UCLouvain

lmat1151

2019

Numerical analysis : tools and software of calculus

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 45.0 h	Q1

Teacher(s)	Van Schaftingen Jean ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	Sources of numerical errors, direct and iterative methods to solve linear systems of equations, iterative methods to solve non-linear equations, least square approximation, numerical integration.
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: - Recognise and understand a basic foundation of mathematics. -- Choose and use the basic tools of calculation to solve mathematical problems. -- Recognise the fundamental concepts of important current mathematical theories. -- Establish the main connections between these theories, analyse them and explain them through the use of examples. - Identify, by use of the abstract and experimental approach specific to the exact sciences, the unifying features of different situations and experiments in mathematics or in closely related fields (probability and statistics, physics, computing). - Show evidence of abstract thinking and of a critical spirit. 1 -- Argue within the context of the axiomatic method Recognise the key arguments and the structure of a proof. -- Construct and draw up a proof independently. -- Evaluate the rigour of a mathematical or logical argument and identify any possible flaws in it. -- Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result. Learning outcomes specific to the course. By the end of this activity, students will be able to: - Understand which are the possible sources of errors in a numerical method. - Solve numerical problems using Matlab. - Apply direct and iterative methods to solve linear systems. - Solve a linear system in the least square sense. - Understand the main idea of some methods of numerical integration. - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • a final written exam on theory and exercises for 70% of the final grade, assessing the knowledge and the understanding of the methods and concepts and the ability to apply them, the specific objectives will be provided to students in review questionnaires, • evaluation of the report and Python code of projects for 30% of the final score, assessing the ability to analyze and numerically solve a mathematical problem. The projects can only be presented during the term of the course and will therefore have their marks attached to all the sessions of the academic year. The projects are personal works, any participation, either voluntary or by negligence, a plagiarism will be sanctioned.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • lectures introducing fundamental methods and concepts of numerical analysis and motivating them through examples and applications, • exercises sessions in which mathematical problems are analyzed from the numerical point of view, • computer practice sessions to implement and use Python-based numerical methods in the SciPy ecosystem • projects to implement mathematical and computer tools for numerical solution of mathematical problems.

Content	• error propagation and stability, • floating-point representation, arithmetic and error • complexity of numerical • solutions of linear • solution nonlinear equations, • introduction to numerical integration of function and of differential equations.
Inline resources	Course materials (syllabus, exercises and practice) will be published on Moodle (https://moodleucl.uclouvain.be/course/view.php?id=10936).
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Mathematics	MATH1BA	5		🔍