


9.0 credits	45.0 h + 45.0 h	2q
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Teacher(s) :	Keunings Roland ; Vitale Enrico (coordinator) ; Glineur François ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	<a href="http://icampus.uclouvain.be/claroline/course/index.php?cid=FSAB1102">http://icampus.uclouvain.be/claroline/course/index.php?cid=FSAB1102</a>
Prerequisites :	LFSAB1101
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 :	<p>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:</p> <p>-- LO 1.1, 1.2 -- LO 3.2 -- LO 4.1</p> <p>Specific learning outcomes of the course: More precisely, at the end of the course the students will be able to</p> <p>-- 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 <math>R^n</math> 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 <math>n</math>. -- Express metric notions in <math>R^n</math> using the language of general topology. Visualise functions from <math>R^2</math> to <math>R</math>. -- 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.</p> <p><i>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".</i></p>
Evaluation methods :	Students are assessed individually by a written exam in order to test the competences announced above. A written test mid-semester permits to add to the exam score a bonus between 0 and 2 points. The written exam involves solving exercises similar to those proposed during tutorials and the understanding of the theory. Each exam consists of three or four questions, one of them being selected among the old exam questions available on iCampus. Memorising complex demonstrations is not required.
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.

<p><b>Content :</b></p>	<p>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 <math>\mathbb{R}^n</math>.                  --                  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.</p>
<p><b>Bibliography :</b></p>	<p>Lecture notes for algebra and linear differential equations, slides for differential calculus, optimization, integration and vector analysis.                  Reference book: R. Adams and C. Essex : Calculus, a complete course (Pearson ed.).</p>
<p><b>Faculty or entity in charge:</b></p>	<p>BTCI</p>

<b>Programmes / formations proposant cette unité d'enseignement (UE)</b>				
Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Bachelor in Engineering : Architecture	ARCH1BA	9	-	
Bachelor in Engineering	FSA1BA	9	-	