

Topics for the PhD-Level Examination in Logic

The following topics will be covered in the MATH 6306-6307 sequence. The qualifying exam will be taken from these topics.

Logic and Model Theory

Consistency, independence, completeness, compactness, Lowenheim-Skolem, Herbrand, Craig interpolation, Beth definability, undecidability of first order logic, elementary chains, ultraproducts, resolution, and unification.

Recursion Theory

Computable functions, the halting problem, Kleene enumeration, recursively enumerable sets, arithmetical hierarchy, Turing degrees, NP-completeness, complexity theory.

Set Theory

Axioms of Zermelo-Frankel set theory, ordinals and transfinite recursion, cardinal arithmetic, rank hierarchy, axiom of choice, constructible sets, forcing and the independence of the continuum hypothesis, measurable cardinals.

Proof Theory and Formal Systems

Godel Incompleteness Theorems, Peano arithmetic, second order arithmetic, Zermelo-Frankel set theory, forcing, decidable theories, elimination of quantifiers.

References

All of the topics mentioned above (and much more!) are in the following books

1. Mathematical Logic, J. R. Shoenfield
2. Introduction to Mathematical Logic, E. Mendelson
3. A Mathematical Introduction to Logic, R. Enderton
4. Mathematical Logic, D. Monk
5. Set Theory, T. Jech
6. Model Theory, C. Chang and H. J. Keisler
7. Theory of Recursive Functions and Effective Computability, F. Rogers
8. Computability: An Introduction to Recursive Function Theory, N. Cutland
9. Foundations of Logic Programming, J. W. Lloyd
10. Introduction to Mathematical Logic, J. Malitz
11. Logic and Computability, G. Boolos and R. Jeffery
12. Introduction to Axiomatic Set Theory, J. L. Krivine