UCL Université catholique de Louvain

LMAT1241

2014-2015

Geometry II

6.0 credits	45.0 h + 15.0 h	1q

Teacher(s) :	Bieliavsky Pierre ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	Website iCampus (> http://icampus.uclouvain.be/claroline/course/index.php?cid=MAT1141). The site contains the syllabus, exercises and their solutions, and solutions of some recent exams. It contains a precise plan of the course as well.
Prerequisites :	LMAT1141 - géométrie 1, LMAT1121 - analyse mathématique 1, LMAT1131 - algèbre linéaire (or equivalent).
Main themes :	Riemannian Geometry of surfaces (curvatures, minimal surfaces, Gauss-Bonnet theorem). Projective geometry presented as a continuation of affine geometry (Theorems of Papaus and Desargues, projectivities, projective duality)
Aims :	Contribution of the course to learning outcomes in the Bachelor in Mathematics programme. By the end of this activity, students will have made progress in: - Knowing and understanding a fundamental socle of mathematics. They will in particular developed their ability at - Choosing and using computational methods and fundamental tools for solving mathematical problems. - Recognizing fundamental concepts of certain current mathematical theories. - Establishing principal links between these theories, explain and motivate them through examples. - Autonomous learning in order to be able to search in mathematical literature, as well as reading and understanding an advanced mathematical text and placing it with respect to the acquired knowledge. Learning outcomes specific to the course. By the end of this activity, students will be able to: - Conceiving the notion of global surface equipped with an atlas. - Using the notion of change of coordinates in order to acquire the global concepts of curvature and fundamental forms. - Using solving techniques for differential equations (seen in LMAT1121) within a concrete geometrical framework: vector fields and geodesics. - Conceiving the notion of topological invariant (Euler characteristic) and its via geometrical methods (GaussBonnet formula). - Conceiving the notion of projective space as a global object affiliated to the notion of surface. - Establishing the geometrical equivalences between real or complex projective planes, and, respectively, 2-sphere or its quotient by antipodal identification. - Conceiving the notion of orientation (or lack of orientation) on a global space. - Conceiving the notion of atlas in higher dimension. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Assessment is based on a written examination that focuses on the one hand on exercises and on the other on theory. The examination tests knowledge and understanding of fundamental concepts and results, ability to construct and write a coherent argument, and mastery of the techniques of calculation.
Teaching methods :	The course aims to develop an intuition for geometrical objects that are in principle more abstract than those that have been studied in the Géométrie 1 course, as well smoothing the passage between algebraic or analytic formalism and geometrical intuition, and vice versa. Learning activities consist of lectures and exercise sessions. The two activities are given in presential sessions.
Content :	The course continues Geometry 1. It has two main parts. The Riemannian geometry of surfaces in R^3, on the one hand, is presented as an extension of the theory of curves and surfaces in R^3. (cf. Geometry 1) where we insist on metric properties and global aspects. On the second hand, projective geometry appears as the completion of affine geometry (cf. Geometry 1); the properties of these two types of geometries are compared. The following topics are investigated. --Riemannian geometry of surfaces in R^3 --Atlas on an embedded surface. --first and second fundamental forms --various notions of curvature -- Theorema Egregium, -- geodesics

	-- Gauss-Bonnet formula -- Complex or real projective geometry -- Pappus theorem -- Desargues theorem - -projective duality -- projective group -- anharmonic ratio -- proiective quadrics -- Pascal theorem
Bibliography :	Syllabus available on iCampus.
Cycle and year of study :	> Bachelor in Mathematics > Bachelor in Economics and Management > Bachelor in Engineering > Bachelor in Physics
Faculty or entity in charge:	MATH