UCLouvain

lmat2925

2023

Advanced topics in mathematics 6

5.00 credits	30.0 h	Q2

This biannual learning unit is not being organized in 2023-2024 !

Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Depending on the subject, mathematics skills at the level of the end of the Bachelor in Mathematics or first year Master in Mathematics.
Main themes	The topic considered varies from year to year depending on the research interests of the course instructor.

Learning outcomes	**At the end of this learning unit, the student is able to :**
	1
	Contribution of the course to learning outcomes in the Master in Mathematics programme. By the end of this activity, students will have made progress in:
	• Show evidence of independent learning.
	• Analyse a mathematical problem and suggest appropriate tools for studying it in depth.
	• Begin a research project thanks to a deeper knowledge of one or more fields and their problematic issues in current mathematics. He will have made progress in:
	  • Develop in an independent way his mathematical intuition by anticipating the expected results (formulating conjectures) and by verifying their consistency with already existing results.
	  • Ask relevant and lucid questions on an advanced mathematical topic in an independent manner.
	Learning outcomes specific to the course.
	The course aims to initiate research in the field under consideration. Specific learning outcomes vary depending on the field.

Evaluation methods	The final mark consists of two parts: • continuous evaluation in the form of tasks/exercises/small projects (40%) • a written exam at the end of the quadrimester (60%) The continuous evaluation will test the capacity of assimilating and applying the notions and results treated in the class. The written exam will test the knowledge and understanding of the main concepts and results of the theory.
Teaching methods	The course will consist of lectures and exercise sessions. During the lectures the theoretical foundations of the subject will be provided, while the exercise sessions will permit students to work on examples and problems to assimilate and apply the material covered in the lectures.
Content	The course will provide an introduction to topos theory from a geometric perspective. The following topics will be covered during the course: • Presheaves and sheaves on topological spaces and locales • Localic topoi • Grothendieck topologies and sites • Presheaves and sheaves on a Grothendieck site • The sheafification functor • Grothendieck topoi and their properties • Characterization of Grothendieck topoi • Morphisms of sites and geometric morphisms
Inline resources	MoodleUCLouvain

Bibliography	• Artin, Michael & Grothendieck, Alexandre & Verdier, Jean-Louis. *Théorie des Topos et Cohomologie Étale des Schémas* (Seminaire de Geometrie Algebrique du Bois-Marie, SGA4) • Borceux, Francis. *Handbook of categorical algebra 3: Categories of sheaves.* • Caramello, Olivia. *Theories, Sites, Toposes. Relating and studying mathematical theories through topos-theoretic bridges.* • Jonhstone, Peter T. *Sketches of an elephant: A topos theory compendium*, volumes 1 and 2. • Johnstone, Peter T. *Topos theory*. • Maclane, Saunders & Moerdijk, Ieke. *Sheaves in Geometry and Logic. A First Introduction to Topos Theory*. • *The Stacks Project* , Chapter 34 Topologies on Schemes.
Other infos	It is recommended that the student is familiar with the basic concepts of category theory (LMAT2150 or a similar course).
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mathematics	MATH2M	5		🔍