

4.00 crédits	30.0 h + 15.0 h	Q1
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Enseignants	Catanzaro Daniele ;
Langue d'enseignement	Anglais
Lieu du cours	Mons
Préalables	<i>Le(s) prérequis de cette Unité d'enseignement (UE) sont précisés à la fin de cette fiche, en regard des programmes/formations qui proposent cette UE.</i>
Thèmes abordés	<p>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;</p> <p>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;</p>
Acquis d'apprentissage	<p>A la fin de cette unité d'enseignement, l'étudiant est capable de :</p> <p>This course contributes to develop the following competencies :</p> <ul style="list-style-type: none"> • Knowledge • Scientific reasoning and systematic approach <p>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.</p> <p>Understand and learn the foundations of continuous and discrete optimization and the main computing techniques to tackle an optimization problem.</p>
Modes d'évaluation des acquis des étudiants	<p>Students are assessed individually by means of an exam that consists of two parts :</p> <ol style="list-style-type: none"> 1. An evaluation of the applied modeling skills, which focuses on the Mosel programming language as well as on the ability to model given toy problems. A poor score on this part precludes the access to the second part (see point 2). 2. An evaluation of the theoretical skills of the students, carried out by means of a written exam.
Méthodes d'enseignement	Slided, Blackboard lectures, and Exercices in the Computing room.
Contenu	<p>This course, taught in English, introduces to the foundations of integer programming and combinatorial optimization as well as to the main computing techniques used to model and solve practical discrete optimization problems enjoying partitioning, coloring, routing, telecommunications, location, sustainable logistics and supply chain management features. Particularly emphasis is given to the development of problem solving skills as well as to the digitalization aspects, including among others, the ability to transform mathematical formulations of real problems into computer programs able to solve them.</p> <p>Table of Contents: Mathematical Preliminaries; Fundamental problems in linear algebra and number theory; Optimizing over diophantine inequalities with positivity constraints; Optimality, relaxations families and relationships among relaxations, and type of bounds; Efficiently solvable combinatorial optimization problems; Rudiments of computational complexity; General solution approach to optimization over integers; Introduction to polyhedral combinatorics; Branch-and-cut; Foundations of the Mosel programming language and applications.</p>
Ressources en ligne	Online resources are posted exclusively in the official channel of the course on Microsoft Teams.
Bibliographie	<p>The lectures will be integrated with some capita selecta from the following references:</p> <ol style="list-style-type: none"> (1) L. A. Wolsey. Integer Programming. Wiley Interscience, 2021. (2) M. Conforti, G. Cornuejols, G. Zambelli. Integer Programming. Springer, 2014. (3) S. Boyd and L. Vandenberghe. Convex Optimization. Cambridge University Press 2004.

Faculté ou entité en charge:	CLSM
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Programmes / formations proposant cette unité d'enseignement (UE)				
Intitulé du programme	Sigle	Crédits	Prérequis	Acquis d'apprentissage
Bachelier : ingénieur de gestion	INGM1BA	4	MQANT1227	