

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.

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

Programme structure

The Master's degree programme consists of:

- A core curriculum (27 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

MAP2M Programme

Detailed programme by subject

CORE COURSES [27.0]

- Mandatory
- ✘ Optional
- △ Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 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
● LINMA2990	Graduation project/End of studies project <i>The graduation project can be written and presented in French or English, in consultation with the supervisor. It may be accessible to exchange students by prior agreement between the supervisors and/or the two universities.</i>		(FR) [q1+q2] [] [25 Credits] 🌐		x
● LEPL2020	Professional integration work <i>The modules of LEPL2020 course are organized over</i>				

PROFESSIONAL FOCUS [30.0]

- Mandatory
- ⊗ Optional
- △ Not offered in 2024-2025
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Year

1 2

o **Content:**

○ LINMA2171	Numerical Analysis : Approximation, Interpolation, Integration	Pierre-Antoine Absil	EN [q1] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	
○ LINMA2370	Modelling and analysis of dynamical systems	Jean-Charles Delvenne	EN [q1] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	
○ LINMA2380	Matrix computations	Raphaël Jungers	EN [q1] [30h+22.5h] [5 Credits] 🌐 > French-friendly	X	
○ LINMA2470	Stochastic modelling	Philippe Chevalier Mehdi Madani (compensates Philippe Chevalier)	EN [q2] [30h+22.5h] [5 Credits] 🌐 > French-friendly		
○ LINMA2471	Optimization models and methods II	Fran]et.664001 0 S Q q 1 0 🌐 64.696999 33.664001 cm -1 0 0 -1 0 0 cm 0 0 m			

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.

- Mandatory
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[FR]

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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- Activity with requisites
- 🌐 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)

MAJOR IN FINANCIAL MATHEMATICS

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.

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 - 🚫🌐 Not open to incoming exchange students
-

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.

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

From 15 to 30credit(s)

Year

1 2

Content:

Elective courses in biomedical engineering

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

⊗ LGBIO2010	Bioinformatics	Vincent Branders (compensates Pierre Dupont)	FR [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2020	Bioinstrumentation	André Mouraux Dounia Mulders (compensates Michel Verleysen)	ES [q2] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2030	Biomaterials	Sophie Demoustier Christine Dupont	FR [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2040	Biomechanics	Greet Kerckhofs	FR [q2] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2050	Medical Imaging	Greet Kerckhofs John Lee Benoît Macq	FR [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2060	Modelling of biological systems	Hari Teja Kalidindi (compensates Philippe Lefèvre) Laurent Opsomer (compensates Philippe Lefèvre)	FR [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X
⊗ LGBIO2072	Mathematical models in neuroscience	Frédéric Crevecoeur	FR [q1] [30h+30h] [5 Credits] 🌐 > French-friendly	X	X

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

Year

1 2

○ **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.

⌘ LACTU2010	Property and casualty insurance actuarial science	Michel Denuit	FR [q1] [45h] [7 Credits]	x1 0 0 1 81.20 7.5
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OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES
[3.0]

BUSINESS RISKS AND OPPORTUNITIES

- Mandatory
- ⊗ Optional
- △ Not offered in 2024-2025
- ⊙ Not offered in 2024-2025 but offered the following year
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- △ ⊕ Not offered in 2024-2025 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:**

Code	Course Title	Instructor	Language	Duration	Credits	Open to incoming exchange students	Year 1	Year 2
LEPL2211	Business issues introduction	Benoît Gailly	EN	[q2] [30h]	[3 Credits]	🌐	X	X
LEPL2212	Financial performance indicators	Anne-Catherine Provost	EN	[q2] [30h+5h]	[4 Credits]	🌐	X	X
LEPL2214	Law, Regulation and Legal Context	Vincent Cassiers Werner Derycke	FR	[q1] [30h+5h]	[4 Credits]	🌐	X	X

○ **One course between**

From 3 to 5 credit(s)

LEPL2210	Ethics and ICT	Axel Gosseries Olivier	EN	[q2] [30h]	[3 Credits]	🌐	X	X
LLSMS2280	Business Ethics and Compliance Management	Ca			Credits	🌐	X	X

⊗ **Cours en marketing**

MGEST1108

**MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP -
INEO**

COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

- Mandatory
 - ✘ Optional
 - △ Not offered in 2024-2025
 - ⊖ Not offered in 2024-2025 but offered the following year
 - ⊕ Offered in 2024-2025 but not the following year
 - △ ⊕ Not offered in 2024-2025 or the following year
 - Activity with requisites
- 
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OTHERS ELECTIVE COURSES

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- Mandatory
- ✘ Optional
- △ Not offered in 2024-2025
- ⊖ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 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:



Course prerequisites

MAP2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the higher education landscape and the academic organisation of courses.

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

Unless explicitly mentioned, the bachelor's, master's and licentiate degrees listed in this table or on this page are to be understood as those issued by an institution of the French, Flemish or German-speaking Community, or by the Royal Military Academy.

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

SUMMARY

- > [General access requirements](#)
- > [Specific access requirements](#)
- > [University Bachelors](#)
- > [Non university Bachelors](#)
- > [Holders of a 2nd cycle University degree](#)
- > [Holders of a non-University 2nd cycle degree](#)
- > [Access based on validation of professional experience](#)
- > [Access based on application](#)
- > [Admission and Enrolment Procedures for general registration](#)

Specific access requirements

This programme is taught in English with no prerequisite in French. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the access on the file.

University Bachelors

Diploma	
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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

