



5.00 credits

30.0 h + 22.5 h

Q2

Teacher(s)	Remacle Jean-François ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	First cycle level in numerical calculus and programming (LEPL1104) and in linear algebra (LEPL1101).
Main themes	<ul style="list-style-type: none"> • Numerical methods for solving non-linear equations • Numerical methods for solving linear systems : iterative methods • Numerical methods for solving eigenvalue and eigenvector problems • Numerical solution of ordinary differential equations : initial value problems
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>With respect to the AA reference, this course contributes to the development, acquisition and evaluation of the following learning outcomes :</p> <p>AA1.1, AA1.2, AA1.3 AA2.1, AA2.4 AA5.2, AA5.3, AA5.5</p> <p>More precisely, after completing this course, the student will have the ability to :</p> <p>1</p> <ul style="list-style-type: none"> • Analyze in depth the various key methods and algorithms for the numerical solution of important classes of problems from science and industry, related to applied mathematics • Better understand the numerical behavior of the various numerical algorithms for the solution of linear as well as nonlinear problems • Implement these methods in a high level computer language and verify their numerical behavior on a practical problem <p>Transversal learning outcomes :</p> <ul style="list-style-type: none"> • Collaborate in a small team to solve a mathematical problem using numerical methods
Evaluation methods	Exam (50% of the grade) and homeworks (50% as well)
Teaching methods	<ul style="list-style-type: none"> • Classes organized following the EPL guidelines. • Homeworks done individually • A more detailed organization is specified each year in the course plan provided on Moodle.
Content	<ul style="list-style-type: none"> • Reminder of the basic notions of linear algebra (linear spaces, vector and matrix norms, ...) • Floating point calculations. • Stability, precision and conditioning of algorithms. • QR and SVD factorizations. • Linear systems of equations : direct methods. LU, Choleski, Pivoting, Renumbering (RCMK), direct resolution of sparse systems, Fill-in. • Iterative methods (Krylov subspaces) : iteration of Arnoldi, conjugate gradients, GMRES, Lanczos. • Preconditioning of iterative methods, preconditioned conjugated gradients. • Computing eigenvalues, QR algorithm
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=10034
Bibliography	<ul style="list-style-type: none"> • http://bookstore.siam.org/ot50/ <p>Nous suivons relativement scrupuleusement l'excellent ouvrage : Trefethen, L. N., & Bau III, D. Numerical linear algebra (Vol. 50). Siam.</p>
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Additionnal module in Mathematics	APPMATH	5		
Minor in Applied Mathematics	LMINOMAP	5		
Specialization track in Applied Mathematics	FILMAP	5		