



## DEPARTMENT OF PHILOSOPHY, LINGUISTICS AND THEORY OF SCIENCE

### **LOG111 Logical theory, 15 credits**

Logisk teori, 15 högskolepoäng

*Second Cycle*

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#### **Confirmation**

This course syllabus was confirmed by Department of Philosophy, Linguistics and Theory of Science on 2020-01-13 and was last revised on 2022-12-22 to be valid from 2023-01-16, spring semester of 2023.

*Field of education:* Science 100%

*Department:* Department of Philosophy, Linguistics and Theory of Science

#### **Position in the educational system**

The course is included in the degree programme Logic, Master's (120 credits) programme (H2LOG) and can also be given as a freestanding course.

#### *Main field of studies*

Logic

#### *Specialization*

A1N, Second cycle, has only first-cycle course/s as entry requirements

#### **Entry requirements**

Admission to the course requires successful completion of

- at least 60 credits in total in the subject areas mathematics, logic, computer science or formal linguistics, or
  - at least 90 credits in philosophy or linguistics, and at least 30 credits in total in the subject areas mathematics, logic, computer science or formal linguistics,
- or equivalent knowledge.

English 6 or equivalent is also required.

#### **Learning outcomes**

On successful completion of the course the student will be able to:

*Knowledge and understanding*

- describe and demonstrate an understanding of basic model and proof theory including completeness theorems, for propositional logic, first-order logic, intuitionistic logic, and second-order logic,
- describe the relationship between intuitionistic and classical logic from both a model theoretic and proof theoretic perspective,
- describe the relationship between second-order logic, first-order logic and propositional logic,
- describe and discuss Gödel's first incompleteness theorem as well as Gödel-Rosser's theorem,

*Competence and skills*

- formulate and present proofs of the most important results in the course including completeness and incompleteness theorems, as well as of lemmas used in the proofs,
- apply methods and results of the course in independent problem-solving,

*Judgement and approach*

- critically discuss, analyse and evaluate the results in the course as well as their applications.

**Course content**

The course starts with a comprehensive presentation of syntax, semantics and proof systems for propositional logic; and continues with classical first-order predicate logic. Detailed proofs of the completeness theorems for both propositional and predicate logic are included.

Basic result that the compactness theorem and Löwenheim-Skolem's theorem form the model theoretical part of the course.

As examples of other logics, second-order and intuitionistic logic are presented together with completeness results.

The course also includes a proof of Gödel's first incompleteness theorem and basic recursion theory.

**Form of teaching**

Teaching is given in the form of lectures, seminars, exercises, individual assignments and group assignments.

*Language of instruction:* English

**Assessment**

The course is assessed individually in written form. In addition to written examinations, there may also be compulsory homework assignments during the course.

When a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

If a student has received a recommendation from the University of Gothenburg regarding pedagogical support for students with disabilities, the examiner may decide, in the case where this is compatible with the learning outcomes for the course, and provided no unreasonable resources are required, to give the student an adjusted examination or an alternative form of examination.

In the case where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination sessions (including the regular examination session) during a period of at least one year on the basis of the course's former structure.

**Grades**

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

For the grade Pass with distinction on the whole course, Pass with distinction is required on a minimum of 7.5 credits of the course and the grade Pass on the rest.

**Course evaluation**

Students who are currently taking the course or have completed it will be given the opportunity to express their views and share their experiences in an anonymous course evaluation. A compilation of the course evaluation and the course coordinator's reflections on it will be made available to the students within reasonable time after the end of the course. The next time the course is taught the compilation and any measures based on it will be presented to the students.

**Additional information**

The course requires access to a computer (or the equivalent) with Internet connection.

The course may not be included in a degree together with the course LOG110.