UCLouvain

lmat1151

2017

Numerical analysis : tools and software of calculus

6 credits	30.0 h + 45.0 h	Q2

Teacher(s)	Claeys Tom ;
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	Assessment is by means of a written examination relating to both theory and exercises (15 points) and by means of a test consisting of exercises in Matlab (5 points). The examination tests knowledge and understanding of the main concepts and the ability to put them into practice. The Matlab test checks whether students are able to construct an algorithm to solve numerical problems and to implement the algorithm in Matlab.
Teaching methods	Learning activities consist of lectures, written exercise sessions and exercise sessions on the computer. Lectures aim to introduce the fundamental concepts of numerical analysis and to explain them by showing examples and applications. Exercise sessions aim to teach how to construct numerical methods and how to use Matlab.
Content	The following topics will be studied in this activity: - machine representation of numbers, - sources of numerical errors, - stability and conditioning of numerical methods, - direct methods to solve linear systems, - iterative methods to solve linear systems, - iterative methods to solve non-linear equations, - QR factorization and solving linear systems in least square sense, - introduction to numerical integration methods
Inline resources	Site iCampus (http://icampus.uclouvain.be/). The site contains lecture notes, an introduction to Matlab, exercises to be solved during the exercise classes, solutions of a selection of exercises, corrections of recent exams.

Bibliography	Syllabus disponible sur iCampus.
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	6		
Bachelor in Mathematics	MATH1BA	6		