



## DEPARTMENT OF PHILOSOPHY, LINGUISTICS AND THEORY OF SCIENCE

### **LOG221 Proof theory, 7.5 credits**

Bevisteori, 7,5 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 to be valid from 2020-01-20, spring semester of 2020.

*Field of education:* Science 100%

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

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

The course can be part of the following programme: 1) Logic, Master's (120 credits) programme (H2LOG) and 2) Computer Science, Master's Programme (N2COS) and can also be given as a freestanding course.

#### *Main field of studies*

Logic

#### *Specialization*

A1F, Second cycle, has second-cycle course/s as entry requirements

#### **Entry requirements**

For admission to the course successful completion of at least 7.5 credits of Logical theory (LOG111) or Logic in Computer Science (DAT060 or DIT201), or the equivalent, is required.

#### **Learning outcomes**

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

#### *Knowledge and understanding*

- describe central concepts, methods and constructions in proof theory,

- contrast proof theory with other disciplines in logic,
- describe the relationship between the logical calculi natural deduction, Hilbert systems and sequent calculus,
- demonstrate knowledge of proof theoretic semantics,

#### *Competence and skills*

- formulate and present proofs of the most important results in the course - elimination, Herbrand's Theorem, interpolation - as well as of lemmas that are used in the proofs,
- carry out advanced derivations in the formal proof systems that are introduced in the course,
- apply results and techniques of proof theory to other disciplines,

#### *Judgement and approach*

- critically discuss, analyse and evaluate results in the course as well as their applications,
- show awareness of the relationships between on the one hand proof theory and constructive mathematics, and on the other hand proof theory and semantics.

### **Course content**

The course treats derivations and proofs as mathematical objects, and study these from a formal, syntactic point of view, unlike model theory that can be said to be the semantic theory of the corresponding phenomena.

Among the many proof formalisms that have been constructed, studied and implemented we focus on two central classes of systems: natural deduction and sequent calculus. The most fundamental theorems, whose proofs are implemented in detail are cut elimination and normalisation for propositional logic and predicate logic, but also for stronger systems, such as formalised arithmetic.

Philosophical and linguistic aspects of proof theory, as its connection with semantics and anti-realism, will also be addressed.

### **Form of teaching**

Teaching is given in the form of lectures, seminars, exercises, individual assignments and group assignments. Compulsory attendance can apply to certain course components, which is indicated in the course schedule.

*Language of instruction:* English

**Assessment**

The course is assessed individually in written form. In addition to the final written examination, there may also be compulsory home work assignments during the course.

If 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).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination sessions (including the ordinary examination) during a period of at least one year from the last time the course was given.

**Grades**

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

**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.