



## MAP2M - Introduction

### Introduction

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#### 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](http://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

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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.





## PROFESSIONAL FOCUS [30.0]

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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, ...)

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



**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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From 20 to 30credit(s)

Year

1 2

**Content:**

⊗ LGBIO2060	Modelling of biological systems	Hari Teja Kalidindi (compensates Philippe Lefèvre) Laurent Opsomer (compensates Philippe Lefèvre)	[q1] [30h+30h] [5 Credits] 🌐
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## MAJOR IN COMPUTATIONAL ENGINEERING

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

- Mandatory
- ✘ Optional
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- 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 24credit(s)*

## MAJOR IN DATA SCIENCE

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

*From 20 to 30credit(s)*

***MAJOR IN FINANCIAL MATHEMATICS***

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

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○ **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*



*OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES*

*[3.0]*

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## MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP - INEO

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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>.

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 accessible en anglais et ne peut être prise simultanément avec l'option « Enjeux de l'entreprise ».

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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...)

Year

1 2

### o Content:

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#### o Required courses

● LINEO2001	Théorie de l'entrepreneuriat	
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## OTHERS ELECTIVE COURSES

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- Activity with requisites
- 🌐 Open to incoming exchange students
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- [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	Caroline Klein (coord.) Mélanie Mottin (compensates Caroline Klein)	DE [q1+q2] [30h] [3 Credits] 🌐	X	X
⊗ LALLE2501	Professional development seminar-German	Caroline Klein (coord.) Mélanie Mottin (compensates Caroline Klein)	DE [q1+q2] [30h] [5 Credits] 🌐	X	X
⊗ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	ES [q1] [30h] [3 Credits] 🌐	X	X
⊗ LESPA2601					

## Course prerequisites

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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

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For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the 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 <a href="#">personalized access</a>
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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](mailto:epl-admission@uclouvain.be)).

## Admission and Enrolment Procedures for general registration

## Teaching method

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### 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 engineering) 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

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***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

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Over the years, EPL has developed over a hundred partnerships with partners in more than 36 countries (EU and non-EU) to offer exchange programmes to its students. We also offer the possibility of obtaining Double degrees, Joint Degrees or Dual Masters in several fields. The EPL is currently participating in two Erasmus Mundus programmes: [FAME](#) and [STRAINS](#).

In addition to exchange programmes under the Erasmus+ programme, numerous agreements have been established with a wide range of universities through various partner networks such as:

- [TIME](#) network (Top Industrial Managers in Europe).
- [CLUSTER](#) network
- [Magalhães](#) network
- [Circle U.](#) network through several networks and European University Alliance

So, there's no shortage of opportunities to gain an additional qualification and/or spend part of the year abroad during your two-year Master's degree! It's the perfect opportunity to discover or improve your knowledge of a foreign language, tackle subjects from a new angle and gain unique experience in Europe or the rest of the world.

If you would like more information, please visit the dedicated pages of the [EPL International Office](#) to discover all the destinations, testimonials from former students and all the procedures to follow to make these opportunities a success.



## Possible trainings at the end of the programme

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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] in Actuarial Science (UCLouvain)

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 [120] in Statistics: Biostatistics (UCLouvain)

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 [120] in Statistics: General (UCLouvain)

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 UCLouvain Master's degree programmes (generally 60) are open to UCLouvain Master's degree diploma holders. For example:

- Different Master's degree programmes (60) in management (automatic admission based on written application)
- The [Master \[60\] in Information and Communication](#) at Louvain-la-Neuve or the [Master \[60\] 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

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### 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: [Claude Oestges](#)
- Secrétaire du Jury: [Geovani Nunes Grapiglia](#)

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- Secrétariat: [Pascale Premereur](#)

