UCLouvain

ELEC2M

2019 - 2020

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 acronym: **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 profil

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.

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ELEC2M - Teaching profile

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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 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-2019-elec2m-lelec220t.html]*

> Professional Focus *[en-prog-2019-elec2m-lelec220s]*

Options courses

> Majors in electrical engineering *[en-prog-2019-elec2m-lelec103g.html]*
>> Major in electrotechnics and electrical energy *[en-prog-2019-elec2m-lelec221o.html]*
>> Major in communication systems *[en-prog-2019-elec2m-lelec222o.html]*
>> Major in information and signal processing *[en-prog-2019-elec2m-lelec224o.html]*
>> Major in electronic circuits and systems *[en-prog-2019-elec2m-lelec227o.html]*
>> Major in cryptography and information security *[en-prog-2019-elec2m-lelec235o.html]*
>> Major in advanced electronic materials and devices *[en-prog-2019-elec2m-lelec236o.html]*
> Majors in business creation and management *[en-prog-2019-elec2m-lelec104g.html]*
>> Major Business risks and opportunities *[en-prog-2019-elec2m-lfsa220o.html]*
>> Major in small and medium sized business creation *[en-prog-2019-elec2m-lfsa221o.html]*
> Elective courses *[en-prog-2019-elec2m-lelec105g.html]*
>> Elective courses available for Master students in electrical engineering *[en-prog-2019-elec2m-lelec952o.html]*
>> Elective courses : Transversal skills and professional contacts *[en-prog-2019-elec2m-lelec951o.html]*

ELEC2M Detailled programme

Programme by subject

CORE COURSES

⚪ Mandatory		⊗ Optional
△ Courses not taught during 2019-2020		⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020		🟨 Activity with requisites

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

The student shall select

							Year	
							1	2
⚪ LELEC2990	Graduation project/End of studies project				28 Credits			x

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

The students select one course between:

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

PROFESSIONAL FOCUS [30.0]

⚪ Mandatory		⊗ Optional
△ Courses not taught during 2019-2020		⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020		🟨 Activity with requisites

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

The student has to take all the following courses:

					Year	
					1	2

⚪ *Contenu:*

						Year	
⚪ 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 Janvier (coord.) Jérôme Louveaux Claude Oestges Luc Vandendorpe	30h+30h	5 Credits	1q	x	
⚪ LELEC2103	Project in Electricity 3 : Electronic systems	Jean-Didier Legat Jérôme Louveaux Luc Vandendorpe	75h	5 Credits	1 + 2q	x	
⚪ LELEC2900	Signal processing	Laurent Jacques Benoît Macq Luc Vandendorpe	30h+30h	5 Credits	2q	x	

						Year	
						1	2
O LINGI2315	Design of Embedded and real-time systems	Jean-Didier Legat	30h+30h	5 Credits	2q	x	
O LINMA1731	Stochastic processes : Estimation and prediction	Pierre-Antoine 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 electrotechnics and electrical energy   *[en-prog-2019-elec2m-lelec221o]*
> > Major in communication systems   *[en-prog-2019-elec2m-lelec222o]*
> > Major in information and signal processing   *[en-prog-2019-elec2m-lelec224o]*
> > Major in electronic circuits and systems   *[en-prog-2019-elec2m-lelec227o]*
> > Major in cryptography and information security   *[en-prog-2019-elec2m-lelec235o]*
> > Major in advanced electronic materials and devices   *[en-prog-2019-elec2m-lelec236o]*

> Majors in business creation and management

> > Major Business risks and opportunities   *[en-prog-2019-elec2m-lfsa220o]*
> > Major in small and medium sized business creation   *[en-prog-2019-elec2m-lfsa221o]*

> Elective courses

> > Elective courses available for Master students in electrical engineering   *[en-prog-2019-elec2m-lelec952o]*
> > Elective courses : Transversal skills and professional contacts   *[en-prog-2019-elec2m-lelec951o]*

MAJOR IN ELECTROTECHNICS AND ELECTRICAL ENERGY

The objective of this major is to provide students with knowledge in electromechanics and control. At the end of this major, the students will have acquired a basic training in power electronics and electrical energy networks. They will master the main aspects related to the use of electricity as an energy vector.

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

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

The student shall select:
De 18 à 21 CREDITS parmi

Year
1 2

○ **Contenu:**

○ **Compulsory courses in electrotechnics and electrical energy (13 credits)**

O LELEC2520	Electric Power Systems	Emmanuel De Jaeger	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 De Jaeger Bruno Dehez	30h+30h	5 Credits	1q	x	x

○ **Elective courses in electrotechnics and electrical energy**

⊠ LELEC2311	Physics of Electromechanical Converters	Bruno Dehez	30h+15h	4 Credits	2q	x	x
⊠ LELEC2595	Electric Power Systems Quality	Emmanuel De Jaeger	30h+30h	5 Credits	2q	x	x
⊠ LELEC2670	Renewable and non conventional sources of electrical energy	Emmanuel De Jaeger (coord.) Pascal Jacques	30h+15h	4 Credits	2q	x	x
⊠ LELEC2753	Electrical Power Systems: Advanced Topics	Emmanuel De Jaeger	30h+15h	5 Credits	2q	x	x
⊠ LELEC2811	Instrumentation and sensors	David Bol (coord.) Laurent Francis	30h+30h	5 Credits	1q	x	x

MAJOR IN COMMUNICATION SYSTEMS

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.

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

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

De 15 à 30 CREDITS parmi

Year
1 2

⚬ Contenu:

⚬ Compulsory courses in communication systems
The student shall select at least 15 credits among:

⚛ LELEC2796	Wireless communications	Claude Oestges (coord.) Luc Vandendorpe	30h+30h	5 Credits	1q	x	x
⚛ LELEC2880	Modem design	Jérôme Louveaux Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
⚛ LELEC2910	Antennas and propagation	Christophe Craeye (coord.) Danielle Janvier	30h+30h	5 Credits	1q	x	x
⚛ LELEC2920	Communication networks	Benoît Macq	30h+30h	5 Credits	1q	x	x
⚛ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	2q	x	x

⚛ Elective courses in communication systems

⚛ LELEC2590	Seminars in electronics and communications	Denis Flandre Isabelle Huynen Jérôme Louveaux	30h	3 Credits	2q	x	x
⚛ LINGI2146	Mobile and Embedded Computing	Ramin Sadre	30h+15h	5 Credits	2q	x	x
⚛ LINMA1702	Optimization models and methods I	François Glineur	30h +22.5h	5 Credits	2q	x	x

MAJOR IN INFORMATION AND SIGNAL PROCESSING

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

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

The student shall select:
De 15 à 30 CREDITS parmi

Year

1 2

o *Contenu:*

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.

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

o Compulsory courses in information and signal processing

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 De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	1q	x	x
O LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	2q	x	x

֎ Elective courses in information and signal processing

֎ LELEC2880	Modem design	Jérôme Louveaux Luc Vandendorpe	30h+30h	5 Credits	2q	x	x
֎ LGBIO2050	Medical Imaging	Anne Bol John Lee Benoît Macq Frank Peeters	30h+30h	5 Credits	1q	x	x
֎ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q	x	x
֎ LINMA1691	Discrete mathematics - Graph theory and algorithms	Vincent Blondel Jean-Charles Delvenne	30h +22.5h	5 Credits	1q	x	x
֎ LINMA1702	Optimization models and methods I	François Glineur	30h +22.5h	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
֎ LINMA2380	Matrix computations	Raphaël Jungers	30h +22.5h	5 Credits	1q	x	x
֎ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	x	x
֎ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x

MAJOR IN ELECTRONIC CIRCUITS AND 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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	🟨 Activity with requisites

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

Students may select 15 to 30 credits from the following courses:
De 15 à 30 CREDITS parmi

Year
1 2

o *Contenu:*

o Compulsory course in electronic circuits and systems

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

o Elective courses in electronic circuits and systems

						Year 1	Year 2
⌘ LELEC2541	Advanced Transistors	Denis Flandre (coord.) Benoît Hackens Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⌘ LELEC2570	Synthesis of digital integrated circuits 🟨	David Bol	30h+30h	5 Credits	1q	x	x
⌘ LELEC2580	Design of RF and microwave communication circuits	Christophe Craeye Danielle Janvier (coord.)	30h+30h	5 Credits	2q	x	x
⌘ LELEC2590	Seminars in electronics and communications	Denis Flandre Isabelle Huynen Jérôme 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
⌘ LELEC2700	Microwaves	Danielle Janvier	30h+30h	5 Credits	1q	x	x
⌘ LELEC2760	Secure electronic circuits and systems	François-Xavier Standaert	30h+30h	5 Credits	2q	x	x
⌘ LELEC2811	Instrumentation and sensors	David Bol (coord.) Laurent Francis	30h+30h	5 Credits	1q	x	x
⌘ LGBIO2020	Bioinstrumentation	André Mouraux Michel Verleysen	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 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	🟨 Activity with requisites

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

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

Year
1 2

o *Contenu:*

✗ Elective courses
In order to validate this option INFO and MAP students have to take at least 20 credits and the ELEC, DATE and DATI students have to take at least 15 credits among:

						1	2
✗ LELEC2760	Secure electronic circuits and systems	François-Xavier Standaert	30h+30h	5 Credits	2q	x	x
✗ LINGI2144	Secured systems engineering	Axel Legay	30h+15h	5 Credits	2q	x	x
✗ LINGI2347	Computer system security	Ramin Sadre	30h+15h	5 Credits	2q	x	x
✗ LINGI2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	30h+15h	5 Credits	2q	x	x
✗ LMAT2440	Number theory	Olivier Pereira Jean-Pierre Tignol	30h+15h	5 Credits	1q	x	x
✗ LMAT2450	Cryptography	Olivier Pereira	30h+15h	5 Credits	1q	x	x
✗ LELEC2770	Privacy Enhancing technology	Olivier Pereira (coord.) François-Xavier Standaert	30h+30h	5 Credits	1q	x	x

MAJOR IN ADVANCED ELECTRONIC MATERIALS AND DEVICES

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

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

De 15 à 30 CREDITS parmi

Year
1 2

o *Contenu:*

O Compulsory courses in advanced electronic materials and devices
Student choose at least 5 credits among:

⊗ LELEC2541	Advanced Transistors	Denis Flandre (coord.) Benoît Hackens Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊗ LELEC2550	Special electronic devices	Vincent Bayot	30h+30h	5 Credits	1q	x	x
⊗ LELEC2700	Microwaves	Danielle Janvier	30h+30h	5 Credits	1q	x	x
⊗ LELEC2895	Design of micro and nanosystems	Laurent Francis	30h+30h	5 Credits	1q	x	x

⊗ Elective courses in advanced electronic materials and devices

⊗ LELEC2560	Micro and Nanofabrication Techniques	Laurent Francis (coord.) Benoît Hackens Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊗ LELEC2580	Design of RF and microwave communication circuits	Christophe Craeye Danielle Janvier (coord.)	30h+30h	5 Credits	2q	x	x
⊗ LELEC2710	Nanoelectronics	Vincent Bayot (coord.) Benoît Hackens	30h+30h	5 Credits	1q	x	x
⊗ LELEC2811	Instrumentation and sensors	David Bol (coord.) Laurent Francis	30h+30h	5 Credits	1q	x	x
⊗ LMAPR2015	Physics of Nanostructures	Jean-Christophe Charlier (coord.) Xavier Gonze 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
⊗ LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye Vincent Legat Jean-François Remacle	30h+30h	5 Credits	2q	x	x
⊗ LPHYS2143	Optics and lasers	Clément Lauzin	22.5h +22.5h	5 Credits	1q	x	x
⊗ LPHYS2303	Cryophysics and vacuum physics	Vincent Bayot Benoît Hackens Sorin Melinte	30h+15h	5 Credits	1q	x	x

MAJOR BUSINESS RISKS AND OPPORTUNITIES

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

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

De 16 à 20 CREDITS parmi

Year
1 2

o *Contenu:*

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

O One course between
De 3 à 5 CREDITS parmi

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

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

MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

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

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

De 20 à 25 CREDITS parmi

Year
| 1 | 2 |

⃝ *Contenu:*

⃝ Required courses for the major in small and medium sized businesses

						1	2
⃝ LCPME2001	Entrepreneurship Theory (in French)	Blanche Havenne (compensates Frank Janssen) Frank Janssen	30h+20h	5 Credits	1q	x	
⃝ LCPME2002	Managerial, legal and economic aspects of the creation of a company (in French)	Yves De Cordt Marine Falize	30h+15h	5 Credits	1q	x	x
⃝ LCPME2003	Business plan of the creation of a company (in French) *Les séances du cours LCPME2003 sont réparties sur les deux blocs annuels du master. L'étudiant doit les suivre dès le bloc annuel 1, mais ne pourra inscrire le cours que dans son programme de bloc annuel 2.*	Frank Janssen	30h+15h	5 Credits	2q		x
⃝ LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	2q	x	x

⌧ Prerequisite CPME courses
Student who have not taken management courses during their previous studies must enroll in LCPME2000.

						1	2
⃝ LCPME2000	Venture creation financement and management I	Yves De Rongé Olivier Giacomin	30h+15h	5 Credits	1q	x	

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN ELECTRICAL ENGINEERING

Students can also include in their curriculum any course included in other EPL masters, subject to the approval of the jury.

ELECTIVE COURSES : TRANSVERSAL SKILLS AND PROFESSIONAL CONTACTS

⊙ Mandatory	⌗ Optional
△ Courses not taught during 2019-2020	⊘ Periodic courses not taught during 2019-2020
⊕ Periodic courses taught during 2019-2020	🟨 Activity with requisites

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

The student selectss between 3 and 22 credits (max 27 if the student selectss the intership) in this list below or in the courses of the major "business risks and opportunities". An alternative is to select the Major in small and medium sized business creation.

Year

1 2

⊙ *Contenu:*

⊙ Transversal skills and contacts with industry
The student selects min 3 credits among the courses of the Majors "business risks and opportunities", "small and medium sized business creation" and courses of professional integration activity specific to the program.

⌗ Internship

⌗ LFSA2995	Company Internship	Jean-Pierre Raskin	30h	10 Credits	1 + 2q	x x

⌗ Professional integration activity specific to the program

⌗ LELEC2590	Seminars in electronics and communications	Denis Flandre Isabelle Huynen Jérôme Louveaux	30h	3 Credits	2q	x x
⌗ LFSA2212	Innovation classes	Benoît Macq Jean-Pierre Raskin Benoît Raucent	30h+15h	5 Credits	1q	x x

⌗ Communication
Max=8 CREDITS parmi

⌗ Languages
Students may select from any language course offered at the ILV. Special attention is placed on the following seminars in professional development:

⌗ LALLE2500	Professional development seminar German	Caroline Klein Ann Rinder (coord.)	30h	3 Credits	1 + 2q	x x
⌗ LALLE2501	Professional development seminar-German	Caroline Klein Ann Rinder (coord.)	30h	5 Credits	1 + 2q	x x
⌗ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.) Alicia Maria Tirado Fernandez (compensates Paula Lorente Fernandez)	30h	3 Credits	1q	x x
⌗ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.) Alicia Maria Tirado Fernandez (compensates Paula Lorente Fernandez)	30h	5 Credits	1q	x x
⌗ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.) Marie-Laurence Lambrecht	30h	3 Credits	1 ou 2q	x x
⌗ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.)	30h	3 Credits	1 ou 2q	x x

⌗ Group dynamics

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

✿ Other non-disciplinary courses

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

Course prerequisites

A document entitled (nb: <u>not available</u> for this programme elec2m) 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 <u>regulation of studies and exams</u> (https://uclouvain.be/fr/decouvrir/rgee.html).

The programme's courses and learning outcomes

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

<table>
<tr><td style="text-align:center">ELEC2M - Information</td></tr>
</table>

Admission

General (https://uclouvain.be/en/study/inscriptions/admission-requirements-master-s-degree.html) *and specific admission requirements for this program must be satisfied at the time of enrolling at the university.*

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

SUMMARY

- > Specific Admission Requirements
- > 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
- > Access on the file
- > Admission and Enrolment Procedures for general registration

Specific Admission Requirements

This programme is taught in English with no prerequisite in French. The student is supposed to have at least a B2 level in the European Framework of Reference. A certificat is required for the holders of a non-Belgian degree, see selection criteria of the personalized access.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		Direct Access	Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted master programme.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in engineering		Direct Access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil engineering master degree may have an adapted master programme.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering		Access with additional training	Students who have no specialisation in the field of their civil enginering master degree may have an adapted master programme with up to 60 additional credits.
Foreign Bachelors			
Bachelor in engineering	Bachelors degree of Cluster Institution	Direct Access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil enginering master degree may have an adapted master programme.

Bachelor in Engineering	For others institutions	Based on application: accepted, conditional on further training, or refusal	See personalized access

Non university Bachelors

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

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters			
Master in Engineering		Direct Access	

Holders of a non-University 2nd cycle degree

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

Adults taking up their university training

> See the website Valorisation des acquis de l'expérience (https://uclouvain.be/fr/etudier/vae)

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

Access on the file

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

The first step of the admission procedure requires to submit an application online: https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html (https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html)

Selection criteria are summarized here.

Admission and Enrolment Procedures for general registration

Teaching method

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 <u>regulations concerning studies and exams</u> (https://uclouvain.be/fr/decouvrir/ rgee.html). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

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 Master's degrees:

Master'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

Contacts

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

Curriculum Management

Entity

Structure entity	SST/EPL/ELEC
Denomination	(ELEC) (https://uclouvain.be/repertoires/entites/elec)
Faculty	Louvain School of Engineering (EPL) (https://uclouvain.be/repertoires/entites/epl)
Sector	Sciences and Technology (SST) (https://uclouvain.be/repertoires/entites/sst)
Acronym	ELEC
Postal address	Place du Levant 3 - bte L5.03.02
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	Tel: +32 (0) 10 47 25 86 - Fax: +32 (0) 10 47 86 67

Academic supervisor: Claude Oestges

Jury

- Jean-Didier Legat
- Claude Oestges

Useful Contact(s)

- Isabelle Dargent

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