ELEC2M

2016 - 2017

Master [120] in Electrical Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In english
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in other languages : **YES**
Activities on other sites : **optional**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Ecole Polytechnique de Louvain (EPL)**
Programme code: **elec2m** - Francophone Certification Framework: 7

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ELEC2M - Introduction

Introduction

Introduction

This Master's degree offers you:

- Diverse professional opportunities in the industrial sector and in the multiple applications of electricity and its related fields;
- Learning how to approach a project;
- Immersion in research laboratories and high technology;
- A large choice of majors;
- The possibility to complete a part of your coursework or internship abroad (in Europe and elsewhere in the world).

Your profile

You:

- have solid skills in the field of electrical sciences and are capable of seeing a job through to the end;
- Wish to develop the skills that will allow you to meet future technological challenges in the scientific and technical fields linked to electricity and its applications;
- Want to design, model, carry out and validate projects by way of experiments, devices, equipment and complex systems;
- Envisage a career in research or industry.

Your programme

This Master's degree offers you:

- Mastery of mathematical and physical methods related to electricity (circuits and measures, electromagnetics, physical electronics);
- Advanced education in electronics, electromagnetics, communication, information technology, mathematics and system design;
- Specialisations in electronic systems, telecommunication, microwaves, information and signal processing, biomedicine, cryptography, electronics, MEMS receptors, nanotechnology and photovoltaic techniques.

ELEC2M - Teaching profile

Learning outcomes

An essential challenge in the training of electrical engineers is the wide variety of elements that must be mastered, which range from knowledge about hardware and software to technology and mathematics to theoretical experiments in modern electricity and its different disciplines to the ability to use a wide variety of applications on a wide scale from small (such as micro-nano-technology) to big (such as spatial communication).

This programme offers diverse professional perspectives in a variety of industrial sectors: the design and achievement [of a project], installation, real time programming, security, marketing, the analysis of given signals from electronic systems, communication networks, information or receptors, electrical equipment used in industrial production, biomedical transport, aerospace, energy and sustainable development.

This Master's programme builds on students' existing knowledge of electricity acquired as part of their Bachelor's degree program including mathematical and physical approaches to electricity (circuits and measures, electromagnetism, physical electronics) as well as key related fields (electronics, telecommunications, signals, and electrotechnology). By the end of their Master's programme in electrical engineering (ELEC), students will have acquired (through their major coursework) in-depth knowledge of the following fields: electronics, electromagnetism, communication, information technologies, mathematics, and system design.

In addition, students may choose between a more general type of major and one that is more specialized (such as a major in a specific technological field).

In its entirety, the programme offers an introduction to industrialisation and research as well as to jobs in production and design or doctoral programmes in R&D.

This Master's programme in electrical engineering is a multipurpose training programme allowing students to acquire expertise in a wide and specialized variety of fields. Its objective is to create engineers who are capable of meeting future technological challenges in the scientific and technical fields linked to electricity and in the context of the rapidly changing circumstances of Europe and the world.

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

1.Show the mastery of a solid body of knowledge in basic and engineering sciences, permitting him/her to understand and solve problems that are raised by electricity (Axis 1)

1.1 Identify and use concepts, laws and reasoning applicable to a given problem

During the first year of studies, in the required courses for the Master's degree in ELEC, we aim for a general education through different classes dealing with the following electrical subjects:

- Methods for mathematics and physics
- Electronics
- Communication
- Signal processing
- Electrotechnology, energy and automation (EEA)
- On board computing

In the major fields of study, the courses are specific to professional fields:

- Nanotechologies
- Electronic systems and circuits
- Electric machines and control
- Electronic security and information technology
- Communication network systems
- RF systems
- Biomedicine

1.2 Identify and use modelling and calculation tools to solve problems

- Measuring devices
- Systems of complex equations
- Calculation and simulation software (Matlab, SPICE)
- CAO software (Comsol, Synopsys, Cadence, TCAD)

1.3 Verify the plausibility and confirm the validity of results; study them closely, notably by comparing them with experimental and/or theoretical results

Verify the units of different variables and the constituent terms in model equations.

Critically compare analytical/simple/approximate solutions with those obtained by more complex numerical methods.

In the first year of studies (major/minor), classes on electrical circuits and electronics, for example, address the problem of modeling by conducting experiments or simulations and formulating simple hypotheses.

During the Master's degree programme (common core courses and coursework for the major field of study), simulation (for example: Matlab) is emphasized above all and laboratories are used to carry out projects on the justification and validation of circuit choices, technologies, programmes, protocols.

2.Organise and carry out an applied engineering process applied to the development of a product (and/or a service) corresponding to a need or a problem specific to the field of electricity (Axis 2)

2.1 Analyse a problem based on actual case studies dealt with by electrical engineers (in interdisciplinary projects) such as devices and electronic circuits and formulate corresponding specifications.

2.2 Model a problem and design one or several original technical solutions corresponding to the assignment specifications (i.e. analysis of existing case studies) and projects (based on new specifications).

2.3 Evaluate and classify solutions in light of the criteria found in the specifications, principally in the context of interdisciplinary projects and specific courses (for example MEMS design or micro-nano-manufacturing technologies).

2.4 Implement and test a solution in the form of a mock-up, a prototype or a numerical model in the context of achieving experimental interdisciplinary projects and for certain classes (for example, micro-nano-manufacturing technologies) as well as for numerical modeling (such as MEMS design).

2.5 Formulate recommendations to improve the operation of the solution under review.

3.Organize and carry out research projects in order to learn about a physical phenomenon or a new problem relating to electricity. (Axis 3)

3.1 When confronted with a new problem, explore the field in question by gathering necessary information through the various available resources (library, scientific articles, Internet, research assistants, industry).

3.2 Suggest a representative mathematical model of an underlying phenomenon and then by working either in a laboratory or via a software platform, create a device or programme that allows the experimental or virtual simulation of the system's behaviour (all the while taking influential parameters into account).

3.3 Write a summary report about the technical aspects of a study in a concise scientific manner; provide an overview of experimental lab results in written reports and suggest possible interpretations of the results.

4.As part of a team, carry out a multidisciplinary project keeping in mind its objectives, allocated resources and relevant constraints. (Axis 4)

4.1 Frame and explain project objectives taking into account the issues and constraints (emergencies, quality, resources, budget) that characterise the project.

4.2 Work collectively to create a project schedule and to determine team member roles in order to successfully carry out the project. This may include the organisation and planning of individual work and that of the team as well as determining the intermediate steps, division of labour, necessary documents, work schedule, and how to integrate your own investigative work into that of the group.

4.3 Work in a multidisciplinary environment in collaboration with other individuals who may hold different points of view or with experts possessing different specialisations all the while being able to put things in perspective in order to overcome any difficulties or conflicts in the team.

4.4 Make team decisions when necessary whether they be about technical solutions or about the division of labour to complete the project.

5.Communicate effectively (speaking or writing in French or a foreign language) with the goal of carrying out assigned projects. (Axis 5)

5.1 Identify the clients' needs: take up a sizable problem regarding an electronic component or system or communicate the functionalities of an algorithm or software program.

5.2 Present your arguments and convince your interlocutors (technicians, colleagues, clients, superiors) by adopting their language; from the laboratory technician to the research engineer or doctoral researcher, notably in the context of graduation projects (TFE) and experiments or APE with access to technical infrastructures or even industry internships.

5.3 Communicate through graphics and diagrams: interpret a diagram, present work results, structure information.

5.4 Read and analyse different technical documents related to the profession (standards, drawings, specifications); for example, circuit or component data sheets, communication protocols, electrical standards.

5.5 Draft a document that takes into account contextual requirements and the target audience: the specifications for an industrial project, the minutes for a project meeting, internship reports, graduation projects (TFE), etc.

5.6 Use modern communication techniques to give scientific and/or technical oral presentations in French and in English and respond to diverse questions (general or specific) generated by your presentation.

6.Demonstrate rigor, openness and critical and ethical awareness in your work: validate the socio-technical relevance of a hypothesis or a solution. (Axis 6)

6.1 Rigorously apply the field's standards (terms, units of measure, quality standards and security).

6.2 Find solutions that go beyond strictly technical issues by considering sustainable development and the socio-economic ethics of a project (for example, in the fields of photovoltaic cells or biomedical applications).

6.3 Demonstrate critical awareness of a technical solution in order to verify its robustness and minimize the risks that may occur during implementation. For example, the development of a solution that impacts work conditions or users' life in the biomedical field.

6.4 Evaluate the knowledge necessary to carry out a project and independently include knowledge that has not been addressed explicitly in the course programme.

Programme structure

The Master's degree program is comprised of:

- a core curriculum (30 to 40 credits)
- a final specialisation (30 credits)
- one or more major or elective courses listed below

The graduation project is normally completed during the second year. However, students opt to complete the project in either the first or second year so long as they have fulfilled the necessary prerequisites. This is particularly the case for students who have completed part of their education abroad.

If during the student's previous studies, he or she has already taken a course that is part of the programme (either required or elective) or they have participated in an academic activity that is approved by the programme commission, the student may count this activity toward their graduation requirements (but only if they respect programme rules). The student will also verify that he/she has obtained the minimum number of credits required for the approval of their diploma as well as for the approval of their major (in order to include their academic distinctions in the diploma supplement).

These types of programmes will be submitted for approval by the relevant Master's degree programme commission.

For a programme-type, and regardless of the focus, options/or elective courses selected, this master will carry a minimum of 120 credits divided over two annual units, corresponding to 60 credits each.

> Core courses for the Master's degree in Electrical Engineering *[en-prog-2016-elec2m-lelec220t.html]*

> Professional focus *[en-prog-2016-elec2m-lelec220s]*

Options courses

> Majors in electrical engineering *[en-prog-2016-elec2m-lelec900r.html]*
- > Major in electro technology-electrical energy *[en-prog-2016-elec2m-lelec221o.html]*
- > Major in telecommunications *[en-prog-2016-elec2m-lelec222o.html]*
- > Major in information and signal processing *[en-prog-2016-elec2m-lelec224o.html]*
- > Major in communication networks *[en-prog-2016-elec2m-lelec225o.html]*
- > Major in microwaves *[en-prog-2016-elec2m-lelec226o.html]*
- > Major in circuits and electronic systems *[en-prog-2016-elec2m-lelec227o.html]*
- > Major in nanotechnology *[en-prog-2016-elec2m-lelec228o.html]*
- > Major in MEMS & NEMS *[en-prog-2016-elec2m-lelec229o.html]*
- > Major in photovoltaic technologies *[en-prog-2016-elec2m-lelec233o.html]*
- > Major in biomedical engineering *[en-prog-2016-elec2m-lelec230o.html]*
- > Major in cryptography and information security *[en-prog-2016-elec2m-lelec235o.html]*

> Major in business creation and management *[en-prog-2016-elec2m-lelec930r.html]*
- > Major in business risks and opportunities *[en-prog-2016-elec2m-lelec231o.html]*
- > Major in small and medium sized business creation *[en-prog-2016-elec2m-lelec232o.html]*

> Elective courses *[en-prog-2016-elec2m-lelec929r.html]*
- > Elective courses for the Master's degree programme in electrical engineering *[en-prog-2016-elec2m-lelec223o.html]*

ELEC2M Detailled programme

Programme by subject

CORE COURSES

- ⭘ Mandatory
- △ Courses not taught during 2016-2017
- ⊕ Periodic courses taught during 2016-2017
- ⯐ Optional
- ⊘ Periodic courses not taught during 2016-2017
- ■ Activity with requisites

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

The student shall select

						Year 1	Year 2
⭘ LELEC2990	Graduation project/End of studies project	Isabelle.Dargent (coord.)		28 Credits			x

⭘ Religion courses for students in natural sciences (2 credits)

						Year 1	Year 2
⯐ 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	Marcela.Lobo	15h	2 Credits	1q	x	x

⯐ Professional contacts

Students who don't take any course in the major "Business risks and opportunities" or CPME must take at least: min=3 credits parmi

						Year 1	Year 2
⯐ LFSA2995	Company Internship	Jean-Pierre.Raskin	30h	10 Credits	1 + 2q	x	x
⯐ LFSA2996	Company Internship			5 Credits	1 + 2q	x	x
⯐ LELEC2590	Seminars in electronics and communications	Denis.Flandre Isabelle.Huynen Jerome.Louveaux	30h	3 Credits	2q	x	x

PROFESSIONAL FOCUS [30.0]

- ⭘ Mandatory
- △ Courses not taught during 2016-2017
- ⊕ Periodic courses taught during 2016-2017
- ⯐ Optional
- ⊘ Periodic courses not taught during 2016-2017
- ■ Activity with requisites

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

The student has to take all the following courses:

						Year 1	Year 2
⭘ LELEC2531	Design and Architecture of digital electronic systems	Jean-Didier.Legat	30h+30h	5 Credits	1q	x	
⭘ LELEC2795	Radiation and communication systems	Christophe.Craeye Danielle.Vanhoenacker Jerome.Louveaux Claude.Oestges Luc.Vandendorpe	30h+30h	5 Credits	1q	x	
⭘ LELEC2103	Project in Electricity 3 : Electronic systems	Jean-Didier.Legat Jerome.Louveaux Luc.Vandendorpe	75h	5 Credits	1 + 2q	x	
⭘ LELEC2900	Signal processing	Benoit.Macq Luc.Vandendorpe	30h+30h	5 Credits	2q	x	
⭘ LINGI2315	Design of Embedded and real-time systems	Jean-Didier.Legat	30h+30h	5 Credits	2q	x	
⭘ LINMA1731	Stochastic processes : Estimation and prediction	Pa.Absil Luc.Vandendorpe (coord.)	30h+30h	5 Credits	2q	x	

OPTIONS

The student has to complete his program with majors and/or elective courses. He shall select
De 60 à 60 credits parmi

Majors in electrical engineering

> Major in electro technology-electrical energy *[en-prog-2016-elec2m-lelec221o]*
> Major in telecommunications *[en-prog-2016-elec2m-lelec222o]*
> Major in information and signal processing *[en-prog-2016-elec2m-lelec224o]*
> Major in communication networks *[en-prog-2016-elec2m-lelec225o]*
> Major in microwaves *[en-prog-2016-elec2m-lelec226o]*
> Major in circuits and electronic systems *[en-prog-2016-elec2m-lelec227o]*
> Major in nanotechnology *[en-prog-2016-elec2m-lelec228o]*
> Major in MEMS & NEMS *[en-prog-2016-elec2m-lelec229o]*
> Major in photovoltaic technologies *[en-prog-2016-elec2m-lelec233o]*
> Major in biomedical engineering *[en-prog-2016-elec2m-lelec230o]*
> Major in cryptography and information security *[en-prog-2016-elec2m-lelec235o]*

Major in business creation and management

> Major in business risks and opportunities *[en-prog-2016-elec2m-lelec231o]*
> Major in small and medium sized business creation *[en-prog-2016-elec2m-lelec232o]*

Elective courses

> Elective courses for the Master's degree programme in electrical engineering *[en-prog-2016-elec2m-lelec223o]*

MAJORS IN ELECTRICAL ENGINEERING

The student can select one or several majors between:

MAJOR IN ELECTRO TECHNOLOGY-ELECTRICAL ENERGY

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

The student shall select:
De 18 à 21 credits parmi

O Compulsory courses electronics and electrotechnics (13 credits)

						Year 1	Year 2
O LELEC2520	Electric Power Systems	Emmanuel.Dejaeger	30h+30h	5 Credits	1q	x	x
O LELEC2660	Power electronics	Marc.Bekemans	30h+15h	4 Credits	1q	x	x
O LELEC2313	Dynamic modelling and control of electromechanical converters	Emmanuel.Dejaeger Bruno.Dehez	30h+30h	4 Credits	1q	x	x

⊠ Elective courses electrotechnics

⊠ LELEC2311	Physics of Electromechanical Converters	Bruno.Dehez	30h+15h	4 Credits	2q	x	x
⊠ LELEC2595	Electric Power Systems Quality	Emmanuel.Dejaeger	30h+30h	5 Credits	2q	x	x
⊠ LELEC2670	Renewable and non conventional sources of electrical energy	Emmanuel.Dejaeger Pascal.Jacques	30h+15h	4 Credits	2q	x	x

						Year 1	2
⊠ LELEC2753	Electrical Power Systems: Advanced Topics	Emmanuel.Dejaeger	30h+15h	5 Credits	2q	x	x
⊠ LELEC2811	Instrumentation and sensors	David.Bol Laurent.Francis	30h+30h	5 Credits	1q	x	x

MAJOR IN TELECOMMUNICATIONS

The objectives of the telecommunications major are:

- Present the general organisation of communication networks and systems (wired or wireless)
- Present communications from the framework of information theory covering data compression (source-coding) and replication (channel coding)
- Present the different elements of modern modems, as well as systematic design methods for detection blocks and required estimates
- Offer a range of design tools for modems and systems

Through this major, students will master important concepts about IP networks, GSM, UMTS and DSL access networks as well as new communications methods.

⭘ Mandatory	✲ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	■ Activity with requisites

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

This major is not compatible with the major in communication networks. The students selecting this major may select 20-25 credits from the following courses:
De 20 à 25 credits parmi

⭘ Compulsory courses telecommunications

Code	Title	Teachers	Hours	Credits	Term	Year 1	Year 2
⭘ LELEC2880	Modem design	Jerome.Louveaux Luc.Vandendorpe	30h+30h	5 Credits	2q	x	x
⭘ LELEC2920	Communication networks	Sebastien.Lugan (compensates Benoît Macq) Benoit.Macq	30h+30h	5 Credits	1q	x	x
⭘ LELEC2796	Wireless communications	Claude.Oestges Luc.Vandendorpe	30h+30h	5 Credits	1q	x	x
⭘ LINGI2348	Information theory and coding	Jerome.Louveaux Jerome.Louveaux (compensates Olivier Pereira) Benoit.Macq (coord.) Olivier.Pereira	30h+15h	5 Credits	2q	x	x

✲ Elective courses telecommunications

Code	Title	Teachers	Hours	Credits	Term	Year 1	Year 2
✲ LINMA1702	Applied mathematics : Optimization I	Francois.Glineur	30h +22.5h	5 Credits	2q	x	x
✲ LELEC2590	Seminars in electronics and communications	Denis.Flandre Isabelle.Huynen Jerome.Louveaux	30h	3 Credits	2q	x	x

MAJOR IN INFORMATION AND SIGNAL PROCESSING

As in the Master's degree programme for electrical engineering, electro-mechanical engineering, and applied mathematics, the objective of this major is to provide students with new tools used to understand graphs, discrete mathematics, matrices, and optimisation. For example, students may use these tools when solving communication problems, analysing and recognising data and signals, cryptography and system identification.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

The student shall select:
De 15 à 30 credits parmi

O Prerequisite courses in information and signal processing

Students who have not previously taken LINMA1510 or its equivalent, must take it as part of their major coursework. In this case, the minimum number of required credits for this major increases to 20.

						Year 1	Year 2
O LINMA1510	Linear Control	Denis.Dochain	30h+30h	5 Credits	2q	x	x

O Required courses (ELEC/ELEM)/recommended courses (MAP) in signal processing

O LINGI2348	Information theory and coding	Jerome.Louveaux Jerome.Louveaux (compensates Olivier Pereira) Benoit.Macq (coord.) Olivier.Pereira	30h+15h	5 Credits	2q	x	x
O LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John.Lee (compensates Michel Verleysen) Michel.Verleysen	30h+30h	5 Credits	1q	x	x
O LELEC2885	Image processing and computer vision	Christophe.Devleeschouwer Laurent.Jacques	30h+30h	5 Credits	1q	x	x

⊠ Elective courses for signal processing

⊠ LELEC2880	Modem design	Jerome.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 (coord.)	30h +22.5h	5 Credits	1q	x	x
⊠ LMAT2450	Cryptography	Francois.Koeune (compensates Olivier Pereira) Olivier.Pereira Thomas.Peters (compensates Olivier Pereira) Francois-Xavier.Standaert (compensates Olivier Pereira)	30h+15h	5 Credits	1q	x	x
⊠ LINMA2875	System Identification	Julien.Hendrickx	30h+30h	5 Credits	2q	x	x

⊠ Elective courses exclusively for students enrolled in the ELEC/ELME Master¿s degree programme

⊠ LINMA1691	Discrete mathematics - Graph theory and algorithms	Vincent.Blondel Jean-Charles.Delvenne	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA1702	Applied mathematics : Optimization I	Francois.Glineur	30h +22.5h	5 Credits	2q	x	x
⊠ LINMA2380	Matrix computations	Paul.Vandooren	30h +22.5h	5 Credits	1q	x	x

						Year 1	Year 2
⊠ Elective courses exclusively for students enrolled in the MAP Master¿s degree programme							
⊠ LELEC1360	TELECOMMUNICATIONS	Luc.Vandendorpe	30h+30h	5 Credits	2q	x	x
⊠ LELEC2900	Signal processing	Benoit.Macq Luc.Vandendorpe	30h+30h	5 Credits	2q	x	x

MAJOR IN COMMUNICATION NETWORKS

This major is organised in conjunction with the Master’s degree in electrical engineering and computer sciences. It may not be selected as the same time as the major in telecommunications. The courses already taken as part of the Master’s degree programme in electrical engineering or computer sciences must be approved to count toward this major.

The objective of the major in communications networks is to allow the student to:

- Understand and implement different devices and protocols used in landlines and wireless networks taking into account application needs (including multimedia).
- Design, configure and manage landlines and wireless networks by taking into account application needs (including multimedia).
- Understand and design wireless communication systems from start to finish.

Mandatory	Optional
Courses not taught during 2016-2017	Periodic courses not taught during 2016-2017
Periodic courses taught during 2016-2017	Activity with requisites

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

To enrol in this major, INFO students must have enrolled in the ELEC major or minor during the Bachelor¿s degree programme and they have to take a minimum of 27 credits. ELEC students must have enrolled in the INFO major or minor during their Bachelor's degree programme and select 25-30 credits from the following courses:
De 25 à 30 credits parmi

Compulsory courses for ELEC and INFO Master -s students

						Year 1	Year 2
LELEC2796	Wireless communications	Claude.Oestges Luc.Vandendorpe	30h+30h	5 Credits	1q	x	x
LELEC2920A	Communication networks	Sebastien.Lugan Benoit.Macq	30h+30h	2 Credits	1q	x	x
LINGI2348	Information theory and coding	Jerome.Louveaux Jerome.Louveaux (compensates Olivier Pereira) Benoit.Macq (coord.) Olivier.Pereira	30h+15h	5 Credits	2q	x	x

Compulsory courses for ELEC Master's students

						Year 1	Year 2
LINGI1341	Computer networks	Olivier.Bonaventure	30h+30h	6 Credits	1q	x	x
LINGI2349	Networking and security seminar	Olivier.Bonaventure	30h+0h	3 Credits	1q	x	x

Compulsory courses for INFO Master's students

						Year 1	Year 2
LINGI2142	Computer networks: configuration and management	Olivier.Bonaventure	30h+30h	5 Credits	2q	x	x

Elective courses for ELEC and INFO Master's students

						Year 1	Year 2
LINMA2470	Stochastic modelling	Philippe.Chevalier	30h +22.5h	5 Credits	2q	x	x
LSINF2345	Distributed application design	Peter.Vanroy	30h+15h	5 Credits	2q	x	x
LINGI2144	Secured systems engineering	Gildas.Avoine	30h+15h	5 Credits	1q	x	x
LINGI2347	Computer system security	Ramin.Sadre	30h+15h	5 Credits	2q	x	x
LMAT2450	Cryptography	Francois.Koeune (compensates Olivier Pereira) Olivier.Pereira Thomas.Peters (compensates Olivier Pereira) Francois-Xavier.Standaert (compensates Olivier Pereira)	30h+15h	5 Credits	1q	x	x

						Year 1	Year 2
LMAT2440	Number theory	Olivier.Pereira Thomas.Peters (compensates Olivier Pereira) Jean-Pierre.Tignol	30h+15h	5 Credits	1q	x	x

Elective courses for INFO Master's students

LELEC2795	Radiation and communication systems	Christophe.Craeye Danielle.Vanhoenacker Jerome.Louveaux Claude.Oestges Luc.Vandendorpe	30h+30h	5 Credits	1q	x	x
LELEC2900	Signal processing	Benoit.Macq Luc.Vandendorpe	30h+30h	5 Credits	2q	x	x
LINMA1731	Stochastic processes : Estimation and prediction	Pa.Absil Luc.Vandendorpe (coord.)	30h+30h	5 Credits	2q	x	x
LINGI2315	Design of Embedded and real-time systems	Jean-Didier.Legat	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

MAJOR IN MICROWAVES

The objective of the major in microwaves is to provide students with the necessary foundation to design, simulate, and create microwave devices and circuits (including antennas) and insert them in communication and detection circuits as well as to model and measure transmission channels. This major includes not only the design of devices and circuits but the numerical simulation of devices and channels as well as means to measure microwaves in devices and transmission channels.

O Mandatory	⯐ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	■ Activity with requisites

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

Students may select 16 to 26 credits from the following courses:
De 16 à 26 credits parmi

O Compulsory courses microwaves

Code	Title	Teachers	Hours	Credits	Term	Year 1	Year 2
O LELEC2580	Design of RF and microwave communication circuits	Christophe.Craeye Danielle.Vanhoenacker	30h+30h	5 Credits	2q	x	x
O LELEC2700	Microwaves	Isabelle.Huynen Danielle.Vanhoenacker Danielle.Vanhoenacker (compensates Isabelle Huynen)	30h+30h	5 Credits	1q	x	x
O LELEC2910	Antennas and propagation	Christophe.Craeye Danielle.Vanhoenacker	30h+30h	5 Credits	1q	x	x

⯐ Elective courses microwaves

Code	Title	Teachers	Hours	Credits	Term	Year 1	Year 2
⯐ LELEC2541	Advanced Transistors	Vincent.Bayot (coord.) Denis.Flandre Jean-Pierre.Raskin	30h+30h	5 Credits	2q	x	x
⯐ LELEC2590	Seminars in electronics and communications	Denis.Flandre Isabelle.Huynen Jerome.Louveaux	30h	3 Credits	2q	x	x
⯐ LELEC2796	Wireless communications	Claude.Oestges Luc.Vandendorpe	30h+30h	5 Credits	1q	x	x
⯐ LMECA2300	Advanced Numerical Methods	Philippe.Chatelain Christophe.Craeye Vincent.Legat Jean-Francois.Remacle	30h+30h	5 Credits	2q	x	x

MAJOR IN CIRCUITS AND ELECTRONIC SYSTEMS

The objective of the major in circuits and electronics systems (which it shares with other Master's degree programmes in electrical engineering) is to introduce students to techniques of system design, computer simulation, manufacturing and experimental classification of electronic circuit components both numerical and analogue as well as the mixed systems associated with these components. Emphasis is placed on the practical applications necessary to carry out projects.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Students may select 15 to 29 credits from the following courses:
De 15 à 29 credits parmi

O Compulsory course in circuits and electronics sytems

						Year 1	Year 2
O LELEC2532	Design and Architecture of analog electronic systems	David.Bol Denis.Flandre	30h+30h	5 Credits	2q	x	x

⊠ Elective courses for circuits and electronic systems

⊠ LELEC2570	Synthesis of digital integrated circuits	David.Bol	30h+30h	5 Credits	1q	x	x
⊠ LELEC2590	Seminars in electronics and communications	Denis.Flandre Isabelle.Huynen Jerome.Louveaux	30h	3 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
⊠ LELEC2650	Synthesis of analog integrated circuits	Denis.Flandre	30h+30h	5 Credits	1q	x	x
⊠ LELEC2660	Power electronics	Marc.Bekemans	30h+15h	4 Credits	1q	x	x
⊠ LELEC2760	Secure electronic circuits and systems	Francois-Xavier.Standaert	30h+30h	5 Credits	2q	x	x

MAJOR IN NANOTECHNOLOGY

As with the Master's degree programmes in electrical and electro-mechanical engineering as well as physics, chemistry and material sciences, the objective of this major is to introduce the student to the physics and simulation of materials and devices used in the field of micro and nano-electronics; to the properties and methods of manufacturing and classifying micro and nano-structures; to the operating methods of nano-devices as well as the development and integration of organic elements into nano-systems.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Students may select 20-30 credits from among the following courses:
De 20 à 30 credits parmi

⊠ Nano-structures and the physics of nano-materials

To enrol in this major, students should have already taken a physical materials class such as MAPR1492. The classes MAPR2451 and 2471 are not open to students in the Master's degree programme in physical engineering

						Year 1	Year 2
⊠ LMAPR2015	Physics of Nanostructures	Jean-Christophe.Charlier Xavier.Gonze Aurelien.Lherbier (compensates Jean-Christophe Charlier) Luc.Piraux	37.5h +22.5h	5 Credits	1q	x	x
⊠ LMAPR2451	Atomistic and nanoscopic simulations	Jean-Christophe.Charlier Xavier.Gonze Aurelien.Lherbier (compensates Jean-Christophe Charlier) Aurelien.Lherbier (compensates Xavier Gonze) Gian-Marco.Rignanese	30h+30h	5 Credits	2q	x	x
⊠ LMAPR2471	Transport phenomena in solids and nanostructures	Jean-Christophe.Charlier Aurelien.Lherbier (compensates Jean-Christophe Charlier) Luc.Piraux	30h+30h	5 Credits	2q	x	x
⊠ LPHY2273	Cryophysique et questions spéciales de supraconductivité	Vincent.Bayot Luc.Piraux	45h+15h	5 Credits	1q	x	x
⊠ LFUND2908	Théorie quantique de l'état solide organique			3 Credits		x	x

⊠ Nano and micro semi-conductor devices

To enrol in these courses it is recommended that students have already taken a course in physical electronics or in semiconductor devices such as ELEC 1330 or ELEC 1755 or similar.

						Year 1	Year 2
⊠ LELEC2541	Advanced Transistors	Vincent.Bayot (coord.) Denis.Flandre Jean-Pierre.Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2550	Special electronic devices	Vincent.Bayot (coord.) Denis.Flandre Laurent.Francis Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x
⊠ LELEC2710	Nanoelectronics	Vincent.Bayot (coord.) Denis.Flandre Laurent.Francis Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x

⊠ Micro and nano-engineering

						Year 1	Year 2
⊠ LELEC2560	Micro and Nanofabrication Techniques	Laurent.Francis Benoit.Hackens Jean-Pierre.Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2895	Design of micro and nanosystems	Denis.Flandre Laurent.Francis (coord.) Thomas.Pardoen Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x

						Year 1	2
⊠ LMAPR2012	Macromolecular Nanotechnology	Sophie.Demoustier (compensates Bernard Nysten) Sophie.Demoustier Sophie.Demoustier (compensates Karine Glinel) Karine.Glinel Jean-Francois.Gohy (compensates Bernard Nysten) Jean-Francois.Gohy Jean-Francois.Gohy (compensates Karine Glinel) Bernard.Nysten	45h+15h	5 Credits	2q	x	x
⊠ LMAPR2631	Surface Analysis	Arnaud.Delcorte Bernard.Nysten Bernard.Nysten (compensates Arnaud Delcorte)	30h+15h	5 Credits	2q	x	x

MAJOR IN MEMS & NEMS

The objective of the major in micro and nano-systems (as with the Master's degree programme in electrical engineering and electromechanics) is to introduce students to the techniques of micro and nano-manufacturing, design and multiphysical simulation and the classification of micro and nano receptors and actuators in integrated technology. Given the applications of MEMS and NEMS in numerous fields (automotive, communications, electronics, domestic, medical) the analysis of micro and nano-structures and the study of their behaviour is based on a multidisciplinary approach.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Students enrolled in this major must also enrol in one of the following minors: ELEC, FYKI or MECA. Students may select 15 to 28 credits from the following courses:
De 15 à 28 credits parmi

O Compulsory courses in MEMS & NEMS

						Year 1	Year 2
O LELEC2560	Micro and Nanofabrication Techniques	Laurent.Francis Benoit.Hackens Jean-Pierre.Raskin	30h+30h	5 Credits	2q	x	x
O LELEC2895	Design of micro and nanosystems	Denis.Flandre Laurent.Francis (coord.) Thomas.Pardoen Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x

⊠ Elective courses in MEMS & NEMS

⊠ LELEC2590	Seminars in electronics and communications	Denis.Flandre Isabelle.Huynen Jerome.Louveaux	30h	3 Credits	2q	x	x
⊠ LMAPR2015	Physics of Nanostructures	Jean-Christophe.Charlier Xavier.Gonze Aurelien.Lherbier (compensates Jean-Christophe Charlier) Luc.Piraux	37.5h +22.5h	5 Credits	1q	x	x
⊠ LMAPR2020	Materials Selection	Christian.Bailly Thomas.Pardoen	30h +22.5h	5 Credits	2q	x	x
⊠ LPHY2246	Basses pressions et physique du vide	Benoit.Hackens Sorin.Melinte	30h	5 Credits	1q	x	x
⊠ LELEC2811	Instrumentation and sensors	David.Bol Laurent.Francis	30h+30h	5 Credits	1q	x	x

MAJOR IN PHOTOVOLTAIC TECHNOLOGIES

This major covers a subject of social and industrial consequence, which it has in common with the Master's degree programmes in ELEC, KIMA and FYAP. Building off of basic knowledge of physical electronics, this major aims first for students to master the internal functioning of photovoltaic cells and then through elective courses learn about applications or advanced R& D regarding manufacturing, quantum or optical properties, thin strata materials, network connections, etc.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

LELEC1330 is a prerequisite for this major. LMAPR 1805, LMAPR 1492 and LMAPR 2014 may also be prerequisites depending on the course selected by the student. Students may choose 20-30 credits from the following courses:
De 20 à 30 credits parmi

O Compulsory courses Photovoltaic technologies (5 credits)

						Year 1	Year 2
O LELEC2550	Special electronic devices	Vincent.Bayot (coord.) Denis.Flandre Laurent.Francis Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x

O Elective courses in photovoltaic technologies

15-25 credits from among:
De 15 à 25 credits parmi

⊠ Solar cells

Students can not take LELEC2710 and LMAPR2015 and the same time

⊠ LELEC2560	Micro and Nanofabrication Techniques	Laurent.Francis Benoit.Hackens Jean-Pierre.Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2710	Nanoelectronics	Vincent.Bayot (coord.) Denis.Flandre Laurent.Francis Jean-Pierre.Raskin	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2015	Physics of Nanostructures	Jean-Christophe.Charlier Xavier.Gonze Aurelien.Lherbier (compensates Jean-Christophe Charlier) Luc.Piraux	37.5h +22.5h	5 Credits	1q	x	x
⊠ LPHY2141	Optique et lasers	Alain.Cornet Clement.Lauzin	30h+10h	5 Credits	1q	x	x

⊠ Thin strata

⊠ LMAPR2020	Materials Selection	Christian.Bailly Thomas.Pardoen	30h +22.5h	5 Credits	2q	x	x
⊠ LMAPR2672	Sintered materials and surface treatments	Jean-Pierre.Erauw Pascal.Jacques Joris.Proost	30h+30h	5 Credits	2q ⊕	x	x
⊠ LPHY2246	Basses pressions et physique du vide	Benoit.Hackens Sorin.Melinte	30h	5 Credits	1q	x	x

⊠ Electrical network

⊠ LELEC2595	Electric Power Systems Quality	Emmanuel.Dejaeger	30h+30h	5 Credits	2q	x	x
⊠ LELEC2670	Renewable and non conventional sources of electrical energy	Emmanuel.Dejaeger Pascal.Jacques	30h+15h	4 Credits	2q	x	x

MAJOR IN BIOMEDICAL ENGINEERING

As with most of the other Master's degree programmes in civil engineering, the objective of this major is to train engineers able to meet future technological challenges in the scientific and technical fields associated with biomedical engineering. This major will provide students with basic knowledge in several biomedical engineering fields such as bioinstrumentation, biomaterials, medical imaging, mathematical modelling, artificial organs and rehabilitation. The School of Engineering and the School of Medicine collaborate to provide students with an interdisciplinary programme of study where the art of engineering is applied to the complex and varied biomedical field.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Students may choose 15-30 credits from the following courses:
De 15 à 30 credits parmi

O Required courses in biomedical engineering

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

					Year 1	Year 2
⊠ LGBIO2010	Bioinformatics	Pierre.Dupont Michel.Ghislain	30h+30h	5 Credits	2q	x	x
⊠ LGBIO2020	Bioinstrumentation	Andre.Mouraux Michel.Verleysen	30h+30h	5 Credits	1q	x	x
⊠ LGBIO2030	Biomaterials	Sophie.Demoustier Christine.Dupont Gaetane.Leloup	30h+30h	5 Credits	1q	x	x
⊠ LGBIO2040	Biomechanics	Francois.Henrotte	30h+30h	5 Credits	2q	x	x
⊠ LGBIO2050	Medical Imaging	Anne.Bol John.Lee Benoit.Macq Frank.Peeters	30h+30h	5 Credits	1q	x	x
⊠ LGBIO2060	Modelling of biological systems	Philippe.Lefevre	30h+30h	5 Credits	1q	x	x

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

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

MAJOR IN CRYPTOGRAPHY AND INFORMATION SECURITY

As with most of the other Master's degree programmes in electrical engineering, computer science and applied mathematics, this major provides students with the knowledge to answer questions about information security with algorithms and mathematics as well as design and solve problems in the context of electronic circuits and information systems.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Students may choose 15-30 credits from the following courses:
De 15 à 30 credits parmi

⊠ Elective courses

In order to validate this option INFO and MAP students have to take at least 20 credits and the ELEC students have to take at least 15 credits among:

						Year 1	Year 2
⊠ LELEC2760	Secure electronic circuits and systems	Francois-Xavier.Standaert	30h+30h	5 Credits	2q	x	x
⊠ LINGI2144	Secured systems engineering	Gildas.Avoine	30h+15h	5 Credits	1q	x	x
⊠ LINGI2347	Computer system security	Ramin.Sadre	30h+15h	5 Credits	2q	x	x
⊠ LINGI2348	Information theory and coding	Jerome.Louveaux Jerome.Louveaux (compensates Olivier Pereira) Benoit.Macq (coord.) Olivier.Pereira	30h+15h	5 Credits	2q	x	x
⊠ LMAT2440	Number theory	Olivier.Pereira Thomas.Peters (compensates Olivier Pereira) Jean-Pierre.Tignol	30h+15h	5 Credits	1q	x	x
⊠ LMAT2450	Cryptography	Francois.Koeune (compensates Olivier Pereira) Olivier.Pereira Thomas.Peters (compensates Olivier Pereira) Francois-Xavier.Standaert (compensates Olivier Pereira)	30h+15h	5 Credits	1q	x	x

MAJOR IN BUSINESS CREATION AND MANAGEMENT

MAJOR IN BUSINESS RISKS AND OPPORTUNITIES

As with most of the Master's degree programs in civil engineering, the aim of this major is to familiarise the student with the basic principles of business management.

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	🟨 Activity with requisites

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

This major may not be taken at the same time as the major in small and medium-sized business creation.Students in this major may choose 16-20 credits from the following courses:
De 16 à 20 credits parmi

						Year 1	2
⊠ LFSA2140	Elements of law for industry and research	Fernand.Devisscher Werner.Derijcke Benedicte.Inghels	30h	3 Credits	1q	x	x
⊠ LFSA2230	Introduction to management and to business economics	Benoit.Gailly Vincent.Reuter (compensates Benoît Gailly)	30h+15h	4 Credits	2q	x	x
⊠ LFSA1290	Introduction to financial and accounting management	Andre.Nsabimana (compensates Gerrit Sarens) Gerrit.Sarens	30h+15h	4 Credits	2q	x	x
⊠ LFSA2202	Ethics and ICT	Axel.Gosseries Maxime.Lambrecht (compensates Olivier Pereira) Olivier.Pereira	30h	3 Credits	2q	x	x
⊠ LFSA2245	Environment and business	Thierry.Brechet	30h	3 Credits	1q	x	x
⊠ LFSA2210	Organisation and human resources	John.Cultiaux	30h	3 Credits	2q	x	x

⊠ *Alternative to the major in business risks and opportunities for computer science students*

Computer science students who have already taken courses in this field while pursuing their Bachelor's degree may choose between 16-20 credits from the courses offered in the management minor for computer sciences.

MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

In keeping with most of the Masters' degrees in civil engineering, the goal of this major is to familiarise the civil engineering student with the specifics of small and medium sized businesses, entrepreneurship, and business development in order to develop the necessary abilities, knowledge and tools to create a business. This major is reserved for a small number of students selection of whom is based on a written application and individual interview. The written application must be submitted before the start of the academic year for Master's 1. Applications may be sent to:

Secrétariat CPME-Place des Doyens, 1

1348 Louvain-la-Neuve (tel. 010/47 84 59)

Selected students will replace their Master's thesis in the common core curriculum with a thesis specific to business creation (the number of credits remaining the same).

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Additional information about this major may be found at http//www.uclouvain.be/cpme. This major may not be taken at the same time as the major in management. Students in this major may choose 20-25 credits from the following courses:
De 20 à 25 credits parmi

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

						Year 1	Year 2
O LCPME2001	Entrepreneurship Theory (in French)	Frank.Janssen	30h+20h	5 Credits	1q	x	
O LCPME2002	Managerial, legal and economic aspects of the creation of a company (in French)	Regis.Coeurderoy Yves.Decordt Marine.Falize (compensates Régis Coeurderoy)	30h+15h	5 Credits	1q	x	x
O LCPME2003	Business plan of the creation of a company (in French)	Frank.Janssen	30h+15h	5 Credits	2q		x
O LCPME2004	Advanced seminar on Enterpreneurship (in French)	Roxane.DeHoe (compensates Frank Janssen) Frank.Janssen	30h+15h	5 Credits	2q	x	x

⊠ Prerequisite CPME courses

Students who have not taken management courses during their previous studies must enroll in LCPME2000.

O LCPME2000	Venture creation financement and management I	Olivier.Giacomin Paul.Vanzeveren	30h+15h	5 Credits	1q	x	

ELECTIVE COURSES

ELECTIVE COURSES FOR THE MASTER'S DEGREE PROGRAMME IN ELECTRICAL ENGINEERING

O Mandatory	⊠ Optional
△ Courses not taught during 2016-2017	⊘ Periodic courses not taught during 2016-2017
⊕ Periodic courses taught during 2016-2017	Activity with requisites

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

Depending on the major, students may need to complete their programme through a combination of elective courses in order to reach 60 credits for the total number of major and elective courses.

						Year 1	Year 2
⊠ LFSA2212	Innovation classes	Pierre.Latteur Benoit.Macq Benoit.Raucent	30h+15h	5 Credits	1q	x	x
⊠ LFSA2351A	Group dynamics	Piotr.Sobieski (coord.) Vincent.Wertz (coord.)	15h+30h	3 Credits	1q	x	x
⊠ LFSA2351B	Group dynamics	Piotr.Sobieski (coord.) Vincent.Wertz (coord.)	15h+30h	3 Credits	2q	x	x

⊠ *Other possible courses*

Students may select up to 6 credits classes in the programmes of the whole university (including humanities), except if he/she took a major in business creation and management.
A list of interesting humanities courses is avaibles at the secretariat of the diploma committee. Students may choose a maximum of 6 credits. This possibility is however not offerred to students who have choose to specialize in Management or Company launching.

⊠ *Advanced courses*

Students should note that any course offered as part of their major but not taken as such may be taken as an elective course.
Students should note that any course appearing in the options of their Master, but not selected as such, remains a possible elective.

⊠ *Languages*

Students may select from any language course offered at the ILV for a maximum of 3 credits out of the 120 core credits needed for their Master's degree.
Special attention is placed on the following seminars in professional development:
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. Their attention is drawn to the following professional insertion seminars:

⊠ LALLE2500	Professional development seminar German	Caroline.Klein Ann.Rinder (coord.)	30h	3 Credits	1 + 2q	x	x
⊠ LALLE2501	Professional development seminar-German	Caroline.Klein Ann.Rinder (coord.)	30h	5 Credits	1 + 2q	x	x
⊠ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula.Lorente (coord.)	30h	3 Credits	1q	x	x
⊠ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula.Lorente (coord.)	30h	5 Credits	1q	x	x
⊠ 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 (coord.)	30h	3 Credits	1 ou 2q	x	x

⊠ *General knowledge courses*

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

⊠ *Short-term exchanges (2 credits)*

Students may include in their curriculum any BEST or ATHENS course subject to approval by the programme 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

Course prerequisites

A document entitled en-prerequis-2016-elec2m.pdf specifies the activities (course units - CU) with one or more pre-requisite(s) within the study programme, that is the CU whose learning outcomes must have been certified and for which the credits must have been granted by the jury before the student is authorised to sign up for that activity.

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

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

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

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

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

For more information, please consult regulation of studies and exams.

The programme's courses and learning outcomes

For each UCL training programme, a reference framework of learning outcomes specifies the competences expected of every graduate on completion of the programme. You can see the contribution of each teaching unit to the programme's reference framework of learning outcomes in the document "In which teaching units are the competences and learning outcomes in the programme's reference framework developed and mastered by the student?"

The document is available by clicking this link after being authenticated with UCL account.

ELEC2M - Information

Admission

Decree of March 31st 2004 defining higher education, favoring its integration in the European framework of higher education and refinancing universities.
The admission requirements have to be met at the time of enrolment at the university.

All information can be obtained from the University's Enrolment Office (Service des inscriptions – SIC).

General conditions
Special conditions
Language examination: knowledge of the French language (Pedagogical Master's degree)

General conditions

Students with one of the following qualifications have access to studies leading to the award of a Master's degree:

- an undergraduate (first-cycle) degree in the same field of study;
- the same Master's (second-cycle) degree, but with a different specialization;
- a university degree, in accordance with a decision by the academic authorities and subject to the additional conditions that they lay down;
- a "long-type" degree that gives access to Master's studies, in accordance with a decision by the Government and subject to the additional conditions that it lays down;
- a degree comparable to those mentioned above, issued under the same conditions by the Flemish Community of Belgium, the German Community of Belgium or the Royal Military Academy;
- a degree obtained abroad and deemed equivalent to those mentioned above.

By way of derogation, Master's programmes are also open to students who, in order to obtain their undergraduate degree in the same field of study, still have to gain no more than 12 credits and are registered for those courses. However, students admitted on these terms cannot be passed by the Master's Examination Board until they have met the admission requirements in full and have obtained the necessary undergraduate degree.

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- Access to the 2nd cycle on the basis of a "short-cut":
  - Access to the 2nd cycle of university for those students who have a short-type non-university higher education degree
  - Access to the 2nd cycle of university for those students who have a long-type non-university higher education degree
- Access to the 2nd cycle on the basis of the enhancement of the knowledge and competence acquired by personal and professional experience:

With the aim of acceding 2nd-cycle studies, the jury of these studies can enhance the knowledge and competence acquired by their personal and professional experience.

This useful experience must correspond to at least 5 years of activities, without taking into account the years of higher-education study that were not passed successfully. At the end of an evaluation procedure organized by the academic authorities, the jury will decide whether the skills and knowledge of the student are sufficient to be able to follow these studies successfully (*).

- For those students who have an academic grade from a Belgian university or a foreign title or grade (which does not give access to studies in this particular year on the basis of the general conditions mentioned above), access to the 2nd basic cycle on the basis of a enhancement of 180 ECTS credits by the admissions jury (personalized admission on the basis of a file). (*)

(*) At the end of the admissions procedure organized by the competent jury and subject to the conditions fixed by the academic authorities, the student may follow complementary studies that make up a maximum of 60 supplementary credits. In case the supplementary workload of this student exceeds 15 credits, this training is considered to be a preparatory year. It does not lead to a degree and is considered to be the last year of a 1st cycle that gives access to the studies aimed at.

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No student can be admitted to any one year of a Pedagogical Master's degree if they have not passed an examination attesting to a sufficient knowledge of the French language .

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

- 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 electricity	Direct access	A student with no major in electricity nor an option deemed equivalent, but with a minor in electricity or an option deemed equivalent, will submit a programme suited to his (her) situation in agreement with an advisor who is a member of Electrical engineering diploma committee. To this end, the student may choose 15 credits from amongst the elective courses of the Master's in electrical engineering curriculum
Bachelor in engineering [180.0]		Access with additional training	A student with no major nor minor in electricity shall submit an application to the Electrical enginnering 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 Master's in electrical engineering , and imposing, if necessary, up to 15 additional credits.
Autres bacheliers		On the file: direct access or access with additional training	The jury may admit candidates with excellent academic records and training on the basis of their written application provided that they integrate a maximum of 60 additional credits into their Master’s degree programme. A minor in engineering sciences (electricity) is considered an advantage for candidates seeking this type of admission.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to electricity.	Direct access	
Bachelor in engineering		Access with additional training	Students with a Bachelor’s degree in engineering sciences (with a focus on electricity engineering) who have not taken the equivalent of a minor in electricity must submit a written application to the electricity programme commission in which they list their detailed course curriculum (list of course work and marks year by year). The jury will suggest a programme in keeping with the student’s

			previous course of study with the possible addition of a maximum of 15 supplemental credits.
Bachelor in engineering	With specific options in former institution related to electricity	Direct access	
Bachelor in engineering		Access with additional training	The jury may admit candidates with excellent academic records and training on the basis of their written application provided that they integrate a maximum of 60 additional credits into their Master's degree programme. A minor in engineering sciences (electricity) is considered an advantage for candidates seeking this type of admission.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to electricity	Direct access	
Bachelor in engineering		Access with additional training	Students who have no specialisation in electricity must submit a written application to the programme commission in electricity engineering in which they list their detailed course curriculum (list of course work and marks year by year). The jury will suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.
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	Students will submit a written application for admission to EPL in which they list their detailed course curriculum (list of course work and marks year by year). The jury will determine whether the candidate may be admitted according to the regulations. Where necessary the jury may suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.

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Non university Bachelors

Diploma	Access	Remarks
> Find out more about links to the university		

> BA en sciences industrielles - type long	Accès au master moyennant ajout de maximum 60 crédits d'enseignements supplémentaires obligatoires au programme. Voir 'Module complémentaire'	Type long

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Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
Engineers considered equivalent to corresponding bachelors		Direct access	
Masters			
Master s 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.

Students may submit an application for admission to the Louvain School of Engineering in which they list their detailed course curriculum (list of course work and marks year by year). The School in collaboration with the relevant programme commission will determine whether the student may be admitted and their decision will respect the programme rules. When necessary, they may suggest an individualised programme consisting of a part of the elective courses in the relevant Master's degree programme in civil engineering with the possible addition of a maximum of 15 supplemental credits.

The School in collaboration with the relevant programme commission will determine whether the student may be admitted and their decision will respect the programme rules. When necessary, the jury may suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.

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Admission and Enrolment Procedures for general registration

Teaching method

Methods that promote multidisciplinary studies

The Master's degree programme in electrical engineering provides students with considerable technical and professional knowledge. It offers in-depth knowledge of the different subjects covered in the Bachelor's degree programme on electricity and expected of electrical engineers (electronics, electromagnetics, communication, system design). It is open to other fields such as

- Computer science, applied mathematics and automation (the latter having been studied in the Bachelor's degree programme for students enrolled in the electricity major); achieved through 15 credits of required common courses
- Electrotechnology, photovoltaic technologies, nanotechnologies, MEMS and NEMS, computer science and communication, biomedical engineering, cryptography and information security via specialised majors.

Regarding elective courses, the programme commission encourages students to broaden their training by choosing classes organised by other programme commissions. Thus the majority of suggested majors are MAPR, INGI, INMA or MATH.

Also of note are the dozen ELEC classes that are open to students enrolled in other Master's degree programmes on the condition that they have taken introductory classes on electric circuits and electronics or complementary classes in electricity.

To encourage interdisciplinary coursework, there are interdisciplinary projects regrouping a series of subjects from the common core curriculum.

Diverse learning situations

The diverse learning situations include lectures, practical work and projects based on the following approach: modelling-simulation-realisation -experimental validation. Depending on the case, students are encouraged to work either in groups or individually. Of note is the interdisciplinary project that requires students to design, model, carry out and test a system. This project draws upon the entirety of their knowledge in the field of their final specialisation as well completes the work begun during their undergraduate studies (ELEC Bachelor's degree programme).

Furthermore, in certain subjects, e-Learning permits students to educate themselves at their own pace and carry out virtual experiments.

This variety of learning situations help students to learn in an iterative and progressive manner, all the while developing their autonomy, organisational abilities, as well as time management and communication skills. Modern information technologies (materials, software, networks) are made available to students.

For example, the major in business creation is based on an interactive approach that emphasizes problem-based learning. Throughout the programme, students enrolled in this major must carry out group work as part of multidisciplinary teams. Their interdisciplinary thesis or graduation project permits groups of three students, ideally from different academic departments, to collaborate on a business creation proposal.

The graduation project aims for the most part to integrate students into research teams at the Institute.

Thus, teaching activities are supplemented by research activities and serve as a starting point for the recruitment of researchers (often a graduation project is the starting point for a doctorate, publication or paper presentation).

Depending on the situation, students are encouraged to work either individually or in groups.

Concrete learning: infrastructure

In ELEC courses, "concrete" learning is characterised by student access to high quality technical infrastructures:

The Marconi and Faraday pedagogical laboratories are equipped with the latest in work stations (oscilloscopes, sources, computers) and are accessible to students as part of their laboratory classes and Bachelor's and Master's degree projects. In the case of projects including the creation of a prototype by groups of students, access to prototypes of electronic cards (PCB, components, welding) is available.

R&D platforms in the areas of electronic components and communication systems (Welcome) and micro and nano-technologies (Winfab) are accessible to Master's degree students as part of certain classes and graduation projects.

Computers and work stations equipped with the most recent professional CAO software are accessible to students in the Maxwell building but also remotely from the Engineering School's computer labs. This software is largely used in classes, APE and projects: design sequences for electronic circuits and microwaves, simulation of manufacturing processes, electronic devices, etc.

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".

Teaching activities are evaluated according to University rules (see the rules for evaluating coursework and exams) namely written and oral exams, laboratory exams, individual or group work, public presentations of projects and theses defences.

In most Master's degree classes, students are primarily evaluated on the basis of their written work, which assesses their mastery of theoretical concepts as well as their ability to solve exercises (of the same level of difficulty as in class).

Group projects are primarily used to evaluate students' ability to solve complex equations and master software. These projects generally result in a report (in the form of a scientific article or a conference paper) or an oral presentation before a jury or lecture hall about the project's results and/or progress. In either case, particular attention is paid to the project's technical qualities as well as the quality of the report's structure, the use of supporting materials, and the students' presentation skills.

For more information on evaluation methods, students may consult the relevant evaluation descriptions.

To obtain a passing grade, the marks received for the teaching units are offset by their respective credits.

Mobility and/or Internationalisation outlook

Since its creation, the Louvain School of Engineering (EPL) has participated in diverse exchange programs that were put into place at the European level and beyond.

Possible trainings at the end of the programme

- Accessible complementary Masterâ€™s degrees:

Masterâ€™s in nuclear engineering

Master in nanotechnologies

- Accessible Ph. D. curricula

The department of electrical engineering is one of those with the largest number of doctoral students. Members of the department are involved in many thematic Ph. D. schools, some of these having been active for many years, others currently being set up. A list of these thematic Ph. D. schools can be obtained from the chairperson of the Ph. D. committee relating to "Engineering sciences and the Art of building and town planning " of the Académie Universitaire Louvain or on the FNRS Website http://www1.FNRS.BE

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