UCLouvain

FYAP2M

2023 - 2024

Master [120] in Physical Engineering

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 (wheTm [amental tools and (in terms of T7ution.k in 30249 Tmo1 00snd 0 -1 articul349 Tm [.hcmentalnol236300659 Tm7 0 0 -

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 anaylsis”).
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 (32 credits)
- A final specialisation (30 credits)
- One of more of the major courses or elective courses.

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.

FYAP2M Programme

Detailed programme by subject

CORE COURSES

Mandatory
Optional
Not offered in 2023-2024
Not offered in 2023-2024 but offered the following year
Offered in 2023-2024 but not the following year
Not offered in 2023-2024 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...)

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

				Year 1	2
LFYAP2990	Graduation project/End of studies project *The graduation project can be written and presented in French or English, in consultation with the supervisor. It may be accessible to exchange students by prior agreement between the supervisors and/or the two universities.*		[EN] [q1+q2] [] [25 Credits]		x

				Year 1	2
LEPL2020	Professional integration work *Les modules du cours LEPL2020 sont organisés sur les deux blocs annuels du master. Il est fortement recommandé à l'étudiant.e de les suivre dès le bloc annuel 1, mais il.elle ne pourra inscrire le cours qu'au plus tôt l'année où il.elle présente son travail de fin d'études.*	Myriam Banaï Francesco Contino (coord.) Delphine Ducarme Jean-Pierre Raskin	EN [q1+q2] [30h+15h] [2 Credits] *> French-friendly*	x	x
LELEC1755	Physics of electronic devices and transmission lines	Denis Flandre (coord.) Claude Oestges	FR [q1] [30h+30h] [5 Credits]	x	

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.

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 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

Content:

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.

LMAPR2015	Physics of Nanostructures	Jean-Christophe Charlier Xavier Gonze Luc Piraux	[EN] [q1] [37.5h+22.5h] [5 Credits] *> French-friendly*

MAJOR ADVANCED ELECTRONIC MATERIALS AND DEVICES

- Mandatory
-

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'entreprenariat 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 (https://uclouvain.be/fr/etudier/ineo).

Course prerequisites

The **table** below lists the activities (course units, or CUs) for which there are one or more prerequisites within the programme, i.e. the programme CU for which the learning outcomes must be certified and the corresponding credits awarded by the jury before registering for that CU.

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

Prerequisites and student's annual programme

As the prerequisite is for CU registration puposes only, there are no prerequisites within a programme year. Prerequisites are defined between CUs of different years and therefore influence the order in which the student will be able to register for the programme's CUs.

In addition, when the jury validates a student's individual programme at the beginning of the year, it ensures its coherence, meaning that it may:

- require the student to combine registration in two separate CUs which it considers necessary from a pedagogical point of view.
- transform a prerequisite into a corequisite if the student is in the final year of a degree course.

For more information, please consult the Academic Regulations and Procedures (https://uclouvain.be/fr/decouvrir/rgee.html).

 # Prerequisities list

MLSMM2134 "e-Consumer Behavior" has prerequisite(s) MGEST1108

- MGEST1108 - Marketing

MLSMM2136 "Trends in Digital Marketing" has prerequisite(s) MGEST1108

- MGEST1108 - Marketing

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.

FYAP2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the hiher education landscape and the academic organisation of courses.

General and specific admission requirements for this programme must be satisfied at the time of enrolling at the university.

Unless explicitly mentioned, the bachelor's, master's and licentiate degrees listed in this table or on this page are to be understood as those issued by an institution of the French, Flemish or German-speaking Community, or by the Royal Military Academy.

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

SUMMARY

Specific access requirements

This programme is taught in English with no prerequisite in French. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the Access on the file.

University Bachelors

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

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

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

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).

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 UCLouvain 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

Contacts

Curriculum Management

Entity

Structure entity	SST/EPL/FYKI
Denomination	(FYKI)
Faculty	Louvain School of Engineering (EPL)
Sector	Sciences and Technology (SST)
Acronym	FYKI
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Academic supervisor: Pascal Jacques (https://uclouvain.be/repertoires/pascal.jacques)