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: kima2m - Francophone Certification Framework: 7

Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Teaching profile</td>
<td>3</td>
</tr>
<tr>
<td>- Learning outcomes</td>
<td>3</td>
</tr>
<tr>
<td>- Programme structure</td>
<td>4</td>
</tr>
<tr>
<td>- Detailed programme</td>
<td>5</td>
</tr>
<tr>
<td>- Programme by subject</td>
<td>5</td>
</tr>
<tr>
<td>- Course prerequisites</td>
<td>17</td>
</tr>
<tr>
<td>- The programme's courses and learning outcomes</td>
<td>17</td>
</tr>
<tr>
<td>Information</td>
<td>18</td>
</tr>
<tr>
<td>- Admission</td>
<td>18</td>
</tr>
<tr>
<td>- Teaching method</td>
<td>20</td>
</tr>
<tr>
<td>- Evaluation</td>
<td>20</td>
</tr>
<tr>
<td>- Mobility and/or Internationalisation outlook</td>
<td>20</td>
</tr>
<tr>
<td>- Possible trainings at the end of the programme</td>
<td>20</td>
</tr>
<tr>
<td>- Contacts</td>
<td>21</td>
</tr>
</tbody>
</table>
Introduction

In order to meet essential challenges such as energy management, communication and information, sustainable development and climate change, it is essential to foster scientific and technological creativity in the field of industrial materials and processes.

You
• have acquired solid knowledge of chemical or physical engineering and mathematics;
• are interested in research and development as well as production and management in cutting edge industries: chemistry, metals and materials, metallic products, plastics, electronics or the process industry;
• would like to take advantage of the most recent research advances in your area of specialisation.

Your Future Job

Jobs in chemical and materials engineering range from research and development to production and marketing.

You can become :
• A « systems » engineer :
Who designs new products or devices with specific properties or functions, e.g. a mitral valve, an electroluminescent polymer for a flexible display, a metallic alloy or a light composite for aerospace applications, a nanomaterial usable for memory storage.
• A « process » engineer :
Who develops new production processes or manages the operation of production units, e.g. a plastics extrusion line, a factory for the extraction of a pharmaceutical compounds from a given plant, a water or waste treatment plant, a production line for electronic components, a production unit for a high purity chemical compound, etc.
• A combination of both :
For instance, you develop a polymer material for the automotive industry and the synthesis/compounding process required for its industrial scale up.

Your Programme

The master offers:
• a specialised training in an international environment; from 2015-2016, all courses organized by the programme commission (i.e. courses with LMAPR2xxx designation) are taught in English ; assistance provided as needed to French-speaking students (“French-friendly” approach).
• an interdisciplinary approach to problem solving, rooted in physics and chemistry;
• research-based training : integration of students in experimental laboratories, research projects ;
• exposure to industry : factory visits, industry internships, graduation project in a company ;
• the possibility to obtain a dual degree if you are accepted in the Master’s degree programme “Functionalised Advanced Materials & Engineering” (FAME), part of the Erasmus Mundus programme. It is entirely in English and starts with a year of general training either at the National Polytechnic Institute of Grenoble (France) or at the University of Augsburg (Germany); in the second year, students specialise in a field of materials sciences at one of 7 partner universities. UCL offers a specialisation in materials and nano-structures engineering. Upon completing the programme, students are granted a dual Master’s degree. More information available on the web page https://www.uclouvain.be/master-fame.html
**Learning outcomes**

Building on fundamental scientific and technical knowledge (physics, chemistry, mechanics, mathematics) acquired during the Bachelor's program, the master's program in chemistry and materials science enables the student to develop polytechnic as well as specialized competences relating to materials, nanotechnology, as well as chemical and environmental engineering, which will allow him/her to fill leadership positions in the design and production of advanced materials and systems as well as the development and management of advanced technological processes.

The program takes up the broad challenges confronting today's engineers, thanks to a curriculum taught entirely in English (courses with MAPR2xxx designation) with assistance provided to French-speaking students.

The program combines coherence and flexibility thanks to a modular structure: a specialized focus and a common core taken by all students, complemented by major and elective courses, which provides students with a specific focus to their training. Depending on the majors chosen, the student may become:

- A systems engineer who designs new products or devices with targeted properties and functions;
- A process or chemical engineer who develops new production processes and optimizes or manages production facilities;
- A combination of both.

Through these activities, the chemical and materials engineer systematically takes into account constraints, values and rules (legal, ethical or economic).

He/she is autonomous, capable of managing industrial projects and comfortable working as part of a team. He/she is able to communicate in a foreign language, English in particular.

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

1. Demonstrate mastery of a solid body of knowledge and skills in engineering sciences allowing one to solve problems related to materials and procedures (axis 1).
   1.1 Identify and use concepts, laws and reasoning to solve a realistic problem.
   1.2 Identify, develop and use adequate modelling and calculation tools to solve realistic and complex problems.
   1.3 Verify the likelihood and confirm the validity of the results relating to a given problem.

2. Organise and carry out an engineering procedure for the development of a specific material, a complex material system, a high purity product and/or complex compound or a process meeting a need or solving a particular problem (axis 2).
   2.1 Analyse a problem or functional requirement of realistic complexity and formulate a corresponding specifications note. An industrial specification for a material or a process contains many elements ranging from technical demands, to economic and logistic constraints as well as legal and safety aspects.
   2.2 Model a problem and design one or more original technical solutions corresponding to the specifications note.
   2.3 Evaluate and classify solutions with regard to all the criteria in the specifications note: efficiency, feasibility, quality, security and interaction/integration with other processes/components.
   2.4 Implement and test a solution in the form of a mock-up, a prototype, a lab or pilot module and/or a numerical model.
   2.5 Come up with recommendations to improve the operationalisation of a solution under study.

3. Organise and carry out a research project to understand a physical or chemical phenomenon or a new problem in materials engineering and science or chemical engineering (axis 3).
   3.1 Document and summarise the existing body of knowledge in the area under consideration.
   3.2 Propose a model and/or an experimental device in order to simulate and test hypotheses relating to the phenomenon under study.
   3.3 Write a summary report that explains the potential of the theoretical or technical innovations 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 (axis 4).
   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.
   4.3 Work in a multidisciplinary environment with peers holding different points of view; manage any resulting disagreement or conflicts.
   4.4 Make individual as well as team decisions when choices have to be made, whether they are about technical solutions or the division of labour to complete a project.

5. Communicate effectively (orally or in writing) with the goal of carrying out assigned projects in the workplace. Ideally, the student should be able to communicate in one or more foreign languages in addition to his/her mother tongue (axis 5).
   5.1 Clearly identify the needs of the client or the user: question, listen and understand all aspects of their request and not just the technical aspects.
   5.2 Present arguments and adapt to the language of the interlocutors: technicians, colleagues, clients, superiors.
   5.3 Communicate through graphs and diagrams: interpret a diagram, present project results, structure information.
   5.4 Read and use different technical documents (rules, plans, specification notes).
5.5 Draft documents that take into account demands and conventions of the field.

5.6 Make a convincing oral presentation possibly using modern communication techniques.

6. demonstrate rigor, openness, critical thinking and a sense of ethics in your work. Using the technological and scientific innovations at
you disposal, validate the socio-technical relevance of a hypothesis or a solution and act responsibly (axis 6).

6.1 Apply the standards of your discipline (terminology, measurement units, quality, security and environmental standards).

6.2 Find solutions that go beyond strictly technical issues by considering sustainable development and the ethical aspects of a project
(for example, "life cycle analysis" among others).

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 during the graduation project which requires the critical analysis of implemented
techniques as well as research for the Master's thesis.)

6.4 Evaluate oneself and independently develop necessary skills for "lifelong learning" in the field (this skill is most notably developed
through projects requiring bibliographic research).

Programme structure

The Master's degree programme consists of:
- a core curriculum (35 credits) including the graduation project (28 credits), the course « molecules and materials analysis »
LMAPR2011 (5 credits) and a religion course (2 credits);
- a professional focus (30 credits);
- one or more majors;
- elective courses to round out the programme.

The overwhelming majority of courses is given in English (all courses with LMAPR2xxx designation and a large proportion of the
courses organized by EPL), with assistance provided to French-speaking students (« French-friendly » approach).

The student MUST choose at least one major among the six proposed in chemistry and materials.

He/she is further ALLOWED to choose a major among the two proposed in Business management and creation.

Normally, professional focus courses are taken during the first annual unit and the graduation project during the last one. However,
students may (depending on their project) take these courses in the 1st or 2nd annual unit as long as they have completed the course
prerequisites. This is particularly the case for students who complete part of their education abroad (ERASMUS or MERCATOR
exchange, FAME dual degree).

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 will replace them with
other elective courses or activities that are in keeping with programme regulations.

Regardless of the focus, major /or elective courses selected, the Master’s degree programme will consist of minimum of 120 credits
divided over two annual units. The first annual unit has to consist of a minimum of 60 credits, the second the number of credits needed
to complete the Master's degree.

The student will verify that he/she has obtained the minimum number of credits required for the approval of the diploma as well as for
the approval of the major, in order to include them in the diploma supplement.

Programmes that respect the above rules will be submitted for approval to 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 chemical and materials engineering [ en-prog-2019-kima2m-lkima220t.html ]

> Professional focus [ en-prog-2019-kima2m-lkima200s ]

Options courses

> Major in chemical and materials [ en-prog-2019-kima2m-lkima936r.html ]
> Major in chemical and environmental engineering [ en-prog-2019-kima2m-lkima221o.html ]
> Major in inorganic materials and processes [ en-prog-2019-kima2m-lkima222o.html ]
> Major in polymers and macro-molecules [ en-prog-2019-kima2m-lkima223o.html ]
> Major in mechanics of materials [ en-prog-2019-kima2m-lkima224o.html ]
> Major in Biomaterials [ en-prog-2019-kima2m-lkima225o.html ]
> Major in nanotechnology [ en-prog-2019-kima2m-lkima233o.html ]
> Major in small and medium sized business creation [ en-prog-2019-kima2m-lkima922r.html ]
> Major in small and medium sized business creation [ en-prog-2019-kima2m-lkima230o.html ]
> Major in business risks and opportunities [ en-prog-2019-kima2m-lkima231o.html ]
> Elective courses [ en-prog-2019-kima2m-lkima950r.html ]
> Elective courses: transversal skills and contacts with industry [ en-prog-2019-kima2m-lkima937o.html ]
KIMA2M Detailed programme

Programme by subject

CORE COURSES [35.0]

| 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...)

Students particularly interested in materials and molecules characterization can complete their training by taking additional major or elective courses. Specifically, these include: LMAPR2631 « surface analysis », LMAPR2642 « crystallographic and microstructural characterization of materials » and LBIRC2102A «organic analysis II, partim" (taught in French)

<table>
<thead>
<tr>
<th>Year</th>
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<th>2</th>
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</thead>
<tbody>
<tr>
<td>LKIMA2990</td>
<td>Graduation project/End of studies project</td>
<td>28 Credits</td>
</tr>
<tr>
<td>LMAPR2011</td>
<td>Molecules and materials analysis</td>
<td>30h+30h</td>
</tr>
</tbody>
</table>

Religion courses for students in exact sciences (2 credits)

The students select one course between:
The student shall select

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Hours</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>LTECO2100</td>
<td>Sociétés, cultures, religions : Biblical readings</td>
<td>2 Credits</td>
<td>15h</td>
<td>Hans Ausloos</td>
</tr>
<tr>
<td>LTECO2200B</td>
<td>Sociétés, cultures, religions : questions humaines fondamentales</td>
<td>2 Credits</td>
<td>15h</td>
<td></td>
</tr>
<tr>
<td>LTECO2300</td>
<td>Societies, cultures, religions : Ethical questions</td>
<td>2 Credits</td>
<td>15h</td>
<td></td>
</tr>
</tbody>
</table>

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 goal of the professional focus is to provide students with fundamental knowledge about materials as well as chemical and environmental processes. These courses are normally taken in the first semester of the first annual unit; furthermore they are intended to help students select their subsequent coursework, namely their major courses

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMAPR2013</td>
<td>Physical Chemistry for Metals and Ceramics</td>
<td>5 Credits</td>
</tr>
<tr>
<td>LMAPR2014</td>
<td>Physics of Functional Materials</td>
<td>5 Credits</td>
</tr>
<tr>
<td>LMAPR2019</td>
<td>Polymer Science and Engineering</td>
<td>5 Credits</td>
</tr>
<tr>
<td>LMAPR2430</td>
<td>Industrial processes for the production of base chemicals</td>
<td>5 Credits</td>
</tr>
<tr>
<td>LMAPR2481</td>
<td>Deformation and fracture of materials</td>
<td>5 Credits</td>
</tr>
<tr>
<td>LMAPR2647</td>
<td>Sustainable treatment of industrial and domestic waste: Fundamentals</td>
<td>5 Credits</td>
</tr>
</tbody>
</table>
OPTIONS

The student selects at least one option among those proposed in chemistry and materials

Major in chemical and materials

- Major in chemical and environmental engineering
- Major in inorganic materials and processes
- Major in Polymers and macro-molecules
- Major in Mechanics of materials
- Major in Biomaterials
- Major in nanotechnology

Major in small and medium sized business creation

- Major in small and medium sized business creation
- Major in business risks and opportunities

Elective courses

- Elective courses available for Master students in Chemical engineering
- Elective courses: transversal skills and contacts with industry

MAJOR IN CHEMICAL AND MATERIALS

The objective of this major is to enable the student to master the concepts and technologies used in chemical and environmental engineering with an emphasis on the dimensioning and optimisation of processes. Particular attention is given to energy control, safety and environmental aspects. The student progressively develops a global understanding of a chemical process and an in-depth knowledge of its parts and mutual interactions.

De 20 à 30 credits parmi

Required courses (15 credits)

- LMAPR2118 Fluid-fluid separations
- LMAPR2330 Reactor Design
- LMAPR2648 Evaluation of sustainability in chemical and environmental engineering

Recommended courses

Students have to take in priority LINMA1510 if they didn't follow it during Bachelor. If they have already taken it they can follow LINMA2300. min=5 credits parmi

- LINMA1510 Linear Control
- LINMA2300 Analysis and control of distributed parameter systems
- LMAPR2320 Advanced Reactor and Separation Technologies for the Production of Base Chemicals and Polymers
<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Year</th>
<th>Credits</th>
<th>%</th>
<th>Teacher(s)</th>
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<tbody>
<tr>
<td>LM2P38</td>
<td>Solid-fluid separation</td>
<td>5</td>
<td>1q</td>
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<tr>
<td>LM2P91</td>
<td>Technology of chemical and environmental engineering</td>
<td>5</td>
<td>2q</td>
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<td>Patricia Luis Alconero, Grégoire Winckelmans</td>
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**Elective courses**

max=10 credits parmi

<table>
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<tr>
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<th>Course Title</th>
<th>Credits</th>
<th>Year</th>
<th>Credits</th>
<th>%</th>
<th>Teacher(s)</th>
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<tbody>
<tr>
<td>LB2C10</td>
<td>Organic Analysis II - partim A</td>
<td>5</td>
<td>2q</td>
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<tr>
<td>LEM207</td>
<td>Renewable energies</td>
<td>4</td>
<td>1q</td>
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<td></td>
<td>Xavier Draye, Patrick Gerin (coord.), Hervé Jeannart, Geoffrey Van Moeseke</td>
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<tr>
<td>LEM210</td>
<td>Sociétés, populations, environnement, développement: problématiques et approches interdisciplinaires</td>
<td>6</td>
<td>1q</td>
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<tr>
<td>LFS245</td>
<td>Environment and business</td>
<td>3</td>
<td>1q</td>
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<tr>
<td>LIN282</td>
<td>Optimization models and methods I</td>
<td>5</td>
<td>2q</td>
<td></td>
<td></td>
<td>François Glineur</td>
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<tr>
<td>LMP202</td>
<td>Materials Selection</td>
<td>5</td>
<td>2q</td>
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<td>Christian Bailly, Thomas Pardoen</td>
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<tr>
<td>LMP214</td>
<td>Metals Processing and Recycling</td>
<td>5</td>
<td>2q</td>
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<tr>
<td>LME264</td>
<td>Major technological hazards in industrial activity.</td>
<td>3</td>
<td>2q</td>
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<td>Denis Dochain</td>
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</table>
**MAJOR IN INORGANIC MATERIALS AND PROCESSES**

This major enables the student to develop in-depth knowledge about the synthesis, processing and recycling of inorganic materials (metals, ceramics, sintered materials, inorganic glasses), their structural and functional properties, their microstructural details at different scales, and the relationship between their properties and their production methods.

- **Mandatory**
- **△ Courses not taught during 2019-2020**
- **★ Periodic courses taught during 2019-2020**

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

### De 20 à 30 credits parmi

#### Required courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
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<th>Hours</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>LMAPR2141</td>
<td>Metals Processing and Recycling</td>
<td>5</td>
<td>30+30</td>
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<tr>
<td>LMAPR2642</td>
<td>Crystallographic and microstructural characterisation of materials</td>
<td>5</td>
<td>30+30</td>
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#### Thermodynamics and processes of elaboration

<table>
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<th>Hours</th>
<th>Year</th>
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<tr>
<td>LMAPR2672</td>
<td>Sintered materials and surface treatments</td>
<td>5</td>
<td>30+30</td>
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<tr>
<td>LKULH2013</td>
<td>Phase equilibria in inorganic materials and processes</td>
<td>5</td>
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</table>

#### Implementation and durability

<table>
<thead>
<tr>
<th>Code</th>
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<th>Year</th>
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<tbody>
<tr>
<td>LMAPR2420</td>
<td>High performance metallic materials</td>
<td>5</td>
<td>30+30</td>
<td>1</td>
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<tr>
<td>LMAPR2482</td>
<td>Plasticity and metal forming</td>
<td>5</td>
<td>30+22.5</td>
<td>2</td>
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</tbody>
</table>

Laurent Delannay
Thomas Pardoen
MAJOR IN POLYMERS AND MACRO-MOLECULES

The objective of this major is to help students master the relationships between the chemical structure of organic macro-molecules (polymers, bio-macromolecules, etc.), the microstructure of their derivative materials, the main synthesis methods and their implementation, and structural and functional properties occurring at a macroscopic and industrial level as well as at the level of nanotechnology and its applications.

De 20 à 30 credits parmi

**Required courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teacher(s)</th>
<th>Credits</th>
<th>Year</th>
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<tbody>
<tr>
<td>LMAPR2016</td>
<td>Project in Polymer Science</td>
<td>Charles-André Fustin, Alain Jonas</td>
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**Polymer science complements**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teacher(s)</th>
<th>Credits</th>
<th>Year</th>
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<tbody>
<tr>
<td>LCHM2261</td>
<td>Physical Chemistry and Chemistry of Polymers</td>
<td>Jean-François Gohy, Alain Jonas</td>
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**Macromolecular bio and nanotechnology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teacher(s)</th>
<th>Credits</th>
<th>Year</th>
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<tbody>
<tr>
<td>LCHM2170</td>
<td>Introduction to protein biotechnology</td>
<td>Pierre Morsomme, Patrice Soumillion</td>
<td>3</td>
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<tr>
<td>LMAPR2012</td>
<td>Macromolecular Nanotechnology</td>
<td>Sophie Demoustier, Karine Glinel, Jean-François Gohy, Bernhard Nysten</td>
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**Polymer materials engineering**

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<th>Year</th>
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</thead>
<tbody>
<tr>
<td>LMAPR2010</td>
<td>Project in materials science and engineering</td>
<td>Christian Bailly, Evelyne Van Ruymbeke</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LMAPR2018</td>
<td>Rheometry and Polymer Processing</td>
<td>Evelyne Van Ruymbeke</td>
<td>5</td>
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</tr>
</tbody>
</table>
MAJOR IN MECHANICS OF MATERIALS

The objective of this major is to introduce students to the principal mechanical characteristics of various categories of materials, to the consequences of these properties on their processing and use, to the methods used to simulate these properties, and to the criteria used to select materials for a given application.

- **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 30 credits parmi

### Required courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Teachers</th>
<th>Total Hrs</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMAPR2018</td>
<td>Rheometry and Polymer Processing</td>
<td>Christian Bailly</td>
<td>30h+22.5h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LMAPR2020</td>
<td>Materials Selection</td>
<td>Christian Bailly</td>
<td>30h+22.5h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LMAPR2482</td>
<td>Plasticity and metal forming</td>
<td>Laurent Delannay</td>
<td>30h+22.5h</td>
<td>5</td>
<td>2q</td>
</tr>
</tbody>
</table>

### Composite materials

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Teachers</th>
<th>Total Hrs</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMECA2141</td>
<td>Rheology</td>
<td>Issam Doghri</td>
<td>30h+30h</td>
<td>5</td>
<td>1q</td>
</tr>
<tr>
<td>LMECA2640</td>
<td>Mechanics of composite materials</td>
<td>Issam Doghri</td>
<td>30h+30h</td>
<td>5</td>
<td>2q</td>
</tr>
</tbody>
</table>

### Solid mechanics and numerical methods

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Teachers</th>
<th>Total Hrs</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMECA1120</td>
<td>Introduction to finite element methods.</td>
<td>Vincent Legat</td>
<td>30h+30h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LGCIV1022</td>
<td>Mechanics of structures</td>
<td>Issam Doghri</td>
<td>30h+30h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LMECA2520</td>
<td>Calculation of planar structures</td>
<td>Issam Doghri</td>
<td>30h+30h</td>
<td>5</td>
<td>2q</td>
</tr>
</tbody>
</table>

### Mechanical metallurgy

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Teachers</th>
<th>Total Hrs</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMAPR2420</td>
<td>High performance metallic materials</td>
<td>Pascal Jacques</td>
<td>30h+30h</td>
<td>5</td>
<td>2q</td>
</tr>
<tr>
<td>LMECA2860</td>
<td>Welding</td>
<td>Pascal Jacques</td>
<td>30h+30h</td>
<td>5</td>
<td>1q</td>
</tr>
</tbody>
</table>
MAJOR IN BIOMATERIALS

The goal of this major is to provide students with the necessary body of knowledge to understand and develop technologies related to biomaterials (implants, biocompatibility, etc.). This major is particularly well-suited for students holding a bachelor in applied chemistry and physics AND biomedical engineering.

KIMA students are required to enrol in LGBIO2030 and LBIR1250 except if these 1st cycle course requirements were fulfilled previously. GBIO students are required to enrol in LMAPR2481 and LMAPR1805 except if these 1st cycle course requirements were fulfilled previously.

De 20 à 30 credits parmi Year

### Required courses (10 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credit(s)</th>
<th>Period(s)</th>
<th>Requisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGBIO2030</td>
<td>Biomaterials</td>
<td>Sophie Demoustier Christine Dupont</td>
<td>5</td>
<td>1Q</td>
<td>X</td>
</tr>
<tr>
<td>LBIR1250</td>
<td>Biochemistry I</td>
<td>Michel Ghislain Yvan Larondelle (coord.)</td>
<td>5</td>
<td>1Q</td>
<td>X</td>
</tr>
</tbody>
</table>

### Recommended courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credit(s)</th>
<th>Period(s)</th>
<th>Requisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBIR1355</td>
<td>Metabolisme microbien et synthèse de biomolécules</td>
<td>Michel Ghislain (coord.) Yvan Larondelle</td>
<td>3</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LBOI1335</td>
<td>Immunology : basis and applications in biology</td>
<td>Yvan Larondelle</td>
<td>3</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LELEC2560</td>
<td>Micro and Nanofabrication Techniques</td>
<td>Laurent Francis (coord.) Benoit Hackens Jean-Pierre Raskin</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LMAPR2012</td>
<td>Macromolecular Nanotechnology</td>
<td>Sophie Demoustier Karine Ginel Jean-François Gehy Bernard Nysten</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
</tbody>
</table>

### Elective courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credit(s)</th>
<th>Period(s)</th>
<th>Requisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBIRC2101A</td>
<td>Analyse biochimique et notions de génie génétique: analyse biochimique</td>
<td>Iwona Cybul ska</td>
<td>4</td>
<td>1Q</td>
<td>X</td>
</tr>
<tr>
<td>LBIRC2108</td>
<td>Biochemical and Microbial Engineering</td>
<td>Iwona Cybul ska</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LGBIO2020</td>
<td>Bioinstrumentation</td>
<td>André Moursaux Michel Verleysen</td>
<td>5</td>
<td>1Q</td>
<td>X</td>
</tr>
<tr>
<td>LGBIO1114</td>
<td>Artificial organs and rehabilitation</td>
<td>Luc-Marie Jacquet Philippe Lefèvre Renaud Ronse</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LMAPR2010</td>
<td>Project in materials science and engineering</td>
<td>Philippe Lefèvre Renaud Ronse</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LMAPR2018</td>
<td>Rheometry and Polymer Processing</td>
<td>Evelyne Van Ruymbeke</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
<tr>
<td>LMAPR2631</td>
<td>Surface Analysis</td>
<td>Arnaud Délorte Bernard Nysten</td>
<td>5</td>
<td>2Q</td>
<td>X</td>
</tr>
</tbody>
</table>
MAJOR IN NANOTECHNOLOGY

The objective of this major is to introduce students to the physics and simulation of materials and devices used in the field of micro- and nanotechnologies, to the properties and methods used to manufacture and characterise micro and nanostructures, to the ways in which nano-devices function as well as to the development and integration of (bio) organic elements in nano-systems.

The student choosing this major selects
De 20 à 30 credits parmi

### 3 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>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMAPR2015</td>
<td>Physics of Nanostructures</td>
<td>Jean-Christophe Charlier, Xavier Gonze, Luc Piraux</td>
<td>5</td>
<td>37.5h +22.5h</td>
</tr>
<tr>
<td>LMAPR2451</td>
<td>Atomistic and nanoscopic simulations</td>
<td>Jean-Christophe Charlier, Xavier Gonze, Gian-Marco Rignanese</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LMAPR2471</td>
<td>Transport phenomena in solids and nanostructures</td>
<td>Jean-Christophe Charlier, Luc Piraux</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LPHYS2351</td>
<td>Superconductivity [TM]</td>
<td></td>
<td>5</td>
<td>22.5h +7.5h</td>
</tr>
</tbody>
</table>

### 3 Nano and micro semi-conductor devices

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>LELEC2541</td>
<td>Advanced Transistors</td>
<td>Denis Flandre, Benoît Hackens, Jean-Pierre Raskin</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LELEC2550</td>
<td>Special electronic devices</td>
<td>Vincent Bayot</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LELEC2710</td>
<td>Nanoelectronics</td>
<td>Vincent Bayot, Benoît Hackens</td>
<td>5</td>
<td>30h+30h</td>
</tr>
</tbody>
</table>

### 3 Micro and nano-engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
<th>Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>LELEC2560</td>
<td>Micro and Nanofabrication Techniques</td>
<td>Laurent Francis, Benoît Hackens, Jean-Pierre Raskin</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LELEC2895</td>
<td>Design of micro and nanosystems</td>
<td>Laurent Francis</td>
<td>5</td>
<td>30h+30h</td>
</tr>
<tr>
<td>LMAPR2012</td>
<td>Macromolecular Nanotechnology</td>
<td>Sophie Demoustier, Jean-François Gohy, Bernard Nysten</td>
<td>5</td>
<td>45h+15h</td>
</tr>
<tr>
<td>LMAPR2631</td>
<td>Surface Analysis</td>
<td>Arnaud Delcorde, Bernard Nysten</td>
<td>5</td>
<td>30h+15h</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. This major is not available in English and may not be taken at the same time as the major “Business risks and opportunities”.

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

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

### Prerequisite CPME courses

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

- **LCPME2000** Venture creation financement and management I by Yves De Rongé, Olivier Giacomin: 30h+15h, 5 Credits, 1q
## 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 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>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFSA1290</td>
<td>Introduction to financial and accounting management</td>
<td>4</td>
<td>30h+15h</td>
<td>x x</td>
</tr>
<tr>
<td>LFSA2140</td>
<td>Elements of law for industry and research</td>
<td>3</td>
<td>30h</td>
<td>x x</td>
</tr>
<tr>
<td>LFSA2210</td>
<td>Organisation and human resources</td>
<td>3</td>
<td>30h</td>
<td>x x</td>
</tr>
<tr>
<td>LFSA2230</td>
<td>Introduction to management and to business economics</td>
<td>4</td>
<td>30h+15h</td>
<td>x x</td>
</tr>
<tr>
<td>LFSA2245</td>
<td>Environment and business</td>
<td>3</td>
<td>30h</td>
<td>x x</td>
</tr>
</tbody>
</table>

### One course between

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFSA2202</td>
<td>Ethics and ICT</td>
<td>3</td>
<td>30h</td>
<td>x x</td>
</tr>
<tr>
<td>LLSMS2280</td>
<td>Business Ethics and Compliance Management</td>
<td>5</td>
<td>30h</td>
<td>x x</td>
</tr>
</tbody>
</table>

### 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

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN CHEMICAL ENGINEERING

The elective courses being recommended and available for Master students in chemical 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

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

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

Company Internship

LFS A2995

Jean-Pierre Raskin

30h

10 Credits

1 + 2q

Professional integration activity specific to the program

Quality management and control.

LMECA2711

Nicolas Bronchart

30h+30h

5 Credits

2q

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:

Professional development seminar German

LALLE2500

Carbon Klein

Ann Rinder (coord.)

30h

3 Credits

1 ou 2q

Professional development seminar-German

LALLE2501

Carbon Klein

Ann Rinder (coord.)

30h

5 Credits

1 ou 2q

Vocational Induction Seminar - Spanish (B2.2/C1)

LESPA2600

Paula Lorente Fernandez (coord.)

30h

3 Credits

1q

Vocational Induction Seminar - Spanish (B2.2/C1)

LESPA2601

Paula Lorente Fernandez (coord.)

30h

5 Credits

1q

Seminar of Entry to professional life in Dutch - Intermediate level

LNEER2500

Isabelle Demeulemaere (coord.)

Marken Smit

30h

3 Credits

1 ou 2q

Seminar of entry to professional life in Dutch - Upper-Intermediate level

LNEER2600

Isabelle Demeulemaere (coord.)

30h

3 Credits

1 ou 2q

Group dynamics

Dynamique des groupes - Q1

LEPL2351

15h+30h

3 Credits

1q

Dynamique des groupes - Q2

LEPL2352

15h+30h

3 Credits

2q
### Other non-disciplinary courses

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

A document entitled en-prerequis-2019-kima2m.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?"

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.
KIMA2M - 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 master programme.</td>
</tr>
<tr>
<td>Bachelor in engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</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>
</tr>
</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>Bachelor 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>
</tbody>
</table>

For others institutions

Based on application: accepted, conditional on further training, or refusal See Personalized access
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>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Masters

<table>
<thead>
<tr>
<th>Diploma</th>
<th>Special Requirements</th>
<th>Access</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master in engineering</td>
<td>Direct Access</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

A student with no major in applied chemistry and physics from UCL, nor any option deemed equivalent, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). Engineering Bachelors are exempted from this procedure, if they have a minor in applied chemistry and physics from UCL, or an option deemed equivalent. The Faculty, after consulting the Applied chemistry and physics diploma committee, will decide as to the applicant's admissibility, pursuant to rules relative to links between degrees. Moreover, the Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the KIMA curriculum and, if necessary, up to 15 additional credits. For some students (e.g. bachelors in industrial engineering), the Faculty might require an additional year of studies prior to the Master's, corresponding to 60 credits of the major in applied chemistry and physics.
Teaching method

A variety of teaching methods

The teaching methods used in the Master’s degree programme in chemical and materials engineering are in keeping with those used in 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. An important characteristic of the programme is the immersion of students in the research laboratories of the professors who teach in the programme (lab work, case studies, projects and theses), which allows students to learn cutting edge methods used in their field and to learn from the questioning process inherent in research. In addition, there is an optional 10 credit internship carried out over at least 9 months in a research centre or company that allows motivated students to get experience in the professional world.

Diverse learning situations

Students are exposed to a variety of pedagogies: lectures, projects, exercise and problem-solving sessions, case studies, experimental laboratories, computer simulations, educational software, internships in industry or research, factory visits, graduation trips, individual or group work, seminars given by visiting scientists. This variety of pedagogies helps students to build their knowledge in an iterative and progressive manner all the while developing their independence, organisational and time management skills as well as their ability to communicate.

Interdisciplinary Methods

The Master’s degree in chemical and materials engineering is by its very nature interdisciplinary because it serves as an interface between chemistry and physics. It has an interdisciplinary foundation, which provides students with an introduction to the large array of applications used in applied physics and chemistry and training through practical work and cutting edge research as well as major courses in chemistry and material technologies: polymers and macromolecules, inorganic materials and processes, materials mechanics, chemical engineering, nanotechnologies and environmentalism and sustainable development. The programme is open to biotechnology with majors in biomaterials and bioprocesses as well as to business management with majors in management and small and medium sized business creation. The programme is composed of a significant number of classes such as PHYS (or PHY), CHIM (or CHM), BIOL, INMA, MECA, ELEC, BRNA and BIR, which shows that the programme is open and interdisciplinary. Finally, the programme allows students to select up to 40 credits of elective courses from the medical and science programmes and up to 6 credits of classes in the humanities and social sciences, which allow students to create a personalised programme of study.

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”.

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. Details about evaluation methods for each teaching unit are explained by the professors at the beginning of the semester.

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

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 specialised Master’s degrees
The Master’s degree in nanotechnology and the Master’s degree in nuclear engineering are natural extensions of the programme.

Accessible doctoral degrees
The Master’s degree programme in chemistry and materials engineering also prepares students for doctoral programmes. Programme professors are members of doctoral programmes such as CHIM (molecular, supramolecular and functional chemistry), MAIN (materials, interfaces and nanotechnologies) and GEPROC (process engineering). These programmes are suitable for students who would like to continue their studies at the doctoral level.

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 Managment

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