

FYAP2M - Teaching profile

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. Demonstrating 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 convertors based on thermoelectric 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.

6.2 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:

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Year

LEPL2020

Professional integration work

The modules of LEPL2020 course are organized over the two annual blocks of the master's degree. It is strongly recommended that students take them from year 1, but they will only be able to register for the course at the earliest the year in which they present their final graduation project.

Students who have other professional integration activities in their personal programme, or who can demonstrate an equivalent activity could be exempted from this course. This equivalence is at the discretion of the examination board. Another activity should then be chosen to reach the number of ECTS required for their graduation.

EN [q1+q2] [30h+15h] [2 Credits]  
 > French-friendly

1 2

x

PROFESSIONAL FOCUS [30.0]

- Mandatory
 - ✘ Optional
 - △ Not offered in 2024-2025
 - ⊗ Not offered in 2024-2025 but offered the following year
 - ⊕ Offered in 2024-2025 but not the following year
 - △ ⊕ Not offered in 2024-2025 or the following year
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Dans la rubrique "Options du master ingénieur civil physicien", l'étudiant-e doit valider au moins une des options proposées.
 Dans la rubrique "Options et cours au choix en connaissances socioéconomiques", l'étudiant-e valide une des deux options ou choisit obligatoirement au minimum 3 crédits parmi les cours au choix ou les cours de l'option en enjeux de l'entreprise.

Majors for the Master's degree in physics

- > [Major in Advanced Engineering Physics](#) [en-prog-2024-fyap2m-lfyap221o]
- > [Major in nanotechnology](#) [en-prog-2024-fyap2m-lfyap225o]
- > [Major advanced electronic materials and devices](#) [en-prog-2024-fyap2m-lfyap223o]

Options et cours au choix en connaissances socio-économiques

- > [Business risks and opportunities](#) [en-prog-2024-fyap2m-lfyap230o]
- > [Major in Interdisciplinary Program in Entrepreneurship - INEO](#) [en-prog-2024-fyap2m-lfyap231o]
- > [Cours au choix en connaissances socio-économiques](#) [en-prog-2024-fyap2m-lfyap200o]

Others elective courses

- > [Others elective courses](#) [en-prog-2024-fyap2m-lfyap952o]

MAJORS FOR THE MASTER'S DEGREE IN PHYSICS

MAJOR IN ADVANCED ENGINEERING PHYSICS

- Mandatory
- ⌘ Optional
- △ Not offered in 2024-2025
- ⊙ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

From 20 to 30credit(s)

Year

1 2

o Content:

⌘ Optics and photonics

⌘ LPHYS2141	Introduction to quantum optics	Matthieu Génévriez Xavier Urbain	EN [q1] [22.5h+7.5h] [5 Credits] 🌐 > French-friendly	X	X
⌘ LPHYS2246	Experimental methods in atomic and molecular physics		EN [q2] [30h] [5 Credits] 🌐 > French-friendly	X	X

⌘ Experimental methods

⌘ Numerical simulations

⌘ LMAPR2483	Durability of materials	Laurent Delannay Thomas Pardoën	EN [q2] [30h+22.5h] [5 Credits]  > French-friendly
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MAJOR IN NANOTECHNOLOGY

MAJOR ADVANCED ELECTRONIC MATERIALS AND DEVICES

- Mandatory
- ✂ Optional
- △ Not offered in 2024-2025
- ⊖ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🌐 Not open to incoming exchange students
- (FR) Teaching language (FR, EN, ES, NL, DE, ...)

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

From 15 to 30credit(s)

Year

1 2

o Content:

OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES
[3.0]

BUSINESS RISKS AND OPPORTUNITIES

- Mandatory
 - ✘ Optional
 - △ Not offered in 2024-2025
 - ⊗ Not offered in 2024-2025 but offered the following year
 - ⊕ Offered in 2024-2025 but not the following year
 - △ ⊕ Not offered in 2024-2025 or the following year
 - Activity with requisites
 - 🌐
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MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP - INEO

Commune à la plupart des masters de l'EPL, cette option a pour objectif de familiariser l'étudiant-e avec les spécificités de l'entrepreneuriat et de la création d'entreprise afin de développer chez lui les aptitudes, connaissances et outils nécessaires à la création d'entreprise.

Cette option rassemble des étudiants de différentes facultés en équipes interdisciplinaires afin de créer un projet entrepreneurial. La formation interdisciplinaire en entrepreneuriat (INEO) est une option qui s'étend sur 2 ans et s'intègre dans plus de 30 Masters de 9 facultés/écoles de l'UCLouvain. Le choix de l'option INEO implique la réalisation d'un mémoire interfacultaire (en équipe) portant sur un projet de création d'entreprise. L'accès à cette option, ainsi qu'à chacun des cours, est limité aux étudiant-es sélectionnés sur dossier. Toutes les informations sur <https://uclouvain.be/fr/etudier/ineo>.

L'étudiant.e qui choisit de valider cette option doit sélectionner au minimum 20 crédits et au maximum 25 crédits. Cette option n'est pas accessible en anglais et ne peut être prise simultanément avec l'option « Enjeux de l'entreprise ».

- Mandatory
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COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

- Mandatory
- ✘ Optional
- △ Not offered in 2024-2025
- ⊖ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🌐 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Year

				Year	
				1	2
⌘ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.)	SE [q1 or q2] [30h] [3 Credits] 🌐	x	x
⌘ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.) Dag Houdmont	SE [q1 or q2] [30h] [3 Credits] 🌐	x	x

⌘ Group dynamics

⌘ LEPL2351	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoën Benoît Raucent	SE [q1] [15h+30h] [3 Credits] 🌐	x	x
⌘ LEPL2352	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoën Benoît Raucent	SE [q2] [15h+30h] [3 Credits] 🌐	x	x

Course prerequisites

There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

The programme's courses and learning outcomes

For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

Bachelor in Engineering	For others institutions	Access based on application	degree may have an adapted master programme. See personalized access
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Non university Bachelors

> Find out more about [links](#) to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters

Master in engineering	Direct access
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Holders of a non-University 2nd cycle degree

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about [Validation of priori experience](#).

Access based on application

Access based on application : access may be granted either directly or on the condition of completing additional courses of a maximum of 60 ECTS credits, or refused.

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](#) (contact : epl-admission@uclouvain.be).

Possible trainings at the end of the programme

Master's degree programmes

The [Advanced Master in Nanotechnologies](#) and the [Advanced Master in Nuclear Engineering](#) of the M.A. in physical engineering.

