FYAP2M
2019 - 2020

Master [120] in Physical Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In english
Dissertation/Graduation Project : YES - Internship : optional
Activities in other languages : YES
Activities on other sites : NO
Main study domain : Sciences de l'ingénieur et technologie
Organized by: Ecole Polytechnique de Louvain (EPL)
Programme acronym: fyap2m - Francophone Certification Framework: 7

Table of contents

Introduction ................................................................. 2
Teaching profile .......................................................... 3
- Learning outcomes ................................................... 3
- Programme structure ............................................... 4
- Detailed programme ............................................... 4
- Programme by subject .......................................... 4
- Course prerequisites ............................................. 15
- The programme's courses and learning outcomes ......... 15
Information .................................................................... 16
- Admission ................................................................. 16
- Teaching method ..................................................... 18
- Evaluation ................................................................. 18
- Mobility and/or Internationalisation outlook ................. 18
- Possible trainings at the end of the programme .............. 18
- Contacts .................................................................... 19
Introduction

The Master's degree programme in Physical Engineering is multidisciplinary due to the in-depth study of various fields pertaining to physics and a wide range of industrial professions and specialisations as well as research based on advanced technologies.

This Master's degree programme is founded on:

• Formal concepts associated with the field
• The use numerical simulation tools
• Experiments based on practical work

Your Profile

You

• Have solid knowledge of physics and mathematics;
• Seek a programme that focuses on current technological and scientific issues and the national and international job market
• Want to participate in the design of high tech products: optics, thin strata, magnetic devices, transducers, sensors, nuclear tools, quantum physics, electronic materials, systems based on the interaction of radiation materials or objects produced from nanotechnologies

Your Future Job

Civil engineers are present in all industrial sectors: the chemical industry, pharmaceuticals and food production, electronics and telecommunication industry, energy, metallurgy, aeronautics, design and civil engineering, large scale distribution, banking or consulting services, nanotechnologies and medical technology, etc.

They play a role as researchers and developers overseeing production or management and holding positions in marketing and sales (of high tech products).

We find them in finance departments, information technology fields, quality control, the public sector, higher education and the Ministry of equipment and transport (www.fabi.be)

Your Programme

This Master's degree offers:

• Solid training applied physics
• An interdisciplinary approach at the interface between physics and material sciences
• Experience in laboratories and with research projects
• Exposure to the industrial sector: factory visits, internships, projects carried out in companies
• The opportunity to complete coursework abroad

This Master's degree programme consists of compulsory classes that aim to round out basic knowledge as well as a large selection of elective courses grouped into five majors that may potentially be completed by classes taken at UCL.
## Learning outcomes

Physical engineers master the physical aspects of how objects function and their interaction with the environment (waves, light, ions, electric and magnetic fields, temperature gradients). Physical engineers have dual training in experiments and simulation. They are capable of using theories and formal representations of objects thanks to numerical simulation tools. They are also capable of carrying out laboratory-based experiments. Their comprehensive understanding of physical properties allows them to make the connection between properties on an atomic scale with those that are macroscopic.

Due to the in-depth study of different fields of physics (material physics, optics, electromagnetics, electronics, mechanics, quantum physics, etc.), the Master’s degree programme in physical engineering (FYAP) prepares students for numerous jobs and specialisations in the industrial sector as well as participation in research-based technological activities.

Physical engineers are called on to resolve technological problems that are often complex and multidisciplinary in nature, linked to the design and creation of materials, devices and systems. They can act as an interface between different professions that use functional materials. They are called on to innovate in a specific technological environment.

Physical engineers systematically take into account constraints, values, rules (both legal and ethical) and economics. Their solid scientific background allows them to be autonomous enough to manage complex industrial projects. They are comfortable working as part of a team and communicating effectively even in English.

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

1. Demonstrate their mastery of a solid body of knowledge in basic engineering sciences allowing them to understand and solve problems related to technological and industrial applications in the physical sciences.
   1.1 Identify and use concepts, laws, and appropriate reasoning to solve a given problem (for example, identifying laws and materials to go from LED to white light; designing energy converters based on thermolectric elements; creating materials and devices to store and/or transfer information; designing photovoltaic panels with optimal output.)
   1.2 Identify and use appropriate modelling and calculation tools to solve problems.
   1.3 Verify solutions to a given problem.

2. Organise and carry out an engineering process in a high-tech field that requires the use of fundamental tools and concepts in order to solve a particular problem.
   2.1 Analyse a problem and formulate a specifications note.
   2.2 Model the problem and design one or more original technical solutions in response to the specifications note (for example, the optimisation and/or combination of materials for thermal insulation), develop measures for electrical and thermal classification of a given material, choose materials for light emission (LEDs) or the creation of photovoltaic panels.
   2.3 Evaluate and classify solutions in terms of all the figures in specifications notes: efficiency, feasibility, quality, ergonomics, and security in the professional environment.
   2.4 Implement and test a solution through a mock-up or a prototype and/or a numerical model.
   2.5 Make recommendations to improve the operational character of a solution under consideration.

3. Organise and carry out a research project to understand a new technological or industrial problem in different areas of applied physics or high tech engineering.
   3.1 Document and summarize the existing body of knowledge.
   3.2 Suggest a model and/or an experimental device allowing for the simulation and testing of hypotheses related to the phenomenon being studied.
   3.3 Write a summary report explaining the potentialities of the theoretical and/or technical innovation resulting from the research project.

4. Contribute as part of a team to the planning and completion of a project while taking into account its objectives, allocated resources, and constraints.
   4.1 Frame and explain the project’s objectives (in terms of performance indicators) while taking into account its issues and constraints (resources, budget, deadlines).
   4.2 Collaborate on a work schedule, deadlines and roles, for example the division of labour among students.
   4.3 Work in a multidisciplinary environment with peers holding different points of view; manage any resulting disagreement or conflicts.
   4.4 Make team decisions (whether they be about technical solutions or the division of labour).

5. Communicate effectively (speaking or writing in French or a foreign language) with the goal of carrying out assigned projects.
   5.1 Identify the needs of the client or the user: question, listen and understand all aspects of their request and not just the technical aspects (for example, select the best-suited equipment for the material concerned, select the best material according to the desired functionalities and systems integration).
   5.2 Present your arguments and convince your interlocutors (technicians, colleagues, clients, superiors) of your technological choices by adopting their language.
   5.3 Communicate through graphics and diagrams: interpret a diagram, present results, structure information.
   5.4 Read and analyse different technical documents, plans, specification notes: progress of physical properties in function of materials, temperature, mechanical limits or external fields, phase diagrams, band structures, etc.
   5.5 Draft documents that take into account contextual requirements and social conventions.
   5.6 Make a convincing oral presentation using modern communication techniques.

6. Demonstrate rigor, openness and critical and ethical awareness in your work: using the technological and scientific innovations at your disposal validate the socio-technical relevance of a hypothesis or a solution.

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, “life cycle analysis”).

6.3 Demonstrate critical awareness of a technical solution in order to verify its robustness and minimize the risks that may occur during implementation (this skill is mainly developed through the graduation project as either a critical analysis of manufacturing and classification techniques or a discussion of research perspectives and development as part of a Master’s thesis).

6.4 Evaluate oneself and independently develop necessary skills for “lifelong learning” (this skill is mainly developed as part of class projects requiring bibliographic research).

Programme structure

The student’s programme includes:

- A common core curriculum (30 credits)
- A final specialisation (30 credits)
- One of more of the major courses or elective courses listed below.

The graduation project is normally completed in the second year. However, students may, depending on the nature of their project, choose to take their classes in the first or second year so long as their course prerequisites allow it. This is particularly the case for students completing part of their program 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 requested 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 [45.0]**

- **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...)

**LECLE 1755 is not compulsory unless it was not taken in the 1st cycle.**

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LFYAP2990</strong></td>
<td>Graduation project/End of studies project</td>
<td>28 Credits</td>
</tr>
<tr>
<td><strong>LELEC1755</strong></td>
<td>ELECTRICITY : ADVANCED TOPICS</td>
<td>5 Credits</td>
</tr>
</tbody>
</table>

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

The students select one course between:
The student shall select

- **LTECO2100** Sociétés, cultures, religions : Biblical readings
  - Hans Ausloos
  - 15h
  - 2 Credits
  - 1q | X |
- **LTECO2300** Sociétés, cultures, religions : Ethical questions
  - Marcela Lobo Bustamante
  - 15h
  - 2 Credits
  - 1q | X |
- **LTECO2200** Sociétés-cultures-religions : Human Questions
  - Régis Burnet
  - Domnique Martens
  - 15h
  - 2 Credits
  - 1 ou 2q | X |

**MASTER [120] IN PHYSICAL ENGINEERING, 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...)

**Content:**

- **LMAPR2014** Physics of Functional Materials
  - Xavier Gonze
  - Luc Piraux
  - Gian-Marco Rignanese
  - 37.5h +22.5h
  - 5 Credits
  - 1q | X |

- **LMAPR2451** Atomistic and nanoscopic simulations
  - Jean-Christophe Charlier
  - Xavier Gonze
  - Gian-Marco Rignanese
  - 30h +30h
  - 5 Credits
  - 2q | X |

- **LMAPR2471** Transport phenomena in solids and nanostructures
  - Jean-Christophe Charlier
  - Luc Piraux
  - 30h +30h
  - 5 Credits
  - 2q | X |

- **LMAPR2481** Deformation and fracture of materials
  - Hosni Idrissi
  - Thomas Pardoen
  - 30h +30h
  - 5 Credits
  - 1q | X |

- **LPHYS2143** Optics and lasers
  - Clément Lauzin
  - 22.5h +22.5h
  - 5 Credits
  - 1q | X |

- **LMAPR2019A** Polymer Science and Engineering-Physics
  - Sophie Demoustier
  - Alain Jonas (coord.)
  - Evelyne Van Ruymbeke
  - 22.5h +7.5h
  - 3 Credits
  - 1q | X |

- **LCHM2261B** Polymer chemistry and physical chemistry (part 2 : Polymer physical chemistry)
  - Charles-André Fustin
  - Jean-François Gothy
  - Alain Jonas
  - 22.5h +7.5h
  - 2 Credits
  - 1q | X |
### OPTIONS

The student may select

**Majors for the Master's degree in physics**

- Major in Advanced Engineering Physics [en-prog-2019-fyap2m-lyfap221o]
- Major in nanotechnology [en-prog-2019-fyap2m-lyfap225o]
- Major advanced electronic materials and devices [en-prog-2019-fyap2m-lyfap223o]

**Major in business creation and management**

- Major in small and medium sized business creation [en-prog-2019-fyap2m-lyfap226o]
- Major in Business risks and opportunities [en-prog-2019-fyap2m-lyfap227o]

**Elective courses**

- Elective courses available for Master students in Physical Engineering [en-prog-2019-fyap2m-lyfap952o]
- Elective courses: transversal skills and contacts with industry [en-prog-2019-fyap2m-lyfap954o]

### MAJOR IN ADVANCED ENGINEERING PHYSICS

<table>
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<tr>
<th>Mandatory</th>
<th>Optional</th>
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<tr>
<td>△ Courses not taught during 2019-2020</td>
<td>○ Periodic courses not taught during 2019-2020</td>
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<tr>
<td>★ Periodic courses taught during 2019-2020</td>
<td>Activity with requisites</td>
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</table>

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

**De 20 à 30 credits parmi**

**Contents:**

#### Optics and photonics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructors</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPHYS2141</td>
<td>Introduction to quantum optics</td>
<td>Bernard Piraux, Xavier Urbain</td>
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</tr>
<tr>
<td>LPHYS2246</td>
<td>Experimental methods in atomic and molecular physics</td>
<td>Clément Lauzin, Xavier Urbain</td>
<td>5</td>
<td>2 q X</td>
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</tbody>
</table>

#### Experimental methods

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructors</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LELEC2811</td>
<td>Instrumentation and sensors</td>
<td>David Bol (coord.), Laurent Francis</td>
<td>5</td>
<td>1 q X</td>
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<tr>
<td>LPHYS2245</td>
<td>Lasers physics</td>
<td>Clément Lauzin</td>
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<td>2 q X</td>
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<tr>
<td>LPHYS2303</td>
<td>Cryophysics and vacuum physics</td>
<td>Vincent Bayot, Benoit Hackens, Sorin Melinte</td>
<td>5</td>
<td>1 q X</td>
</tr>
<tr>
<td>LPHYS2351</td>
<td>Superconductivity</td>
<td>Luc Piraux</td>
<td>5</td>
<td>1 q X</td>
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<tr>
<td>LPHYS2102</td>
<td>Detectors and sensors</td>
<td>Eduardo Cortina Gil, Krzysztof Piotrzkowski</td>
<td>5</td>
<td>1 q X</td>
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<tr>
<td>LPHYS2248</td>
<td>Ultra-fast laser physics</td>
<td>Clément Lauzin</td>
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<td>2 q X</td>
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</table>

#### Numerical simulations

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructors</th>
<th>Credits</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>LMAPR2482</td>
<td>Plasticity and metal forming</td>
<td>Laurent Delannay, Thomas Pardoen</td>
<td>5</td>
<td>2 q X</td>
</tr>
<tr>
<td>LMECA2300</td>
<td>Advanced Numerical Methods</td>
<td>Philippe Chatelain, Christophe Craey, Vincent Legat, Jean-François Renacle</td>
<td>5</td>
<td>2 q X</td>
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<tr>
<td>LPHYS1303</td>
<td>Numerical Simulation in Physics</td>
<td>Michel Crucifix, Bernard Piraux</td>
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</table>
## Fundamental concepts of physics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<th>Credits</th>
<th>Credit Type</th>
<th>Year</th>
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<tbody>
<tr>
<td>LPHYS1231</td>
<td>Special Relativity</td>
<td>Jean-Marc Gérard</td>
<td>30h+15h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LPHYS1344</td>
<td>subatomic, atomic and molecular physics</td>
<td>Clément Lauzin, Vincent Lemaitre, Xavier Urbain</td>
<td>45h+45h</td>
<td>6</td>
<td>2q</td>
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<tr>
<td>LPHYS2242</td>
<td>Fundamentals of quantum information</td>
<td>Sorin Melinte, Bernard Piraux</td>
<td>30</td>
<td>5</td>
<td>2q</td>
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<tr>
<td>LPHYS2132A</td>
<td>Quantum field theory 1</td>
<td>Céline Degrande, Marco Drewes</td>
<td>30</td>
<td>5</td>
<td>1q</td>
</tr>
</tbody>
</table>
**MAJOR IN NANOTECHNOLOGY**

The objective of this major is to introduce students to physics and the simulation of materials and devices used in the field of micro and nano-electronics, to the properties and methods associated with the manufacturing and classification of micro and nano-structures; to the ways in which nano-devices function as well as the development and integration of organic elements into nano-systems.

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

De 20 à 30 credits parmi

### Contenu:

#### 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.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credits</th>
<th>Year</th>
<th>Period</th>
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<tbody>
<tr>
<td>LMAPR2015</td>
<td>Physics of Nanostructures</td>
<td>Jean-Christophe Charlier (coord.)</td>
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<td></td>
<td></td>
<td>Xavier Gonze</td>
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<td></td>
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<td>Luc Piraux</td>
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<tr>
<td>LMAPR2451</td>
<td>Atomistic and nanoscopic simulations</td>
<td>Jean-Christophe Charlier</td>
<td>5</td>
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<td>Xavier Gonze</td>
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<td>Gian-Marco Rignanese</td>
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<tr>
<td>LMAPR2471</td>
<td>Transport phenomena in solids and nanostructures</td>
<td>Jean-Christophe Charlier</td>
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<td>Luc Piraux</td>
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<tr>
<td>LPHYS2351</td>
<td>Superconductivity</td>
<td>Luc Piraux</td>
<td>5</td>
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</table>

#### 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 1765 or similar.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
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<th>Year</th>
<th>Period</th>
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<tbody>
<tr>
<td>LELEC2541</td>
<td>Advanced Transistors</td>
<td>Denis Flandre (coord.)</td>
<td>5</td>
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<td></td>
<td>Benoît Hackens</td>
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<td></td>
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<td>Jean-Pierre Raskin</td>
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<tr>
<td>LELEC2550</td>
<td>Special electronic devices</td>
<td>Vincent Bayot</td>
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<tr>
<td>LELEC2710</td>
<td>Nanoelectronics</td>
<td>Vincent Bayot (coord.)</td>
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<td></td>
<td></td>
<td>Benoît Hackens</td>
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#### Micro and nano-engineering

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<th>Year</th>
<th>Period</th>
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<tr>
<td>LELEC2560</td>
<td>Micro and Nanofabrication Techniques</td>
<td>Laurent Francis (coord.)</td>
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<td>Benoît Hackens</td>
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<td>Jean-Pierre Raskin</td>
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<tr>
<td>LELEC2895</td>
<td>Design of micro and nanosystems</td>
<td>Laurent Francis</td>
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<tr>
<td>LMAPR2012</td>
<td>Macromolecular Nanotechnology</td>
<td>Sophie Demoustier</td>
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<tr>
<td></td>
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<td>Karine Glinel</td>
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<td>Karine Glinel (compensates</td>
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<td>Bernard Nysten</td>
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<td>Jean-François Gohy</td>
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<td>Bernard Nysten</td>
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<tr>
<td>LMAPR2631</td>
<td>Surface Analysis</td>
<td>Arnaud Delcorte</td>
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<td>Bernard Nysten</td>
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## MAJOR ADVANCED ELECTRONIC MATERIALS AND DEVICES

- **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

#### Contenu:

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Coordinator(s)</th>
<th>Credits</th>
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<tbody>
<tr>
<td>LELEC2541</td>
<td>Advanced Transistors</td>
<td>Denis Flandre (coord.)</td>
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<td>Benoît Hackens</td>
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<tr>
<td></td>
<td></td>
<td>Jean-Pierre Raskin</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LELEC2550</td>
<td>Special electronic devices</td>
<td>Vincent Bayot</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LELEC2700</td>
<td>Microwaves</td>
<td>Danielle Janvier</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LELEC2895</td>
<td>Design of micro and nanosystems</td>
<td>Laurent Francis</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
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</tr>
</tbody>
</table>

- **Elective courses in advanced electronic materials and devices**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Coordinator(s)</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LELEC2560</td>
<td>Micro and Nanofabrication Techniques</td>
<td>Laurent Francis (coord.)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benoît Hackens</td>
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<td></td>
<td></td>
<td>Jean-Pierre Raskin</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>2q</td>
<td></td>
</tr>
<tr>
<td>LELEC2580</td>
<td>Design of RF and microwave communication circuits</td>
<td>Christophe Craeye (coord.)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Danielle Janvier</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>2q</td>
<td></td>
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<tr>
<td>LELEC2710</td>
<td>Nanoelectronics</td>
<td>Vincent Bayot (coord.)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benoît Hackens</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LELEC2811</td>
<td>Instrumentation and sensors</td>
<td>David Bol (coord.)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laurent Francis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LMAPR2015</td>
<td>Physics of Nanostructures</td>
<td>Jean-Christophe Charlier (co</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ord.)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Xavier Gonzalez</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Luc Piraux</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.5h +22.5h</td>
<td>1q</td>
<td></td>
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<tr>
<td>LMAPR2020</td>
<td>Materials Selection</td>
<td>Christian Bailly</td>
<td>5</td>
<td>2</td>
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<tr>
<td></td>
<td></td>
<td>Thomas Pardoen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h +22.5h</td>
<td>2q</td>
<td></td>
</tr>
<tr>
<td>LMECA2300</td>
<td>Advanced Numerical Methods</td>
<td>Philippe Chatelain</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Christophe Craeye</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Vincent Legat</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Jean-François Renacle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+30h</td>
<td>2q</td>
<td></td>
</tr>
<tr>
<td>LPHYS2143</td>
<td>Optics and lasers</td>
<td>Clément Lauzin</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.5h +22.5h</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LPHYS2303</td>
<td>Cryophysics and vacuum physics</td>
<td>Vincent Bayot</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benoît Hackens</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sorin Melinte</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30h+15h</td>
<td>1q</td>
<td></td>
</tr>
</tbody>
</table>
## MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

In keeping with most of the Masters’ degrees in civil engineering, the goal of this major is to familiarize the civil engineering student with the specifics of entrepreneurship and business development in order to develop the necessary abilities, knowledge and tools to create a business. It is a truly interdisciplinary initiative where students from different faculties are brought together in cross-disciplinary teams to create an entrepreneurial project. The Interdisciplinary program in entrepreneurship (CPME) is spread over two years and is integrated into more than 20 Masters (8 faculties). The program includes a collective and interdisciplinary master thesis focused on an entrepreneurial project (start-up or spin-off) and realized in teams of 3 to 4 students from 3 to 4 different faculties. The access is reserved for a small number of students by a selection procedure. Additional information may be found at www.uclouvain.be/cpme

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructors</th>
<th>Credits</th>
<th>Period</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCPME2001</td>
<td>Entrepreneurship Theory (in French)</td>
<td>Blanche Havenne (compensates Frank Janssen)</td>
<td>5</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LCPME2002</td>
<td>Managerial, legal and economic aspects of the creation of a company (in French)</td>
<td>Yves De Cordt, Marine Falize</td>
<td>5</td>
<td>1q</td>
<td></td>
</tr>
<tr>
<td>LCPME2003</td>
<td>Business plan of the creation of a company (in French)</td>
<td>Frank Janssen</td>
<td>5</td>
<td>2q</td>
<td></td>
</tr>
<tr>
<td>LCPME2004</td>
<td>Advanced seminar on Entrepreneurship (in French)</td>
<td>Frank Janssen</td>
<td>5</td>
<td>2q</td>
<td></td>
</tr>
<tr>
<td>LCPME2020</td>
<td>Venture creation financement and management</td>
<td>Yves De Rongé, Olivier Giacomin</td>
<td>5</td>
<td>1q</td>
<td></td>
</tr>
</tbody>
</table>

Prerequisite CPME courses

Student who have not taken management courses during their previous studies must enroll in LCPME2000.
MAJOR IN BUSINESS RISKS AND OPPORTUNITIES

This major is not available in English and may not be taken at the same time as the major « Interdisciplinary program in entrepreneurship – CPME ».

- **Mandatory**
- **Optional**
- **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

<table>
<thead>
<tr>
<th>De 16 à 20 credits parmi</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

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

- **One course between**
  De 3 à 5 credits parmi
  - LFSA2202 Ethics and ICT
    - Axel Gossieres
    - Olivier Pereira
    - 30h
    - 3 Credits
    - 2q
  - LLSMS2280 Business Ethics and Compliance Management
    - Carlos Desmet
    - 30h
    - 5 Credits
    - 1q

- **Alternative to the major in business risks and opportunities for computer science students**
  Computer science students who have already taken courses in this field while pursuing their Bachelor's degree may choose between 16-20 credits from the courses offered in the management minor for computer sciences.
ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN PHYSICAL ENGINEERING

The elective courses being recommended and available for Master students in physical engineering are listed here above, in the majors and other lists of elective courses. However, a student can further suggest other courses that would be relevant for his/her personal curriculum, pending that this is compliant with the rules for setting up a personal Master program.

ELECTIVE COURSES: TRANSVERSAL SKILLS AND CONTACTS WITH INDUSTRY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credits</th>
<th>Period</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFSA2995</td>
<td>Company Internship</td>
<td>Jean-Pierre Raskin</td>
<td>10</td>
<td>1 + 2q</td>
<td></td>
</tr>
<tr>
<td>LMECA2711</td>
<td>Quality management and control.</td>
<td>Nicolas Bronchart</td>
<td>5</td>
<td>2q</td>
<td></td>
</tr>
</tbody>
</table>

The student selects between 3 and 22 credits (max 27 if the student selects the internship) 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

* Contents:

- 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.

- 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:

- Group dynamics
<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Lecturers</th>
<th>Hours</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEPL2352</td>
<td>Dynamique des groupes - Q2</td>
<td>Christine Jacqmot, Benoit Raucen, Vincent Wertz (coord.)</td>
<td>15h+30h</td>
<td>3</td>
<td>2q</td>
</tr>
</tbody>
</table>

**Other non-disciplinary courses**

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

A document entitled en-prerequis-2019-fyap2m.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 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?"

The document is available by clicking this link after being authenticated with UCL account.
FYAP2M - Information

Admission

General 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 certificate is required for the holders of a non-Belgian degree, see selection criteria of the personalized access.

University Bachelors

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCLouvain Bachelors</td>
<td></td>
<td>Direct Access</td>
<td>Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted programme.</td>
</tr>
<tr>
<td>Bachelor in Engineering</td>
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</table>

Others Bachelors of the French speaking Community of Belgium

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor in Engineering</td>
<td></td>
<td>Direct Access</td>
<td>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.</td>
</tr>
</tbody>
</table>

Bachelors of the Dutch speaking Community of Belgium

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor in Engineering</td>
<td></td>
<td>Access with additional training</td>
<td>Students who have no specialisation in the field of their civil engineering master degree may have an adapted master programme with up to 60 additional credits.</td>
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</tbody>
</table>

Foreign Bachelors

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor in engineering</td>
<td>Bachelors degree of Cluster Institution</td>
<td>Direct Access</td>
<td>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.</td>
</tr>
<tr>
<td>Bachelor in Engineering</td>
<td>For others institutions</td>
<td>Based on application: accepted, conditional on further training, or refusal</td>
<td></td>
</tr>
</tbody>
</table>
Non university Bachelors

> Find out more about links to the university

Holders of a 2nd cycle University degree

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Licenciés&quot;</td>
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</tbody>
</table>

Masters
Master in engineering                      Direct Access

Holders of a non-University 2nd cycle degree

Adults taking up their university training

> See the website Valorisation des acquis de l'expérience

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

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 physical engineering is interdisciplinary because acts as an interface between physics and materials science. Its versatile foundation exposes students to the wide scope of applied physics from practical training and cutting edge research to majors in the main branches of physics and materials science: nano-technologies, materials science, photovoltaics, fundamental and applied physics and light-matter interaction. Students also have the possibility of studying management thanks to majors in management and small and medium sized business creation. The programme includes a significant portion of the classes with the PHYS (or PHY) designation as well as MATH, INMA and MECA classes, which is evidence of the programme’s multidisciplinary nature. Finally students are allowed to select up to 40 credits of elective courses offered as part of the programmes in natural sciences or medicine at UCL and up to 6 credits of courses in human sciences, which allows for tailor made course schedules.

Various teaching strategies
The pedagogy used in the Master’s degree programme in physical engineering is consistent with that of the Bachelor’s degree programme in engineering sciences: active learning, an equal mix of group work and individual work, and emphasis on the development of non-technical skills. A major characteristic of the programme is the immersion of students in professors’ research laboratories (and at times teaching laboratories, case studies, projects, theses) that expose students to advanced methods used in the discipline and allows them to learning by questioning, a process inherent in the research process. An optional 9-week internship of 10 credits (or 5 credits if completed alongside a thesis) places students at the centre of research and allows them to develop their skills through their contact with the professional world.

Diverse learning situations
Students will be exposed to varied pedagogical methods: lectures, projects, exercise tutorials, problem-solving sessions, case studies, experimental laboratories, computer simulations, internships in industry or research, graduation projects, group work, individual work, conferences given by outside researchers, exposure to cutting edge research, etc. This variety of teaching techniques allows students to learn in an iterative and progressive manner all the while developing their autonomy as well as their organisational, time management and communication skills.

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”.

Evaluation methods conform to the rules used to evaluate coursework and exams. Further details about the methods specific to each academic department may be found in their respective evaluation descriptions (“Evaluating students’ knowledge”).

Student work is evaluated according to University rules (see the rules for evaluating coursework and exams) namely written and oral exams, laboratory exams, individual or group work, public presentations of projects and theses defences. Professors provide details about evaluation methods used in their courses at the beginning of each semester.

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

Master’s degree programmes
The Master’s degree programme in nanotechnology and the Master’s degree in nuclear engineering are natural continuations of the M.A. in physical engineering.

Doctoral degree programmes
The Master’s degree programme in physical engineering prepares students for doctoral programmes. The programme’s professors are members of the MAIN (“Materials, Interfaces and Nanotechnology) doctoral programme and interested students are welcome to pursue a doctoral degree.

UCL Master’s degrees (about 60) are accessible to UCL Master’s degree holders
For example:
• The Master’s degree (120) in sciences and environmental management and the Master’s degree (60) in sciences and environmental management (automatic admission with possible complementary coursework)
• Different Master’s degree programmes in management (automatic admission based on written application): see this list
• The Master’s degree (60) in information and communication at Louvain-la-Neuve or the Master’s degree (60) in information and communication at Mons

Contacts

Curriculum Management

Entity
Structure entity
Denomination
Faculty
Sector
Acronym
Postal address

SST/EPL/FYKI
(FYKI)
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Sciences and Technology (SST)
FYKI
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Academic supervisor: Pascal Jacques

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• Secrétaire du Jury: Jean-Christophe Charlier

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