



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 bloc 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. demonstrating their mastery of a solid body of knowledge in basic engineering sciences allowing them to understand and solve problems related to their discipline
 - 1.1 Identify and use concepts, laws, and appropriate reasoning to solve a given problem
 - 1.2 Identify and use appropriate modelling and calculation tools to solve problems
 - 1.3 Verify the plausibility and confirm the validity of results
2. organise and carry out a procedure in applied engineering to develop a product (and/or service) that meets a need or solves a particular problem:
 - 2.1 Analyse the problem and formulate a corresponding specifications note
 - 2.2 Model the problem and design one or more original technical solutions that correspond to the specifications note
 - 2.3 Evaluate and classify the solutions in terms of all the criteria found in the specifications note: efficiency, feasibility, quality, ergonomics and environmental security
 - 2.4 Implement and test a solution through a mock up, a prototype or a numerical model
 - 2.5 Formulate recommendations to improve the operational character of the solution being studied
3. organise and carry out a research project in order to understand a physical phenomenon or a new problem relevant to the discipline
 - 3.1 Document and summarize the existing body of knowledge in the area under consideration
 - 3.2 Propose a model and/or an experimental device in order to simulate or test hypotheses relating to the phenomenon being studied
 - 3.3 Write a cumulative report that explains the potential of the theoretical or technical innovations resulting from the research project
4. contribute as part of a team to the planning and completion of a project while taking into account its objectives, allocated resources, and constraints
 - 4.1 Frame and explain the project's objectives (in terms of performance indicators) while taking into account its issues and constraints (resources, budget, deadlines)
 - 4.2 Collaborate on a work schedule, deadlines and roles
 - 4.3 Work in a multidisciplinary environment with peers holding different points of view; manage any resulting disagreement or conflicts
 - 4.4 Make team decisions and assume the consequences of these decisions (whether they are about technical solutions or the division of labour to complete a project)
5. communicate effectively (orally or in writing) with the goal of carrying out assigned projects in the workplace.
 - 5.1 Identify the needs of the client or the user: question, listen and understand all aspects of their request and not just the technical aspects.
 - 5.2 Present your arguments and adapt to the language of your interlocutors: technicians, colleagues, clients, superiors
 - 5.3 Communicate through graphics and diagrams: interpret a diagram, present project results, structure information
 - 5.4 Read and analyse different technical documents (rules, plans, specification notes)
 - 5.5 Draft documents that take into account contextual requirements and social conventions
 - 5.6 Make a convincing oral presentation using modern communication techniques.
6. Demonstrate that you are able to do your job with a professional conscience and in a socially responsible manner. Show that you can evaluate the socio-technical relevance of a solution before putting it into place.
 - 6.1 Rigorously apply the standards of your discipline (terminology, measurement units, quality standards and security)
 - 6.2 Find solutions that go beyond strictly technical issues by considering sustainable development and the socio-economic ethics of a project
 - 6.3 Demonstrate critical awareness of a technical solution in order to verify its robustness and minimize the risks that may occur during implementation.
 - 6.4 Evaluate oneself and independently develop necessary skills for "lifelong learning" in the field

PROFESSIONAL FOCUS [30.0]

MAJORS FOR THE MASTER'S DEGREE IN MATHEMATICAL ENGINEERING

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).

- Mandatory
- ✂ Optional
- △ Not offered in 2023-2024
- ⊙ Not offered in 2023-2024 but offered the following year
- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

From 20 to 25credit(s)

Year

1 2

o Content:

				Year	
				1	2
✂ LINMA2415	Quantitative Energy Economics	Gauthier de Maere d'Aertrycke	EN [q2] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	X
✂ LINMA2450	Combinatorial optimization	Julien Hendrickx Geovani Nunes Grapiglia	EN [q1] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	X
✂ LINMA2460	Optimization : Nonlinear programming	Geovani Nunes Grapiglia	EN [q2] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	X
✂ LINMA2491	Operational Research	Mehdi Madani	EN [q2] [30h+22.5h] [5 Credits]		

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.

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- ⊗ Optional
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- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

From 20 to 30credit(s)

Year

1 2

o Content:

⊗ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	EN
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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.

- Mandatory
- ⊗ Optional
- △ Not offered in 2023-2024
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- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

From 20 to 24credit(s)

Year
1 2

Content:

				Year	
				1	2
⊗ LGCIV2041	Numerical analysis of civil engineering structures	Hadrien Rattez João Saraiva Esteves Pacheco De Alm	EN [q2] [20h+15h] [4 Credits] 🌐 > French-friendly	X	X
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Jean-Charles Delvenne Jean-Charles Delvenne (compensates Vincent Blondel)	EN [q1] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LINMA2720	Mathematical modelling of physical systems		EN [q2] [30h+22.5h] [5 Credits] △ 🌐 > French-friendly	X	X
⊗ LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	EN [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye (coord.) Vincent Legat Jean-François Remacle	EN [q2] [30h+30h] [5 Credits] 🌐 > French-friendly	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.

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- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
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[Click on the course title to see detailed informations \(objectives, methods, evaluation...\)](#)

From 20 to 30credit(s)

Year

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.

- Mandatory
- ⌘ Optional
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- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Year

1 2




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:

⌘ LELEC2760	Secure electronic circuits and systems	François-Xavier Standaert	30 [q2] [30h+30h] [5 Credits] 🌐 > French-friendly
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- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫🌐 Not open to incoming exchange students
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[Click on the course title to see detailed informations \(objectives, methods, evaluation...\)](#)

				Year	
				1	2
⊗ LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	EN [q1] [15h+5h] [4 Credits] 	x	x
⊗ LSTAT2170	Times series	Rainer von Sachs	EN [q2] [30h+7.5h] [5 Credits] 	x	x
⊗ LDATS2360	Seminar in data management: basic	Céline Bugli	FR [q1] [15h+10h] [5 Credits] 	x	x

⊗ Courses of interest

⊗ LECON2021	Economic Fluctuations and Foundations of Macro Policy	Grégory de Walque (compensates David De la Croix)	
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OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES
 [3.0]

BUSINESS RISKS AND OPPORTUNITIES

- Mandatory
- ✂ Optional
- △ Not offered in 2023-2024
- ⊙ Not offered in 2023-2024 but offered the following year
- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫🌐 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Year

1 2

○ **Content:**

○ LEPL2211	Business issues introduction [q2] [30h] [3 Credits]	Benoit Gailly	EN [q2] [30h] [3 Credits]
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○ LEPL2211

Business issues introduction

MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP - INEO

Commune à la plupart des masters de l'EPL, cette option a pour objectif de familiariser l'étudiant-e avec les spécificités de l'entrepreneuriat et de la création d'entreprise afin de développer chez lui les aptitudes, connaissances et outils nécessaires à la création d'entreprise.

Cette option rassemble des étudiants de différentes facultés en équipes interdisciplinaires afin de créer un projet entrepreneurial. La formation interdisciplinaire en entrepreneuriat (INEO) est une option qui s'étend sur 2 ans et s'intègre dans plus de 30 Masters de 9 facultés/écoles de l'UCLouvain. Le choix de l'option INEO implique la réalisation d'un mémoire interfacultaire (en équipe) portant sur un projet de création d'entreprise. L'accès à cette option, ainsi qu'à chacun des cours, est limité aux étudiant-es sélectionnés sur dossier. Toutes les informations sur <https://uclouvain.be/fr/etudier/ineo> (<https://uclouvain.be/fr/etudier/ineo>).

L'étudiant.e qui choisit de valider cette option doit sélectionner au minimum 20 crédits et au maximum 25 crédits. Cette option n'est pas

COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

- Mandatory
- ⊗ Optional
- △ Not offered in 2023-2024
- ⊙ Not offered in 2023-2024 but offered the following year
- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫🌐 Not open to incoming exchange students
- (FR) Teaching language (FR, EN, ES, NL, DE, ...)

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

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Year

1 2

o **Content:**

⊗ LFSA2995	Company Internship	Dimitri Lederer Jean-Pierre Raskin	FR [q1+q2] [30h] [10 Credits] 🌐	X	X
⊗ LFSA2212	Innovation classes	Benoît Macq Jean-Pierre Raskin Benoît Raucent	FR [q1] [30h+15h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil Laurent Jacques	EN [q1+q2] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LINMA2120	Applied mathematics seminar	Pierre-Antoine Absil Gianluca Bianchin Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques Raphaël Jungers Estelle Massart (coord.) Geovani Nunes Grapiglia	EN [q1+q2] [30h] [3 Credits] 🌐 > French-friendly	X	X
⊗ LINMA2415	Quantitative Energy Economics	8.290985 363.576996 268.290985 385.908997 71.865997.32 1 1 1 h W n 1			



Grapiglia

OTHERS ELECTIVE COURSES

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- Mandatory
- ⊗ Optional
- △ Not offered in 2023-2024
- ⊖ Not offered in 2023-2024 but offered the following year
- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Year

1 2

o Content:

Les étudiant-e-s peuvent également inscrire à leur programme tout cours faisant partie des programmes d'autres masters de l'EPL moyennant l'approbation du jury restreint.

o Languages

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

⊗ LALLE2500	Professional development seminar German	
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Course prerequisites

The **table** below lists the activities (course units, or CUs) for which there are one or more prerequisites within the programme, i.e. the programme CU for which the learning outcomes must be certified and the corresponding credits awarded by the jury before registering for that CU.

These activities are also identified **in the detailed programme**: their title is followed by a yellow square.

Prerequisites and student's annual programme

As the prerequisite is for CU registration purposes only, there are no prerequisites within a programme year. Prerequisites are defined between CUs of different years and therefore influence the order in which the student will be able to register for the programme's CUs.

In addition, when the jury validates a student's individual programme at the beginning of the year, it ensures its coherence, meaning that it may:

- require the student to combine registration in two separate CUs which it considers necessary from a pedagogical point of view.
- transform a prerequisite into a corequisite if the student is in the final year of a degree course.

For more information, please consult the [Academic Regulations and Procedures](https://uclouvain.be/fr/decouvrir/rgee.html) (<https://uclouvain.be/fr/decouvrir/rgee.html>).

Prerequisites list

MLSMM2134 "E-comportement du consommateur" has prerequisite(s) MGEST1108

- MGEST1108 - [Marketing](#)

MLSMM2136 "Tendances en Digital Marketing" has prerequisite(s) MGEST1108

- MGEST1108 - [Marketing](#)

The programme's courses and learning outcomes

For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

Bachelor in Engineering	For others institutions	Access based on application	degree may have an adapted master programme. See personalized access
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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
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Holders of a non-University 2nd cycle degree

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about [Validation of priori experience](#).

Access based on application

Access based on application : access may be granted either directly or on the condition of completing additional courses of a maximum of 60 ECTS credits, or refused.

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

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.

