UCLouvain

MAP2M

2019 - 2020

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 other languages : **YES**
Activities on other sites : **NO**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Ecole Polytechnique de Louvain (EPL)**
Programme acronym: **map2m** - Francophone Certification Framework: 7

Table of contents

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 profil

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 futur 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.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 (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-2019-map2m-lmap220t.html]*

> Professional Focus *[en-prog-2019-map2m-lmap220s]*

Options courses

- > Majors for the Master's degree in mathematical engineering *[en-prog-2019-map2m-lmap103g.html]*
  - > Major in Optimization and operations research engineering *[en-prog-2019-map2m-lmap221o.html]*
  - > Major in Systems and control engineering *[en-prog-2019-map2m-lmap222o.html]*
  - > Major in Computational engineering *[en-prog-2019-map2m-lmap223o.html]*
  - > Major in Data science *[en-prog-2019-map2m-lmap224o.html]*
  - > Major in Financial mathematics *[en-prog-2019-map2m-lmap226o.html]*
  - > Major in Cryptography and information security *[en-prog-2019-map2m-lmap234o.html]*
  - > Major in biomedical engineering *[en-prog-2019-map2m-lmap230o.html]*
- > Majors in business creation and management *[en-prog-2019-map2m-lmap104g.html]*
  - > Major in small and medium sized business creation *[en-prog-2019-map2m-lmap232o.html]*
  - > Major in business risks and opportunities *[en-prog-2019-map2m-lmap231o.html]*
- > Elective courses *[en-prog-2019-map2m-lmap105g.html]*
  - > Elective courses available for Master students in Mathematical Engineering *[en-prog-2019-map2m-lmap229o.html]*
  - > Elective courses : Transversal skills and professional contacts *[en-prog-2019-map2m-lmap951o.html]*

MAP2M Detailled programme

Programme by subject

CORE COURSES [30.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2019-2020
⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020
Activity with requisites

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

Students may select

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

O *Societies, Cultures, Religions (2 credits)*

The students select one course between:
The student shall select

⊠ LTECO2100	Sociétés, cultures, religions : Biblical readings	Hans Ausloos	15h	2 Credits	1q	x	x
⊠ LTECO2300	Societies, cultures, religions : Ethical questions	Marcela Lobo Bustamante	15h	2 Credits	1q	x	x
⊠ LTECO2200	Societies-cultures-religions : Human Questions	Régis Burnet Dominique Martens	15h	2 Credits	1 ou 2q	x	x

PROFESSIONAL FOCUS [30.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2019-2020
⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020
Activity with requisites

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

O *Contenu:*

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

						Year 1	Year 2
LINMA2710	Scientific computing	Pierre-Antoine Absil (coord.) Karl Meerbergen (compensates Anthony Papavasiliou) Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	

OPTIONS

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

Majors for the Master's degree in mathematical engineering

> Major in Optimization and operations research engineering *[en-prog-2019-map2m-lmap221o]*
> Major in Systems and control engineering *[en-prog-2019-map2m-lmap222o]*
> Major in Computational engineering *[en-prog-2019-map2m-lmap223o]*
> Major in Data science *[en-prog-2019-map2m-lmap224o]*
> Major in Financial mathematics *[en-prog-2019-map2m-lmap226o]*
> Major in Cryptography and information security *[en-prog-2019-map2m-lmap234o]*
> Major in biomedical engineering *[en-prog-2019-map2m-lmap230o]*

Majors in business creation and management

> Major in small and medium sized business creation *[en-prog-2019-map2m-lmap232o]*
> Major in business risks and opportunities *[en-prog-2019-map2m-lmap231o]*

Elective courses

> Elective courses available for Master students in Mathematical Engineering *[en-prog-2019-map2m-lmap229o]*
> Elective courses : Transversal skills and professional contacts *[en-prog-2019-map2m-lmap951o]*

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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student shall select
De 20 à 25 CREDITS parmi

O Contenu:

						Year 1	Year 2
⊠ LINMA2415	Quantitative Energy Economics	Gauthier de Maere d'Aertrycke (compensates Anthony Papavasiliou) Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊠ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne (coord.) Julien Hendrickx	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2460	Optimization : Nonlinear programming	Yurii Nesterov	30h +22.5h	5 Credits	2q	x	x
⊠ LINMA2491	Operational Research	El-Houssaine Aghezzaf (compensates Anthony Papavasiliou) Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊠ LINMA2345	Game theory	Raphaël Jungers	30h +22.5h	5 Credits	2q	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student shall select
De 20 à 30 CREDITS parmi

O Contenu:

						Year 1	Year 2
⊠ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	1q	x	x
⊠ LINMA2300	Analysis and control of distributed parameter systems	Denis Dochain	30h+30h	5 Credits	1q	x	x
⊠ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2671	Advanced control and applications	Julien Hendrickx	30h+30h	5 Credits	1q	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	x	x
⊠ LINMA2510	Mathematical ecology	Eric Deleersnijder (coord.) Denis Dochain Emmanuel Hanert	30h +22.5h	5 Credits	2q ⊕	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student shall select
De 20 à 25 CREDITS parmi

O Contenu:

						Year 1	Year 2
⊠ LGCIV2041	Numerical analysis of civil engineering structures	Luca Sgambi	20h+15h	5 Credits	2q	x	x
⊠ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel Jean-Charles Delvenne (coord.)	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2720	Mathematical modelling of physical systems	Roland Keunings	30h +22.5h	5 Credits	2q	x	x
⊠ LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	30h+30h	5 Credits	1q	x	x
⊠ LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye Vincent Legat Jean-François Remacle	30h+30h	5 Credits	2q	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student may choose
De 20 à 30 CREDITS parmi

O Contenu:

O Compulsory courses in data science

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

⊠ Elective courses in data science

⊠ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen) Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊠ LINGI2145	Cloud Computing	Etienne Riviere	30h+15h	5 Credits	1q	x	x
⊠ LINGI2172	Databases	Siegfried Nijssen	30h+30h	6 Credits	2q	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q	x	x
⊠ LINGI2364	Mining Patterns in Data	Siegfried Nijssen	30h+15h	5 Credits	2q	x	x
⊠ LSINF2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	2q	x	x
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	1q	x	x
⊠ LSTAT2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	1q	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student shall select
De 15 à 20 CREDITS parmi

O Contenu:

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

○ Mandatory	⊠ Optional
△ Courses not taught during 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

The student shall select
De 15 à 30 CREDITS parmi

○ Contenu:

⊠ 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	2q	x	x
⊠ LINGI2144	Secured systems engineering	Axel Legay	30h+15h	5 Credits	2q	x	x
⊠ LINGI2347	Computer system security	Ramin Sadre	30h+15h	5 Credits	2q	x	x
⊠ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	2q	x	x
⊠ LMAT2440	Number theory	Olivier Pereira Jean-Pierre Tignol	30h+15h	5 Credits	1q	x	x
⊠ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x
⊠ LELEC2770	Privacy Enhancing technology	Olivier Pereira (coord.) François-Xavier Standaert	30h+30h	5 Credits	1q	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	🟨 Activity with requisites

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

The student may choose
De 15 à 30 CREDITS parmi

Year
1 2

O Contenu:

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.

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

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

⊠ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen) Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊠ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	1q	x	x

MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

In keeping with most of the Masters' degrees in civil engineering, the goal of this major is to familiarize the civil engineering 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 20 Masters (8 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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

De 20 à 25 CREDITS parmi

O Contenu:

O Required courses for the major in small and medium sized businesses

						Year 1	Year 2
O LCPME2001	Entrepreneurship Theory (in French)	Blanche Havenne (compensates Frank Janssen) Frank Janssen	30h+20h	5 Credits	1q	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	1q	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	2q		x
O LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	2q	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	1q	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	Activity with requisites

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

De 16 à 20 CREDITS parmi

O Contenu:

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

O One course between

De 3 à 5 CREDITS parmi

⊠ LFSA2202	Ethics and ICT	Axel Gosseries Olivier Pereira	30h	3 Credits	2q	x	x
⊠ LLSMS2280	Business Ethics and Compliance Management	Carlos Desmet	30h	5 Credits	1q	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.

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN MATHEMATICAL ENGINEERING

○ Mandatory	⊠ Optional
△ Courses not taught during 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	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.

○ Contenu:

⊠ Complement to the major in financial mathematics

De plus, l'étudiant qui souhaiterait s'inscrire par la suite au master en sciences actuarielles pourra valoriser tous les cours obligatoires du programme ACTU2M qu'il aura validés dans le cadre de l'option en mathématiques financières.

					Year		
					1	2	
⊠ LACTU2010	NON LIFE INSURANCE	Michel Denuit	45h	7 Credits	1q	x	x
⊠ LACTU2040	PENSION FUNDING	Sébastien de Valeriola (compensates Pierre Devolder) Pierre Devolder	30h+15h	5 Credits	2q	x	x
⊠ LACTU2210	Quantitative Risk Management	Christian Hafner	30h	5 Credits	2q	x	x

⊠ Module en biostatistique et technométrie

Les étudiants qui suivent 30 crédits dans ce module pourront réaliser en un an le Master en statistique, orientation biostatistique [120 crédits]. Plus d'informations concernant ces cours et cette passerelle peuvent être obtenues via le Secrétariat de l'Ecole en statistique, biostatistique et sciences actuarielles (LSBA): info-stat-actu@uclouvain.be

⊠ LBIRA2101	Biometry : analysis of the variance	Xavier Draye (coord.) Bernadette Govaerts	30h+15h	4 Credits	1q	x	x
⊠ LBIRC2106	Chemometrics	Bernadette Govaerts	22.5h +15h	3 Credits	1q	x	x
⊠ LSTAT2040	Statistical analysis	Benjamin Colling	30h+15h	5 Credits	2q	x	x
⊠ LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	15h+5h	4 Credits	2q	x	x
⊠ LSTAT2220	Analysis of survival and duration data	Ingrid Van Keilegom	15h+5h	4 Credits	1q	x	x
⊠ LSTAT2310	Statistical quality control.	Bernard Francq (compensates Bernadette Govaerts) Bernadette Govaerts	15h+5h	4 Credits	1q	x	x
⊠ LSTAT2330	Statistics in clinical trials.	Catherine Legrand Annie Robert	22.5h +7.5h	5 Credits	2q	x	x
⊠ LSTAT2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	1q	x	x
⊠ LSTAT2370	Data Management II : SAS ADVANCED PROGRAMMING	Christophe Kabacinski	15h+10h	6 Credits	2q	x	x

⊠ Module en statistique générale et mathématique

Les étudiants qui suivent 30 crédits dans ce module pourront réaliser en un an le Master en statistique, orientation générale [120 crédits]. Plus d'informations concernant ces cours et cette passerelle peuvent être obtenues via le Secrétariat de l'Ecole en statistique, biostatistique et sciences actuarielles (LSBA): info-stat-actu@uclouvain.be

⊠ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen) Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q	x	x
⊠ LINMA2472	Algorithms in data science	Vincent Blondel Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	x	x
⊠ LSINF2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	2q	x	x
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	1q	x	x
⊠ LSTAT2040	Statistical analysis	Benjamin Colling	30h+15h	5 Credits	2q	x	x
⊠ LSTAT2110	Data Analysis	Johan Segers	30h+7.5h	5 Credits	1q	x	x

						Year 1	2
⊠ LSTAT2120	Linear models	Christian Hafner	30h+7.5h	5 Credits	1q	x	x
⊠ LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	15h+5h	4 Credits	2q	x	x
⊠ LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	15h+5h	4 Credits	1q	x	x
⊠ LSTAT2170	Times series	Rainer von Sachs	22.5h +7.5h	5 Credits	2q	x	x
⊠ LSTAT2180	Resampling methods with applications	Eugen Pircalabelu	15h+5h	4 Credits	1q	x	x
⊠ LSTAT2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	1q	x	x

⊠ Courses of interest

⊠ LECON2021	Economic Fluctuations and Foundations of Macro Polici	David De la Croix	30h	5 Credits	2q	x	x
⊠ LECON2031	Applied Econometrics : Time Series	Vera Jotanovic	30h+12h	5 Credits	1q	x	x
⊠ LECON2033	Applied econometrics: Microeconometrics	Bertrand Verheyden (compensates Muriel Dejemeppe)	30h+12h	5 Credits	1q	x	x
⊠ LELEC1350	APPLIED ELECTROMAGNETISM	Christophe Craeye Danielle Janvier (coord.)	30h+30h	5 Credits	1q	x	x
⊠ LELEC1360	TELECOMMUNICATIONS	Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⊠ LELEC2880	Modem design	Jérôme Louveaux Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⊠ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	1q	x	x
⊠ LELEC2900	Signal processing	Laurent Jacques Benoît Macq Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⊠ LINGI1123	Computability and complexity	Yves Deville	30h+30h	5 Credits	2q	x	x
⊠ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	2q	x	x
⊠ LMAT1371	Probability Theory	Johan Segers	30h +22.5h	5 Credits	2q	x	x
⊠ LMAT2130	Partial differential equations	Heiner Olbermann	30h+15h	5 Credits	1q	x	x
⊠ LMAT2410	Partial differential equation : heat equation, brownian moves and numerical aspects	Augusto Ponce	30h+15h	5 Credits	2q	x	x
⊠ LMAT2460	Finite mathematics and combinatorial structures	Jean-Charles Delvenne Raphaël Jungers	30h	5 Credits	1q	x	x
⊠ LMECA1100	Deformable solid mechanics.	Brieux Delsaute (compensates Issam Doghri) Issam Doghri	30h+30h	5 Credits	2q	x	x
⊠ LMECA1321	Fluid mechanics and transfer phenomena.	Vincent Legat Vincent Legat (compensates Grégoire Winckelmans) Grégoire Winckelmans	30h+30h	5 Credits	2q	x	x
⊠ LMECA2141	Rheology	Vincent Legat Evelyne Van Ruymbeke	30h+30h	5 Credits	1q	x	x
⊠ LMECA2771	Thermodynamics of irreversible phenomena.	Miltiadis Papalexandris	30h+30h	5 Credits	2q	x	x
⊠ LMECA2660	Numerical methods in fluid mechanics	Laurent Bricteux (compensates Grégoire Winckelmans) Grégoire Winckelmans	30h+30h	5 Credits	2q	x	x
⊠ LMECA2732	Introduction to robotics	Renaud Ronsse	30h+30h	5 Credits	2q	x	x
⊠ LSINF1121	Algorithmics and data structures	Pierre Schaus	30h+30h	5 Credits	1q	x	x
⊠ LSTAT2100	Discrete data analysis.	Anouar El Ghouch	30h+7.5h	5 Credits	2q	x	x
⊠ LSTAT2350	Data Mining	Tim Verdonck	15h+15h	5 Credits	2q	x	x

						Year 1	2
⊠ LGCIV2056	Marine Hydrodynamics	Michel Crucifix (compensates Eric Deleersnijder) Eric Deleersnijder François Massonnet (compensates Eric Deleersnijder)	30h+15h	5 Credits	1q	x	x

ELECTIVE COURSES : TRANSVERSAL SKILLS AND PROFESSIONAL CONTACTS

○ Mandatory	⊠ Optional
△ Courses not taught during 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	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.

○ Contenu:

○ 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	1 + 2q	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	1 + 2q	x	x
⊠ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil Nikolaos Deligiannis (compensates Anthony Papavasiliou) Yurii Nesterov Anthony Papavasiliou (coord.)	30h +22.5h	5 Credits		x	x

⊠ Communication

Max=8 CREDITS parmi

⊠ 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 Ann Rinder (coord.)	30h	3 Credits	1 + 2q	x	x
⊠ LALLE2501	Professional development seminar-German	Caroline Klein Ann Rinder (coord.)	30h	5 Credits	1 + 2q	x	x
⊠ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.) Alicia Maria Tirado Fernandez (compensates Paula Lorente Fernandez)	30h	3 Credits	1q	x	x
⊠ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.) Alicia Maria Tirado Fernandez (compensates Paula Lorente Fernandez)	30h	5 Credits	1q	x	x
⊠ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.) Marie-Laurence Lambrecht	30h	3 Credits	1 ou 2q	x	x
⊠ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.)	30h	3 Credits	1 ou 2q	x	x

⊠ Group dynamics

						Year 1	2
⊠ LEPL2351	Dynamique des groupes - Q1	Christine Jacqmot Benoît Raucent Vincent Wertz (coord.)	15h+30h	3 Credits	1q	x	x
⊠ LEPL2352	Dynamique des groupes - Q2	Christine Jacqmot Benoît Raucent Vincent Wertz (coord.)	15h+30h	3 Credits	2q	x	x

⊠ Other non-disciplinary courses

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

Course prerequisites

A document entitled (nb: not available for this programme map2m) specifies the activities (course units - CU) with one or more pre-requisite(s) within the study programme, that is the CU whose learning outcomes must have been certified and for which the credits must have been granted by the jury before the student is authorised to sign up for that activity.

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

As the prerequisites are a requirement of enrolment, there are none within a year of a course.

The prerequisites are defined for the CUs for different years and therefore influence the order in which the student can enrol in the programme's CUs.

In addition, when the panel validates a student's individual programme at the beginning of the year, it ensures the consistency of the individual programme:

- It can change a prerequisite into a corequisite within a single year (to allow studies to be continued with an adequate annual load);
- It can require the student to combine enrolment in two separate CUs it considers necessary for educational purposes.

For more information, please consult regulation of studies and exams (https://uclouvain.be/fr/decouvrir/rgee.html).

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?"*

MAP2M - Information

Admission

General (https://uclouvain.be/en/study/inscriptions/admission-requirements-master-s-degree.html) 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 suppossed 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 personalized access.

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 additional 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	Based on application: accepted, conditional on further training, or refusal	See personalized access

Non university Bachelors

> Find out more about links (https://uclouvain.be/fr/etudier/passerelles) 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 (https://uclouvain.be/fr/etudier/vae)

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 (https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html)

Selection criteria are summarized here.

Admission and Enrolment Procedures for general registration

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 (https://uclouvain.be/fr/decouvrir/rgee.html). 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

Attention, you are currently reading an archived page: below contact informations were for program study 2019-2020 only. To get current contact informations please got to current program study site.

Curriculum Management

Entity

Structure entity	SST/EPL/MAP
Denomination	(MAP) (https://uclouvain.be/repertoires/entites/map)
Faculty	Louvain School of Engineering (EPL) (https://uclouvain.be/repertoires/entites/epl)
Sector	Sciences and Technology (SST) (https://uclouvain.be/repertoires/entites/sst)
Acronym	MAP
Postal address	Avenue Georges Lemaître 4-6 - bte L4.05.01 1348 Louvain-la-Neuve Tel: +32 (0) 10 47 25 97 - Fax: +32 (0) 10 47 21 80

Academic supervisor: Julien Hendrickx

Jury

- Jean-Didier Legat
- Jean-Charles Delvenne

Useful Contact(s)

- Pascale Premereur

Attention, you are currently reading an archived page: below contact informations were for program study 2019-2020 only. To get current contact informations please got to current program study site.