

MAP2M

2014 - 2015

Master [120] in Mathematical Engineering**At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In french**Dissertation/Graduation Project : **YES** - Internship : **optional**Activities in English: **optional** - Activities in other languages : **NO**Activities on other sites : **NO**Organized by: **Ecole Polytechnique de Louvain (EPL)**Programme code: **map2m** - European Qualifications Framework (EQF): 7**Table of contents**

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MAP2M - Introduction

Introduction

MAP2M - Teaching profile

Learning outcomes

The Applied Mathematics degree will provide students with the competencies and expertise required in mathematical engineering. They will 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. Throughout their training, students will acquire both the theoretical and methodological tools which will be implemented in all fields of engineering, as well as in other walks of life in society, such as economics, environmental sciences or life sciences. The Master's degree in Applied mathematics engineering is characterized by its great flexibility in setting up students' curriculum: half of the latter will be made up of elective courses. In particular, students are offered a wide spectrum of eleven coherent course modules (called « options »), some of these focussing on basic disciplines of applied mathematics (Optimization and operations research, Systems and control, Discrete mathematics and computer science), others relating to associated application fields (Financial mathematics, Information and signal processing, Biomedical engineering, Modelling and simulation of physical phenomena, Statistics), the remainder pertaining more specifically to the world of economics (Management, Economics and econometrics, Launching of small and medium-sized companies).

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

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

- 1.1 Identifier et mettre en oeuvre les concepts, lois, raisonnements applicables à une problématique donnée
- 1.2 Identifier et utiliser les outils de modélisation et de calcul adéquats pour résoudre cette problématique
- 1.3 Vérifier la vraisemblance et confirmer la validité des résultats obtenus au regard de la nature du problème posé

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

- 2.1 Analyser le problème à résoudre ou le besoin fonctionnel à rencontrer et formuler le cahier des charges correspondant
- 2.2 Modéliser le problème et concevoir une ou plusieurs solutions techniques originales répondant à ce cahier des charges
- 2.3 Evaluer et classer les solutions au regard de l'ensemble des critères figurant dans le cahier des charges : efficacité, faisabilité, qualité, ergonomie et sécurité dans l'environnement
- 2.4 Implémenter et tester une solution sous la forme d'une maquette, d'un prototype et/ou d'un modèle numérique
- 2.5 Formuler des recommandations pour améliorer le caractère opérationnel de la solution étudiée

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

- 3.1 Se documenter et résumer l'état des connaissances actuelles dans le domaine considéré
- 3.2 Proposer une modélisation et/ou un dispositif expérimental permettant de simuler et de tester des hypothèses relatives au phénomène étudié
- 3.3 Mettre en forme un rapport de synthèse visant à expliciter les potentialités d'innovation théoriques et/ou techniques résultant de ce travail de recherche

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

- 4.1 Cadrer et expliciter les objectifs d'un projet (en y associant des indicateurs de performance) compte tenu des enjeux et des contraintes (ressources, budget, échéance,...) qui caractérisent l'environnement du projet
- 4.2 S'engager collectivement sur un plan de travail, un échéancier et des rôles à tenir
- 4.3 Fonctionner dans un environnement pluridisciplinaire, conjointement avec d'autres acteurs porteurs de différents points de vue : gérer des points de désaccord ou des conflits
- 4.4 Prendre des décisions en équipe lorsqu'il y a des choix à faire: que ce soit sur les solutions techniques ou sur l'organisation du travail pour faire aboutir le projet

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

- 5.1 Identifier clairement les besoins du "client" ou de l'utilisateur : questionner, écouter et comprendre toutes les dimensions de sa demande et pas seulement sur les aspects techniques
- 5.2 Argumenter et convaincre en s'adaptant au langage de ses interlocuteurs : techniciens, collègues, clients, supérieurs hiérarchiques
- 5.3 Communiquer sous forme graphique et schématique; interpréter un schéma, présenter les résultats d'un travail, structurer des informations
- 5.4 Lire, analyser et exploiter des documents techniques (normes, plans, cahier de charge,...)
- 5.5 Rédiger des documents écrits en tenant compte des exigences contextuelles et des conventions sociales en la matière
- 5.6 Faire un exposé oral convaincant en utilisant les techniques modernes de communication

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

- 6.1 Appliquer les normes en vigueur dans sa discipline (terminologie, unités de mesure, normes de qualité et de sécurité,...)
- 6.2 Trouver des solutions qui vont au-delà des enjeux strictement techniques, en intégrant les enjeux de développement durable et la dimension éthique d'un projet
- 6.3 Faire preuve d'esprit critique vis-à-vis d'une solution technique pour en vérifier la robustesse et minimiser les risques qu'elle présente au regard du contexte de sa mise en oeuvre
- 6.4 S'autoévaluer et développer de manière autonome les connaissances nécessaires pour rester compétent dans son domaine (lifelong learning)

Programme structure

The Master's curriculum in Applied mathematics engineering will consist of at least 120 credits covering two years, with a minimum of 60 credits per year, and comprising :

- a fixed set of 60 credits, consisting of a 30-credit core curriculum and a 30-credit specialization module;
- a flexible set of 60 credits, made up of elective courses and possibly one or more « options » (15 to 30 credits apiece) chosen amongst the eleven available options : Optimization and operations research, Systems and control, Discrete mathematics and computer science, Information and signal processing, Biomedical engineering, Modelling and simulation of physical phenomena, Management, Economics and econometrics, Launching of small and medium-sized companies, Financial mathematics, Statistics.

The final thesis is generally written during the last year. However, students may choose to take any given course in the first or second year, subject to possible prerequisites. This will be the case in particular for students pursuing part of their education abroad.

If, in the course of his (her) former curriculum, a student has already been credited with a subject included in the compulsory core curriculum, or any training deemed equivalent, this subject will be replaced by any recommended elective course of the Applied mathematics curriculum, within the imposed constraints. The student is responsible for checking whether the minimum total number of credits has been reached, as well as those of the specialized field, which will appear on the final diploma.

The student's curriculum will be scrutinized for acceptance by the Mechanical engineering diploma committee.

Whatever the focus or the options chosen, the programme of this master shall totalize 120 credits, spread over two years of studies each of 60 credits.

[> core curriculum](#) [en-prog-2014-map2m-lmap220t.html]

[> Professional focus](#) [en-prog-2014-map2m-lmap220s]

[Options courses](#)

- > [Options du master ingénieur civil en mathématiques appliquées](#) [en-prog-2014-map2m-lmap902r.html]
- > [Option in optimization and operations research](#) [en-prog-2014-map2m-lmap221o.html]
- > [Control and dynamical systems](#) [en-prog-2014-map2m-lmap222o.html]
- > [Discrete mathematics and computer science](#) [en-prog-2014-map2m-lmap223o.html]
- > [Financial mathematics](#) [en-prog-2014-map2m-lmap226o.html]
- > [Information and signal processing](#) [en-prog-2014-map2m-lmap233o.html]
- > [Option in biomedical engineering](#) [en-prog-2014-map2m-lmap230o.html]
- > [option : Cryptography & Information Security](#) [en-prog-2014-map2m-lmap234o.html]
- > [Modeling and simulation of physical systems](#) [en-prog-2014-map2m-lmap224o.html]
- > [Statistics](#) [en-prog-2014-map2m-lmap227o.html]
- > [Business risks and opportunities](#) [en-prog-2014-map2m-lmap231o.html]
- > [Economics and econometrics](#) [en-prog-2014-map2m-lmap225o.html]
- > [Option in launching of small and medium-sized companies](#) [en-prog-2014-map2m-lmap232o.html]
- > [Elective courses accessible to master's student in applied mathematics engineering](#) [en-prog-2014-map2m-lmap229o.html]

MAP2M Detailed programme

Programme by subject

CORE COURSES [30.0]

- Mandatory
 Courses not taught during 2014-2015
 Periodic courses taught during 2014-2015
- Optional
 Periodic courses not taught during 2014-2015
 Two years course

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

The student shall select

						Year	
						1	2
<input checked="" type="radio"/> LINMA2990	Graduation project/End of studies project	N.		28 Credits			x

Religion courses for student in exact sciences

The student shall select 2 credits from amongst

The student shall select

<input checked="" type="radio"/> LTECO2100	Questions of religious sciences: Biblical readings	Hans Ausloos	15h	2 Credits	1q	x	x
<input checked="" type="radio"/> LTECO2200	Questions of religious sciences: reflections about Christian faith	Dominique Martens	15h	2 Credits	2q	x	x
<input checked="" type="radio"/> LTECO2300	Questions of religious sciences: questions about ethics	Philippe Cochinaux	15h	2 Credits	1q	x	x

PROFESSIONAL FOCUS [30.0]

- Mandatory
 Courses not taught during 2014-2015
 Periodic courses taught during 2014-2015
- Optional
 Periodic courses not taught during 2014-2015
 Two years course

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

						Year	
						1	2
<input checked="" type="radio"/> LINMA2171	Numerical Analysis : Approximation, Interpolation, Integration	Pierre-Antoine Absil	30h +22.5h	5 Credits	1q	x	
<input checked="" type="radio"/> LINMA2370	Modelling and analysis of dynamical systems	Jean-Charles Delvenne, Denis Dochain (coord.)	30h +22.5h	5 Credits	1q	x	
<input checked="" type="radio"/> LINMA2380	Matrix theory	Paul Van Dooren	30h +22.5h	5 Credits	1q	x	
<input checked="" type="radio"/> LINMA2470	Discrete stochastic models	Philippe Chevalier	30h +22.5h	5 Credits	2q	x	
<input checked="" type="radio"/> LINMA2471	Optimization models and methods	François Glineur	30h +22.5h	5 Credits	1q	x	

Cours au choix de la finalité spécialisée du master en Mathématiques Appliquées (5 credits)

L'étudiant complète son programme en choisissant un des deux cours suivants. S'il les a déjà suivis au cours de son parcours académique antérieur, il choisit un autre cours de 5 crédits du master ingénieur civil en mathématiques appliquées.

<input checked="" type="radio"/> LINMA1510	Linear Control	Denis Dochain	30h+30h	5 Credits	2q	x	x
<input checked="" type="radio"/> LINMA1731	Stochastic processes : Estimation and prediction	Pierre-Antoine Absil, Luc Vandendorpe (coord.)	30h+30h	5 Credits	2q	x	x

OPTIONS

L'étudiant complète son programme avec des options et/ou des cours au choix. Il sélectionne 60 crédits parmi ce qui suit.

Options du master ingénieur civil en mathématiques appliquées

- > [Option in optimization and operations research](#) [en-prog-2014-map2m-lmap221o]
- > [Control and dynamical systems](#) [en-prog-2014-map2m-lmap222o]
- > [Discrete mathematics and computer science](#) [en-prog-2014-map2m-lmap223o]
- > [Financial mathematics](#) [en-prog-2014-map2m-lmap226o]
- > [Information and signal processing](#) [en-prog-2014-map2m-lmap233o]
- > [Option in biomedical engineering](#) [en-prog-2014-map2m-lmap230o]
- > [option : Cryptography & Information Security](#) [en-prog-2014-map2m-lmap234o]
- > [Modeling and simulation of physical systems](#) [en-prog-2014-map2m-lmap224o]
- > [Statistics](#) [en-prog-2014-map2m-lmap227o]
- > [Business risks and opportunities](#) [en-prog-2014-map2m-lmap231o]
- > [Economics and econometrics](#) [en-prog-2014-map2m-lmap225o]
- > [Option in launching of small and medium-sized companies](#) [en-prog-2014-map2m-lmap232o]
- > [Elective courses accessible to master's student in applied mathematics engineering](#) [en-prog-2014-map2m-lmap229o]

OPTIONS DU MASTER INGÉNIEUR CIVIL EN MATHÉMATIQUES APPLIQUÉES

L'étudiant sélectionne une ou plusieurs options parmi les suivantes.

OPTION IN OPTIMALIZATION AND OPERATIONS RESEARCH

Cette option a pour objectif d'introduire l'étudiant à certaines méthodes et concepts avancés en optimisation (utilisation de variables entières ou de fonctions non-linéaires, caractère stochastique) et à le familiariser avec certains de leurs domaines d'application, parmi lesquels la recherche opérationnelle (méthodologie quantitative d'aide à la prise de décisions).

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

‡ Two years course

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

The student shall select

De 15 à 30 credits parmi

Year

1 2

						1	2
⊗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil , François Glineur (coord.), Yurii Nesterov , Paul Van Dooren	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2415	Quantitative Energy Economics	Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne	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	Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2345	Game theory	Raphaël Jungers	30h +22.5h	5 Credits	2q	x	x

CONTROL AND DYNAMICAL SYSTEMS

Cette option a pour objectif de familiariser l'étudiant avec certains concepts avancés en automatique et théorie des systèmes dynamiques, parmi lesquels l'identification des systèmes dynamiques, la synthèse des lois de commande et la mise en oeuvre de la régulation numérique, la modélisation et l'analyse des phénomènes dynamiques non linéaires.

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

The student shall select
De 15 à 30 crédits parmi

Year

1 2

⊗ Cours conseillés en automatique et systèmes dynamiques

L'étudiant sélectionne au minimum 10 crédits parmi

⊗ LINMA2120	Applied mathematics research seminar	Pierre-Antoine Absil, Vincent Blondel, Philippe Chevalier, Jean-Charles Delvenne (coord.), François Glineur, Julien Hendrickx, Raphaël Jungers, Philippe Lefèvre, Yurii Nesterov, Paul Van Dooren, Mathieu Van Vyve	30h	3 Credits			X	X
⊗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil, François Glineur (coord.), Yurii Nesterov, Paul Van Dooren	30h +22.5h	5 Credits	2q		X	X
⊗ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	1q		X	X
⊗ LINMA2671	Automatic : Theory and implementation	Julien Hendrickx	30h+30h	5 Credits	1q		X	X
⊗ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q		X	X

⊗ Cours d'intérêt en automatique et systèmes dynamiques

⊗ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen), Michel Verleysen	30h+30h	5 Credits	1q		X	X
⊗ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	1q		X	X
⊗ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q		X	X
⊗ LMAPR2510	Mathematical ecology	Eric Deleersnijder, Emmanuel Hanert, Thierry Van Effelterre	30h +22.5h	5 Credits	2q		X	X
⊗ LMECA2732	Introduction to robotics	Renaud Ronsse	30h+30h	5 Credits	2q		X	X

DISCRETE MATHEMATICS AND COMPUTER SCIENCE

Cette option a pour objectif de familiariser l'étudiant avec certains concepts avancés des mathématiques discrètes tels que l'analyse d'algorithmes (complexité), le calcul numérique, les problèmes combinatoires ainsi qu'avec les outils informatiques spécifiques au domaine des mathématiques appliquées.

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

*The student shall select
De 15 à 30 credits parmi*

						Year	
						1	2
⊗ LINGI1123	Computability and complexity	Yves Deville	30h+30h	5 Credits	2q	x	x
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2472	Advanced topics in discrete mathematics	Vincent Blondel (coord.), Jean-Charles Delvenne, Gautier Krings (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2710	Numerical algorithms	Paul Van Dooren	30h +22.5h	5 Credits	2q	x	x
⊗ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x
⊗ LMAT2460	Finite mathematics and combinatorial structures	Jean-Charles Delvenne, Jean-Pierre Tignol	30h	5 Credits	1q	x	x
⊗ LSINF1121	Algorithmics and data structures	Pierre Dupont, Virginie Van den Schrieck (compensates Pierre Dupont)	30h+30h	5 Credits	1q	x	x

FINANCIAL MATHEMATICS

L'objectif de cette option est d'initier l'étudiant aux techniques de la finance quantitative et des sciences actuarielles en présentant les méthodes mathématiques déterministes et stochastiques modernes de la finance de marché. Les principaux sujets abordés concernent l'évaluation en temps continu des actifs financiers et des produits d'assurance. Une attention toute particulière sera donnée aux méthodes numériques de simulation.

De plus, l'étudiant qui suivra INMA2725, ACTU2020, ACTU2030, ACTU2070 et au moins 15 crédits au sein du module complémentaire en mathématiques financières (voir la rubrique "cours au choix") dans le cadre de ses cours au choix bénéficiera d'un accès direct à la seconde année du [Master 120 en sciences actuarielles](#).

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

‡ Two years course

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

The student shall select

De 15 à 20 credits parmi

						Year	
						1	2
⊗ LINMA2725	Financial mathematics	Pierre Devolder	30h +22.5h	5 Credits	1q	x	x
⊗ LACTU2020	Fixed income mathematics	Pierre Devolder	30h+15h	5 Credits	1q	x	x
⊗ LACTU2030	LIFE INSURANCE 1	Michel Denuit, Françoise Gilles (compensates Michel Denuit), Françoise Gilles	30h+15h	5 Credits	1q	x	x
⊗ LACTU2070	STOCHASTIC FINANCE 1	Pierre Devolder	30h	5 Credits	2q	x	x

INFORMATION AND SIGNAL PROCESSING

Commune aux masters ingénieur civil électricien, électromécanicien et en mathématiques appliquées, cette option a pour objectif de fournir aux étudiants de nouveaux outils liés aux graphes, aux mathématiques discrètes, aux matrices et à l'optimisation; il pourra utiliser ces outils par exemple dans des problèmes de communications, d'analyse et de reconnaissance de données et de signal, de cryptographie et d'identification des systèmes.

○ Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

*The student shall select
De 15 à 30 credits parmi*

Year

1 2

○ Cours préalable en traitement de l'information et du signal

Les étudiants qui n'ont pas suivi LINMA 1510 ou un équivalent au cours de leur parcours antérieur doivent l'inclure dans leur programme d'option. Dans ce cas le minimum de crédits requis par l'option passe à 20 crédits

○ LINMA1510	Linear Control	Denis Dochain	30h+30h	5 Credits	2q	X	X
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○ Cours obligatoires (ELEC/ELME) / conseillés (MAP) en traitement du signal

○ LINGI2348	Information theory and coding	Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira	30h+15h	5 Credits	2q	X	X
○ 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 (compensates Christophe De Vleeschouwer), Benoît Macq	30h+30h	5 Credits	1q	X	X

⊗ Cours au choix en traitement du signal

⊗ LELEC2880	Modem design	Jérôme Louveaux, Luc Vandendorpe	30h+30h	5 Credits	2q	X	X
⊗ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q	X	X
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	2q	X	X
⊗ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	X	X
⊗ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	X	X

⊗ Cours au choix exclusivement pour les étudiants du master ELEC/ELME

⊗ LINMA1691	Discrete mathematics - Graph theory and algorithms	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	X	X
⊗ LINMA1702	Applied mathematics : Optimization I	Vincent Blondel, François Glineur (compensates Vincent Blondel), François Glineur (coord.)	30h +22.5h	5 Credits	2q	X	X
⊗ LINMA2380	Matrix theory	Paul Van Dooren	30h +22.5h	5 Credits	1q	X	X

Year

1 2

⌘ Cours au choix uniquement pour les étudiants du master MAP

⌘ LELEC1360	TELECOMMUNICATIONS	Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⌘ LELEC2900	Signal processing	Benoît Macq, Luc Vandendorpe	30h+30h	5 Credits	2q	x	x

OPTION IN BIOMEDICAL ENGINEERING

Commune à la plupart des masters ingénieur civil, cette option a pour objectif d'assurer la formation d'ingénieurs capables de répondre aux défis technologiques futurs dans les domaines scientifiques et techniques liés au génie biomédical. Cette option procurera aux étudiants des connaissances de base dans plusieurs domaines du génie biomédical comme la bioinstrumentation, les biomatériaux, l'imagerie médicale, la modélisation mathématique, les organes artificiels et la réhabilitation, la biomécanique. Par la collaboration entre l'Ecole polytechnique de Louvain et la Faculté de médecine, la formation dispensée vise à développer chez les étudiants une formation interdisciplinaire où l'art de l'ingénieur s'applique au domaine biomédical, à la fois complexe et varié.

○ Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

⊞ Two years course

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

*The student shall select
De 15 à 30 credits parmi*

Year

1 2

○ Compulsory courses in biomedical engineering

Students who have chosen this option shall select at least 15 credits from amongst the following compulsory courses, except engineering Master's students in computer science who shall take 20 credits.

⊗ LGBIO2010	Bioinformatics	Pierre Dupont, Michel Ghislain	30h+30h	5 Credits	2q	x	x
⊗ LGBIO2020	Bioinstrumentation	André Mouraux, Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2030	Biomaterials	Sophie Demoustier, Christine Dupont, Gaétane Leloup	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2040	Biomechanics	François Henrotte (compensates Emilie Marchandise), Emilie Marchandise	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
⊗ LGBIO2070	Artificial organs and rehabilitation	Luc-Marie Jacquet, Philippe Lefèvre, Renaud Ronsse	30h+30h	5 Credits	2q	x	x

⊗ Elective courses in biomedical engineering for ELEC students

⊗ 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 (compensates Christophe De Vleeschouwer), Benoît Macq	30h+30h	5 Credits	1q	x	x

OPTION : CRYPTOGRAPHY & INFORMATION SECURITY

Commune aux masters ingénieur civil en électricité, en informatique et en mathématiques appliquées, cette option fournit les compétences permettant d'aborder les questions de sécurité de l'information tant du point de vue de leurs fondements algorithmiques et mathématiques, que de la conception et de la mise en oeuvre de solutions dans le contexte de circuits électroniques et de systèmes informatiques.

○ Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

The student shall select
De 15 à 30 credits parmi

Year

1 2

○ Cours obligatoires ELEC, INFO et MAP

Code	Titre	Enseignant	Volume	Credits	Semestre	1	2
○ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x
○ LINGI2347	Computer system security	Gildas Avoine, Marco Canini (compensates Gildas Avoine)	30h+15h	5 Credits	2q	x	x
○ LELEC2760	Secure electronic circuits and systems	François- Xavier Standaert	30h+30h	5 Credits	2q	x	x

⊗ Cours au choix ELEC, INFO et MAP

Pour être validés dans l'option, ces cours nécessitent la validation préalable des cours LELEC 2760, LINGI 2347 et LMAT 2450

⊗ LINGI2144	Secured systems engineering	Gildas Avoine	30h+15h	5 Credits	1q	x	x
⊗ LINGI2348	Information theory and coding	Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira	30h+15h	5 Credits	2q	x	x
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	2q	x	x
⊗ LELEC2620	Modeling and implementation of analog and mixed analog/digital circuits and systems on chip	David Bol	30h+30h	5 Credits	2q	x	x
⊗ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen), Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊗ LMAT2440	Number theory	Olivier Pereira, Jean-Pierre Tignol	30h+15h	5 Credits	1q	x	x

⊗ Cours au choix ELEC et MAP

Pour être validé dans l'option, ce cours nécessite la validation préalable des cours LELEC2760, LINGI 2347 et LMAT 2450

⊗ LINGI1341	Computer networks: information transfer	Olivier Bonaventure	30h+30h	6 Credits	1q	x	x
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MODELING AND SIMULATION OF PHYSICAL SYSTEMS

Cette option a pour objectif de familiariser l'étudiant avec la modélisation des phénomènes physiques, notamment dans le domaine de la mécanique des milieux continus (fluides, écoulements, transferts, solides déformables) et de l'électromagnétisme, ainsi qu'avec les méthodes et outils informatiques de simulation numérique correspondants.

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

*The student shall select
De 15 à 30 credits parmi*

						Year	
						1	2
⊗ LELEC1350	APPLIED ELECTROMAGNETISM	Christophe Craeye, Danielle Janvier	30h+30h	5 Credits	1q	x	x
⊗ LMAPR2510	Mathematical ecology	Eric Deleersnijder, Emmanuel Hanert, Thierry Van Effelterre	30h +22.5h	5 Credits	2q	x	x
⊗ LMAT2130	Partial differential equations : Poisson and Laplace equations	Augusto Ponce, Jean Van Schaftingen	30h+30h	5 Credits	1q	x	x
⊗ LMAT2410	Partial differential equation : heat equation, brownian moves and numerical aspects	Augusto Ponce, Jean Van Schaftingen	30h+15h	5 Credits	2q	x	x
⊗ LMECA1100	Deformable solid mechanics.	Issam Doghri	30h+30h	5 Credits	2q	x	x
⊗ LMECA1321	Fluid mechanics and transfer phenomena.	Vincent Legat, Grégoire Winckelmans	30h+30h	5 Credits	2q	x	x
⊗ LMECA1120	Introduction to finite element methods.	Vincent Legat	30h+30h	5 Credits	2q	x	x
⊗ LMECA2131	Introduction to nonlinear solid mechanics.	Issam Doghri	30h+30h	5 Credits	2q	x	x
⊗ LMECA2141	Rheology.	Vincent Legat, Evelyne Van Ruymbeke	30h+30h	5 Credits	1q	x	x
⊗ LMECA2660	Numerical methods in fluid mechanics.	Grégoire Winckelmans	30h+30h	5 Credits	2q	x	x
⊗ LPHY1352A	Physique des fluides	N.	22.5h +7.5h	4 Credits		x	x
⊗ LINMA2720	Mathematical modelling of physical systems	Roland Keunings	30h +22.5h	5 Credits	2q	x	x

STATISTICS

Cette option permet à l'étudiant d'acquérir les concepts fondamentaux des probabilités et de la statistique mathématique et lui propose une formation aux principaux outils utiles dans la plupart des domaines d'applications de la statistique.

De plus, les étudiants qui suivent 25 crédits dans cette option bénéficieront d'un accès direct à la seconde année du [Master 120 en statistiques](#) (finalité spécialisée ou approfondie).

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

⊞ Two years course

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

The student shall select

De 15 à 30 credits parmi

						Year	
						1	2
⊗ LMAT1371	Probability	Jan Johannes, Johan Segers, Johan Segers (compensates Jan Johannes)	30h +22.5h	5 Credits	2q	x	x
⊗ LSTAT2020	Statistical computing	Céline Bugli	20h+20h	5 Credits	1q	x	x
⊗ LSTAT2040	Statistical analysis	Anouar El Ghouch, Ingrid Van Keilegom	30h+15h	4 Credits	2q	x	x
⊗ LSTAT2100	Discrete data analysis.	Patrick Bogaert, Anouar El Ghouch	22.5h +7.5h	4 Credits	2q	x	x
⊗ LSTAT2110	Data Analysis	Christian Hafner, Johan Segers	22.5h +7.5h	4 Credits	1q	x	x
⊗ LSTAT2120	Linear models	Christian Hafner	22.5h +7.5h	4 Credits	1q	x	x
⊗ LSTAT2130	Introduction to Bayesian statistics.	Philippe Lambert	15h+5h	3 Credits	2q	x	x
⊗ LSTAT2170	Times series	Rainer von Sachs	22.5h +7.5h	4 Credits	2q	x	x
⊗ LSTAT2320	Design of experiment.	Patrick Bogaert, Bernadette Govaerts	22.5h +7.5h	4 Credits	2q	x	x
⊗ LSTAT2350	Data Mining	Libei Chen	15h+15h	4 Credits	2q	x	x

BUSINESS RISKS AND OPPORTUNITIES

Commune à la plupart des masters ingénieur civil, cette option a pour objectif de familiariser l'étudiant avec les principes de base de la gestion des entreprises.

Les étudiants peuvent être dispensés de certains de ces cours sur base d'activités jugées équivalentes pour lesquelles ils ont obtenu des crédits dans le cadre de leur formation antérieure. Les cours dont les étudiants sont dispensés sont remplacés par des cours approfondis du tronc commun du master ingénieur de gestion et/ou un projet technologique en commun avec des étudiants de la LSM.

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

‡ Two years course

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

De 16 à 20 credits parmi

						Year	
						1	2
⊗ LFSA2140	Elements of law for industry and research	Fernand De Visscher , Werner Derijcke , Bénédicte Inghels	30h	3 Credits	1q	x	x
⊗ LFSA2230	Introduction to management and to business economics	Benoît Gailly	30h+15h	4 Credits	2q	x	x
⊗ LFSA1290	Introduction to financial and accounting management	Thomas Lambert (compensates Gerrit Sarens), Gerrit Sarens	30h+15h	4 Credits	2q	x	x
⊗ LFSA2202	Ethics and ICT	Maxime Lambrecht , Olivier Pereira	30h	3 Credits	2q	x	x
⊗ LFSA2245	Environment and Business	Thierry Bréchet	30h	3 Credits	1q	x	x
⊗ LFSA2210	Organisation and human resources	John Cultiaux	30h	3 Credits	1q	x	x

⊗ Alternative to the "Business risks and opportunities" for computer science students

Computer science students who have already followed various courses of this discipline during their Bachelor's curriculum can select between 16 and 20 credits in the program "mineure en gestion pour les sciences informatiques" <http://www.uclouvain.be/xprog-2013-min-lgesc100i>

ECONOMICS AND ECONOMETRICS

L'objectif de cette option est de former des universitaires capables de comprendre et d'analyser les questions économiques et sociales concrètes de leur temps, qu'elles soient de nature « microéconomique » (stratégies d'entreprises, problèmes de concurrence, etc.) ou « macroéconomique » (croissance, inégalités, taux de change et politique monétaire, etc.). Les cours de cette option permettent de comprendre et utiliser les concepts et outils fondamentaux de l'analyse économique, ainsi que les méthodes quantitatives qui y sont associées, en particulier l'économétrie. Ils donnent les bases nécessaires pour une éventuelle spécialisation en économie.

De plus, l'étudiant qui suivra INMA2415, ECON2011 ECON2021, au moins un cours parmi la paire ECON2031/ECON2033 et au moins 15 crédits au sein du module complémentaire en économie et économétrie (voir la rubrique "cours au choix") dans le cadre de ses cours au choix bénéficiera d'un accès direct à la seconde année du [Master 120 en sciences économiques, orientation générale](#) (finalité spécialisée ou approfondie).

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

⊞ Two years course

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

The student shall select

De 15 à 25 credits parmi

						Year	
						1	2
⊗ LECON2011	Interdependencies and Strategic Behavior	N.	30h+12h	5 Credits	2q	x	x
⊗ LECON2021	Economic Fluctuations and Foundations of Macro Polici	David De la Croix, Jean-François Fagnart (compensates David De la Croix)	30h	5 Credits	2q	x	x
⊗ LECON2031	Applied Econometrics : Time Series	Zhengyuan Gao	30h+12h	5 Credits	1q	x	x
⊗ LECON2033	Applied econometrics: Microeconometrics	Muriel Dejemepe	30h+12h	5 Credits	1q	x	x
⊗ LINMA2415	Quantitative Energy Economics	Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x

OPTION IN LAUNCHING OF SMALL AND MEDIUM-SIZED COMPANIES

Commune à la plupart des masters ingénieur civil, cette option a pour objectif de familiariser l'étudiant ingénieur civil avec les spécificités des P.M.E., de l'entrepreneuriat et de la création afin de développer chez lui les aptitudes, connaissances et outils nécessaires à la création d'entreprise. L'accès en est réservé uniquement à un nombre restreint d'étudiants sélectionnés sur base d'un dossier de motivation et d'interviews individuelles.

Les dossiers de motivation pour cette filière doivent être introduits avant la rentrée académique de Master1 auprès du :

Secrétariat CPME - Place des Doyens 1
1348 Louvain-la-Neuve (tél 010/47 84 59).

Les étudiants sélectionnés remplaceront le mémoire prévu dans le tronc commun par un mémoire spécifique en création d'entreprise (nombre de crédits inchangé).

○ Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊖ Periodic courses not taught during 2014-2015

‡ Two years course

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

De 20 à 25 credits parmi

Year

1 2

○ Compulsory courses

○ LCPME2001	Entrepreneurship Theory (in French)	Frank Janssen	30h+20h	5 Credits	1q	x	
○ LCPME2003	Business plan of the creation of a company (in French)	Frank Janssen	30h+15h	5 Credits	2q		x
○ LCPME2002	Managerial, legal and economic aspects of the creation of a company (in French)	Régis Coeurderoy, Yves De Cordt	30h+15h	5 Credits	1q	x	x
○ LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	2q	x	x

⊗ Prerequisite CPME course

Students who have not taken a management course within their former curriculum shall include LCPME2000 in their current curriculum.

○ LCPME2000	Venture creation financing and management I	Régis Coeurderoy, Olivier Giacomini, Paul Vanzeveren	30h+15h	5 Credits	1 + 2q	x	
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ELECTIVE COURSES ACCESSIBLE TO MASTER'S STUDENT IN APPLIED MATHEMATICS ENGINEERING

● Mandatory

△ Courses not taught during 2014-2015

⊕ Periodic courses taught during 2014-2015

⊗ Optional

⊙ Periodic courses not taught during 2014-2015

‡ Two years course

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

						Year	
						1	2
⊗ LFSA2351A	Group dynamics	Piotr Sobieski (coord.)	15h+30h	3 Credits	1q	x	x
⊗ LFSA2351B	Group dynamics	Piotr Sobieski (coord.)	15h+30h	3 Credits	2q	x	x

⊗ Cours de base

Il est conseillé aux étudiants n'ayant pas suivi durant leur parcours académique antérieur les trois cours ci après (ou des équivalents) de les intégrer à leur programme.

⊗ LINMA1315	Mathematical analysis : complements	Michel Willem	30h +22.5h	5 Credits	2q	x	
⊗ LMECA1901	Continuum mechanics.	Philippe Chatelain, Issam Doghri (compensates Emilie Marchandise), Emilie Marchandise	30h+30h	5 Credits	1q	x	
⊗ LMAT1222	Complex analysis	Luc Haine	30h+15h	5 Credits	2q	x	

⊗ Cours recommandés

Parmi les 60 crédits de cours au choix et d'options, l'étudiant sélectionne au minimum 30 crédits parmi la liste ci-dessous et celle des cours de base.

⊗ LELEC2900	Signal processing	Benoît Macq, Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⊗ LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	1q	x	x
⊗ LINGI2348	Information theory and coding	Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira	30h+15h	5 Credits	2q	x	x
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2120	Applied mathematics research seminar	Pierre-Antoine Absil, Vincent Blondel, Philippe Chevalier, Jean-Charles Delvenne (coord.), François Glineur, Julien Hendrickx, Raphaël Jungers, Philippe Lefèvre, Yurii Nesterov, Paul Van Dooren, Mathieu Van Vyve	30h	3 Credits		x	x
⊗ LINMA2345	Game theory	Raphaël Jungers	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil, François Glineur (coord.), Yurii Nesterov, Paul Van Dooren	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2415	Quantitative Energy Economics	Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2460	Optimization : Nonlinear programming	Yurii Nesterov	30h +22.5h	5 Credits	2q	x	x

						Year	
						1	2
⊗ LINMA2472	Advanced topics in discrete mathematics	Vincent Blondel (coord.), Jean-Charles Delvenne, Gautier Krings (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2491	Operational Research	Anthony Papavasiliou	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2671	Automatic : Theory and implementation	Julien Hendrickx	30h+30h	5 Credits	1q	x	x
⊗ LINMA2710	Numerical algorithms	Paul Van Dooren	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2720	Mathematical modelling of physical systems	Roland Keunings	30h +22.5h	5 Credits	2q	x	x
⊗ LINMA2725	Financial mathematics	Pierre Devolder	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	x	x
⊗ LMAT2130	Partial differential equations : Poisson and Laplace equations	Augusto Ponce, Jean Van Schaftingen	30h+30h	5 Credits	1q	x	x
⊗ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x
⊗ LMECA1120	Introduction to finite element methods.	Vincent Legat	30h+30h	5 Credits	2q	x	x
⊗ LFSA2995	Company Internship	Claude Oestges	30h	10 Credits		x	x
⊗ LFSA2996	Company Internship	N.		5 Credits		x	x

⊗ Advanced courses for applied math. Master

Students should note that any course appearing in the options of their Master, but not selected as such, remains a possible elective.

⊗ LMAT2110	Eléments de géométrie différentielle	Luc Haine	30h+30h	5 Credits	1q	x	x
⊗ LMAT2160	Mathematics seminar	Pedro Dos Santos Santana Forte Vaz	15h+30h	6 Credits	1 + 2q	x	x

⊗ Languages

Students may include in their electives any language course of the Institute of Modern Languages (ILV) for a maximum of 3 credits within the 120 basic credits of their Masters. Their attention is drawn to the following professional insertion seminars:

Students may include in their electives any language course of the Institute of Modern Languages (ILV) for a maximum of 3 credits within the 120 basic credits of their Master's. Their attention is drawn to the following professional insertion seminars:

⊗ LNEER2500	Professional development seminar: Dutch - intermediate level	Isabelle Demeulenaere (coord.), Mariken Smit	30h	3 Credits	1 ou 2q	x	x
⊗ LNEER2600	Professional development seminar: Dutch - upper-intermediate level	Isabelle Demeulenaere, Marie-Laurence Lambrecht	30h	3 Credits	1 ou 2q	x	x
⊗ 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	Professional development seminar - Spanish	Isabel Baeza Varela, Carmen Vallejo Villamor	30h	3 Credits	1 ou 2q	x	x
⊗ LESPA2601	Professional development seminar- Spanish	Paula Lorente Fernandez (coord.)	30h	5 Credits	1q	x	x

⊗ Short term exchanges

Students may include in their curriculum any BEST or ATHENS courses subject to approval by the Program committee. These courses are worth 2 credits
Students may include in their curriculum any BEST or ATHENS subject to approval by the Diploma committee. These courses are worth 2 credits

⌘ General knowledge courses

Students can also include in their curriculum any course given at UCL, KULeuven or Von Karman Institute subject to approval of the program committee. Students can also include in their curriculum any course given at UCL or FIW / KULeuven subject to approval of the Diploma committee.

⌘ LMECA2645	Major technological hazards in industrial activity.	Denis Dochain, Alexis Dutrieux	30h	3 Credits	2q	x	x
⌘ LDROP2063	Environmental Law	Nicolas de Sadeleer, Damien Jans	30h	5 Credits	2q	x	x
⌘ LECGE1223	Production and Operations Management	Pierre Semal	30h	4 Credits	1q	x	x
⌘ LELEC2811	Instrumentation and sensors	David Bol, Laurent Francis	30h+30h	5 Credits	1q	x	x
⌘ LINMA2671	Automatic : Theory and implementation	Julien Hendrickx	30h+30h	5 Credits	1q	x	x
⌘ LMAPR2018	Rheometry and Polymer Processing	Christian Bailly, Evelyne Van Ruymbeke	30h +22.5h	5 Credits	2q	x	x
⌘ LMAPR2510	Mathematical ecology	Eric Deleersnijder, Emmanuel Hanert, Thierry Van Effelterre	30h +22.5h	5 Credits	2q	x	x
⌘ LMAPR2648	Sustainable treatment of industrial and domestic waste: Case studies	Spyridon Agathos, Damien Debecker, Olivier Françoisse, Patricia Luis Alconero, Olivier Noiset	30h+15h	5 Credits	1q	x	x
⌘ LPHY2150	Physique et dynamique de l'atmosphère et de l'océan I	Michel Crucifix, Thierry Fichet	45h+9h	6 Credits	1q	x	x
⌘ LPHY2153	Introduction à la physique du système climatique et à sa modélisation	Hugues Gooose (compensates Jean- Pascal van Ypersele de Strihou), Hugues Gooose, Jean-Pascal van Ypersele de Strihou	30h+15h	5 Credits	1q	x	x

⌘ Cours de sciences humaines.

Les étudiants peuvent choisir des cours de sciences humaines pour un maximum de 6 crédits. Cette possibilité n'est cependant pas ouverte aux étudiants qui ont déjà 6 crédits de sciences humaines dans leurs options.

⌘ Module complémentaire en mathématiques financières.

Les étudiants qui suivent 15 crédits dans ce module, ainsi que LINMA 2725, LACTU 2020, LACTU 2030 et LACTU 2070, bénéficieront d'un accès direct en 2ème année du master en sciences actuarielles. Ce module n'est destiné qu'aux étudiants qui prévoient cette passerelle avec l'option en mathématiques financières.

⌘ LACTU2010	NON LIFE INSURANCE 1	Cindy Courtois (compensates Michel Denuit), Michel Denuit	30h+15h	5 Credits	1q	x	x
⌘ LACTU2040	PENSION FUNDING	Pierre Devolder	30h+15h	5 Credits	2q	x	x
⌘ LACTU2060	LIFE INSURANCE 2	Michel Denuit	30h	5 Credits	2q	x	x
⌘ LACTU2080	Reinsurance	Jean-François Walhin	30h	5 Credits	2q	x	x

⌘ Module complémentaire en économie et économétrie

Les étudiants qui suivent 15 crédits dans ce module, ainsi que LINMA 2415, LECON 2011 et LECON 2021, ainsi qu'un des 2 cours LECON 2031 ou LECON 2033 bénéficieront d'un accès direct en 2ème année du master en sciences économiques, orientation générale. Ce module n'est destiné qu'aux étudiants qui prévoient cette passerelle avec l'option en économie et économétrie.

⌘ LECON2041	International Trade	Fabio Mariani, Aminata Sissoko (compensates Fabio Mariani)	30h	5 Credits	2q	x	x
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						Year	
						1	2
⊗ LECON2051	Labour, unemployment and Politics	Muriel Dejemeppe, Bruno Van der Linden, Bruno Van der Linden (compensates Muriel Dejemeppe)	30h	5 Credits	2q	x	x
⊗ LECON2061	Philosophy and epistemology of the economics	Christian Arnsperger, Laurent de Brie	30h	5 Credits	2q	x	x
⊗ LECON2421	History of Economic and Social Development	Isabelle Cassiers	30h	5 Credits	1q	x	x
⊗ LECON2372	Economics of Competition Policy	Elisabeth Van Hecke	30h	5 Credits	1q	x	x

⊗ Cours pour lequel le cours LECON 2031 est conseillé

⊗ LECON2311	Business cycle analysis and short-term macroeconomic forecasts	Vincent Bodart, Philippe Ledent (compensates Vincent Bodart)	30h	5 Credits	2q	x	x
⊗ LECON2312	Macroeconomics of the development	Frédéric Docquier	30h	5 Credits	2q	x	x
⊗ LECON2314	Economic Geography	Florian Mayneris	30h	5 Credits	2q	x	x
⊗ LECON2382	Seminar on Contemporary Economic Issues III	Bernard Delbecque	30h	5 Credits	1q	x	x
⊗ LECON2310	Topics in Economic Growth: Theory and Applications	Fabio Mariani	30h	5 Credits	2q	x	x

⊗ Cours pour lesquels le cours LECON2033 est conseillé

⊗ LECON2350	Public Management	Jean Hindriks	30h	5 Credits	2q	x	x
⊗ LECON2352	Methods for the evaluation of public policies	William Parienté	30h	5 Credits	1q	x	x
⊗ LECON2370	Industrial Organization and Competition Policy	Mathieu Parenti	30h	5 Credits	1q	x	x

⊗ **Company training periods (10 credits)**

Students may include in their curriculum a company training period worth 10 credits. However, if this activity is related to their final thesis, they shall choose the 5-credit LFSA 2996 course.

Students may include in their curriculum a company training period worth 10 credits. However, if this activity is related to their final thesis, they shall choose the 5-credit FSA 2996 course.

⊗ LFSA2995	Company Internship	Claude Oestges	30h	10 Credits		x	x
⊗ LFSA2996	Company Internship	N.		5 Credits		x	x

MAP2M - Information

Admission

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

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

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

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

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

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

- [University Bachelors](#)
- [Non university Bachelors](#)
- [Holders of a 2nd cycle University degree](#)
- [Holders of a non-University 2nd cycle degree](#)
- [Adults taking up their university training](#)
- [Personalized access](#)

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCL Bachelors			
Bachelor in engineering [180.0]	Major or minor in applied mathematics	Direct access	
Bachelor in engineering [180.0]		Access with additional training	A bachelor in engineering, with no major nr minor in applied maths, nor any option deemed equivalent, shall submit an application to the Applied mathematics diploma committee, including a detailed past curriculum (courses and grades by year). The committee will propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum.
Bachelor in physics [180.0] Bachelor in mathematics [180.0] Bachelor in computer science [180.0] Bachelor in chemistry [180.0] Bachelor in biology [180.0] Bachelor in geography [180.0] Bachelor in bioengineering [180.0]	Minor in applied mathematics	Access with additional training	A student who is not a bachelor in engineering, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied mathematics programme committee, will decide as to the applicant's admissibility (the latter pertaining only to the core curriculum of the engineering bachelor curriculum), pursuant to rules relative to links between degrees. If necessary the

			Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in engineering [180.0]	Major or minor in applied mathematics	Direct access	
Bachelor in engineering [180.0]		Access with additional training	A bachelor in engineering, with no major nor minor in applied maths, nor any option deemed equivalent, shall submit an application to the Applied mathematics diploma committee, including a detailed past curriculum (courses and grades by year). The committee will propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum.
Bachelor in physics, mathematics, computer science, chemistry, biology, geography, bioengineering [180.0]	Option in applied mathematics at former institution	Access with additional training	A student who is not a bachelor in engineering, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied mathematics programme committee, will decide as to the applicant's admissibility (the latter pertaining only to the core curriculum of the engineering bachelor curriculum), pursuant to rules relative to links between degrees. If necessary the Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum and, if necessary, up to 15 additional credits.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in ingenieurs wetenschappen	Option in applied mathematics at former institution	Direct access	
Bachelor in ingenieurs wetenschappen		Access with additional training	A student with no former option in applied mathematics shall submit an application to the Applied mathematics diploma committee, including a detailed past curriculum (courses and grades by year). The committee will propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum and, if necessary, up to 15 additional credits.

Bachelor's degree equivalent to one of those required from graduates of the French-speaking community	Option in applied mathematics at former institution	Access with additional training	A student who is not a bachelor in engineering, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied mathematics programme committee, will decide as to the applicant's admissibility (the latter pertaining only to the core curriculum of the engineering bachelor curriculum), pursuant to rules relative to links between degrees. If necessary the Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the Applied mathematics curriculum and, if necessary, up to 15 additional credits.
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Foreign Bachelors

Bachelor in engineering	Bachelors from the Cluster network	Direct access	Conditions imposed on UCL engineering Bachelor.
Bachelor in engineering	Other institutions	Access with additional training	The student shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the relevant programme committee, will decide as to the applicant's admissibility pursuant to rules relative to links between degrees. If necessary the Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the relevant engineering Master's curriculum and, if necessary, up to 15 additional credits.

Non university Bachelors

Diploma	Access	Remarks
> Find out more about links to the university		
> BA en sciences industrielles - type long	Accès au master moyennant réussite d'une année préparatoire de max. 60 crédits	Type long

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Engineers, bioengineers, and graduates in computer science, chemistry, physics, mathématiques, biology or geography, considered equivalent to corresponding Bachelor's.		Direct access	
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Masters

Master in engineering		Direct access	
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Holders of a non-University 2nd cycle degree

Diploma	Access	Remarks
> Find out more about links to the university		
> MA en sciences de l'ingénieur industriel (toutes finalités) > MA en sciences industrielles (toutes finalités)	Accès direct au master moyennant ajout éventuel de 15 crédits max	Type long

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Adults taking up their university training

> See the website [Valorisation des acquis de l'expérience](#)

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

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Personalized access

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

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Admission and Enrolment Procedures for general registration

Specific procedures :

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

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

Teaching method

. Features favouring interdisciplinarity :

The curriculum of the Master's in Applied mathematics engineering is intrinsically interdisciplinary. It aims to provide students with a training in mathematical modelling which is then implemented in the various disciplines of engineering, as well as in other walks of life in society, such as economics, environmental sciences or life sciences. In particular, the wide range of electives, some depending on other departments (Information and data processing, modelling and simulation of physical processes) or even other faculties (Financial mathematics, Biomedical engineering, Economics and econometrics, Statistics), will naturally contribute to strengthening this interdisciplinarity.

The final thesis, when carried out outside the department of engineering mathematics (which is often the case), is yet another source of interdisciplinarity.

. Variety of teaching situations

The pedagogy implemented in the engineering Master's curriculum is aligned with that of the engineering Bachelor's curriculum: active learning, a balanced mix of group and individual work, and substantial time devoted to the development of non-technical competencies.

The final thesis amounts to half of the workload of the final year ; it offers the possibility to thoroughly investigate a given subject and, through its mere volume and context, can be considered as a genuine introduction to the professional life of an engineer or a researcher. This activity can be carried out :

- either on a subject directly related to one or many basic disciplines of applied mathematics and its applications, within a research team of the department of mathematical engineering (possibly in cooperation with an external industrial partner),
- or else on a subject involving applied mathematics in some other department of the Faculty of applied sciences, or the Faculties of science, economics, management or actuarial science.

. Variety of learning situations :

The student will encounter a variety of pedagogical tools tailored to the various disciplines : formal lectures, individual projects in small groups, tutorials, project-based learning, case studies, imposed readings, experimental laboratory work, computer simulations, teachware, industrial or research training, individual and group work, seminars given by outside scientists, etc.

This variety of situations will help students to build their knowledge in an iterative and progressive manner, while developing their autonomy, organizational skills, time management, and capacity to use various modes of communication, and the most advanced computer equipment (hardware, software, networks) is made available to assist students in their work.

The company launching specialization is based on an interactive approach and problem-based learning. Throughout the curriculum, students are required to perform group activities in multi-disciplinary groups. The final thesis is also multi-disciplinary and designed in such a way that groups of three students, ideally from three different faculties, should work on a company launching project.

Evaluation

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

Les activités d'enseignement sont évaluées selon les règles en vigueur à l'Université (voir [le règlement des études et des examens](#)), à savoir à l'aide d'examens écrits et oraux, d'examens de laboratoire, de travaux personnels ou en groupe, de présentations publiques de projets et de la défense du mémoire de fin d'études.

Mobility and/or Internationalisation outlook

Global framework

The Faculty of Applied Sciences has taken part, since their inception, in all the various mobility programmes which have been set up at both the European and world levels.

The numerous contacts it has with professional circles, notably via its Advisory Board, have demonstrated to what extent employers are favourably impressed by a mobility experience in someone's CV. The ever-increasing internationalization of research via networks linking laboratories throughout the world, speaks in favour of encouraging this mobility.

Students' interest is aroused at the end of their Bachelor studies, notably via intensive courses such as those of the ATHENS () or BEST () networks.

In the course of the two-year Master's programme, students are encouraged to take part in a 1- or 2-semester exchange scheme.

Within Belgium, the Faculty of Applied Sciences is involved in a privileged partnership with the Faculteit Ingenieurswetenschappen of the Katholieke Universiteit Leuven, with whom it has set up an exchange scheme relating to the first year of the Master's curriculum ().

At the European level, the Faculty of Applied Sciences is strongly involved in the CLUSTER excellence network (). This network encourages internal mobility, since this is a guarantee of quality as concerns both the level of teaching and the hosting of exchange students. Moreover, Cluster partners have signed an agreement recognizing each other's Bachelor's curricula. This agreement stipulates that all Bachelors of network institutions will have access to the Master's studies in any institution on a par with local students.

Outside Europe, the Faculty of Applied Sciences is a partner in the Magalhaes network, which groups about fifteen European universities together with the best South American science and technology universities ().

Besides these network partnerships, the Faculty has also signed a number of individual agreements with various universities in Europe, North America or elsewhere in the world. A list of these agreements may be found on the website of UCL International Relations ().

International possibilities (for UCL students)

UCL is also a partner in the TIME programme () which gives students the opportunity to obtain two engineering degrees, via a specifically tailored curriculum.

Double engineering degree : students may replace the second year of their Master's by two years of study in a different institution within the TIME programme and conventions with the Ecole nationale supérieure du pétrole et des moteurs (ENSPM). Upon completion of their curriculum, students are automatically awarded the UCL degree following that of the host institution. Under certain conditions, students may take part in the selection process for a Master of Business Administration (MBA) at Chicago and Cornell universities (for further information, refer to website <https://www.uclouvain.be/10490.html>)

Besides intensive courses which are one component of international relations, FAS students with outstanding results are encouraged to apply for 5- or 10-month exchange programmes. When taking place during the first Master's year, exchanges are generally 10 months long. In the second year, they only last for a semester, either as courses or else research in a foreign laboratory as a complement to the final thesis.

Some other more specific exchange programmes have been set up with South America, where the academic year is naturally on an "austral" basis.

Students are informed about the various exchange programmes as from their second Bachelor's year. They are encouraged to prepare for their exchange in a timely manner, notably by taking language courses at the Modern Languages Institute of UCL.

Possible trainings at the end of the programme

Accessible complementary Master's degrees

The Master's in Applied mathematics engineering provides the prerequisites for many other Master's degrees which can then be obtained after one year of studies :

1. 120 Master's in actuarial science (UCL) A student with at least 35 credits within the Financial mathematics option has direct access to the second year of the 120 Master's in actuarial science at UCL.
2. 120 Master's in economics, general stream (specialized or advanced) (UCL) A student with at least 35 credits within the Economics and econometrics option has direct access to the second year of the 120 Master's in economics, general stream (specialized or advanced) at UCL.
3. 120 Master's in statistics, general stream (specialized or advanced) (UCL) A student with at least 35 credits within the Statistics option has direct access to the second year of the 120 Master's in statistics, general stream (specialized or advanced) at UCL.

Accessible Ph.D. studies

Registration for a Ph.D. in applied science is open to any bearer of a Master's in engineering. The department of mathematical engineering is a partner in various thematic doctoral schools, in particular the « Systems, Optimization, Control and Networks » school of which it is the coordinator (for additional details, refer to <https://www.inma.ucl.ac.be/graduate/>).

Contacts

Curriculum Management

Entite de la structure MAP

Acronyme	MAP
Dénomination	Commission de programme - Ingénieur civil en mathématiques appliquées
Adresse	Avenue Georges Lemaître, 4-6 bte L4.05.01 1348 Louvain-la-Neuve Tél 010 47 25 97 - Fax 010 47 21 80
Secteur	Secteur des sciences et technologies (SST)
Faculté	Ecole Polytechnique de Louvain (EPL)
Commission de programme	Commission de programme - Ingénieur civil en mathématiques appliquées (MAP)

Academic Supervisor : [Pierre-Antoine ABSIL](#)

Jury

Président du Jury : **Jean-Didier LEGAT**

Secrétaire du Jury : **Raphaël JUNGERS**

Usefull Contacts

Secrétariat : **Nathalie PONET**

