UCLouvain

mqant1329

2019

OPTIMIZATION

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Catanzaro Daniele ;Catanzaro Daniele (compensates Meskens Nadine) ;
Language :	English
Place of the course	Mons
Prerequisites	• MQANT1110 - Mathématiques de gestion 1 • MQANT1227 - Mathématiques de gestion 2 *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.*
Main themes	**Part I (Continuous Optimization):** Continuity, differentiability in n dimension, conditions for differentiability, necessary conditions for optimality, convex sets, convex functions, convex optimization problems, Lagrangian duality, descent methods, rudiments of smooth and non-smooth nonlinear optimization; **Part II (Discrete Optimization):** Introduction to integer and combinatorial optimization; formulations; optimality, relaxations, and relationships among relaxations; well-solved problems; matchings and assignments; branch and bound;
Aims	This course contributes to develop the following competencies : • Knowledge • Scientific reasoning and systematic approach 1 Study limits, continuity, directional derivatives and differentiability for functions of several variables. Locate and identify free extrema of a function; locate extrema under constraints of a function using the technique of Lagrange multipliers. Understand and learn the foundations of continuous and discrete optimization and the main computing techniques to tackle an optimization problem. - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Students are assessed individually in order to test the competences announced above. The modes of the exam may involve either a continuous evaluation or a final written exam; the lecturer will communicate this information during the first (mandatory) lecture of the course. The content of the exam will focus both on (i) solving exercises similar to those proposed during the course and (ii) understanding and applying the theory to specific cases. Please note that, depending upon the academic calendar, the content of such exam may be subjected to changes from year to year and from session to session. More details will be communicated by the lecturer in charge during the first (and mandatory) lecture of the course.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Blackboard lectures.
Content	This course aims to introduce to the foundations of continuous and discrete optimization as well as the main computing techniques to tackle and solve an optimization problem. Table of Contents: Part I (Continuous Optimization): Continuity, differentiability in n dimensions, conditions for differentiability, gradient, Jacobian and Hessian matrices, necessary conditions for optimality, free extrema and extrema under constraints, convex sets, convex functions, convex optimization problems, Lagrangian duality, descent methods, rudiments of smooth and non-smooth nonlinear optimization. Part II (Discrete Optimization): Introduction to integer and combinatorial optimization; polyhedral combinatorics: formulations and convex hulls; optimality conditions, relaxations and relationships among relaxations; well-solved problems; branch and bound.

Bibliography	The lectures will be integrated with some capita selecta from the following references: (1) S. Boyd and L. Vandenberghe. Convex Optimization. Cambridge University Press 2004. (2) L. A. Wolsey. Integer Programming. Wiley Interscience, 1988. (3) M. Conforti, G. Cornuejols, G. Zambelli. Integer Programming. Springer, 2014. (4) Bagirov, M. Karmitsa and M. M. Mäkelä. Introduction to non smooth optimization. Springer 2014. (5) F. F. Clarke. Optimization and nonsmooth analysis, Siam 1987.
Faculty or entity in charge	CLSM

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Bachelor : Business Engineering	INGM1BA	5	MQANT1227	