

Haim Gaifman

### Course Description and Plan

The course covers in a fully rigorous way the basic material of first-order logic, from sentential calculus to the completeness and compactness of first-order logic and the downwards and upwards Skolem-Löwenheim theorems. The plan includes also basic notions and results of model theory, some elements of set theory and, possibly, some results relating to models of arithmetic. Emphasis will be placed on philosophical aspects, such as the significance of formal systems, semantics versus syntax, the notion of truth, and Skolem's paradox.

It is assumed that the students have some previous training in logic, such as the Symbolic Logic course. In principle however the material is self contained and can be mastered by beginners with sufficient technical ability.

There will be no required text book, though students might use as aid some standard text, such as Mendelson's *Introduction to Mathematical Logic*, or Enderton's *Mathematical Introduction to Logic*. Wide use will be made of distributed course notes.

General plan:

1. Sentential calculus: truth tables and well formed formulas.
2. Ways of specifying syntactic structures, components and the unique readability theorem.
3. Deductive systems.
4. Soundness and completeness of sentential logic.
5. Compactness of sentential logic and some of its applications.
6. Basic elements and notions of set theory.
7. The general formal language of first-order logic.
8. The semantics and deductive system of first-order logic.
9. Soundness, completeness and compactness of first-order logic.
10. Basic notions of model theory.
11. Set theory as a first-order axiomatic theory.
12. The Skolem-Löwenheim downwards and upwards theorems.
13. Skolem's paradox.
14. Non-standard models of arithmetic.