UCLouvain

lfilo2210

2021

Formalized logic A

5.00 credits	30.0 h	Q1

This biannual learning is being organized in 2021-2022

Teacher(s)	Verdée Peter ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	Basic instruction in logic and philosophy of language.
Main themes	Each year this course will select a particular theme - for example, theories of grammaticality, meaning, discourse analysis, pragmatics, modal logics, lambda calculus, theory of proof, set theory, non-classical logic, contemporary approaches to ancient logic, etc.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 At the end of the course the student should be able to understand the background of current debates in logic - understood as including the theory of argumentation (rhetoric) and philosophy of language - and eventually be able to conduct research in one of these areas. At the end of the course the student should : - Be able to use certain specific tools for research in logic and philosophy of language ; - Have a good general grasp of the breadth of contemporary research, and if appropriate, of the history of logic and philosophy of language ; - Be able to make use of contributions from other disciplines in philosophical research in logic and philosophy of language.
Evaluation methods	The final grade for June is composed as follows: • 10/20: An individual presentation during the workshops organized during the semester • 10/20: An oral exam with written preparation at home (the questions will be given 24 hours before the exam The final grade for September is composed as follows: • 10/20: A written work • 10/20: An oral exam with written preparation at home (the questions will be given 24 hours before the exam)
Teaching methods	This year, the course is built around a number of workshop. During these workshops the students present their own treatment of a philosophical text which will then be discussed and analyzed in depth by the teacher and the other students. The teacher also remains available throughout the year to accompany the student in their processing of the content and in preparing for the presentation.
Content	**Limitative theorems in logic and their philosophical implication** In this course we study the limitative theorems proven by Gödel, Tarski, Church and Turing in the 1930's. It concerns the following five famous results. 1) Every formal system of a certain expressive strength is necessarily incomplete. (Gödel 2) Every formal system of a certain expressive strength is unable to prove its own consistency. (Gödel) 3) Every formal system of a certain expressive strength cannot contain its own truth predicate. (Tarski) 4) There is no general algorithm that can compute whether a procedure is going to halt for a given input, neither is there one that can compute whether a predicate logic formula is valid. (Church and Turing) 5) Every theory formulated in predicate logic which has an infinite model, has a model of arbitrary cardinality. (Löwenheim and Skolem) All of these results have had an enormous humbling effect on the foundations of mathematical and scientific theories. They destroyed the hope that we would be able to reduce complex theories to their logical axiomatizations that would once and forever decide on the truth of each sentence. The influence of these theorems on epistemology, (the philosophy of) mathematics and (the philosophy of) computer science can hardly be overestimated. Unfortunately, all of these results have also been abused by drawing too far reaching (often post-modernist) conclusions from some interpretation of the formal theorems. We will go through some essential preliminaries in order to be able to understand the five theorems (predicate logic, recursive functions, Turing machines, Peano and Robinson arithmetic). We will study the precise formal meaning of the five theorems. For the first four we will give a clear sketch of their ingenious proofs. Finally we

	will carefully study the philosophical implications of the studies theorems on the basis of selections from [1] and [4] of the bibliography.
Bibliography	1. Torkel Franzén, Gödel's Theorem: An Incomplete Guide to its Use and Abuse, A K Peters 2005. 2. Kurt Gödel: Collected Works, Volume I: Publications 1929-1936, Oxford University Press, New York, Oxford 1986; Volume III, Oxford University Press, 1995. 3. Douglas R. Hofstadter, Gödel, Escher, Bach, an Eternal Golden Braid, Basic Books, NY 1979. 4. Jean Ladrière. Les limitations internes des formalismes. Étude sur la signification du théorème de Gödel et des théorèmes apparentés dans la théorie des fondements des mathématiques, ed.Nauwelaerts-Gauthier-Villars, Leuven-Paris, 1957; réed. éd. J. Gabay, coll "les grands classiques", Paris 1992. 5. Peter Smith, An Introduction to Gödel's Theorems, Cambridge University Press 2007. 6. Raymond M. Smullyan, Gödel's Incompleteness Theorems, Oxford University Press, New York, Oxford 1992.
Faculty or entity in charge	EFIL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Linguistics	LING2M	5		🔍
Master [120] in Philosophy	FILO2M	5		🔍
Master [60] in Philosophy	FILO2M1	5		🔍
Certificat universitaire en philosophie (approfondissement)	FILA9CE	5		🔍
Master [120] in French and Romance Languages and Literatures : French as a Foreign Language	FLE2M	5		🔍