UCL Université catholique de Louvain

LFSAB1103

2016-2017

Mathematics 3

5.0 credits	30.0 h + 30.0 h	1q

Teacher(s) :	Winckelmans Grégoire ; Keunings Roland ; Remacle Jean-François ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	https://www.moodleucl.uclouvain.be
Prerequisites :	*The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Aims :	*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 :	The students are evaluated individually and in writting. An short interrogation (typically 1 hour), covering the first 6 courses and APE, can also be organized by the Commission BTCI, so as to allow the students to evaluate, at mid term, their level of comprehension and acquisition of competences ; a reference solution is then also put on the Moodle site. The final exam is longer (3 to 4 hours). The note of the interrogation (in case there was one) participates to the final note only if the computation using both notes (and a formula defined by the BTCI) is in favor of the student. The APE (APE1 to APE12) are not graded, but solutions are put on the Moodel site. This too allows the students to continiously evaluate their level of comprehension and acquisition of competences
Teaching methods :	The course is organized in 12 courses (CM1 to CM12), given in a large auditorium, and into 12 sessions of « learning through exercises » (APE1 to APE12) that are realized, in part, in tutored groups (with one assistant-tutor per group) and, for the rest, out of the tutored groups.
Content :	Partial differential equations (PDE) : 1st and 2nd order PDE: presentation, classification (hyperbolic, parabolic, elliptic) and links with physical phenomena (transport equation, wave equation, diffusion equation, Laplace's equation, Poisson's equation), Cauchy problem and method of characteristics for hyperbolic PDE, initial and/or boundary conditions (Dirichlet, Neumann, Robin), solutions in infinite domain (by Green's functions) for the diffusion equation, and for Poisson's equation. self-adjoint operators, eignevalues and eigenfunctions, orthogonality of eigenfunctions. Developpement of functions in series of eigenfunctions. Helmholtz problem. Bessel functions of the 1st and 2nd kind. Method of separation of variables for problems in infinite domain: Laplace's equation in 2-D (rectangle, circle, annulus, sector of circle or annulus) ; wave equation in 1-D and in 2-D, diffison equation in 1-D and in 2-D. Similarity solutions for the diffusion equation in 1-D semi-infinite domain. Functions of a complex variable, f(z) : Recall the complex plane and the complex numbers. Definition of elementary functions: za, exp(z), log(z), az, sin(z), sinh(z), arcsin(z), etc. Branch point(s) and branch cut(s), Riemann surface(s). Limits and continuity, derivability, holomorphic (analytic) functions, entire functions, Cauchy-Riemann equations and links with Laplace's equation. Integration, Cauchy theorem and consequences: Cauchy integral formula, Taylor and Laurent series, poles, residue(s) theorem. Evaluation of definite integrals (also using Jordan's lemma). Introduction to conformal transformations and examples of applications.
Bibliography :	Part on PDE : J.-F. Remacle and G. Winckelmans, syllabus « Partie EDP » (with theory and examples of solved exercises), complement notes: « Modèle LWR du traffic routier », « Fonctions de Bessel de 1ère et de 2ème espèces », « Méthodes de résolution de l'équation de diffusion ». Reference book: Richard Haberman , « Elementary Applied Partial Differential Equations: with Fourier Series and Boundary Value Problems », Prentice Hall. Part on f(z) : G. Winckelmans and J.-F. Remacle : complement notes : « Lemmes de Jordan ». Reference books: Stephen D. Fisher , « Complex Variables » , Dover; Georges F. Carrier, M. Krook, Carl E. Pearson, « Functions of a Complex Variable : Theory and Practice » , Hod Books. The course documents (syllabus, complement notes, APE and their solutions, solution of the interoogation (in case there was one) are put on the Moodle site

Faculty or entity in charge:	BTCI

Programmes / formations proposant cette unité d'enseignement (UE)				
Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Bachelor in Engineering	FSA1BA	5	LFSAB1101 **and** LFSAB1102	🔍