

**INFO2M**

2013 - 2014

**Master [120] in Computer Science and Engineering****At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In english**Dissertation/Graduation Project : **YES** - Internship : **optional**Activities in English: **YES** - Activities in other languages : **NO**Activities on other sites : **NO**Main study domain : **Sciences de l'ingénieur**Organized by: **Ecole Polytechnique de Louvain (EPL)**Programme code: **info2m** - European Qualifications Framework (EQF): 7**Table of contents**

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## INFO2M - Introduction

### Introduction

The program tries to maintain a **balance between soft skills and scientific/technical skills, between striving for excellence and pragmatism**. It offers :

- an approach based basic **concepts** in computer science which remain valid beyond the rapidly changing technology ;
- a program **entirely in English** to improve your skills both in written and spoken technical English ;
- **exchange programs** and dual degrees in Belgium, Europe and worldwide .

As a continuation to the Bachelor in Engineering Sciences, it offers versatility in engineering sciences through options in conjunction with other related disciplines such as applied mathematics or electronics and telecommunications.

### Your profile

You

- aspire to **imagine, design, implement and deploy** the computer applications that will shape our future;
- **focus your engineering background to computer science** after having acquired during the bachelor a solid general training in science and technology (mathematics, mechanics, electricity, chemistry, ...);
- want to improve your **theoretical knowledge** and develop your **practical skills** in disciplines such as artificial intelligence, computer networks, information security, software engineering and programming systems;
- would like to build up **soft skills** such as foreign languages, management of resources, team work and communication, work discipline and ethics;
- possibly open your training to management or creation of small and medium enterprises;
- benefit from a training entirely in **English**.

### Your future job

We train

- **scientists** who can understand and analyze the complex requirements to be met by a software system in its environment;
- **professionals** who will design computer systems which encounter customer needs;
- **innovators** who master a broad range of technologies and their continuous evolution;
- **specialists** able to implement software solutions with a particular attention to quality of the product and of its development process.

### Your programme

The training includes

- a **mandatory part**, to acquire the skills necessary to model, design complex applications, which completes the required training to all university computer scientists;
- at least one **option** that you choose, to acquire advanced skills in a field of interest:
  - in computer science : **software engineering and programming systems** , **artificial intelligence**, **networking and security** ;
  - at the frontier with electricity, applied mathematics or life science : **communication networks, cryptography and information security, computing and applied mathematics, biomedical engineering and bioinformatics** ;
  - or in **Management** or **SME creation**, as computer scientists have to manage projects, lead a team and focus on the socio-economic context.
- **elective courses** that allow you to focus your training to your interests , whether computer science or any other discipline (management, entrepreneurship , foreign languages ...); as the UCL is a wide university , many opportunities are offered;
- an **master's thesis**, half the workload of the last year , offers the possibility of treating a subject in depth and its magnitude is a true introduction to life as a computer scientist; the subject of this work is chosen in consultation between you, the program committee and possibly an industry.

## INFO2M - Admission

***For the specific conditions of this program : refer to the French version***

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

## INFO2M - Information

### Learning outcomes

#### Training based on research

The UCL is a place for teaching and research. The research conducted in the field of Computer Science within the ICTEAM Institute is internationally recognized. Through the options of the Master's program, students benefit from this cutting-edge knowledge in the fields of

- Artificial Intelligence,
- Networking and Security,
- Software Engineering and Systems Programming,
- or cryptographie and information security.

Beyond the mere acquisition of knowledge, training is based on a **deep understanding of concepts, reflection and abstraction**. These skills enable graduates to adapt quickly to the demands of employers. Furthermore, these studies can be extended to research activities and lead to a PhD.

#### Concepts to their application

The adaptability of graduates is further enhanced by the importance attributed to the application of concepts in the curriculum. **It is inconceivable to master concepts at a theoretical level and not to be able to apply them while facing a practical problem.** Therefore, the program contains many projects, assignments, a master's thesis and the possibility to perform an internship.

#### Openness to other engineering disciplines

Through various options, the program takes advantage of the **diversity of engineering programs** of the faculty. The student can select options related to telecommunication networks, applied mathematics or biomedical engineering. In addition, as the University of Louvain (UCL) is a comprehensive university, it is possible to steer his training to management or entrepreneurship.

#### International perspective

English is the language most widely used in business and in particular in the technical field. The **Master's program is taught in English**. It enables non English native students to acquire good skills both oral and written in this language. Furthermore, teaching in English enables to welcome and host foreign students in good conditions, while allowing them to be immersed in a French environment. It also expands the possibilities for exchange programs and joint degrees with well-known universities.

Offering a master's program in English is definitely a position with an **international outlook**.

#### Regarding learning outcomes ...

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

**demonstrate mastery of a solid body of knowledge in computer science, enabling him to solve problems within its discipline**

- Facing a problem related to computer science, he **identifies the concepts, algorithms and data structures applicable** to solve it; and he uses them to decompose the problem into sub-problems and to develop computer based solutions.
- Confronted with a problem within its discipline, he **chooses the tools** ( eg development environment, programming language, libraries and software repositories ) best suited to achieve a correct and proper software solution .
- Confronted with the results of the reasoning and implementation of tools and concepts he mobilized, he takes the perspective necessary to verify the relevance, regarding the functionality and quality of the solution sought. In this context, he will develop relevant tests and checks which can **guarantee the quality of the solution** developed.

**organize and carry out every step of the software development process, meeting the generally complex needs of a customer**

- Before working on the solution, he **explores and analyzes the dimensions of the problem** by using the documentation provided and discussing with the stakeholders and future users of the computer system to be developed. He reformulates the specifications, including not only the requirements for system functionalities, but also other constraints related to time or ease of operation for future users.
- In the design phase, he **models and imagines the architecture of the computer system to develop** in terms of functional components (subsystems) so as to facilitate and optimize the development. He takes advantage of available verification technologies and methods to ensure, from the design phase, the quality of the system or software to be implemented.
- In the analysis phase of the system (server, OS, software, ...), he **lists, evaluates and compares different technologies** (hardware, languages, algorithms, routing) in order to favor those that best meet the various performance and quality criteria explained in the specifications.
- In the implementation phase of the solution, he **demonstrates his mastery of the principles, techniques and development tools** at its disposal. It creates a prototype of software designed to check that the software matches the customer's expectations. It creates an environment and a battery of tests to ensure that the solution developed meets specifications. Applying the techniques of program validation and verification, he **identifies, locates bugs and corrects them**.

- Based on a development achieved at the level of a prototype, he **manages the evolution** of the system quality : monitoring, optimization, maintenance, fault detection, communication in case of failure, etc. He uses metrics and tools to evaluate / validate the **structural quality of a software system in terms of safety and maintainability**.

#### organize and carry out research to understand a new problem within its discipline

- Facing a problem related to computer science whose subject and background are new to him, he plans actions to **explore** this area and to obtain the information to **perform an inventory of the state of the art in this new domain** using multiple channels (library, Internet, researchers, industry, ...).
- In the master's thesis (possibly coupled with an internship) centered on the study of a new problem, he models the underlying phenomenon keeping in mind to solve the problem using a computer system. Based on this model, he **develops and experimentally tests various computer systems likely to address the problem** (eg computer processing of images generated by a scanner to facilitate a medical diagnosis).
- Once the experimental results are available, he synthesizes the findings in a research report, **highlighting the key parameters and their influence on the behavior of the phenomenon**. He extracts useful recommendations to **develop and implement innovative technical solutions** in concrete problems of the industrial environment considered.

#### contribute in a team, to plan and bring a project to completion, taking into account the objectives, resources and other constraints

- As a member of the team in charge of the project, he helps to explore the issues and the context in which the project is located in order to inventory the various stakeholders, issues and constraints involved. At the end of this inventory work, he helps to **write with colleagues specifications incorporating the key elements of project scope**: issues and stakeholders, objectives and performance indicators, risks, constraints of time and resources available ...
- Once the scope of the project is defined, he **contributes to plan** the related tasks. The team must agree and **engage collectively** on a plan of work, milestones, allocation of tasks, deliverables to be provided, and a schedule to meet the objectives of the project.
- He takes advantage on the strengths and expertises within the team to **collectively solve problems that inevitably arise during the project**: either technical problems or interpersonal difficulties. It takes the perspective needed to overcome the difficulties encountered or conflicts within the team.
- To respect the project scheduling, he warns his teammates on decisions to take in case of drift or blockage. During the steering meetings, he **contributes to decision making**, organizes (or reorganizes) the project in order to meet its objectives.

#### communicate both orally and in writing to carry out the projects entrusted to him in his work environment, and improve its foreign language skills (e.g. French and English)

- Involved in a project of development of a computer system, it identifies and the stakeholders involved in the implementation and the operation of the system to be developed. **Discussing with the stakeholders**, he perceives the scope of the environment and the challenges of the project, he **makes them clarify their needs and expectations**, as well as constraints to be included in the specifications of the project, both system functionalities on operating conditions (interfaces with other applications, maintenance, evolution ...).
- In its communication, he **takes into account the fact that his interlocutors do not necessarily master the computer science concepts and terminology** and do not share his point of view on the issues and performance of the proposed solution.
- Critical phases of the project imply that critical choices are made collectively. To facilitate decision making, the graduate must be able to **provide his partners synthetic view of the current issues**. In this perspective, he is able to organize and communicate the required information **using diagrams or graphs** suited to the representation of the architecture of a computer system.
- He uses efficiently **reference books** or tutorials about computer language or software, both in English and French. He **understand technical presentations in English**.
- During the development of a computer system, he **ensures traceability** and he **documents the system** in a concise and precise language : specification, software and data structure, user's guide. He does be the same when he writes a **summary report describing and arguing choices** (design and technology) made during the project.

#### will demonstrate both autonomy, rigor, openness, critical thinking and ethics in his work.

- In his discipline, he **masters the vocabulary and technical standards**; this allows him to easily decode a scientific or technical document or communicate with specialists in the discipline.
- Being concerned with the industrial reality of the applications he develops, he naturally takes into account the socio-economic context for the user and his environment - as soon as writing specifications - including for compatibility with the evolution of technology and ethics of the profession. Especially for the development of critical systems (eg ambulance management), he ensures robustness and reliability of the computer system testing hazards of the user work environment.
- Confronted with a new problem, he **demonstrates his autonomy to acquire and integrate information and tools** he will need, even if these topics have not been explicitly addressed in the curriculum.

## Teaching method

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### Active learning and soft skills

Pedagogy used in the master's program is in the continuation of the bachelor's program in engineering science: active learning, a balanced mix of group work and individual work, prominence to the development of soft skills, in particular, a pedagogy highlighting project activities (including a large-scale project involving student groups in semi-professional situation).

The student will encounter a variety of pedagogical devices: lectures, projects, exercises, problem-based learning, case studies, industry internships or research, group work, individual assignments, seminars, conferences by industry. This variety of situations will help students to build their knowledge in an iterative and progressive manner, while developing its autonomy, organizational skills, time management, communication skills ...

### Foreign languages

Globalisation imposes on any society to open its doors towards foreign markets. Moreover, English is by far the most commonly used language in computer science. The use of English during the entire curriculum allows students to develop their mastery of the English language, which will ease their integration in foreign universities and companies. All course material and supervision are in English but the student can always ask questions or answer his exams in French if desired.

Moreover, the programme allows for attending language courses at the university's Language Institute ( [ILV](#) ) and for taking part in foreign exchange programmes.

The entire program is offered in English , except for the options in biomedical engineering management and SME creation.

### Interdisciplinarity

Students are encouraged to open their training to other engineering sciences and technologies , management , human science , ... Computer scientist, especially with a master degree, will be brought during his career to project and team management, and he will be concerned by the complex socio-economic context in which computer applications belong. He will interact with colleagues carrying different perspectives on the projects. It is therefore imperative to expand his field of vision to other areas than computer science.

## Evaluation

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The learning activities are assessed according to the rules of the University (see [exam regulations](#)), that is through written and oral exams, personal or group assignments, public presentation of projects and defence of the graduation thesis. For the courses given in English, questions will be expressed in English by the teacher, but the student may choose to answer in French. For the courses given in French, the questions will be expressed in French by the teacher, but the student may ask for help in translation and choose to answer in English.

Some activities such as projects during the semester under the supervision of the teaching staff and in collaboration with other students are not reorganized outside the period prescribed for the course. They are not re-evaluated at a later session.

Evaluation methods specific to each course are communicated to students by teachers at the beginning of the semester.

## Mobility and/or Internationalisation outlook

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### Outgoing students

The Louvain School of Engineering (EPL) participates since their inception in the various existing mobility programmes at the European as well as worldwide levels.

The students' interest in internationalisation and mobility is aroused as of the end of their bachelor programmes, notably through the existence of intensive study programmes such as the [ATHENS](#) or [BEST](#) networks. These networks are also accessible in the master programme and allow the students to get a first contact with international mobility.

In addition, in the context of the Erasmus and Mercator exchange programmes, students have the possibility of performing an extended stay of typically 5 months (first semester of the second master year) at a partner university. To this extent, the Louvain School of Engineering (EPL) participates in several networks.

- In Belgium, EPL maintains a privileged partnership with the [Faculteit Ingenieurswetenschappen of the Katholieke Universiteit Leuven](#) with which it has developed an exchange programme covering the first year of the master.
- At the European level, EPL was particularly involved in the [CLUSTER](#). CLUSTER provides a guarantee of quality, both in terms of education and in terms of hosting for exchange students. Moreover, the CLUSTER partners have signed a convention of mutual recognition of their bachelor programmes. This convention implies that all bachelors of the CLUSTER institutions benefit, in each institution of the network, of the same accessibility conditions to the masters as the local students.

- Outside of Europe, EPL is a partner of the [Magalhães](#) network which associates fifteen European universities with the best universities in science and technology of Latin America.

Alongside these network partnerships, the Louvain School of Engineering has also signed a number of individual agreements with various universities in Europe, in North America and elsewhere in the world. The list of these agreements can be found on [UCL's International Relations Administration website](#).

EPL also takes part in the [TIME](#) programme which allows students to obtain, at the end of an adapted curriculum, two engineering degrees with a different specialisation in each institute.

Moreover, several dual master agreements have been set up and allow, after two years of master (one at UCL, the other in a host university), to obtain engineering degrees from both universities. In computer science engineering, such agreements have been established with the KULeuven (Belgium), UPC (Barcelona, Spain) and Grenoble (France). Others are currently being negotiated.

The students are informed about the various exchange programmes at the start of their second bachelor year. They are invited to prepare in time, especially at the linguistic level, through the courses of UCL's Language Institute (ILV).

Beyond exchange programmes, an internship may be conducted in a research laboratory or in an enterprise abroad.

More information about [mobility programmes](#).

### Incoming students

In the context of the Cluster network, foreign students benefit at UCL from exactly the same status and conditions as local students, which facilitates Erasmus exchanges for students coming from institutes in this network.

The whole programme is offered in English and can be followed without prior knowledge of French, except for the options in biomedical engineering, management and creation of small and medium-sized enterprises. All courses, but a few exceptions, are given in English. For non-French-speaking students, alternatives to the courses in French will be proposed by the programme commission on a case-by-case basis, according to the student's curriculum.

More information about [mobility programmes](#).

## Possible trainings at the end of the programme

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-Accessible supplementary masters : not applicable.

-Accessible doctoral programmes:

The Master of science in computer science and engineering gives access to a PhD in Engineering Science, in the context of which doctoral students can partake in the doctoral courses of one or more of the thematic doctoral schools.

## INFO2M - Contacts

### Curriculum Managment

Entite de la structure INFO

Acronyme	<b>INFO</b>
Dénomination	Commission de programme - Sciences informatiques et ingénieur civil en informatique
Adresse	Place Sainte Barbe, 2 bte L5.02.01 1348 Louvain-la-Neuve Tél 010 47 31 50 - Fax 010 45 03 45
Secteur	Secteur des sciences et technologies ( <a href="#">SST</a> )
Faculté	Ecole Polytechnique de Louvain ( <a href="#">EPL</a> )
Commission de programme	Commission de programme - Sciences informatiques et ingénieur civil en informatique ( <a href="#">INFO</a> )

**Academic Supervisor :** [Kim MENS](#)

### Jury

Président du Jury : **Piotr SOBIESKI**

Secrétaire du Jury : **Marc LOBELLE**

### Usefull Contacts

Conseillère aux études : **Chantal PONCIN**



## INFO2M - Detailed programme

### Programme structure

The Master of science in computer science and engineering programme includes:

- core curriculum, mainly the master's thesis (38 ECTS credits);
- focus, mandatory courses (30 ECTS credits);
- at least one option to specialize in one computer science domain (20 to 52 ECTS credits),
- some optional courses (0 to 52 ECTS credits).

A master's thesis is conducted during the last year. On the other hand, as long as it suits his/her educational project and the prerequisites are respected, courses can be placed at will by the student in the first or second year. This is particularly true in the case of a student carrying out part of his studies abroad. Consequently, the years to which activities are assigned in the detailed programme are only indicative.

The whole programme is provided in English, except for the options in biomedical engineering, management and SME creation. For non-French-speaking students, alternatives to the compulsory courses in French will be proposed by the program committee on a case-by-case basis, according to the student's curriculum. In particular, for students who did not obtain their bachelor degree at UCL, the course in religious sciences may be replaced by a supplementary activity to the master thesis, under item FSA2993.

*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 study

> [Core curriculum](#) [ en-prog-2013-info2m-linfo220t.html ]

> [Professional focus](#) [ en-prog-2013-info2m-linfo220s ]

#### Options courses

- > [Options du master ingénieur civil en informatique](#) [ en-prog-2013-info2m-linfo904r.html ]
  - > [Artificial Intelligence](#) [ en-prog-2013-info2m-linfo221o.html ]
  - > [Software Engineering and Programming Systems](#) [ en-prog-2013-info2m-linfo222o.html ]
  - > [Networking and Security](#) [ en-prog-2013-info2m-linfo223o.html ]
  - > [Computing and Applied Mathematics](#) [ en-prog-2013-info2m-linfo224o.html ]
  - > [Option : Cryptography & Information Security](#) [ en-prog-2013-info2m-linfo230o.html ]
  - > [Communication Networks](#) [ en-prog-2013-info2m-linfo226o.html ]
  - > [Option in biomedical engineering](#) [ en-prog-2013-info2m-linfo227o.html ]
  - > [Business risks and opportunities](#) [ en-prog-2013-info2m-linfo228o.html ]
  - > [Option in launching of small and medium-sized companies](#) [ en-prog-2013-info2m-linfo229o.html ]
- > [Elective courses of the master's in computer science engineering](#) [ en-prog-2013-info2m-linfo225o.html ]

### Programme by subject

#### Core courses [38.0]

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

⊞ Two years course

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

*The student shall select*

Year

1 2

○ LINGI2990	Travail de fin d'études	N.		28 Credits			x
○ LELEC2525	Introduction to electric and electronic circuits	Jean-Didier Legat, Michel Verleysen	30h+30h	5 Credits	1q	x	x

### ○ Religion courses for student in exact sciences

The student shall select 2 credits from amongst

The student shall select

⊗ LTECO2100	Questions of religious sciences: biblical readings	Hans Ausloos	15h	2 Credits	1q	x	x
⊗ LTECO2200	Questions of religious sciences: reflections about christian faith	Dominique Martens	15h	2 Credits	2q	x	x
⊗ LTECO2300	Questions of religious sciences: questions about ethics	Philippe Cochinaux	15h	2 Credits	1q	x	x

### ○ Computing seminars

The student shall select 3 credits from amongst

The student shall select 3 credits from amongst

⊗ LINGI2359	Software engineering seminar	Kim Mens	30h	3 Credits	2q		x
⊗ LINGI2349	Network and communication seminar	Gildas Avoine, Olivier Bonaventure (compensates Gildas Avoine), Olivier Bonaventure	30h	3 Credits	1q		x
⊗ LINGI2369	Artificial intelligence seminar	Yves Deville	30h	3 Credits	2q		x
⊗ LINGI2379	Machine learning seminar	Pierre Dupont (coord.), Michel Verleysen	30h	3 Credits	2q		x

## Professional focus [30.0]

○ Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

‡ Two years course

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

The student shall take all the specialization courses

Year

1 2

### ○ Computer science courses

○ LINGI2132	Languages and translators	Pierre Schaus	30h+30h	6 Credits	2q	x	
○ LINGI2141	Computer networks: information transfer	Olivier Bonaventure	30h+30h	6 Credits	1q	x	
○ LINGI2255	Software development project	Kim Mens	15h+45h	6 Credits	1q	x	
○ LINGI2261	Artificial intelligence: representation and reasoning	Yves Deville	30h+30h	6 Credits	1q	x	
○ LINGI2172	Databases	Bernard Lambeau	30h+30h	6 Credits	2q	x	

## Options [52.0]

L'étudiant complète son programme avec des options et/ou des cours au choix. Il sélectionne

### Options du master ingénieur civil en informatique

- > [Artificial Intelligence](#) [ en-prog-2013-info2m-linfo221o ]
- > [Software Engineering and Programming Systems](#) [ en-prog-2013-info2m-linfo222o ]
- > [Networking and Security](#) [ en-prog-2013-info2m-linfo223o ]
- > [Computing and Applied Mathematics](#) [ en-prog-2013-info2m-linfo224o ]
- > [Option : Cryptography & Information Security](#) [ en-prog-2013-info2m-linfo230o ]
- > [Communication Networks](#) [ en-prog-2013-info2m-linfo226o ]
- > [Option in biomedical engineering](#) [ en-prog-2013-info2m-linfo227o ]
- > [Business risks and opportunities](#) [ en-prog-2013-info2m-linfo228o ]
- > [Option in launching of small and medium-sized companies](#) [ en-prog-2013-info2m-linfo229o ]
- > [Elective courses of the master's in computer science engineering](#) [ en-prog-2013-info2m-linfo225o ]

## OPTIONS DU MASTER INGÉNIEUR CIVIL EN INFORMATIQUE

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

### ARTIFICIAL INTELLIGENCE

Les étudiants ayant suivi l'option "Artificial Intelligence" devront être capables de:

- Identifier et mettre en oeuvre une classe de méthodes et de techniques permettant à un logiciel de résoudre des problèmes complexes qui, résolus par un être humain, nécessitent de l'"intelligence",
- Comprendre et appliquer à bon escient des méthodes et techniques relevant de l'intelligence artificielle telles que raisonnement automatisé, recherche et heuristiques, acquisition et représentation de connaissances, apprentissage automatique, problèmes de satisfaction de contraintes,
- Identifier des classes d'applications où ces méthodes et outils peuvent être appliqués; appréhender des classes particulières d'applications et leurs techniques spécifiques - par exemple, robotique, vision par ordinateur, planification, fouille de données, traitement de la langue naturelle et de données bioinformatiques,
- Formaliser et structurer des corps de connaissances complexes en utilisant une approche systématique et rigoureuse pour développer des systèmes "intelligents" de qualité.

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

⊞ Two years course

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

The student can select  
De 20 à 30 credits parmi

Year  
1 2

#### ● Compulsory courses in Artificial intelligence

● LINGI2262	<a href="#">Machine Learning :classification and evaluation</a>	<a href="#">Pierre Dupont</a>	30h+30h	5 Credits	1q	x	x
● LINGI2263	<a href="#">Computational Linguistics</a>	<a href="#">Pierre Dupont, Cédric Fairon</a>	30h+15h	5 Credits	2q	x	x
● LINGI2264	<a href="#">Automated reasoning</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	1q △	x	x
● LINGI2365	<a href="#">Constraint programming</a>	<a href="#">Yves Deville</a>	30h+15h	5 Credits	2q	x	x

#### ⊗ Elective courses in Artificial Intelligence

The student can select 10 credits amongst

						Year	
						1	2
⊗ LSINF2275	Data mining & decision making	Marco Saerens	30h+30h	5 Credits	2q	x	x
⊗ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.), Laurent Jacques (compensates Benoît Macq), Benoît Macq	30h+30h	5 Credits	1q	x	x
⊗ LINGI2368	Computational biology	N.	30h+15h	5 Credits	1q Δ	x	x
⊗ LGBIO2010	Bioinformatics	Pierre Dupont, Michel Ghislain	30h+30h	5 Credits	2q	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
⊗ LINMA1691	Discrete mathematics - Graph theory and algorithms	Vincent Blondel, Jean-Charles Delvenne (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	x	x
⊗ LINMA2111	Discrete mathematics II : Algorithms and complexity	Vincent Blondel	30h +22.5h	5 Credits	2q Δ	x	x
⊗ LSTAT2320	Design of experiment.	Patrick Bogaert, Bernadette Govaerts	22.5h +7.5h	5 Credits	2q	x	x
⊗ LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊗ LINMA2450	Combinatorial optimization	Jean-Charles Delvenne	30h +22.5h	5 Credits	1q	x	x

## SOFTWARE ENGINEERING AND PROGRAMMING SYSTEMS

Les étudiants ayant suivi l'option "Software engineering and programming systems" devront être capables de :

- Comprendre et expliquer les problèmes rencontrés dans la conduite de gros projets logiciels, ainsi que l'impact critique du choix de solutions tout au long de leur cycle de vie (dimensions de construction, de validation, de documentation, de communication et de gestion de projet impliquant de grosses équipes ainsi que des coûts et délais à respecter),
- Choisir et appliquer des méthodes et outils d'ingénierie de systèmes logiciels complexes répondant à des critères stricts de qualité: fiabilité, adaptabilité, évolutivité, performance, sécurité, utilisabilité...,
- Modéliser les produits et processus nécessaires à l'obtention de tels systèmes et analyser ces modèles,
- Concevoir et réaliser des programmes d'analyse, de conversion et d'optimisation de représentations informatiques,
- Utiliser à bon escient différents paradigmes et langages de programmation, en particulier en ce qui concerne la programmation fonctionnelle, orientée-objet et concurrente,
- Comprendre les enjeux des différents modèles de programmation concurrente et répartie et utiliser le modèle approprié,
- Définir un nouveau langage (syntaxe et sémantique) approprié à un contexte spécifique.

○ Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊙ Periodic courses not taught during 2013-2014

⊞ Two years course

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

The student can select

De 20 à 30 credits parmi

Year

1 2

### ○ Compulsory courses in Software Engineering and Programming Systems

Course ID	Course Title	Instructor	Hours	Credits	Period	Year 1	Year 2
○ LSINF2224	<a href="#">Programming methods</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	2q	x	x
○ LINGI2252	<a href="#">Software Engineering : Measures and Maintenance</a>	<a href="#">Kim Mens</a>	30h+15h	5 Credits	1q	x	x
○ LSINF2345	<a href="#">Languages and algorithms for distributed applications</a>	<a href="#">Peter Van Roy</a>	30h+15h	5 Credits	2q	x	x
○ LINGI2251	<a href="#">Software engineering: development methods</a>	<a href="#">Charles Pecheur</a>	30h+30h	5 Credits	2q	x	x

### ⊗ Elective courses in Software Engineering and Programming Systems

The student can select 10 credits amongst

⊗ LSINF2335	<a href="#">Programming paradigms : theory, practice and applications</a>	<a href="#">Kim Mens</a>	30h+15h	5 Credits	2q	x	x
⊗ LSINF2382	<a href="#">Computer supported collaborative work</a>	<a href="#">Jean Vanderdonckt</a>	30h+15h	5 Credits	2q	x	x
⊗ LINGI2143	<a href="#">Concurrent systems : models and analysis</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	1q	x	x
⊗ LINGI2264	<a href="#">Automated reasoning</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	1q △	x	x
⊗ LINGI2346	<a href="#">Distributed application design</a>	<a href="#">Marc Lobelle</a>	30h+15h	5 Credits	1q	x	x
⊗ LINGI2365	<a href="#">Constraint programming</a>	<a href="#">Yves Deville</a>	30h+15h	5 Credits	2q	x	x
⊗ LINMA2111	<a href="#">Discrete mathematics II : Algorithms and complexity</a>	<a href="#">Vincent Blondel</a>	30h +22.5h	5 Credits	2q △	x	x
⊗ LINGI2355	<a href="#">Software requirements &amp; architecture</a>	N.	30h+15h	5 Credits	2q △	x	x
⊗ LINGI2339	<a href="#">Abstract interpretation</a>	<a href="#">Baudouin Le Chartier</a>	30h+15h	5 Credits	1q △ ⊕	x	x
⊗ LINGI2347	<a href="#">Computer system security</a>	<a href="#">Gildas Avoine, Marco Canini (compensates Gildas Avoine)</a>	30h+15h	5 Credits	2q	x	x

**NETWORKING AND SECURITY**

Cette option ne peut pas être validée en même temps que les options « Cryptography and information security » ou « Communication Networks ». Les étudiants gardent toutefois la possibilité de choisir des cours au choix parmi ces autres options.

Les étudiants ayant suivi l'option "Networking and security" devront être capables de :

- Comprendre et expliquer les différents dispositifs et protocoles utilisés dans les réseaux informatiques,
- Concevoir, configurer et gérer des réseaux informatiques en prenant en compte les besoins des applications,
- Identifier les grandes classes d'applications réparties et parallèles, les problèmes suscités et les solutions à apporter,
- Réaliser des applications réparties en mettant en oeuvre des moyens et des techniques appropriées,
- Comprendre les caractéristiques des systèmes répartis : parallélisme, synchronisation, communication, modèles de fautes et de menaces,
- Utiliser les techniques, algorithmes et langages appropriés pour concevoir, modéliser et analyser des applications réparties,
- Comprendre et mettre en oeuvre les mécanismes (cryptographie, protocoles...) permettant de sécuriser des réseaux et systèmes répartis.

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

‡ Two years course

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

The student shall select  
De 20 à 30 credits parmi

Year

1 2

**o Compulsory courses in Networking and Security**

● LINGI2142	<a href="#">Computer networks: configuration and management</a>	<a href="#">Olivier Bonaventure</a>	30h+30h	5 Credits	2q	x	x
● LINGI2143	<a href="#">Concurrent systems : models and analysis</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	1q	x	x
● LINGI2346	<a href="#">Distributed application design</a>	<a href="#">Marc Lobelle</a>	30h+15h	5 Credits	1q	x	x
● LINGI2347	<a href="#">Computer system security</a>	<a href="#">Gildas Avoine, Marco Canini (compensates Gildas Avoine)</a>	30h+15h	5 Credits	2q	x	x

**⊗ Elective courses in Networking and Security**

The student can select 10 credits amongst

⊗ LINGI2315	<a href="#">Design of Embedded and real-time systems</a>	<a href="#">Jean-Didier Legat, Marc Lobelle</a>	30h+30h	5 Credits	2q	x	x
⊗ LINGI2348	<a href="#">Information theory and coding</a>	<a href="#">Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira</a>	30h+15h	5 Credits	2q	x	x
⊗ LSINF2345	<a href="#">Languages and algorithms for distributed applications</a>	<a href="#">Peter Van Roy</a>	30h+15h	5 Credits	2q	x	x
⊗ LMAT2450	<a href="#">Cryptography</a>	<a href="#">Olivier Pereira</a>	30h+15h	5 Credits	1q	x	x
⊗ LINMA2470	<a href="#">Discrete stochastic models</a>	<a href="#">Philippe Chevalier</a>	30h +22.5h	5 Credits	2q	x	x
⊗ LINGI2144	<a href="#">Secured systems engineering</a>	<a href="#">Gildas Avoine</a>	30h+15h	5 Credits	1q △	x	x

**COMPUTING AND APPLIED MATHEMATICS**

Les étudiants ayant suivi l'option "Computing and Applied Mathematics" devront être capables de :

- Appréhender des domaines de l'ingénierie nécessitant une synergie entre mathématiques appliquées et informatique, tels que l'algorithmique, le calcul scientifique, la modélisation de systèmes informatiques, l'optimisation, l'apprentissage automatique ou la fouille de données,
- Comprendre et appliquer à bon escient des méthodes et techniques relevant de l'algorithmique avancée telles que des méthodes d'optimisation, de programmation par contraintes, d'algorithmique des graphes, d'algorithmique numérique ou d'analyse et de conception d'algorithmes,
- Identifier et mettre en oeuvre des modèles et des techniques relevant des statistiques, de l'apprentissage automatique et de la fouille de données; appréhender des classes d'applications telles que le traitement de données bruitées, la reconnaissance des formes ou l'extraction automatique d'informations dans de grandes collections de données.

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊙ Periodic courses not taught during 2013-2014

‡ Two years course

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

The student shall select

De 20 à 30 credits parmi

Year

1 2

**● Compulsory courses in computing and applied mathematics**

● LINMA2710	<a href="#">Numerical algorithms</a>	<a href="#">Paul Van Dooren</a>	30h +22.5h	5 Credits	2q	X	X
● LINMA2111	<a href="#">Discrete mathematics II : Algorithms and complexity</a>	<a href="#">Vincent Blondel</a>	30h +22.5h	5 Credits	2q △	X	X
● LINMA1702	<a href="#">Applied mathematics : Optimization I</a>	<a href="#">Vincent Blondel</a> , <a href="#">François Glineur</a> (compensates Vincent Blondel), <a href="#">François Glineur</a> (coord.)	30h +22.5h	5 Credits	2q	X	X
● LINGI2365	<a href="#">Constraint programming</a>	<a href="#">Yves Deville</a>	30h+15h	5 Credits	2q	X	X

**⊗ Elective courses in computing and applied mathematics**

The student can select 10 credits amongst

⊗ LINMA1170	<a href="#">Numerical analysis</a>	<a href="#">Pierre-Antoine Absil</a> , <a href="#">Paul Van Dooren</a> (coord.)	30h +22.5h	5 Credits	1q	X	X
⊗ LINMA1691	<a href="#">Discrete mathematics - Graph theory and algorithms</a>	<a href="#">Vincent Blondel</a> , <a href="#">Jean-Charles Delvenne</a> (compensates Vincent Blondel)	30h +22.5h	5 Credits	1q	X	X
⊗ LINMA2450	<a href="#">Combinatorial optimization</a>	<a href="#">Jean-Charles Delvenne</a>	30h +22.5h	5 Credits	1q	X	X
⊗ LINMA2470	<a href="#">Discrete stochastic models</a>	<a href="#">Philippe Chevalier</a>	30h +22.5h	5 Credits	2q	X	X
⊗ LINMA2471	<a href="#">Optimization models and methods</a>	<a href="#">François Glineur</a>	30h +22.5h	5 Credits	1q	X	X
⊗ LMAT2450	<a href="#">Cryptography</a>	<a href="#">Olivier Pereira</a>	30h+15h	5 Credits	1q	X	X
⊗ LINGI2262	<a href="#">Machine Learning :classification and evaluation</a>	<a href="#">Pierre Dupont</a>	30h+30h	5 Credits	1q	X	X
⊗ LINGE1222	<a href="#">Multivariate Statistical Analysis</a>	<a href="#">Johan Segers</a>	30h+15h	4 Credits	2q	X	X
⊗ LSTAT2020	<a href="#">Statistical computing</a>	<a href="#">Céline Bugli</a> (compensates Bernadette Govaerts), <a href="#">Bernadette Govaerts</a>	20h+20h	6 Credits	1q	X	X
⊗ LSINF2275	<a href="#">Data mining &amp; decision making</a>	<a href="#">Marco Saerens</a>	30h+30h	5 Credits	2q	X	X
⊗ LSINF2224	<a href="#">Programming methods</a>	<a href="#">Charles Pecheur</a>	30h+15h	5 Credits	2q	X	X
⊗ LINGI2339	<a href="#">Abstract interpretation</a>	<a href="#">Baudouin Le Charlier</a>	30h+15h	5 Credits	1q △ ⊕	X	X

							Year	
							1	2
⊗ LINGI2348	Information theory and coding	Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira	30h+15h	5 Credits	2q	x	x	
⊗ LINGI2143	Concurrent systems : models and analysis	Charles Pecheur	30h+15h	5 Credits	1q	x	x	
⊗ LMECA2300	Advanced Numerical Methods	Christophe Craeye, Jonathan Lambrechts, Vincent Legat, Jean-François Remacle	30h+30h	5 Credits	2q	x	x	
⊗ LMECA2170	Numerical Geometry	Vincent Legat, Jean-François Remacle	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 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

‡ Two years course

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

The student selects 15 to 30 credits in the following course list. For students following the master in computer engineering, the minimum is raised to 20 credits, and the validation of this option is not compatible with the validation of the "Networking and Security" and "Communication Networks" options.

De 15 à 30 crédits parmi

Year

1 2

**○ Cours obligatoires ELEC,INFO, et MAP**

○ LMAT2450	<a href="#">Cryptography</a>	<a href="#">Olivier Pereira</a>	30h+15h	5 Credits	1q	x	x
○ LINGI2347	<a href="#">Computer system security</a>	<a href="#">Gildas Avoine, Marco Canini</a> (compensates Gildas Avoine)	30h+15h	5 Credits	2q	x	x
○ LELEC2760	<a href="#">Secure electronic circuits and systems</a>	<a href="#">François-Xavier Standaert</a>	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	<a href="#">Secured systems engineering</a>	<a href="#">Gildas Avoine</a>	30h+15h	5 Credits	1q △	x	x
⊗ LINGI2348	<a href="#">Information theory and coding</a>	<a href="#">Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira</a>	30h+15h	5 Credits	2q	x	x
⊗ LINMA2111	<a href="#">Discrete mathematics II : Algorithms and complexity</a>	<a href="#">Vincent Blondel</a>	30h +22.5h	5 Credits	2q △	x	x
⊗ LELEC2620	<a href="#">Modeling and implementation of analog and mixed analog/digital circuits and systems on chip</a>	<a href="#">David Bol</a>	30h+30h	5 Credits	2q	x	x
⊗ LELEC2870	<a href="#">Machine Learning : regression, dimensionality reduction and data visualization</a>	<a href="#">Michel Verleysen</a>	30h+30h	5 Credits	1q	x	x
⊗ LMAT2440	<a href="#">Number theory</a>	<a href="#">Olivier Pereira, Jean-Pierre Tignol</a>	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

⊗ LINGI2141	<a href="#">Computer networks: information transfer</a>	<a href="#">Olivier Bonaventure</a>	30h+30h	6 Credits	1q	x	x
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## COMMUNICATION NETWORKS

Cette option ne peut pas être validée en même temps que les options « Networking and Security » ou « Cryptography and information security ». Les étudiants gardent toutefois la possibilité de choisir des cours au choix parmi ces autres options.

Cette option n'est accessible qu'aux étudiants ayant suivi la majeure ou la mineure en Electricité durant leur programme de bachelier.

Les étudiants ayant suivi cette option "Networks and telecommunications" devront être capables de :

- Comprendre et pouvoir mettre en oeuvre les différents dispositifs et protocoles utilisés dans les réseaux fixes et mobiles,
- Concevoir, configurer et gérer des réseaux fixes et mobiles en prenant en compte les besoins des applications (y compris multimedia),
- Comprendre et utiliser efficacement les techniques de codage de l'information,
- Comprendre et pouvoir concevoir des systèmes de communication mobiles sans fil depuis la couche physique jusqu'au niveau applicatif.

○ Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

⊞ Two years course

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

*In order to qualify for this option, INFO students must have chosen an ELEC major or minor in their Bachelor -s curriculum. ELEC students must have chosen an INFO major or minor in their Bachelor -s curriculum and shall select De 20 à 30 credits parmi*

Year

1 2

### ○ Compulsory courses for ELEC and INFO Master -s students

Course ID	Course Title	Instructor	Hours	Credits	Year	1	2
LELEC2796	<a href="#">Wireless communications</a>	Claude Oestges (coord.), Luc Vandendorpe	30h+30h	5 Credits	1q	x	x
LELEC2920A	<a href="#">Communication networks</a>	N.	30h+30h	2 Credits	1q	x	x
LINGI2348	<a href="#">Information theory and coding</a>	Jérôme Louveaux, Benoît Macq (coord.), Olivier Pereira	30h+15h	5 Credits	2q	x	x

### ○ Compulsory courses for ELEC Master's students

Course ID	Course Title	Instructor	Hours	Credits	Year	1	2
LINGI2141	<a href="#">Computer networks: information transfer</a>	Olivier Bonaventure	30h+30h	6 Credits	1q	x	x
LINGI2349	<a href="#">Network and communication seminar</a>	Gildas Avoine, Olivier Bonaventure (compensates Gildas Avoine), Olivier Bonaventure	30h	3 Credits	1q	x	x

### ○ Compulsory courses for INFO Master's students

Course ID	Course Title	Instructor	Hours	Credits	Year	1	2
LINGI2142	<a href="#">Computer networks: configuration and management</a>	Olivier Bonaventure	30h+30h	5 Credits	2q	x	x

### ⊗ Elective courses for ELEC and INFO Master's students

Course ID	Course Title	Instructor	Hours	Credits	Year	1	2
LINMA2470	<a href="#">Discrete stochastic models</a>	Philippe Chevalier	30h +22.5h	5 Credits	2q	x	x
LSINF2345	<a href="#">Languages and algorithms for distributed applications</a>	Peter Van Roy	30h+15h	5 Credits	2q	x	x
LINGI2144	<a href="#">Secured systems engineering</a>	Gildas Avoine	30h+15h	5 Credits	1q △	x	x
LINGI2346	<a href="#">Distributed application design</a>	Marc Lobelle	30h+15h	5 Credits	1q	x	x
LINGI2347	<a href="#">Computer system security</a>	Gildas Avoine, Marco Canini (compensates Gildas Avoine)	30h+15h	5 Credits	2q	x	x
LMAT2450	<a href="#">Cryptography</a>	Olivier Pereira	30h+15h	5 Credits	1q	x	x
LMAT2440	<a href="#">Number theory</a>	Olivier Pereira, Jean-Pierre Tignol	30h+15h	5 Credits	1q	x	x

Year

1 2

⌘ *Elective courses for INFO Master's students*

⌘ LELEC2795	Radiation and communication systems	Christophe Craeye, Danielle Janvier, Jérôme Louveaux, Claude Oestges, Luc Vandendorpe	30h+30h	5 Credits	1q	x	x
⌘ LELEC2900	Signal processing	Benoît Macq, Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⌘ LINMA1731	Stochastic processes : Estimation and prediction	Pierre-Antoine Absil, Luc Vandendorpe (coord.)	30h+30h	5 Credits	2q	x	x
⌘ LINGI2315	Design of Embedded and real-time systems	Jean-Didier Legat, Marc Lobelle	30h+30h	5 Credits	2q	x	x

⌘ *Elective courses for ELEC Master's students*

⌘ LINGI2142	Computer networks: configuration and management	Olivier Bonaventure	30h+30h	5 Credits	2q	x	x
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**OPTION IN BIOMEDICAL ENGINEERING**

Cette option n'est accessible qu'aux étudiants ayant suivi la mineure en génie biomédical durant le programme de bachelier.

Cette option n'est pas offerte en anglais.

L'option génie biomédical 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 en bioinformatique ainsi que dans plusieurs autres domaines du génie biomédical parmi: bioinstrumentation, biomatériaux, imagerie médicale, modélisation mathématique, organes artificiels et réhabilitation et biomécanique.

Par la collaboration entre l'Ecole Polytechnique et la faculté de médecine, la curriculum 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 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊖ Periodic courses not taught during 2013-2014

⊞ Two years course

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

*The student who has chosen this option shall select*

*De 20 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	<a href="#">Bioinformatics</a>	<a href="#">Pierre Dupont,</a> <a href="#">Michel Ghislain</a>	30h+30h	5 Credits	2q	x	x
⊗ LGBIO2020	<a href="#">Bioinstrumentation</a>	<a href="#">André Mouraux,</a> <a href="#">Michel Verleysen</a>	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2030	<a href="#">Biomaterials</a>	<a href="#">Sophie Demoustier,</a> <a href="#">Christine Dupont,</a> <a href="#">Gaétane Leloup</a>	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2040	<a href="#">Biomechanics</a>	<a href="#">François Henrotte</a> (compensates Emilie Marchandise), <a href="#">Emilie Marchandise</a>	30h+30h	5 Credits	2q	x	x
⊗ LGBIO2050	<a href="#">Medical Imaging</a>	<a href="#">Anne Bol,</a> <a href="#">John Lee,</a> <a href="#">John Lee</a> (compensates Benoît Macq), <a href="#">Benoît Macq,</a> <a href="#">Frank Peeters</a>	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2060	<a href="#">Modelling of biological systems</a>	<a href="#">Philippe Lefèvre</a>	30h+30h	5 Credits	1q	x	x
⊗ LGBIO2070	<a href="#">Artificial organs and rehabilitation</a>	<a href="#">Luc-Marie Jacquet,</a> <a href="#">Philippe Lefèvre,</a> <a href="#">Renaud Ronsse</a>	30h+30h	5 Credits	2q	x	x

**⊗ Elective courses in biomedical engineering for ELEC students**

⊗ LELEC2870	<a href="#">Machine Learning : regression, dimensionality reduction and data visualization</a>	<a href="#">Michel Verleysen</a>	30h+30h	5 Credits	1q	x	x
⊗ LELEC2885	<a href="#">Image processing and computer vision</a>	<a href="#">Christophe De Vleeschouwer</a> (coord.), <a href="#">Laurent Jacques</a> (compensates Benoît Macq), <a href="#">Benoît Macq</a>	30h+30h	5 Credits	1q	x	x

**BUSINESS RISKS AND OPPORTUNITIES**

Cette option n'est pas accessible aux étudiants ayant sélectionné l'option création des petites et moyennes entreprises.

Cette option n'est pas offerte en anglais.

L'objectif de cette option est de familiariser l'étudiant ingénieur civil avec les principes de base de la gestion des entreprises.

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊙ Periodic courses not taught during 2013-2014

‡ Two years course

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

*This option cannot be chosen along with the option relating to the launching of small and medium-sized companies. The student who chooses this option shall select*

*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	Gerrit Sarens	30h+15h	4 Credits	2q	x	x
⊗ LFSA2202	Ethics and ICT	Axel Gosseries, Olivier Pereira	30h	3 Credits	2q	x	x
⊗ LFSA2245	Environment and Enterprise	Thierry Bréchet	30h	3 Credits	1q	x	x
⊗ LFSA2210	Organisation and human resources	John Cultiaux	30h	3 Credits	1+2q	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>

**OPTION IN LAUNCHING OF SMALL AND MEDIUM-SIZED COMPANIES**

Cette option n'est pas accessible aux étudiants ayant sélectionné l'option en gestion.

Cette option n'est pas offerte en anglais.

L'objectif de cette option est 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 réservée 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 introduites 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 2013-2014

⊕ Periodic courses taught during 2013-2014

⌘ Optional

⊖ Periodic courses not taught during 2013-2014

‡ Two years course

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

*Additional information relative to this option can be found at <http://www.uclouvain.be/cpme> . This option cannot be chosen along with that in management. The student who chooses this option shall select 20 to 25 credits from amongst De 20 à 25 crédits parmi*

Year

1 2

**○ Compulsory courses**

● LCPME2001	<a href="#">Entrepreneurship Theory (in French)</a>	<a href="#">Frank Janssen</a>	30h+20h	5 Credits	1q	x	
● LCPME2003	<a href="#">Business plan of the creation of a company (in French)</a>	<a href="#">Frank Janssen</a>	30h+15h	5 Credits	2q		x
● LCPME2002	<a href="#">Managerial, legal and economic aspects of the creation of a company (in French)</a>	<a href="#">Régis Coeurderoy,</a> <a href="#">Yves De Cordt</a>	30h+15h	5 Credits	1q	x	x
● LCPME2004	<a href="#">Advanced seminar on Entrepreneurship (in French)</a>	<a href="#">Frank Janssen</a>	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	<a href="#">Venture creation financement and management I</a>	<a href="#">Régis Coeurderoy,</a> <a href="#">Olivier Giacomini</a> (compensates R&eacute;gis Coeurderoy), <a href="#">Paul Vanzeveren</a>	30h+15h	5 Credits	1+2q	x	
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## ELECTIVE COURSES OF THE MASTER'S IN COMPUTER SCIENCE ENGINEERING

● Mandatory

△ Courses not taught during 2013-2014

⊕ Periodic courses taught during 2013-2014

⊗ Optional

⊙ Periodic courses not taught during 2013-2014

‡ Two years course

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

						Year	
						1	2
⊗ LFSA2351A	Group dynamics	Piotr Sobieski	15h+30h	3 Credits	1q	x	x
⊗ LFSA2351B	Group dynamics	Piotr Sobieski	15h+30h	3 Credits	2q	x	x
⊗ LFSA2202	Ethics and ICT	Axel Gosseries, Olivier Pereira	30h	3 Credits	2q	x	x
⊗ LINGI2325	Graphic systems and applications	N.	30h+15h	5 Credits	2q △	x	x

### ⊗ Company training periods

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.

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⊗ LFSA2995	Stage en entreprise	Claude Oestges	30h	10 Credits		x	x
⊗ LFSA2996	Stage en entreprise	Claude Oestges		5 Credits		x	x

### ⊗ Advanced courses

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

### ⊗ 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	Laurent Francis, Ernest Matagne	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	30h +22.5h	5 Credits	2q	x	x
⊗ LMAPR2680	Treatments of gaseous wastes	Jacques Devaux, Olivier Françoisse	30h+7.5h	4 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 Goosse, Jean-Pascal van Ypersele de Strihou	30h+15h	5 Credits	1q	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:

						Year	
						1	2
⌘ LNEER2500	Seminar of professional integration: Dutch - intermediate level	Isabelle Demeulenaere (coord.), Mariken Smit	30h	3 Credits		x	x
⌘ LNEER2600	Seminar of professional integration: Dutch - upper-intermediate level	Isabelle Demeulenaere	30h	3 Credits		x	x
⌘ LALLE2500	German - Seminar of professional integration, intermediate level	Caroline Klein, Ann Rinder (coord.)	30h	3 Credits	1+2q	x	x
⌘ LALLE2501	German - Seminar of professional integration, intermediate level	Caroline Klein, Ann Rinder (coord.)	30h	5 Credits	1+2q	x	x
⌘ LESPA2600	Séminaire d'insertion professionnelle - espagnol	Isabel Baeza Varela, Carmen Vallejo Villamor (compensates Isabel Baeza Varela)	30h	3 Credits	1q	x	x
⌘ LESPA2601	Spanish - Seminar of professional integration	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



