UCLouvain

lfsab1102

2017

Mathematics 2

9 credits	45.0 h + 45.0 h	Q2

Teacher(s)	Glineur François ;Keunings Roland ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	Linear operators, euclidean spaces and quadratic forms, linear differential equations, continuity and differentiability for functions of several real variables, optimization problems, vector analysis and integral theorems
Aims	**Contribution of the course to the program objectives**: Regarding the learning outcomes of the program of Bachelor in Engineering, this course contributes to the development and the acquisition of the following learning outcomes: • LO 1.1, 1.2 • LO 3.2 • LO 4.1 **Specific learning outcomes of the course**: More precisely, at the end of the course the students will be able to 1 • Analyse and write rigorously statements and demonstrations on the mathematical content specified below, and illustrate them with examples and counter-examples. • Apply the concept of Euclidean space and orthogonal projection to solve problems of distance and approximation in Rn and other spaces. • Apply diagonalization techniques of a linear operator to study the evolution of a linear system and to determine the character of a quadratic form. • Apply the resolving method for linear differential equations with constant coefficients of order n. • Express metric notions in Rn using the language of general topology. Visualise functions from R2 to R. • Study limits, continuity, directional derivatives and differentiability for functions of several variables. Apply Taylor polynomial in order to approximate a function. • Locate and identify free extrema of a function; locate extrema under constraints of a function using the technique of Lagrange multipliers. • Calculating multiple integrals possibly using a change of variables. • Calculate line integrals, surface integrals, the flow of a vector field along a curve and the flow of a vector field through a surface possibly using Stokes type theorems. - - - - *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	Students are assessed individually in order to test the competences announced above. A mid-semester written test is organized for this course. Standard EPL rules apply regarding how grades from the test and the final exam are combined. The final written exam involves solving exercises similar to those proposed during tutorials and the understanding and application of the theory (e.g. asking short proofs -- memorizing complex proofs is not required). Each exam consists features one question extracted from the compilation of former exams available on Moodle.
Teaching methods	The course is organized following an alternation between lectures and tutorial sessions. The tutorial sessions help to appropriate content presented during lectures and acquire calculation techniques. Four problem sessions are integrated in the course, in order to help students to think about issues that will be addressed in the course and to make them more receptive during lecture sessions and tutorial sessions. On the occasion of the tutorial and problem sessions an active learning for students is encouraged.
Content	This activity is aimed to introduce algebraic concepts and techniques of calculus, optimization, and vector analysis which play an important role in several courses of the bachelor and master's degree in engineering sciences. The following content are covered during the course: • Euclidean spaces, orthogonal projection and approximation problems. • Linear operators, eigenvectors and diagonalization. • Adjoint operator, spectral theorem, quadratic forms, law of inertia. • Cauchy problem for linear differential equations with constant coefficients. • Closed, open, compact sets and boundary in Rn. • Limits, continuity and continuous extension for functions of several variables. • Directional Derivative, differentiation, tangent plane and Jacobian matrix.

	• Partial derivatives of higher order and Taylor polynomial. • Free extrema and extrema under constraints, Lagrange multipliers;. • Multiple integrals and changes of variables. • Line and surface integrals, circulation and flow of a vector field. • Bord and theorems of Stokes type.
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=9065
Bibliography	Pour l'algèbre linéaire et les équations différentielles : syllabus (iCampus). Pour le calcul différentielle et l'optimisation : livre R. Adams and C. Essex : Calculus, a complete course (Pearson, eighth ed.) et transparents présentés aux cours (iCampus). Pour le calcul intégral et l'analyse vectorielle : livre R. Adams and C. Essex : Calculus, a complete course (Pearson, eighth ed.) et transparents rédigés aux cours. Pour les séances APP et APE : exercices corrigés et questions d'examen corrigées (iCampus).
Faculty or entity in charge	BTCI

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Engineering	FSA1BA	9		
Bachelor in Engineering : Architecture	ARCH1BA	9		