22 and 24	<p><i>The Non-Compossibility Theorem: expressive power and deductive power cannot be maximized simultaneously in any language for mathematics.</i></p> <p>Read: selections posted to Carmen.</p>
8	Mar 1 and 3	<p>Classical negation rules.</p> <p><i>Discharging assumptions</i> in the course of an argument. The notion of a <i>formal proof</i> of a conclusion from a set of undischarged assumptions. <i>Deducibility</i> and <i>theoremhood</i> in a particular logical system. Interdefinability of logical operators in the classical case. Interderivability of rules of inference.</p> <p>What rules make up the systems of Minimal, Intuitionistic and Classical logic.</p> <p>Using the rules of inference of Intuitionistic Logic to mimic the left-right readings of the rows of the truth-tables for the connectives. Deriving any of the four classical negation rules from any other such rule, within Intuitionistic Logic.</p> <p>Prenex normal forms.</p> <p>Normalizability of natural deductions.</p> <p>Read: Chapter 4, again.</p>
9	Mar 8 and 10	<p><i>The decidability problem in logic: Can we algorithmically find proofs of, or counterexamples to, formal arguments with finitely many premises?</i></p> <p>There is an effective method to do this in monadic predicate logic, but not in first-order logic with but one binary predicate.</p>

Week	Dates	Topics, Readings, Assignments, Deadlines
		<p>The difference between <i>automated</i> theorem-proving and <i>interactive</i> theorem-proving in computational logic. The algorithmic complexity of automated theorem-proving in various propositional logics.</p> <p>Read: selections posted to Carmen.</p>
	Mar 14-18	<i>Spring Break</i>
10	Mar 22 and 24	<p>Free logic: how to accommodate non-denoting singular terms.</p> <p>Abstractive terms in mathematical theories.</p> <p>Read: Chapter 6, and selections posted to Carmen.</p>
11	Mar 29 and 31	<p>Various well-known first-order axiomatic theories in mathematics, dealing with numbers, orderings, sets, and algebras.</p> <p>Monomathematics v. Polymathematics.</p> <p>Read: selections posted to Carmen.</p>
12	Apr 5 and 7	<p>The <i>consistency</i> or <i>inconsistency</i> of a set of sentences.</p> <p>Maximal consistent sets of first-order sentences.</p> <p>Matching logical consequence to logical deducibility; logical truth to logical theoremhood; and logical falsity to logical refutability.</p> <p>Read: Sections 4.6, 5.3, pp 98-9.</p>
13	Apr 12 and 14	<p>Soundness and completeness of classical first-order logic.</p> <p>The Countable Models Theorem.</p> <p>Skolem's Paradox: the ineffability of uncountability.</p> <p>Read: Sections 4.11, 5.3, and selections posted to Carmen.</p>
14	Apr 19 and 21	Review and SEIs
Finals Week	Registrar scheduled time	<b>Final Exam</b>