FYAP2M

2014 - 2015

Master [120] in Physical Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In french
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **NO**
Activities on other sites : **NO**
Organized by: **Ecole Polytechnique de Louvain (EPL)**
Programme code: **fyap2m** - European Qualifications Framework (EQF): 7

Table of contents

FYAP2M - Introduction

Introduction

FYAP2M - Teaching profile

Learning outcomes

Thanks to an in-depth coverage of the various fields of physics (optics, electricity, mechanics, quantum physics, physics of materials,...), this open and comprehensive training will prepare the student towards a broad spectrum of professional and industrial specializations, as well as advanced technology activities featuring a strong “research” bias. It is based on a close dialogue between the formal representation of concepts within the field, the implementation of numerical simulation tools to grasp the consequences of these representations, and also experimentation via practical tutorials. Throughout the training, the student will have many opportunities to frequent experimental labs, to put formal learning into practice, and to implement cutting-edge research tools within these application fields. A traineeship in industry or in a research lab in Belgium or abroad can complement the training.

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

démontrer la maîtrise d’un solide corpus de connaissances en sciences fondamentales et sciences de l’ingénieur, lui permettant d’appréhender et de résoudre les problèmes relatifs aux applications technologiques et industrielles des sciences physiques.

1.1. Identifier et mettre en oeuvre de façon réaliste au vu de la complexité, les concepts, lois, raisonnements applicables à une problématique donnée (p.ex. identification des lois et matériaux pour la réalisation de LEDs à lumière blanche, pour la conception de convertisseurs d’énergie à base d’éléments thermoélectriques, pour la réalisation de supports et de dispositifs pour le stockage et/ou le transfert de l’information , pour la conception de panneaux photovoltaïques à rendement optimal ...)
1.2. Identifier et utiliser les outils de modélisation et de calcul adéquats pour résoudre cette problématique.
1.3. Vérifier la vraisemblance et confirmer la validité des résultats obtenus au regard de la nature du problème posé.

organiser et de mener à son terme une démarche complète d’ingénierie relative à une application dans le domaine des hautes technologies nécessitant les outils et concepts fondamentaux de la physique, répondant à un besoin ou à un problème particulier.

2.1. Analyser un problème ou un besoin fonctionnel de complexité réaliste et formuler le cahier des charges correspondant.
2.2. Modéliser le problème et concevoir une ou plusieurs solutions techniques originales répondant à ce cahier des charges (p.ex. optimisation de matériaux et/ou de combinaison de ceux ci pour l’isolation thermique (batiments, ...) ou, au contraire, pour favoriser l’évacuation de la chaleur (aérospatiale, microélectronique, ...), développement de mesures de caractérisation électrique et thermique répondant à une géométrie de matériau donnée, choix des matériaux pour l’émission de lumière (LEDs) ou la réalisation de panneaux photovoltaiques...)
2.3. Evaluer et classer les solutions au regard de l’ensemble des critères figurant dans le cahier des charges : efficacité, faisabilité, qualité, ergonomie et sécurité dans l’environnement professionnel.
2.4. Implémenter et tester une solution sous la forme d’une maquette, d’un prototype et/ou d’un modèle numérique.
2.5. Formuler des recommandations pour améliorer le caractère opérationnel de la solution étudiée.

organiser et de mener à son terme un travail de recherche pour appréhender une problématique inédite technologique ou industrielle dans différents domaines de la physique appliquée et de l'ingénierie de haute technologie.

3.1. Se documenter et résumer l’état des connaissances actuelles dans le domaine considéré.
3.2. Proposer une modélisation et/ou un dispositif expérimental permettant de simuler et de tester des hypothèses relatives au phénomène étudié.
3.3. Mettre en forme un rapport de synthèse visant à expliciter les potentialités d’innovation théorique et/ou technique résultant de ce travail de recherche.

contribuer, en équipe, à la programmation d’un projet et de le mener à son terme en tenant compte tenu des objectifs, des ressources allouées et des contraintes qui le caractérisent.

4.1. Cadrer et expliciter les objectifs d’un projet (en y associant des indicateurs de performance) compte tenu des enjeux et des contraintes (ressources, budget, échéance, …) qui caractérisent l’environnement du projet.
4.2. S’engager collectivement sur un plan de travail, un échéancier et rôles à tenir par exemple, répartition des tâches entre étudiants dans la réalisation d’un projet
4.3. Fonctionner dans un environnement pluridisciplinaire, conjointement avec d’autres acteurs porteurs de différents points de vue : gérer des points de désaccord ou des conflits
4.4. Prendre des décisions en équipe lorsqu’il y a des choix à faire : que ce soit sur les solutions techniques ou sur l’organisation du travail pour faire aboutir le projet.

communiquer efficacement oralement et par écrit en vue de mener à bien les projets qui lui sont confiés dans son environnement de travail. Idéalement, il devrait être capable de communiquer également dans une ou plusieurs langues étrangères en plus du français.

5.1. Identifier clairement les besoins du « client » ou de l'usager : questionner, écouter et comprendre toutes les dimensions de sa demande et pas seulement sur les aspects techniques (par exemple sélectionner l'équipement d'analyse et/ou de caractérisation le plus adapté selon la nature et la géométrie d'un matériau, choisir les matériaux les plus adaptés suivant les fonctionnalités visées et l'intégration dans des systèmes, …).

5.2. Argumenter et convaincre des choix technologiques en s'adaptant au langage de ses interlocuteurs : techniciens, collègues, clients, supérieurs hiérarchiques.

5.3. Communiquer sous forme graphique et schématique ; interpréter un schéma, présenter les résultats d'un travail, structurer des informations.

5.4. Lire, analyser et exploiter des documents techniques normes, plans, cahier de charge : évolution de propriétés physiques en fonction du matériau, de la température, d'une contrainte mécanique ou de champs extérieurs, diagrammes de phases, structures de bandes…

5.5. Rédiger des documents écrits en tenant compte des exigences contextuelles et des conventions sociales en la matière.

5.6. Faire un exposé oral convaincant en utilisant les techniques modernes de communication.

faire preuve de rigueur, d'ouverture, d'esprit critique et d'éthique dans son travail. Tout en tirant parti des innovations technologiques et scientifiques à sa disposition, il prendra le recul nécessaire pour valider la pertinence socio-technique d'une hypothèse ou d'une solution et se comporter en acteur responsable.

6.1. Appliquer les normes en vigueur dans sa discipline (terminologie, unités de mesure, normes de qualité et de sécurité …).

6.2. Trouver des solutions qui vont au-delà des enjeux strictement techniques, en intégrant les enjeux de développement durable et la dimension éthique d'un projet (par exemple « life cycle analysis » et similaires).

6.3. Faire preuve d'esprit critique vis-à-vis d'une solution technique pour en vérifier la robustesse et minimiser les risques qu'elle présente au regard du contexte de sa mise en Œuvre (cette compétence est principalement développée dans le cadre du travail de fin d'étude tant au niveau de l'analyse critique des techniques mises en oeuvre pour la fabrication et la caractérisation de matériaux qu'au niveau des perspectives de recherche et de développement rédigées au terme du mémoire).

6.4. S'autoévaluer et développer de manière autonome les connaissances nécessaires pour rester compétent dans son domaine – « lifelong learning » (cette compétence est notamment développée dans le cadre de cours à projets nécessitant des recherches bibliographiques).

Programme structure

The student's curriculum will consist of at least 120 credits covering two years, with a minimum of 60 credits per year, and comprising :

• a core curriculum of at least 53 credits, including a final thesis, compulsory courses, and general interest electives;

• a 30-credit specialization;

• specialized elective courses, or one or more additional options (each totalling at least 20 credits, except for the management option) chosen from amongst the 8 options of the curriculum (nanotechnology, materials science, applied physics, basic physics, numerical modelling, optics, management or launching of small and medium-sized companies).

The final thesis is generally written during the last year. However, students may choose to take any given course in the first or second year, subject to possible prerequisites. This will be the case in particular for students pursuing part of their education abroad.

If, in the course of his (her) former curriculum, a student has already been credited with a subject included in the compulsory core curriculum, or any training deemed equivalent, this subject will be replaced by elective courses, while conforming to imposed constraints. The student is responsible for checking whether the minimum total number of credits has been reached, as well as those of the specialized field, which will appear on the final diploma.

The student's curriculum will be submitted for acceptance by the Applied physics and chemistry diploma committee, using an ad hoc form to be found on the website of the committee.

Whatever the focus or the options chosen, the programme of this master shall totalize 120 credits, spread over two years of studies each of 60 credits.

> Core courses *[en-prog-2014-fyap2m-lfyap220t.html]*

> Professional focus *[en-prog-2014-fyap2m-lfyap200s]*

Options courses

> Advanced Physics *[en-prog-2014-fyap2m-lfyap221o.html]*
> Option en simulation numérique de la matière *[en-prog-2014-fyap2m-lfyap220o.html]*
> Nanotechnology *[en-prog-2014-fyap2m-lfyap225o.html]*
> Option en technologies photovoltaïques . *[en-prog-2014-fyap2m-lfyap229o.html]*
> Setting up small and medium-sized businesses *[en-prog-2014-fyap2m-lfyap226o.html]*
> Business risks and opportunities *[en-prog-2014-fyap2m-lfyap227o.html]*
> Optional courses *[en-prog-2014-fyap2m-lfyap228o.html]*

FYAP2M Detailled programme

Programme by subject

CORE COURSES [45.0]

O Mandatory
△ Courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015
⊠ Optional
⊘ Periodic courses not taught during 2014-2015
⧺ Two years course

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

Les cours ELEC ne sont obligatoires que s'ils n'ont pas été suivis en 1er cycle.

						Year 1	Year 2
O LFYAP2990	Graduation project/End of studies project	N.		28 Credits			x
O LELEC1330	Physics of electronics	Vincent Bayot (coord.), Denis Flandre, Laurent Francis, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	
O LELEC1350	APPLIED ELECTROMAGNETISM	Christophe Craeye, Danielle Janvier	30h+30h	5 Credits	1q	x	x
O LPHY2141	Optique et lasers	Alain Cornet	30h+10h	5 Credits	1q	x	x

O *Religion courses for student in exact sciences*

The student shall select 2 credits from amongst
The student shall select

⊠ LTECO2100	Questions of religious sciences: Biblical readings	Hans Ausloos	15h	2 Credits	1q	x	x
⊠ LTECO2200	Questions of religious sciences: reflections about Christian faith	Dominique Martens	15h	2 Credits	2q	x	x
⊠ LTECO2300	Questions of religious sciences: questions about ethics	Philippe Cochinaux	15h	2 Credits	1q	x	x

PROFESSIONAL FOCUS [30.0]

O Mandatory
△ Courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015
⊠ Optional
⊘ Periodic courses not taught during 2014-2015
⧺ Two years course

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

						Year 1	Year 2
O LMAPR2014	Physics of Functional Materials	Xavier Gonze, Luc Piraux, Gian-Marco Rignanese	37.5h +22.5h	5 Credits	1q	x	
O LMAPR2451	Study of materials at the atomic scale	Jean-Christophe Charlier, Xavier Gonze, Gian-Marco Rignanese	30h+30h	5 Credits	2q	x	
O LMAPR2471	Transport phenomena in solids and nanostructures	Jean-Christophe Charlier, Luc Piraux (coord.)	30h+30h	5 Credits	2q	x	
O LMAPR2481	Deformation and fracture of materials	Thomas Pardoen	30h+30h	5 Credits	1q	x	x

						Year 1	2
LMAPR2011	Methods of Physical and Chemical Analysis	Arnaud Delcorte, Jacques Devaux	30h+30h	5 Credits	1q	x	
LMAPR2019	Polymer Science and Engineering	Sophie Demoustier, Alain Jonas, Evelyne Van Ruymbeke	45h+15h	5 Credits	1q	x	

OPTIONS

ADVANCED PHYSICS

L'objectif de cette option est de doter l'étudiant de connaissances complémentaires concernant les techniques d'expérimentation et phénomènes physiques reliés aux basses températures, au domaine du nucléaire, et aux capteurs.

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

The student registered in this option chooses
De 20 à 30 credits parmi

⊠ Orientation "Concept fondamentaux de la physique".

						Year 1	Year 2
⊠ LPHY1223	Special Relativity	Jean-Marc Gérard	22.5h +15h	4 Credits	1q	x	x
⊠ LPHY1331	Elementary nuclei and particules	Vincent Lemaitre	30h+10h	4 Credits	2q	x	x
⊠ LPHY2120	Quantum Field Theory	Jean-Marc Gérard, David Lopez Val	22.5h	4 Credits	1q	x	x

⊠ Orientation " méthodes expérimentales".

⊠ LELEC2811	Instrumentation and sensors	David Bol, Laurent Francis	30h+30h	5 Credits	1q	x	x
⊠ LPHY2245	Lasers and applications	Clément Lauzin	45h+15h	6 Credits	2q	x	x
⊠ LPHY2372	Experimental methods	Krzysztof Piotrzkowski, Xavier Urbain	30h+15h	4 Credits	1q	x	x
⊠ LPHY2273	Cryophysique et questions spéciales de supraconductivité	Vincent Bayot, Luc Piraux	45h+15h	6 Credits	1q	x	x

⊠ Orientation " matériaux avancée ".

⊠ LMAPR2010	Polymer Materials	Christian Bailly, Bernard Nysten	45h+15h	5 Credits	1q	x	x
⊠ LMAPR2012	Macromolecular Nanotechnology	Sophie Demoustier, Karine Glinel, Jean-François Gohy, Bernard Nysten	45h+15h	5 Credits	2q	x	x
⊠ LMAPR2013	Physical Chemistry for Metals and Ceramics	Pascal Jacques	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2631	Solid surface analysis and treatment	Arnaud Delcorte, Bernard Nysten	37.5h +15h	5 Credits	2q	x	x
⊠ LMAPR2642	Characterisation of Inorganic Materials	Pascal Jacques, Quentin Van Overmeere	30h+30h	5 Credits	1q	x	x

⊠ *Orientation " optique et photonique".*

					Year 1	Year 2
⊠ LPHY2140	Photons, atoms and molecules	André Nauts, Xavier Urbain	30h	5 Credits 1q	x	x
⊠ LPHY2242	Méthodes d'analyse en physique atomique et moléculaire	Xavier Urbain	30h	5 Credits 1q	x	x

OPTION EN SIMULATION NUMÉRIQUE DE LA MATIÈRE

L'objectif de cette option est de permettre à l'étudiant d'approfondir ses connaissances des métaux, céramiques, polymères, et matériaux pour l'électronique, sur base de la maîtrise des aspects physiques de leur comportement.

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

The student registered in this option chooses
De 20 à 30 credits parmi

						Year 1	2
⊠ LMAPR2451	Study of materials at the atomic scale	Jean-Christophe Charlier, Xavier Gonze, Gian-Marco Rignanese	30h+30h	5 Credits	2q	x	x
⊠ LMAPR2482	Plasticity and metal forming	Laurent Delannay, Thomas Pardoen (coord.)	30h +22.5h	5 Credits	2q	x	x
⊠ LMECA1120	Introduction to finite element methods.	Vincent Legat	30h+30h	5 Credits	2q	x	x
⊠ LMECA2300	Advanced Numerical Methods	Christophe Craeye, Jonathan Lambrechts, Vincent Legat, Vincent Legat (compensates Jean-François Remacle), Jean-François Remacle	30h+30h	5 Credits	2q	x	x
⊠ LPHY2371	Numerical Simulation in Physics	Michel Crucifix, Bernard Piraux	22.5h +30h	5 Credits	1q	x	x
⊠ LINMA1170	Numerical analysis	Pierre-Antoine Absil, Paul Van Dooren (coord.)	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA1702	Applied mathematics : Optimization I	Vincent Blondel, François Glineur (compensates Vincent Blondel), François Glineur (coord.)	30h +22.5h	5 Credits	2q	x	x

NANOTECHNOLOGY

Commune aux masters ingénieur civil électricien, électromécanicien, physicien, en chimie et science des matériaux, cette option a pour objectif d'introduire l'étudiant à la physique et à la simulation des matériaux et des dispositifs utilisés dans le domaine de la micro- et de la nano-électronique, aux propriétés et aux méthodes de fabrication et de caractérisation des micro- et nano-structures, aux modes de fonctionnement des nano-dispositifs, ainsi qu'au développement et à l'intégration d'éléments (bio-) organiques dans les nano-systèmes.

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	╪ Two years course

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

The student registered in this option chooses
De 20 à 30 credits parmi

⊠ Physique des nano-structures et nano-matériaux

Pour participer aux cours proposés dans cette rubrique, il est recommandé d'avoir déjà suivi au préalable un cours de Physique des Matériaux, comme par exemple le cours MAPR 1492. Les cours MAPR 2451 et 2471 ne sont pas accessibles aux étudiants du master ingénieur civil physicien.

						Year 1	Year 2
⊠ LMAPR2015	Physics of Nanostructures	Jean-Christophe Charlier, Xavier Gonze, Luc Piraux	37.5h +22.5h	5 Credits	1q	x	x
⊠ LMAPR2451	Study of materials at the atomic scale	Jean-Christophe Charlier, Xavier Gonze, Gian-Marco Rignanese	30h+30h	5 Credits	2q	x	x
⊠ LMAPR2471	Transport phenomena in solids and nanostructures	Jean-Christophe Charlier, Luc Piraux (coord.)	30h+30h	5 Credits	2q	x	x
⊠ LPHY2273	Cryophysique et questions spéciales de supraconductivité	Vincent Bayot, Luc Piraux	45h+15h	5 Credits	1q	x	x
⊠ LFUND2908	Théorie quantique de l'état solide organique	N.		3 Credits		x	x

⊠ Nano- et micro-dispositifs semi-conducteurs

Pour participer aux cours proposés dans cette rubrique, il est recommandé d'avoir déjà suivi au préalable un cours d'électronique physique ou de dispositifs semiconducteurs, comme par exemple un des cours ELEC 1330 ou ELEC 1755.

⊠ LELEC2541	Advanced Transistors	Vincent Bayot (coord.), Denis Flandre, Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2550	Special electronic devices	Vincent Bayot (coord.), Denis Flandre, Laurent Francis, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	x
⊠ LELEC2710	Nanoelectronics	Vincent Bayot (coord.), Denis Flandre, Laurent Francis, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	x

⊠ Micro- et nano-ingénierie

⊠ LELEC2560	Micro and nanofabrication techniques	Vincent Bayot, Laurent Francis, Benoît Hackens, Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2895	Design of micro and nanosystems	Denis Flandre, Laurent Francis (coord.), Thomas Pardoen, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2012	Macromolecular Nanotechnology	Sophie Demoustier, Karine Glinel, Jean-François Gohy, Bernard Nysten	45h+15h	5 Credits	2q	x	x

						Year 1	2
⊠ LMAPR2631	Solid surface analysis and treatment	Arnaud Delcorte, Bernard Nysten	37.5h +15h	5 Credits	2q	x	x

OPTION EN TECHNOLOGIES PHOTOVOLTAÏQUES .

Cette option couvre une thématique de grande importance sociétale et industrielle. Elle est commune aux étudiants des Masters ELEC, KIMA et FYAP. A partir de connaissances de base préalables en électronique physique, l'option vise d'abord la maîtrise du fonctionnement interne des cellules photovoltaïques, et est ensuite une extension par des cours au choix, vers des aspects applicatifs ou de R&D avancée, concernant leur fabrication, les propriétés quantiques ou optiques, les matériaux en couches minces, la connexion au réseau...

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

O Cours obligatoire de l'option en technologies photovoltaïques (5 credits)

						Year 1	Year 2
O LELEC2550	Special electronic devices	Vincent Bayot (coord.), Denis Flandre, Laurent Francis, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	x

O Cours au choix de l'option en technologies photovoltaïques

De 15 à 25 credits parmi

⊠ Orientation cellules solaires

Les étudiants ne peuvent choisir simultanément les cours LELEC 2710 et LMAPR 2015

⊠ LELEC2560	Micro and nanofabrication techniques	Vincent Bayot, Laurent Francis, Benoît Hackens, Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊠ LELEC2710	Nanoelectronics	Vincent Bayot (coord.), Denis Flandre, Laurent Francis, Jean-Pierre Raskin	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2015	Physics of Nanostructures	Jean-Christophe Charlier, Xavier Gonze, Luc Piraux	37.5h +22.5h	5 Credits	1q	x	x
⊠ LPHY2141	Optique et lasers	Alain Cornet	30h+10h	5 Credits	1q	x	x

⊠ Orientation couches minces

⊠ LMAPR2020	Materials Selection	Christian Bailly, Thomas Pardoen	30h +22.5h	5 Credits	2q	x	x
⊠ LMAPR2672	Processing of ceramics, powder metallurgy and surface treatments	Jean-Pierre Erauw, Pascal Jacques, Joris Proost	30h+30h	5 Credits	2q ⊕	x	x
⊠ LPHY2246	Basses pressions et physique du vide	Laurent Francis, Benoît Hackens	30h	5 Credits	1q	x	x

⊠ Orientation réseau électrique

⊠ LELEC2595	Power quality	Emmanuel De Jaeger	30h+30h	5 Credits	2q	x	x
⊠ LELEC2670	Renewable and non conventional sources of electrical energy	Emmanuel De Jaeger, Pascal Jacques	30h+15h	4 Credits	2q	x	x

SETTING UP SMALL AND MEDIUM-SIZED BUSINESSES

Commune à la plupart des masters ingénieur civil, cette option a pour objectif de familiariser l'étudiant ingénieur civil avec les spécificités des P.M.E., de l'entreprenariat et de la création afin de développer chez lui les aptitudes, connaissances et outils nécessaires à la création d'entreprise. L'accès en est réservé uniquement à un nombre restreint d'étudiants sélectionnés sur base d'un dossier de motivation et d'interviews individuelles.

Les dossiers de motivation pour cette filière doivent être introduits avant la rentrée académique de Master1 auprès du :

Secrétariat CPME – Place des Doyens 1

1348 Louvain-la-Neuve (tél 010/47 84 59).

Les étudiants sélectionnés remplaceront le mémoire prévu dans le tronc commun par un mémoire spécifique en création d'entreprise (nombre de crédits inchangé).

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

De 20 à 25 credits parmi

O Compulsory courses

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

⊠ Prerequisite CPME course

Students who have not taken a management course within their former curriculum shall include LCPME2000 in their current curriculum.

O LCPME2000	Venture creation financement and management I	Régis Coeurderoy, Olivier Giacomin, Paul Vanzeveren	30h+15h	5 Credits	1 + 2q	x	

BUSINESS RISKS AND OPPORTUNITIES

Commune à la plupart des masters ingénieur civil, cette option a pour objectif de familiariser l'étudiant avec les principes de base de la gestion des entreprises.

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

De 16 à 20 credits parmi

						Year 1	2
⊠ LFSA2140	Elements of law for industry and research	Fernand De Visscher, Werner Derijcke, Bénédicte Inghels	30h	3 Credits	1q	x	x
⊠ LFSA2230	Introduction to management and to business economics	Benoît Gailly	30h+15h	4 Credits	2q	x	x
⊠ LFSA1290	Introduction to financial and accounting management	Thomas Lambert (compensates Gerrit Sarens), Gerrit Sarens	30h+15h	4 Credits	2q	x	x
⊠ LFSA2202	Ethics and ICT	Maxime Lambrecht, Olivier Pereira	30h	3 Credits	2q	x	x
⊠ LFSA2245	Environment and Business	Thierry Bréchet	30h	3 Credits	1q	x	x
⊠ LFSA2210	Organisation and human resources	John Cultiaux	30h	3 Credits	1q	x	x

⊠ Alternative to the "Business risks and opportunities" for computer science students

Computer science students who have already followed various courses of this discipline during their Bachelor's curriculum can select between 16 and 20 credits in the program "mineure en gestion pour les sciences informatiques" http://www.uclouvain.be/xprog-2013-min-lgesc100i

OPTIONAL COURSES

L'étudiant complète son programme par des cours au choix moyennant l'accord d'un conseiller, membre de la commission de programmes en chimie et physique appliquées (FYKI).

O Mandatory	⊠ Optional
△ Courses not taught during 2014-2015	⊘ Periodic courses not taught during 2014-2015
⊕ Periodic courses taught during 2014-2015	⧺ Two years course

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

						Year 1	Year 2
⊠ LFSA2351A	Group dynamics	Piotr Sobieski (coord.)	15h+30h	3 Credits	1q	x	x
⊠ LFSA2351B	Group dynamics	Piotr Sobieski (coord.)	15h+30h	3 Credits	2q	x	x

⊠ Company training periods (10 credits)

Students may include in their curriculum a company training period worth 10 credits. However, if this activity is related to their final thesis, they shall choose the 5-credit LFSA 2996 course.
Students may include in their curriculum a company training period worth 10 credits. However, if this activity is related to their final thesis, they shall choose the 5-credit FSA 2996 course.

⊠ LFSA2995	Company Internship	Claude Oestges	30h	10 Credits		x	x
⊠ LFSA2996	Company Internship	N.		5 Credits		x	x

⊠ Sciences humaines

L'étudiant peut choisir jusqu'à 6 crédits, à l'exception des étudiants ayant choisi une option en gestion ou en création des petites et moyennes entreprises.

⊠ Langues

L'étudiant peut choisir jusqu'à 3 crédits, à l'exception des étudiants ayant choisi une option en gestion ou en création des petites et moyennes entreprises.

⊠ Autres cours

L'étudiant sélectionne librement des cours parmi les programmes de sciences exactes ou médicales de l'UCL ou de la FTW/KULeuven. Les cours apparaissant dans les options de leur programme de master sont aussi accessibles à titre de cours au choix. L'attention des étudiants est également attirée sur les cours des masters ingénieur civil physicien, en chimie et science des matériaux, électricien, mécanicien ou en génie biomédical, et de la mineure en génie biomédical.

FYAP2M - Information

Admission

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

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 (FYKI), 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 FYAP 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.

- 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
- Personalized access

—

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCL Bachelors			
Bachelor in engineering [180.0]	Major or minor in applied chemistry and physics	Direct access	
Bachelor in engineering [180.0]	Major or minor in applied chemistry and physics	Access with additional training	A student with no major nor minor in applied chemistry and physics, nor any option deemed equivalent, as well as any student with no major in applied chemistry and physics, nor any option deemed equivalent, but with a minor in applied chemistry and physics, or any option deemed equivalent shall submit an application to the Applied chemistry and physics diploma committee) (FYKI), including a detailed past curriculum (courses and grades by year. The committee will propose a customized curriculum by drawing on the volume of elective courses of the FYAP curriculum.
Bachelor in chemical sciences [180.0] Bachelier in physics [180.0] Bachelier in mathematics [180.0] Bachelier en biology [180.0] Bachelier in geography, main stream [180.0] Bachelier in bioengineering [180.0]	Minor in applied chemical and physicaal engineering	Access with additional training	A student who is not a bachelor in engineering, but with a minor in applied chemistry and physics, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied chemistry and physics diploma committee, will decide as to the applicant's admissibility; an admitted student shall complete the workload by adding to the

			120 credits of the basic curriculum, the following extra 10 prerequisirte credits, unless proof can be given of prior equivalent courses, or in agreement with an advisor who is a member of the Applied chemistry and physics diploma committee : FSAB 1106 Applied mathematics: signals and systems [5 credits]; ELEC 1755 Advanced topics in electricity [5 credits]
Others Bachelors of the French speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to applied chemistry and physics	Direct access	
Bachelor in engineering		Access with additional training	A student with no former option in applied chemistry and physics shall submit an application to the Applied physics diploma committee, including a detailed past curriculum (courses and grades by year). The committee will propose a customized curriculum by drawing on the volume of elective courses of the applied physics curriculum, and imposing, if necessary, up to 15 additional credits.
Bachelor in chemistry, physics, mathematics, biology or geography Bachelor in bio-engineering	With specific options in former institution related to applied chemistry and physics	Access with additional training	A student who is not a bachelor in engineering, but with a minor in applied chemistry and physics, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied chemistry and physics diploma committee, will decide as to the applicant's admissibility; an admitted student shall complete the workload by adding to the 120 credits of the basic curriculum, the following extra 10 prerequisite credits, unless proof can be given of prior equivalent courses, or in agreement with an advisor who is a member of the Applied chemistry and physics diploma committee : FSAB 1106 Applied mathematics:signals and systems [5 credits]; ELEC 1755 Advanced topics in electricity [5 credits]
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to applied chemistry and physics	Direct access	
Bachelor in engineering		Access with additional training	A student with no former option in applied chemistry and physics shall submit an application to the Applied physics diploma committee, including a detailed past curriculum (courses and grades

			by year). The committee will propose a customized curriculum by drawing on the volume of elective courses of the applied physics curriculum, and imposing, if necessary, up to 15 additional credits.
Bachelor's degree equivalent to one of those required from graduates of the French-speaking community	With specific options in former institution related to applied chemistry and physics	Access with additional training	A student who is not a bachelor in engineering, but with a prior option in applied chemistry and physics, shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the Applied chemistry and physics diploma committee, will decide as to the applicant's admissibility; an admitted student shall complete theworkload by adding to the 120 credits of the basic curriculum, the following extra 10 prerequisirte credits, unless proof can be given of prior equivalent courses, or in agreement with an advisor who is a member of the Applied chemistry and physics diploma committe : FSAB 1106 Applied mathematics : signals and systems [5 credits]; ELEC 1755 Advanced topics in electricity [5 credits]
Foreign Bachelors			
Bachelor in engineering	Bachelors from the Cluster network	Direct access	Conditions imposed on UCL Engineering Bachelor
Bachelor in engineering	Other institutions	Access with additional training	The student shall submit an application to the Faculty of applied sciences, including a detailed past curriculum (courses and grades by year). The Faculty, after consulting the relevant programme committee, will decide as to the applicant's admissibility pursuant to rules relative to links between degrees. If necessary the Faculty can propose a customized curriculum, by drawing on the volume of elective courses of the relevant engineering Master's curriculum and, if necessary, up to 15 additional credits.

—

Non university Bachelors

Diploma	Access	Remarks
> Find out more about links to the university		
> BA en sciences industrielles - type long	Accès au master moyennant réussite d'une année préparatoire de max. 60 crédits	Type long

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
Engineers, bioengineers, graduates in chemistry, physics, mathematics, biology or geography, all of these being considered equivalent to the corresponding Bachelor's degree.		Direct access	
Masters			
Master in engineering		Direct access	

Holders of a non-University 2nd cycle degree

Diploma	Access	Remarks
> Find out more about links to the university		
> MA en sciences de l'ingénieur industriel (toutes finalités) > MA en sciences industrielles (toutes finalités)	Accès direct au master moyennant ajout éventuel de 15 crédits max	Type long

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.

Personalized access

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

Admission and Enrolment Procedures for general registration

Specific procedures :

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 (FYKI), 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 FYAP 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

. Features favouring interdisciplinarity :

The Master's in applied physics is intrinsically interdisciplinary, since it is located at the interface between physics and materials science. It features a comprehensive base allowing the student to acquire the basics of the main application fields of applied physics, a training through practice and cutting edge research, and various options in each field of physics and materials science: nano-technology, materials science, numerical modelling, basic and applied physics and optics. Access to the field of management is included via options in management and the launching of small and medium-sized companies. The curriculum features a significant fraction of PHYS (or PHY) courses, as well as a few MATH, INMA, and MECA courses, bearing witness to the intent of being trans-disciplinary. What's more, the curriculum permits to chooses up to 39 elective credits from amongst the UCL exact or medical sciences curricula, and up to 6 credits in the humanities, which allows a student to customize a curriculum depending on personal choices.

. Variety of teaching situations :

The pedagogy implemented in the engineering Master's curriculum is aligned with that of the engineering Bachelor's curriculum: active learning, a balanced mix of group and individual work, and substantial time devoted to the development of non-technical competencies. A salient feature of the curriculum is the immersion of students in the research laboratories of the various instructors (during teaching laboratory sessions, case studies, projects and final thesis), which allows them to become familiar with up-to-date methods in the related fields, and to learn through the questioning approach which is inherent to research. An optional 10-credit training period, to be performed for at least 2 months in a research centre or a company, will allow a motivated student to experience a professional environment.

. Variety of learning situations :

The student will encounter a variety of pedagogical tools tailored to the various disciplines : formal lectures, individual projects in small groups, tutorials, project-based learning, case studies, experimental laboratory work, computer simulations, teachware, industrial or research training, visits to industries, individual and group work, seminars given by outside scientists, etc.

This variety of situations will help students to build their knowledge in an iterative and progressive manner, while developing their autonomy, organizational skills, time management, and capacity to use various modes of communication, etc.

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".

All learning activities are assessed as prescribed by the University internal regulations (see exam regulations), viz. written and oral exams, laboratory exams, individual or group work, public presentation of projects and final thesis.

Detailed assessment rules will be made clear by each individual instructor, at the first lecture.

Mobility and/or Internationalisation outlook

Global framework

The Faculty of Applied Sciences has taken part, since their inception, in all the various mobility programmes which have been set up at both the European and world levels.

The numerous contacts it has with professional circles, notably via its Advisory Board, have demonstrated to what extent employers are favourably impressed by a mobility experience in someone's CV. The ever-increasing internationalization of research via networks linking laboratories throughout the world, speaks in favour of encouraging this mobility.

Students' interest is aroused at the end of their Bachelor studies, notably via intensive courses such as those of the ATHENS ( ) or BEST ( ) networks.

In the course of the two-year Master's programme, students are encouraged to take part in a 1- or 2-semester exchange scheme

Within Belgium, the Faculty of Applied Sciences is involved in a privileged partnership with the Faculteit Ingenieurswetenschappen of the Katholieke Universiteit Leuven, with whom it has set up an exchange scheme relating to the first year of the Master's curriculum (https://eng.kuleuven.be/).

At the European level, the Faculty of Applied Sciences is strongly involved in the CLUSTER excellence network ( ). This network encourages internal mobility, since this is a guarantee of quality as concerns both the level of teaching and the hosting of exchange students. Moreover, Cluster partners have signed an agreement recognizing each other's Bachelor's curricula. This agreement stipulates that all Bachelors of network institutions will have access to the Master's studies in any institution on a par with local students.

Outside Europe, the Faculty of Applied Sciences is a partner in the Magalhaes network, which groups about fifteen European universities together with the best South American science and technology universities (https://www.magalhaes-network.net/).

Besides these network partnerships, the Faculty has also signed a number of individual agreements with various universities in Europe, North America or elsewhere in the world. A list of these agreements may be found on the website of UCL International Relations (https://www.uclouvain.be/international.html).

UCL is also a partner in the TIME programme ( ) which gives students the opportunity to obtain two engineering degrees, via a specifically tailored curriculum.

Specific features of the FYAP Master's:

Moreover, in order to further the insertion of the Master's into international programmes, all first semester MAPR courses are taught in English, unless all attendees decide otherwise at the outset, out of respect for non-French speaking participants. However, all second semester MAPR courses are taught in French, unless all attendees decide otherwise at the outset.

International possibilities (for UCL students)

Besides intensive courses which are one component of international relations, EPL students with outstanding results are encouraged to apply for 5- or 10-month exchange programmes.

When taking place during the first Master's year, exchanges are generally 10 months long. In the second year, they only last for a semester, either as courses or else research in a foreign laboratory as a complement to the final thesis.

Some other more specific exchange programmes have been set up with South America, where the academic year is naturally on an "austral" basis.

Students are informed about the various exchange programmes as from their second Bachelor's year. They are encouraged to prepare for their exchange in a timely manner, notably by taking language courses at the Modern Languages Institute of UCL.

International appeal (for non-residents)

As described below, the University of Louvain (UCL) has developed a long-standing experience of greeting foreign students within the framework of international or exchange programmes. The "Master in Chemical and Materials Engineering" fits within this general tradition, and offers the student a top-notch programme in Chemical Engineering and Materials Science, encompassing a wide field of scientific activities in Applied Physics and Chemistry. Admission requires approval by the Committee for Engineering Studies in Chemistry and Physics, on the basis of a comprehensive résumé submitted by the student pursuant to the general regulations of the University of Louvain published on www.uclouvain.be.

To facilitate the integration of foreign students, courses are given in English during the first and third semesters of the Master's (this rule may be relaxed for some courses at the onset of the semester, if so decided by ALL participating students). This allows non-French-speaking students to begin their Master's studies under the best conditions, while upgrading their knowledge of French by following French-as-a-Foreign-Language classes (see below) or by immersion into the student life of Louvain-la-Neuve. However, the courses of the second and fourth semesters are given in French (unless decided otherwise by all participating students), which provides foreign students with a unique opportunity to master French, one of the important official languages of the European Union.

The curriculum consists of a large number of elective courses which allow students to set up a customized programme based on their previous learning experience, and comprises an optional traineeship in industry, 30 credits of work in research laboratories, and projects giving a more practical bent to the training. The instructors of the Master's in Chemical and Materials Science Engineering are recognized scientists, with track records of excellence in applied chemistry and physics, as testified by their integration into European networks of excellence (FAME, NANOBEAMS, NANOQUANTA), their participation in international research programmes, their numerous contracts with European industrial companies, and their large number of publications in high ranking scientific journals including Nature, Science, Nature Materials, Physical Review Letters, Journal of the American Chemical Society, Nano Letters, etc. This not only ensures that the most recent scientific advances in the fields of chemistry and physics are passed on to the students, but also that students are introduced to typical industrial concerns, issues and recent developments.

Partner programmes

- With European institutions

FYKI is currently concentrating on setting up partnership programmes with European institutions, in the fields of chemistry and materials science (refer to engineering Master's in chemistry and materials science for further details). Parts of these programmes will also be accessible to FYAP students, via Erasmus exchanges. The possibility of including the Master's engineering degree in applied physics within the framework of international Master's will be examined later.

- TIME programme with :

- Ecole Centrale Paris
- Supaero Toulouse
- Universidad Politecnica de Madrid
- Politecnico di Milano
- Politecnico di Torino

-The EPL has also signed a specific convention with the Institut Français du Pétrole (https://www.ifp.fr/) which allows the possibility of combining the second Master's year with the first year of the complementary programme at IFP.

Possible trainings at the end of the programme

Accessible complementary Master's degrees: Master's degrees in nanotechnology and nuclear engineering, biotechnology and applied biology, once they have been set up, will be natural extensions of the curriculum.

Accessible Ph. D. curricula : by virtue of its training towards and via research, the Master's in applied physics engineering gives its students an excellent preparation towards Ph. D. studies. Instructors involved in the Master's are members of the MAIN ("materials, interfaces and nanotechnology") doctoral school, which is there to welcome students who wish to further their studies via a Ph. D.

Contacts

Curriculum Managment

Entite de la structure FYKI

Acronyme	**FYKI**
Dénomination	Commission de programme - Ingénieur civil en chimie et sciences des matériaux et ingénieur civil physicien
Adresse	Place Sainte Barbe, 2 bte L5.02.02 1348 Louvain-la-Neuve Tél 010 47 24 87 - Fax 010 47 40 28
Secteur	Secteur des sciences et technologies (SST)
Faculté	Ecole Polytechnique de Louvain (EPL)
Commission de programme	Commission de programme - Ingénieur civil en chimie et sciences des matériaux et ingénieur civil physicien (FYKI)

Academic Supervisor : Christian BAILLY

Jury

Président du Jury : **Jean-Didier LEGAT**
Secrétaire du Jury : **Luc PIRAUX**

Usefull Contacts