UCLouvain

MAP2M

2020 - 2021

Master [120] in Mathematical Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In English
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **NO** - Activities in other languages : **YES**
Activities on other sites : **NO**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Louvain School of Engineering (EPL)**
Programme acronym: **MAP2M** - Francophone Certification Framework: 7

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MAP2M - Introduction

Introduction

Introduction

This Master's degree programme develops the necessary knowledge and expertise for mathematical engineering:

- the design, analysis and implementation of mathematical models for the engineering of the complex systems of the industrial sector and the elaboration of effective strategies to optimise their performance;
- the implementation of theoretical and methodological tools in all areas of engineering sciences as well as in other fields such as economics, finance, environmental and life sciences.

Your profile

You

- have solid knowledge of mathematics
- are seeking an engineering programme with a focus on applied mathematics
- want access to engineering jobs (in manufacturing and services companies) or to the areas of life sciences, environment or finance;
- want to take advantage of the most recent research advances in your area of specialisation.

Your future job

Mathematical engineers are present in all industrial sectors: industrial chemistry, pharmaceutical and food industries, electronics and telecommunications, energy, metallurgy, aeronautics, civil engineering, mass distribution, banking or consulting services, nanotechnologies and medical technology.

They play a role in research and development, oversee production or management and work in marketing and sales (of high tech products).

We find them in departments of finance, computer science, training and quality control, in the public sector, higher education and in the Minister of equipment and transport (www.fabi.be)

Your programme

This Master's degree programme offers you

- training in mathematical modelling in all areas of engineering sciences;
- flexibility when it comes to building your programme (major and elective courses compose more than half of the programme);
- the opportunity to complete part of the programme abroad or at KULeuven;
- via complementary modules, direct access to the second year Master's degree programme in general statistics, biostatistics or actuarial sciences.

MAP2M - Teaching profile

Learning outcomes

The Master in Mathematical Engineering is an interdisciplinary engineering master centred on the notion of mathematical model that has become instrumental in engineering sciences. Through a training in modelling, simulation and optimization (MSO), the students learn to design, analyse and implement mathematical models to be applied to complex systems of the industrial or corporate world, and to create efficient strategies to optimize their performance.

The mandatory courses provide the students with the necessary common skills in MSO. They span the domains of numerical analysis and scientific computing, dynamical systems, matrix computations, stochastic models, optimization models and methods.

Students are moreover offered several coherent lists of courses, called “options”. Some of the options provide them with advanced skills in various branches of MSO: optimization and operations research, dynamical systems and control, and computational engineering. The other options pertain to data science, financial mathematics, cryptography & information security, biomedical engineering, business risks and opportunities, and launching of small and medium-sized companies.

Below is the competency framework common to all the engineering masters. The Master in Mathematical Engineering distinguishes itself by the interdisciplinary engineering scope of the competencies and by the fact that modelling-related competencies are strengthened by the strong MSO background acquired by the students.

On successful completion of this programme, each student is able to :

1.démontrer la maîtrise d'un solide corpus de connaissances en sciences fondamentales et sciences de l'ingénieur lui permettant d'appréhender et de résoudre les problèmes qui relèvent de sa discipline.

1.1 Identifier et mettre en oeuvre les concepts, lois, raisonnements applicables à une problématique donnée

1.2 Identifier et utiliser les outils de modélisation et de calcul adéquats pour résoudre cette problématique

1.3 Vérifier la vraisemblance et confirmer la validité des résultats obtenus au regard de la nature du problème posé

2.organiser et mener à son terme une démarche complète d'ingénierie appliquée au développement d'un produit (et/ou d'un service) répondant à un besoin ou à un problème particulier.

2.1 Analyser le problème à résoudre ou le besoin fonctionnel à rencontrer et formuler le cahier des charges correspondant

2.2 Modéliser le problème et concevoir une ou plusieurs solutions techniques originales répondant à ce cahier des charges

2.3 Evaluer et classer les solutions au regard de l'ensemble des critères figurant dans le cahier des charges : efficacité, faisabilité, qualité, ergonomie et sécurité dans l'environnement

2.4 Implémenter et tester une solution sous la forme d'une maquette, d'un prototype et/ou d'un modèle numérique

2.5 Formuler des recommandations pour améliorer le caractère opérationnel de la solution étudiée

3.organiser et mener à son terme un travail de recherche pour appréhender un phénomène physique ou une problématique inédite relevant de sa discipline.

3.1 Se documenter et résumer l'état des connaissances actuelles dans le domaine considéré

3.2 Proposer une modélisation et/ou un dispositif expérimental permettant de simuler et de tester des hypothèses relatives au phénomène étudié

3.3 Mettre en forme un rapport de synthèse visant à expliciter les potentialités d'innovation théoriques et/ou techniques résultant de ce travail de recherche

4. contribuer, en équipe, à la programmation d'un projet et le mener à son terme en tenant compte des objectifs, des ressources allouées et des contraintes qui le caractérisent.

4.1 Cadrer et expliciter les objectifs d'un projet (en y associant des indicateurs de performance) compte tenu des enjeux et des contraintes (ressources, budget, échéance,...) qui caractérisent l'environnement du projet

4.2 S'engager collectivement sur un plan de travail, un échéancier et des rôles à tenir

4.3 Fonctionner dans un environnement pluridisciplinaire, conjointement avec d'autres acteurs porteurs de différents points de vue : gérer des points de désaccord ou des conflits

4.4 Prendre des décisions en équipe lorsqu'il y a des choix à faire: que ce soit sur les solutions techniques ou sur l'organisation du travail pour faire aboutir le projet

5.communiquer efficacement oralement et par écrit en vue de mener à bien les projets qui lui sont confiés dans son environnement de travail. Idéalement, il devrait être capable de communiquer également dans une ou plusieurs langues étrangères en plus du français.

5.1 Identifier clairement les besoins du "client" ou de l'usager : questionner, écouter et comprendre toutes les dimensions de sa demande et pas seulement sur les aspects techniques

5.2 Argumenter et convaincre en s'adaptant au langage de ses interlocuteurs : techniciens, collègues, clients, supérieurs hiérarchiques

5.3 Communiquer sous forme graphique et schématique; interpréter un schéma, présenter les résultats d'un travail, structurer des informations

5.4 Lire, analyser et exploiter des documents techniques (normes, plans, cahier de charge,...)

5.5 Rédiger des documents écrits en tenant compte des exigences contextuelles et des conventions sociales en la matière

5.6 Faire un exposé oral convaincant en utilisant les techniques modernes de communication

6.montrer sa capacité à exercer sa profession avec conscience professionnelle et de manière socialement responsable. Il saura prendre le recul nécessaire pour évaluer la pertinence socio-technique d'une solution avant de la mettre en oeuvre.

6.1 Appliquer les normes en vigueur dans sa discipline (terminologie, unités de mesure, normes de qualité et de sécurité,...)

6.2 Trouver des solutions qui vont au-delà des enjeux strictement techniques, en intégrant les enjeux de développement durable et la dimension éthique d'un projet

6.3 Faire preuve d'esprit critique vis-à-vis d'une solution technique pour en vérifier la robustesse et minimiser les risques qu'elle présente au regard du contexte de sa mise en oeuvre

6.4 S'autoévaluer et développer de manière autonome les connaissances nécessaires pour rester compétent dans son domaine (lifelong learning)

Programme structure

The Master's degree programme consists of:

• A core curriculum (30 credits)
• The professional focus (30 credits).
• Elective courses (in the options, modules, courses of interest, or other courses if suitably motivated) to reach a total of at least 120 credits, including at least 20 credits among options 1 (optimization), 2 (systems) and 3 (computational engineering).

The graduation (or end of studies) project is normally carried out at the end of the programme (second year). Depending on the students' programme, he/she may take the courses in the first or second year if the course prerequisites allow it. This may be particularly useful for those students who pursue a portion of their studies outside of UCL as part of an exchange programme.

If during the student's previous studies, he or she has already taken a course that is part of the programme (either required or elective) or they have participated in an academic activity that is approved by the programme commission, the student may count this activity toward their graduation requirements (but only if they respect programme rules). The student will also verify that he/she has obtained the minimum number of credits required for the approval of their diploma as well as for the approval of their major (in order to include their academic distinctions in the diploma supplement).

These types of programmes will be submitted for approval by the relevant Master's degree programme jury

For a programme-type, and regardless of the focus, options/or elective courses selected, this master will carry a minimum of 120 credits divided over two annual units, corresponding to 60 credits each.

> Core curriculum for the Master¿s degree in Engineering and Applied Mathematics *[en-prog-2020-map2m-tronc_commun]*

Liste au choix de finalités MAP2M

> Professional Focus *[en-prog-2020-map2m-lmap220s]*

> List of electives *[en-prog-2020-map2m-options]*

List of electives

> Major in Optimization and operations research engineering *[en-prog-2020-map2m-lmap221o]*
> Major in Systems and control engineering *[en-prog-2020-map2m-lmap222o]*
> Major in Computational engineering *[en-prog-2020-map2m-lmap223o]*
> Major in Data science *[en-prog-2020-map2m-lmap224o]*
> Major in Financial mathematics *[en-prog-2020-map2m-lmap226o]*
> Major in Cryptography and information security *[en-prog-2020-map2m-lmap234o]*
> Major in biomedical engineering *[en-prog-2020-map2m-lmap230o]*

List of electives

> Major in small and medium sized business creation *[en-prog-2020-map2m-lmap232o]*
> Major in business risks and opportunities *[en-prog-2020-map2m-lmap231o]*

List of electives

> Elective courses available for Master students in Mathematical Engineering *[en-prog-2020-map2m-lmap229o]*
> Elective courses : Transversal skills and professional contacts *[en-prog-2020-map2m-lmap951o]*

Preparatory Module *(only for students who qualify for the course via complementary coursework)*

> Master [120] in Mathematical Engineering *[en-prog-2020-map2m-module_complementaire]*

MAP2M Detailled programme

Programme by subject

CORE COURSES [30.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Students may select

						Year 1	2
O LINMA2990	Graduation project/End of studies project			28 Credits			x

O Religion courses for students in exact sciences (2 credits)

The students select one course between:
The student shall select

⊠ LTECO2100	Sociétés, cultures, religions : Biblical readings	Hans Ausloos	15h	2 Credits	q1	x	x
⊠ LTECO2300	Societies, cultures, religions : Ethical questions	Marcela Lobo Bustamante	15h	2 Credits	q1	x	x
⊠ LTECO2200	Societies-cultures-religions : Human Questions	Régis Burnet Dominique Martens	15h	2 Credits	q1 or q2	x	x

PROFESSIONAL FOCUS [30.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Content:

						Year 1	Year 2
O LINMA2171	Numerical Analysis : Approximation, Interpolation, Integration	Pierre-Antoine Absil	30h +22.5h	5 Credits	q1	x	
O LINMA2370	Modelling and analysis of dynamical systems	Jean-Charles Delvenne (coord.) Denis Dochain	30h +22.5h	5 Credits	q1	x	
O LINMA2380	Matrix computations	Raphaël Jungers	30h +22.5h	5 Credits	q1	x	
O LINMA2470	Stochastic modelling	Philippe Chevalier	30h +22.5h	5 Credits	q2	x	
O LINMA2471	Optimization models and methods II	François Glineur	30h +22.5h	5 Credits	q1	x	
O LINMA2710	Scientific computing	Pierre-Antoine Absil (coord.) Karl Meerbergen (compensates Anthony Papavasiliou)	30h +22.5h	5 Credits	q2	x	

OPTIONS

The student selects at least 20 credits from the first three options

List of electives

> Major in Optimization and operations research engineering *[en-prog-2020-map2m-lmap221o]*
> Major in Systems and control engineering *[en-prog-2020-map2m-lmap222o]*
> Major in Computational engineering *[en-prog-2020-map2m-lmap223o]*
> Major in Data science *[en-prog-2020-map2m-lmap224o]*
> Major in Financial mathematics *[en-prog-2020-map2m-lmap226o]*
> Major in Cryptography and information security *[en-prog-2020-map2m-lmap234o]*
> Major in biomedical engineering *[en-prog-2020-map2m-lmap230o]*

List of electives

> Major in small and medium sized business creation *[en-prog-2020-map2m-lmap232o]*
> Major in business risks and opportunities *[en-prog-2020-map2m-lmap231o]*

List of electives

> Elective courses available for Master students in Mathematical Engineering *[en-prog-2020-map2m-lmap229o]*
> Elective courses : Transversal skills and professional contacts *[en-prog-2020-map2m-lmap951o]*

LIST OF ELECTIVES

The student shall select at least 20 credits among the first three options

MAJOR IN OPTIMIZATION AND OPERATIONS RESEARCH ENGINEERING

This option provides the students with advanced skills in optimization models and methods (continuous or discrete, deterministic or stochastic) and introduces them to various domains of application, among which operations research (quantitative methods for decision making).

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
From 20 to 25 credits

O *Content:*

						Year 1	Year 2
⊠ LINMA2415	Quantitative Energy Economics	Gauthier de Maere d'Aertrycke (compensates Anthony Papavasiliou)	30h +22.5h	5 Credits	q2	x	x
⊠ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne Julien Hendrickx	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2460	Optimization : Nonlinear programming	Yurii Nesterov	30h +22.5h	5 Credits	q2	x	x
⊠ LINMA2491	Operational Research	El-Houssaine Aghezzaf (compensates Anthony Papavasiliou)	30h +22.5h	5 Credits	q2	x	x
⊠ LINMA2345	Game theory	Matthew Philippe (compensates Raphaël Jungers)	30h +22.5h	5 Credits	q2	x	x

MAJOR IN SYSTEMS AND CONTROL ENGINEERING

This option provides students with advanced skills in the modelling and analysis of dynamical systems and in the design of control laws, with applications in biological systems and ecological and epidemiological processes in particular.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
From 20 to 30 credits

O Content:

						Year 1	Year 2
⊠ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	q1	x	x
⊠ LINMA2300	Analysis and control of distributed parameter systems	Denis Dochain	30h+30h	5 Credits	q1	x	x
⊠ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2671	Advanced control and applications	Julien Hendrickx	30h+30h	5 Credits	q1	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	q2	x	x
⊠ LINMA2510	Mathematical ecology	Eric Deleersnijder (coord.) Denis Dochain Emmanuel Hanert	30h +22.5h	5 Credits	q2 ⊘	x	x

MAJOR IN COMPUTATIONAL ENGINEERING

This option provides students with advanced skills in modelling techniques and numerical simulation methods to analyse and solve various engineering problems.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
From 20 to 25 credits

O Content:

						Year 1	Year 2
⊠ LGCIV2041	Numerical analysis of civil engineering structures	Luca Sgambi	20h+15h	5 Credits	q2	x	x
⊠ LINMA2111	Discrete mathematics II : Algorithms and complexity	Jean-Charles Delvenne Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2720	Mathematical modelling of physical systems	Roland Keunings	30h +22.5h	5 Credits	q2	x	x
⊠ LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	30h+30h	5 Credits	q1	x	x
⊠ LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye (coord.) Vincent Legat Jean-François Remacle	30h+30h	5 Credits	q2	x	x

MAJOR IN DATA SCIENCE

This option proposes a selection of courses of statistics, data mining, algorithmics and data architectures that introduce the students to several facets of Data Science.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student may choose
From 20 to 30 credits

O Content:

O Compulsory courses in data science

						Year 1	Year 2
O LINMA2472	Algorithms in data science	Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel)	30h +22.5h	5 Credits	q1	x	x

⊠ Elective courses in data science

						Year 1	Year 2
⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LINGI2145	Cloud Computing	Etienne Riviere	30h+15h	5 Credits	q1	x	x
⊠ LINGI2172	Databases	Siegfried Nijssen	30h+30h	6 Credits	q2	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	q2	x	x
⊠ LINGI2364	Mining Patterns in Data	Siegfried Nijssen	30h+15h	5 Credits	q2	x	x
⊠ LSINF2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	q2	x	x
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	q1	x	x
⊠ LDATS2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	q1	x	x
⊠ LDATA2010	Information visualisation	John Lee	30h+30h	5 Credits	q1	x	x

MAJOR IN FINANCIAL MATHEMATICS

The objective of this major is to introduce students to quantitative financial techniques and actuarial sciences by presenting deterministic and stochastic mathematical methods used in financial markets. The main subjects covered deal with the evaluation of financial assets and insurance products in continuous-time. Special attention is paid to numerical simulation methods. In addition, for students who will to enroll in the Master's degree programme in actuarial sciences, all the compulsory courses of the programme ACTU2M validated in this major will be valorized.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
From 15 to 20 credits

O Content:

						Year 1	Year 2
⊠ LINMA2725	Financial mathematics	Pierre Devolder	30h +22.5h	5 Credits	q1	x	x
⊠ LACTU2020	Fixed income mathematics	Pierre Devolder	45h+15h	7 Credits	q1	x	x
⊠ LACTU2030	LIFE INSURANCE	Donatien Hainaut	45h	7 Credits	q1	x	x
⊠ LACTU2170	STOCHASTIC FINANCE	Donatien Hainaut	30h	5 Credits	q2	x	x

MAJOR IN CRYPTOGRAPHY AND INFORMATION SECURITY

As with the Master's degree engineering programmes in electricity, computer sciences and applied mathematics, this major provides students with the knowledge of fundamental algorithms and mathematics in order to better understand information security as well as the design and implementation of solutions for problems related to electronic circuits and information systems.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
From 15 to 30 credits

O Content:

⊠ Elective courses

In order to validate this option INFO and MAP students have to take at least 20 credits and the ELEC, DATE and DATI students have to take at least 15 credits among:

						Year 1	Year 2
⊠ LELEC2760	Secure electronic circuits and systems	François-Xavier Standaert	30h+30h	5 Credits	q2	x	x
⊠ LINGI2144	Secured systems engineering	Axel Legay	30h+15h	5 Credits	q2	x	x
⊠ LINGI2347	Computer system security	Ramin Sadre	30h+15h	5 Credits	q2	x	x
⊠ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	q2	x	x
⊠ LMAT2440	Number theory	Olivier Pereira Jean-Pierre Tignol	30h+15h	5 Credits	q1	x	x
⊠ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	q1	x	x
⊠ LELEC2770	Privacy Enhancing technology	Olivier Pereira (coord.) François-Xavier Standaert	30h+30h	5 Credits	q1	x	x

MAJOR IN BIOMEDICAL ENGINEERING

The goal of this major is to train engineers who are capable of meeting the future technological challenges in the scientific and technical areas of biomedical engineering. This major provides students with basic knowledge of several areas of biomedical engineering such as bioinstrumentation, biomaterials, medical imaging, mathematical modelling, artificial organs and rehabilitation, and biomechanics. Through the collaboration between the Louvain School of Engineering and the School of Medicine, students benefit from an interdisciplinary programme where the art of engineering is applied to the complex and varied biomedical field.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	🟨 Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student may choose
From 15 to 30 credits

O Content:

O Required courses in biomedical engineering

Students enrolled in this major must select a minimum of 15 credits among the following required courses except for those students enrolled in the Master's degree programme in computer science and engineering who are required to take 20 credits.

						Year 1	Year 2
⊠ LGBIO2010	Bioinformatics	Pierre Dupont	30h+30h	5 Credits	q1	x	x
⊠ LGBIO2020	Bioinstrumentation	André Mouraux Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LGBIO2030	Biomaterials	Sophie Demoustier Christine Dupont	30h+30h	5 Credits	q1	x	x
⊠ LGBIO2040	Biomechanics	Greet Kerckhofs	30h+30h	5 Credits	q2	x	x
⊠ LGBIO2050	Medical Imaging	Greet Kerckhofs John Lee Benoît Macq Frank Peeters	30h+30h	5 Credits	q1	x	x
⊠ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	q1	x	x

⊠ Elective courses in biomedical engineering for students enrolled in the ELEC Master's degree programme

⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	q1	x	x

LIST OF ELECTIVES

MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

In keeping with most of the EPL Masters' degrees, the goal of this major is to familiarize the student with the specifics of entrepreneurship and business development in order to develop the necessary abilities, knowledge and tools to create a business. It is a truly interdisciplinary initiative where students from different faculties are brought together in cross-disciplinary teams to create an entrepreneurial project.

The Interdisciplinary program in entrepreneurship (CPME) is spread over two years and is integrated into more than 30 Masters (9 faculties). The program includes a collective and interdisciplinary master thesis focused on an entrepreneurial project (start-up or spin-off) and realized in teams of 3 to 4 students from 3 to 4 different faculties. The access is reserved for a small number of students by a selection procedure. Additional information may be found at www.uclouvain.be/cpme.

This major is not available in English and may not be taken at the same time as the major "Business risks and opportunities".

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

From 20 to 25 credits

Content:

Required courses for the major in small and medium sized businesses

						Year 1	Year 2
O LCPME2001	Entrepreneurship Theory (in French)	Frank Janssen	30h+20h	5 Credits	q1	x	
O LCPME2002	Managerial, legal and economic aspects of the creation of a company (in French)	Yves De Cordt Marine Falize	30h+15h	5 Credits	q1	x	x
O LCPME2003	Business plan of the creation of a company (in French) *Les séances du cours LCPME2003 sont réparties sur les deux blocs annuels du master. L'étudiant doit les suivre dès le bloc annuel 1, mais ne pourra inscrire le cours que dans son programme de bloc annuel 2.*	Frank Janssen	30h+15h	5 Credits	q2		x
O LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	q2	x	x

⊠ Prerequisite CPME courses

Student who have not taken management courses during their previous studies must enroll in LCPME2000.

O LCPME2000	Venture creation financement and management I	Yves De Rongé Olivier Giacomin	30h+15h	5 Credits	q1	x	

MAJOR IN BUSINESS RISKS AND OPPORTUNITIES

This major is not available in English and may not be taken at the same time as the major « Interdisciplinary program in entrepreneurship – CPME ».

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

From 17 to 20 credits

O Content:

						Year 1	Year 2
O LFSA1290	Introduction to financial and accounting management	Philippe Grégoire	30h+15h	4 Credits	q2	x	x
O LFSA2140	Elements of law for industry and research	Vincent Cassiers Werner Derijcke Bénédicte Inghels	30h	3 Credits	q1	x	x
O LFSA2210	Organisation and human resources	John Cultiaux Eline Jammaers	30h	3 Credits	q2	x	x
O LFSA2230	Introduction to management and to business economics	Benoît Gailly	30h+15h	4 Credits	q2	x	x
O LFSA2245	Environment and business	Jean-Pierre Tack	30h	3 Credits	q1	x	x

O One course between

From 3 to 5 credits

⊠ LFSA2202	Ethics and ICT	Axel Gosseries Olivier Pereira	30h	3 Credits	q2	x	x
⊠ LLSMS2280	Business Ethics and Compliance Management	Carlos Desmet	30h	5 Credits	q1	x	x

⊠ Alternative to the major in business risks and opportunities for computer science students

Computer science students who have already taken courses in this field while pursuing their Bachelor's degree may choose between 16-20 credits from the courses offered in the management minor for computer sciences.

LIST OF ELECTIVES

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN MATHEMATICAL ENGINEERING

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Students must accumulate a minimum of 120 credits over the course of their Master's degree programme.

O *Content:*

⊠ Complement to the major in financial mathematics

In addition, students who would like to enrol subsequently in the Master in Actuarial Sciences will be able to add value to all the compulsory courses in the ACTU2M programme that they will have validated in the financial mathematics option.

						Year 1	Year 2
⊠ LACTU2010	NON LIFE INSURANCE	Michel Denuit	45h	7 Credits	q1	x	x
⊠ LACTU2040	PENSION FUNDING	Pierre Devolder	30h+15h	5 Credits	q2	x	x
⊠ LACTU2210	Quantitative Risk Management	Christian Hafner	30h	5 Credits	q2	x	x

⊠ Module in Biostatistics and Technometry

Students taking 30 credits in this module will be able to complete the Master in Statistics, Biostatistics orientation [120 credits] in one year. More information via the Secretariat of the School of Statistics, Biostatistics and Actuarial Sciences (LSBA): info-stat-actu@uclouvain.be

						Year 1	Year 2
⊠ LBIRA2110B	Applied Econometrics	Xavier Draye Frédéric Gaspart Bernadette Govaerts	27.5h +7.5h	3 Credits	q1	x	x
⊠ LSTAT2040	Statistical analysis	Benjamin Colling (compensates Anouar El Ghouch)	30h+15h	5 Credits	q2	x	x
⊠ LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	15h+5h	4 Credits	q2	x	x
⊠ LSTAT2220	Analysis of survival and duration data	Ingrid Van Keilegom	15h+5h	4 Credits	q1	x	x
⊠ LSTAT2310	Statistical quality control.	Bernard Francq	15h+5h	4 Credits	q1	x	x
⊠ LSTAT2330	Statistics in clinical trials.	Catherine Legrand Annie Robert	22.5h +7.5h	5 Credits	q2	x	x
⊠ LDATS2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	q1	x	x
⊠ LDATS2370	Data Management II : SAS ADVANCED PROGRAMMING	Christophe Kabacinski	15h+10h	5 Credits	q2	x	x

⊠ Module in General Statistics and Mathematics

Students taking 30 credits in this module will be able to complete the Master in Statistics [120 credits] in one year. More information via the Secretariat of the School of Statistics, Biostatistics and Actuarial Sciences (LSBA): info-stat-actu@uclouvain.be

						Year 1	Year 2
⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	q2	x	x
⊠ LINMA2472	Algorithms in data science	Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel)	30h +22.5h	5 Credits	q1	x	x
⊠ LSINF2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	q2	x	x
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	q1	x	x
⊠ LSTAT2040	Statistical analysis	Benjamin Colling (compensates Anouar El Ghouch)	30h+15h	5 Credits	q2	x	x
⊠ LSTAT2110	Data Analysis	Johan Segers	30h+7.5h	5 Credits	q1	x	x
⊠ LSTAT2120	Linear models	Christian Hafner	30h+7.5h	5 Credits	q1	x	x
⊠ LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	15h+5h	4 Credits	q2	x	x
⊠ LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	15h+5h	4 Credits	q1	x	x

						Year 1	2
⊠ LSTAT2170	Times series	Rainer von Sachs	22.5h +7.5h	5 Credits	q2	x	x
⊠ LSTAT2180	Resampling methods with applications	Eugen Pircalabelu	15h+5h	4 Credits	q1	x	x
⊠ LDATS2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	q1	x	x

⊠ Courses of interest

⊠ LECON2021	Economic Fluctuations and Foundations of Macro Polici	Grégory de Walque (compensates David De la Croix)	30h	5 Credits	q2	x	x
⊠ LECON2031	Applied Econometrics : Time Series	Amma Panin	30h+12h	5 Credits	q1	x	x
⊠ LECON2033	Applied econometrics: Microeconometrics	Muriel Dejemeppe	30h+12h	5 Credits	q1	x	x
⊠ LELEC1360	TELECOMMUNICATIONS	Luc Vandendorpe	30h+30h	5 Credits	q2	x	x
⊠ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	q1	x	x
⊠ LELEC2880	Modem design	Jérôme Louveaux (coord.) Luc Vandendorpe	30h+30h	5 Credits	q2	x	x
⊠ LELEC2900	Signal processing	Laurent Jacques Benoît Macq Luc Vandendorpe	30h+30h	5 Credits	q2	x	x
⊠ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	q2	x	x
⊠ LMAT2410	Partial differential equation : heat equation, brownian moves and numerical aspects	Augusto Ponce	30h+15h	5 Credits	q2 △	x	x
⊠ LMAT1371	Probability Theory	Johan Segers	30h +22.5h	5 Credits	q2	x	x
⊠ LMAT2130	Partial differential equations	Heiner Olbermann	30h+15h	5 Credits	q1	x	x
⊠ LMAT2460	Finite mathematics and combinatorial structures	Jean-Charles Delvenne Raphaël Jungers	30h	5 Credits	q1	x	x
⊠ LMECA1100	Deformable solid mechanics.	Issam Doghri	30h+30h	5 Credits	q1	x	x
⊠ LMECA1321	Fluid mechanics and transfer phenomena.	Vincent Legat Grégoire Winckelmans	30h+30h	5 Credits	q1	x	x
⊠ LMECA2660	Numerical methods in fluid mechanics	Grégoire Winckelmans	30h+30h	5 Credits	q2	x	x
⊠ LMECA2771	Thermodynamics of irreversible phenomena.	Miltiadis Papalexandris	30h+30h	5 Credits	q2	x	x
⊠ LMECA2732	Robot modelling and control	Renaud Ronsse	30h+30h	5 Credits	q2	x	x
⊠ LSTAT2100	Discrete data analysis.	Anouar El Ghouch	30h+7.5h	5 Credits	q2	x	x
⊠ LDATS2350	Data Mining	Robin Van Oirbeek	15h+15h	5 Credits	q2	x	x
⊠ LGCIV2056	Marine Hydrodynamics	Eric Deleersnijder	30h+15h	5 Credits	q1	x	x
⊠ LLSMS2034	Supply Chain Planning (in English)	Marc Foret Mathieu Van Vyve	30h	5 Credits	q2	x	x
⊠ LMAPR2018	Rheology	Evelyne Van Ruymbeke	30h+30h	5 Credits	q2	x	x

ELECTIVE COURSES : TRANSVERSAL SKILLS AND PROFESSIONAL CONTACTS

○ Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student chooses between 3 and 22 credits (max 27 if the student chooses the internship) in this list below or in the courses of the major "business risks and opportunities". An alternative is to choose the Major in small and medium sized business creation.

○ Content:

○ Transversal skills and contacts with industry

The student selects minimum 3 credits among the courses of the majors "business risks and opportunities", "small and medium sized business creation" and courses of professional integration activity specific to the program.

⊠ Internship

					Year 1	Year 2
⊠ LFSA2995	Company Internship	Jean-Pierre Raskin	30h	10 Credits	q1+q2	x	x

⊠ Professional integration activity specific to the program

					Year 1	Year 2
⊠ LINMA2120	Applied mathematics seminar	Pierre-Antoine Absil Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques (coord.) Raphaël Jungers Yurii Nesterov Anthony Papavasiliou	30h	5 Credits	q1+q2	x	x
⊠ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil Nikolaos Deligiannis (compensates Anthony Papavasiliou) Yurii Nesterov	30h +22.5h	5 Credits	q1+q2	x	x

⊠ Communication

Students may select max. 8 credits of languages courses or group dynamics :
Maximum 8 credits

⊠ Languages

Students may select from any language course offered at the ILV. Special attention is placed on the following seminars in professional development:

					Year 1	Year 2
⊠ LALLE2500	Professional development seminar German	Caroline Klein (coord.)	30h	3 Credits	q1+q2	x	x
⊠ LALLE2501	Professional development seminar-German	Caroline Klein (coord.)	30h	5 Credits	q1+q2	x	x
⊠ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	30h	3 Credits	q1	x	x
⊠ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	30h	5 Credits	q1	x	x
⊠ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.) Marie-Laurence Lambrecht	30h	3 Credits	q1 or q2	x	x
⊠ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.) Dag Houdmont	30h	3 Credits	q1 or q2	x	x

⊠ Group dynamics

					Year 1	Year 2
⊠ LEPL2351	Dynamique des groupes - Q1	Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz	15h+30h	3 Credits	q1	x	x
⊠ LEPL2352	Dynamique des groupes - Q2	Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz	15h+30h	3 Credits	q2	x	x

Year
1 2

⊠ Other non-disciplinary courses

The student may further select maximum 8 credits in other disciplines.

Course prerequisites

There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

The programme's courses and learning outcomes

For each UCLouvain training programme, a reference framework of learning outcomes specifies the competences expected of every graduate on completion of the programme. You can see the contribution of each teaching unit to the programme's reference framework of learning outcomes in the document *"In which teaching units are the competences and learning outcomes in the programme's reference framework developed and mastered by the student?"*

The document is available by clicking this link after being authenticated with your UCLouvain account.

MAP2M - Information

Admission

General and specific admission requirements for this program must be satisfied at the time of enrolling at the university.

In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.

SUMMARY

Specific Admission Requirements

This programme is taught in English with no prerequisite in French. The student is supposed to have at least a B2 level in the European Framework of Reference. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the access on the file.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		direct_access	Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted master programme.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in Engineering		direct_access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil engineering master degree may have an adapted master programme.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering		access_with_training	Students who have no specialisation in the field of their civil enginering master degree may have an adapted master programme with up to 60 additional credits.
Foreign Bachelors			
Bachelor in engineering	Bachelors degree of Cluster Institution	direct_access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil enginering master degree may have an adapted master programme.
Bachelor in Engineering	For others institutions	on_the_file	See personalized access

Non university Bachelors

> Find out more about links to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
Masters			
Master in Engineering		direct_access	

Holders of a non-University 2nd cycle degree

Adults taking up their university training

> See the website Valorisation des acquis de l'expérience

It is possible to gain admission to all masters courses via the validation of professional experience procedure.

Access on the file

Reminder : all Masters (apart from Advanced Masters) are also accessible on file.

The first step of the admission procedure requires to submit an application online: https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html

Selection criteria are summarized here (epl-admission@uclouvain.be).

Admission and Enrolment Procedures for general registration

Unconditional admission to a Master's degree in Applied mathematics engineering is afforded to bachelors in engineering, with a major or minor in applied mathematics.

Admission to this Master's via a customized curriculum is also afforded to bachelors of science (in particular mathematics and physics), bachelors in bioengineering, as well as bachelors in engineering with no major nor minor in applied mathematics, under the following conditions.

A student with no major nor minor in applied mathematics, nor a curriculum deemed equivalent, shall submit a résumé to the Applied mathematics diploma committee, who will propose a customized Master's curriculum (drawing on the volume of elective courses, without any additional credits). The procedure mentioned in note 1 of the conditions of admission applies.

A student who is not a bachelor in engineering, shall submit a résumé to the Faculty of Applied sciences. If this application is accepted, the Faculty will propose a customized Master's curriculum (15 additional credits and possibility part of the volume of elective courses, or else an additional year of studies). The procedure mentioned in note 2 of the conditions of admission applies.

In some cases, a student might have to follow both above-mentioned procedures (when not a bachelor in engineering and with no minor in applied mathematics). The procedures mentioned in notes 1 and 2 of the conditions of admission then apply.

Teaching method

Interdisciplinary methods

The Master's degree programme in engineering and Applied Mathematics is by its very nature interdisciplinary because it consists of a wide range of major courses some of which are research-based (Cryptography and information security, biomedical engeering) and offered by other academic departments (financial mathematics); this naturally reinforces the interdisciplinary nature of the programme.

The programme aims to give students knowledge and skills in mathematical modelling that is used in all engineering disciplines as well as in other areas such as economics, environmental sciences or life sciences.

A final interdisciplinary aspect to the programme is the graduation project, which is frequently completed outside the department of mathematical engineering. The graduation project makes up half of the workload for the second year of the programme. It offers students the opportunity to work in-depth on a given subject and due to its size and context, introduces students to the engineering or research professions. This project may focus on a topic relating to an applied mathematics research cluster (or possibly in collaboration with an external industrial partner); or it may focus on subjects related to applied mathematics in other research clusters at the Louvain School of Engineering as well as the faculties of science, economics, management or actuarial sciences.

Diverse learning situations

The pedagogy used in the Master's degree programme in engineering is similar to that in the Bachelor's degree programme in engineering. Students are exposed to a variety of pedagogies: lectures, individual projects and small group work, exercise and problem-solving sessions, case studies, experimental laboratories, computer simulations, educational software, internships in industry or research, individual or group work, seminars given by external scientists.

These various learning situations develop students' knowledge of their discipline in a way that is interdisciplinary and non-technical. They permit students to build their knowledge in an iterative and progressive manner all the while developing their independence, organisational and time management skills as well as their ability to communicate. Students have access to the newest information technology (materials, software, networks) during their studies.

For example, the Business Creation major has an interactive approach and promotes "problem-based learning". Throughout the programme, students must work as part of multidisciplinary teams. The project has an interdisciplinary focus and groups of three students, ideally from different faculties, may collaborate on a business creation project.

Evaluation

The evaluation methods comply with the regulations concerning studies and exams. More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

Evaluation methods conform to the rules used to evaluate coursework and exams. Further details about the methods specific to each academic department may be found in their respective evaluation descriptions ("Evaluating students' knowledge").

Student work is evaluated according to University rules (see the rules for evaluating coursework and exams) namely written and oral exams, laboratory exams, individual or group work, public presentations of projects and theses defences.

For more information on evaluation methods, students may consult the relevant evaluation descriptions.

To obtain a passing grade, the marks received for the teaching units are offset by their respective credits.

Mobility and/or Internationalisation outlook

Since its creation, the Louvain School of Engineering (EPL) has participated in diverse exchange programs that were put into place at the European level and beyond.

Possible trainings at the end of the programme

The Master's degree programme in engineering and Applied Mathematics satisfies the prerequisites for other Master's degree programmes that may be obtained upon completion of an additional year:

1.Master [120] en sciences actuarielles (UCL)

Students who take LINMA2725, LACTU2020, LACTU2030, LACTU2070 and at least 15 credits in the Complement to the major in financial mathematics (see "Elective courses") will get direct access to the second year of the Master [120] en sciences actuarielles.

2.Master's degree [120] in general economics (UCL)

Students who take 30 credits in the Module en biostatistique et technométrie will be able to complete in one year the Master [120] en statistique, orientation biostatistique.

3.Master's degree [120] in general statistics (UCL)

Students who take 30 credits in the Module en statistique générale et mathématique will be able to complete in one year the Master [120] en statistique, orientation générale.

Furthermore, most of the UCL Master's degree programmes (generally 60) are open to UCL Master's degree diploma holders. For example:

-The Master's degree (120) in sciences and environmental management and the Master's degree (60) in sciences and environmental management (automatic admission with possible complementary coursework)

-Different Master's degree programmes (60) in management (automatic admission based on written application): see this list

-The Master's degree (60) in information and communication at Louvain-la-Neuve or the Master's degree (60) in information and communication at Mons

Doctoral degree programmes

Enrolment in a doctoral degree programme in engineering sciences is open to students holding a Master's degree in civil engineering. The Institute ICTEAM is associated with several specialised doctoral schools in particular the school "Systems, Optimization, Control and Networks" (for details see https://uclouvain.be/sites/socn/).

Contacts

Curriculum Management

Entity

Structure entity	SST/EPL/MAP
Denomination	(MAP)
Faculty	Louvain School of Engineering (EPL)
Sector	Sciences and Technology (SST)
Acronym	MAP
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Jury

- Président du Jury: Jean-Didier Legat
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