

COURSE OUTLINE**Philosophy 123 (C-ID Number: PHIL 210)  
Introduction to Symbolic Logic (C-ID Title: Symbolic Logic)****I. Catalog Statement**

Philosophy 123 introduces students to the calculus of propositional and predicate logic to enable students to formally evaluate arguments. Students learn to translate English arguments, use truth tables, create natural deduction derivations, use defined identity relations, acquire a precise understanding of soundness and validity, and to begin to develop a working grasp on logic meta theory.

Total Lecture Units: 3.0

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Total Lecture Hours: 48.0

**Total Faculty Contact Hours: 48**

Recommended preparation: Eligibility for ENGL 101.

**II. Course Entry Expectations**

Prior to enrolling in the course, the student should be able to:

1. use detailed examples, facts, logical explanations, and other appropriate support for thesis statements;
2. critically analyze selected prose works dealing with important contemporary issues;
3. summarize, analyze, and synthesize information, express and apply standards for judgment, compare and contrast, and evaluate evidence in order to form and state reasoned opinions.

**III. Course Exit Standards**

Upon successful completion of the required course work, the student will be able to:

1. analyze and compare English sentences by formally representing their truth conditions;
2. codify and evaluate arguments for validity using truth tables;
3. construct formal derivations using the rules of a natural deduction system of logic;
4. extend the propositional calculus to include the formalism of predicate/quantifier logic in order to do translations and complex derivations in first order logic;
5. understand some meta-proofs and meta-theoretical issues concerning first order predicate logic.

**IV. Course Content**

**Total Faculty Contact Hours = 48**

**A. The Nature of Logic**

4 hours

1. Difference between statements and arguments
2. Assessing statements: truth and falsity
3. Assessing arguments: validity and invalidity
4. Parts of arguments: premises and conclusion
5. Soundness
6. Deductive and inductive logic

- B. Sentential Connectives and their Semantics 20 hours
1. Basic sentential connectives and their meaning
  2. Translating English sentences
  3. Truth table test for validity or invalidity of arguments
  4. Truth table tests for tautologies and contradictions
  5. Truth table tests for equivalences
  6. Derivations
    - a. Structure of a derivation
    - b. Implication rules
    - c. Equivalence rules
    - d. Conditional proof
    - e. Indirect proof (proof by contradiction)
- C. Predicate Logic 15 hours
1. Monadic predicate symbolism
  2. Individual constants and individual variables
  3. Symbolism for existential and universal quantifiers
  4. Translating English sentences into monadic predicate symbolism
  5. Derivations in predicate logic
    - a. Instantiation rules
    - b. Generalization rules
    - c. Confinement of quantifiers
    - d. Quantifier conversions
    - e. Derivation strategies
  6. Logic of relations
    - a. Symbolizing relations
    - b. Translation English sentences into relational symbolism
    - c. Derivations involving relational predicates
  7. Logic of identity
    - a. Symbolism for identity
    - b. Translating English sentences involving identity
    - c. Philosophical and mathematical statements using identity
    - d. Identity rules for derivations
    - e. Proofs using the identity rules
- D. Meta-theory 9 hours
1. Distinction between object language and meta-language
  2. Concept of a meta-theory
  3. Important meta-theoretical properties
    - a. Consistency
    - b. Completeness
    - c. Independence of axioms
    - d. Decidability
    - e. Computability
  4. Meta-theoretical results
    - a. Introducing Godel's incompleteness theorem
    - b. Church's theorem
    - c. Turing machines and testing for Artificial Intelligence.
  5. Philosophy and Logic (i.e. logicism and alternative logics)

**V. Methods of Instruction**

The following instructional methodologies may be used in the course:

1. lecture (i.e. explaining new material in a context of ongoing musing about what is gained and lost in thinking within a bivalent truth functional language);
2. co-operative learning through group problem solving (competition and discussion about how and when to use indirect proof strategies);
3. computerized logic tutoring programs (get immediate feedback on very creative derivations).

**VI. Out of Class Assignments**

The following out of class assignments may be used in the course:

1. homework problems and puzzles (e. g. translate into English important but formalized claims made in a philosophy journal article, one, say, by S. Yablo on contingent necessity; write one page argument for the view that St. Anselm's ontological argument commits a modal fallacy; find at least one counterexample to the claim that our formal rules for negation capture our informal conversational negating).

**VII. Methods of Evaluation**

The following methods of evaluation may be used in the course:

1. in class objective and/or essay examinations;
2. final examination.

**VIII. Textbook(s)**

Bergmann, Merrie, James Moor, and Jack Nelson. *The Logic Book*. 6<sup>th</sup> ed. New York: McGraw-Hill, 2013. Print.  
13<sup>th</sup> Grade Textbook Reading Level. ISBN 978-0078038419.

**IX. Student Learning Outcomes**

Upon successful completion of the required coursework a student will be able to:

1. demonstrate an understanding of logic;
2. evaluate arguments using truth tables;
3. analyze some meta-proofs and meta-theoretical issues concerning first order predicate logic.