GBIO2M

2015 - 2016

Master [120] in Biomedical Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In english
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in other languages : **YES**
Activities on other sites : **optional**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Ecole Polytechnique de Louvain (EPL)**
Programme code: **gbio2m** - Francophone Certification Framework: 7

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GBIO2M - Introduction

Introduction

Introduction

This Master's degree programme produces engineers capable of using a large set of skills (analytical, modelling, design and inventiveness) in order to face future technological challenges in the scientific and technical fields linked to biomedical engineering and this in ever evolving European and global contexts.

Upon completion of this Master's degree programme, you will have fundamental knowledge in all areas of biomedical engineering (bioinstrumentation, biomaterials, imaging and medical physics, mathematical modelling, artificial organs and rehabilitation, bioinformatics and biomechanics) as well as cutting edge knowledge of one or more major fields of study.

Your profile

You:

- Have developed a marked interest in the biomedical field and its technological outputs (as a result of your undergraduate studies);
- Seek targeted information about current scientific or technological issues as well as the national and international job market;
- Want to play a role in development, production or management in the healthcare field.

Your programme

This Master's degree offers:

- Knowledge of the main scientific and industrial issues in the fields of applied biomedical engineering;
- Classes that emphasize theories and practice to develop advanced professional knowledge;
- The choice of one of more major fields of study in biomedical engineering;
- The chance to complete an internship in a hospital, in industry or in a research centre;
- The possibility of completing part of your master's degree abroad (in Europe or elsewhere) and in certain cases the granting of of a dual master's degree (diploma granted jointly by UCL and the institution where you studied abroad).

GBIO2M - Teaching profile

Learning outcomes

Currently, increasing numbers of engineers are bringing their ingenuity and analytical skills to the healthcare sector. The objective of the Master's degree programme in biomedical engineering is to ensure that its engineers are capable of meeting the scientific and technological challenges of biomedical engineering in an ever-changing global and European context. Inherently multidisciplinary, this programme is based on both the scientific and technological sector and health sciences field.

Building on students' existing knowledge of basic science (physics, chemistry, mathematics) and natural science (biology, anatomy, biochemistry and physiology), this Master's degree programme offers students the opportunity to develop polytechnic knowledge of a wide range of subjects. Degree holders will be able to understand and model living systems and ultimately be able to design analytical or therapeutic tools (for example, developing new biomedical technology).

Degree holders will have fundamental knowledge of the principal fields of biomedical engineering: bioinstrumentation, biomaterials, imaging and medical physics, mathematical modelling, artificial organs and rehabilitation, bioinformatics and biomechanics. Students will have acquired advanced training in one or more of these fields of expertise.

By placing importance on elective courses, students can choose either a polyvalent course of study or one that is more specialised. Fields of particular interest include (1) software development and algorithms for biomedical data; (2) biomaterials (implants, etc.); (3) biomechanics and medical robotics; (4) medical imaging and medical physics; (5) clinical engineering (the engineer's role in the hospital).

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

1. Demonstrate mastery of a solid body of knowledge and skills in basic science and engineering science allowing them to understand and solve biomedical engineering problems (Axis 1).

1.1 Identify and use biomedical engineering concepts, laws and reasoning to solve problems in a variety of areas:
-Develop algorithms and software particularly for dealing with biomedical data; analyse biological data and medical images
- Biomaterials (interfaces, biocompatibility, etc.)
-Biomechanics, motor control and medical robotics (for surgery and rehabilitation)
-Clinical engineering
1.2 Identify and use the modelling and calculation tools necessary to solve problems raised by the fields mentioned above
1.3 Validate problem solving results, notably those expressed in orders of magnitude:
-in particular validate models by comparing them to theoretical or experimental results

2.Organise and carry out a procedure in applied engineering related to the development of a product and/or a service that meets a need or solves a particular problem in the field of biomedical engineering (Axis 2).

2.1 Analyse a problem, take stock of its functionalities and constraints; create a specifications note that takes into account technical and economic limits.
2.2 Model a problem and design one or more technical solutions using mechanical, electric, electronic and computerised approaches with the specifications note in mind.
2.3 Evaluate and classify solutions with regard to all the criteria in the specifications note: efficiency, feasibility, quality, ergonomics, security, biocompatibility, etc.
2.4 Test a solution though a mock up, a prototype and/or a numerical model.
2.5 Formulate recommendations to improve a technical solution either to reject it or to explain necessary improvements to make the product operational.

3.Organise and carry out a research project to understand a physical phenomenon or new problem related to biomedical engineering (Axis 3).

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 (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). Understand the principal mechanisms that govern the healthcare economy as well as the financing of social security.
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 and assume the consequences of these decisions (whether they are about technical solutions or the division of labour to complete a project).

5.Communicate effectively (speaking or writing in French or a foreign language) with the goal of carrying out assigned projects (Axis 5).

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.

5.2 Present your arguments and convince your interlocutors (doctors, therapists, 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 (rules, plans, specification notes).

5.5 Draft documents that take into account contextual requirements and social conventions as well as the vocabulary specific to biomedical disciplines.

5.6 Make a convincing oral presentation (in French or English) using modern communication techniques.

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

6.1 Rigorously apply the standards of biomedical engineering (terms, units of measure, quality standards and security).

6.2 Find solutions that go beyond strictly technical issues by considering sustainable development and the socio-economic ethics of a project, particularly concerning the consequences of a medical or therapeutic practice;

6.3 Demonstrate critical awareness of a technical solution in order to verify its robustness and minimize the risks that may occur during implementation.

6.4 Evaluate oneself and independently develop necessary skills for “lifelong learning” in the field.

Programme structure

The Master’s degree programme includes:

- core curriculum (35 credits) including a graduation project and an additional project;
- final specialisation (30 credits);
- one or more major courses;
- elective courses to round out the programme

The Master’s degree project (5 credits) is completed at the beginning of the programme (1st year) while the graduation project is normally completed at the end of the programme (2nd year). It is recommended that students take courses in their specialisation (30 credits) at the beginning of their Master’s programme (1st year). However, students may take specialised courses in the 1st or 2nd year as long as they have completed the course prerequisites. This is particularly the case for students who completed part of their education 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 required for the approval of their diploma as well as for the approval of their major (in order to include their academic distinctions in the diploma supplement).

These types of programmes will be submitted for approval by the relevant Master’s degree programme commission.

For a programme-type, and regardless of the focus, options/or elective courses selected, this master will carry a minimum of 120 credits divided over two annual units, corresponding to 60 credits each.

> Core courses for the Master¿s degree in biomedical engineering *[en-prog-2015-gbio2m-lgbio220t.html]*

> Professional focus *[en-prog-2015-gbio2m-lgbio200s]*

Options courses

> Options biomedical engineering *[en-prog-2015-gbio2m-lgbio907r.html]*
> > Major in Clinical Engineering *[en-prog-2015-gbio2m-lgbio221o.html]*
> > Major in biomedical data analysis *[en-prog-2015-gbio2m-lgbio222o.html]*
> > Major in Biomaterials *[en-prog-2015-gbio2m-lgbio226o.html]*
> > Major in Biomechanics and medical robotics *[en-prog-2015-gbio2m-lgbio227o.html]*
> > Major in Medical physics and medical imaging *[en-prog-2015-gbio2m-lgbio232o.html]*

> Major in business creation and management *[en-prog-2015-gbio2m-lgbio908r.html]*
> > Business risks and opportunities *[en-prog-2015-gbio2m-lgbio230o.html]*

> Major in small and medium sized business creation *[en-prog-2015-gbio2m-lgbio231o.html]*
> Elective courses *[en-prog-2015-gbio2m-lgbio229o.html]*

GBIO2M Detailled programme

Programme by subject

CORE COURSES [35.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

						Year 1	2
O LGBIO2990	Master Thesis	N.		28 Credits			x
O LGBIO2220	Seminar and project in biomedical engineering: Scientific and industrial challenges	Sophie Demoustier, Philippe Lefèvre, Renaud Ronsse	30h+30h	5 Credits	1 + 2q	x	x

O *Religion courses for students in natural sciences*

Select 2 credits from among
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	Marcela Lobo Bustamante	15h	2 Credits	1q	x	x

PROFESSIONAL FOCUS [30.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

The "professional focus" block of the Master in biomedical engineering offers a series of courses describing the main field of biomedical engineering, from bioinformatics to biomecanics and imaging. It thus consolidates the "general" profile of the program. Students can expect to acquire a deep level of knowledge in each of the disciplines, owing to the large volume of credits devoted to this block.

						Year 1	2
O LGBIO2010	Bioinformatics	Pierre Dupont, Michel Ghislain	30h+30h	5 Credits	2q	x	x

						Year 1	2
LGBIO2020	Bioinstrumentation	André Mouraux, Michel Verleysen	30h+30h	5 Credits	1q	x	x
LGBIO2030	Biomaterials	Sophie Demoustier, Christine Dupont, Gaëtane Leloup	30h+30h	5 Credits	1q	x	x
LGBIO2040	Biomechanics	François Henrotte (compensates Emilie Marchandise), Emilie Marchandise	30h+30h	5 Credits	2q	x	x
LGBIO2050	Medical Imaging	Anne Bol, John Lee, Benoît Macq, Frank Peeters	30h+30h	5 Credits	1q	x	x
LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	1q	x	x

OPTIONS

Students MUST choose at least one major from the 5 biomedical engineering majors. They MAY choose one or more courses from the electives in biomedical engineering, management and business creation.

Options biomedical engineering

> Major in Clinical Engineering *[en-prog-2015-gbio2m-lgbio221o]*
> Major in biomedical data analysis *[en-prog-2015-gbio2m-lgbio222o]*
> Major in Biomaterials *[en-prog-2015-gbio2m-lgbio226o]*
> Major in Biomechanics and medical robotics *[en-prog-2015-gbio2m-lgbio227o]*
> Major in Medical physics and medical imaging *[en-prog-2015-gbio2m-lgbio232o]*

Major in business creation and management

> Business risks and opportunities *[en-prog-2015-gbio2m-lgbio230o]*
> Major in small and medium sized business creation *[en-prog-2015-gbio2m-lgbio231o]*
> Elective courses *[en-prog-2015-gbio2m-lgbio229o]*

OPTIONS BIOMEDICAL ENGINEERING

MAJOR IN CLINICAL ENGINEERING

The objective of this major is to provide students with the necessary body of knowledge to work as an engineer in a hospital or in a biomedical products company. It covers areas related to the management of medical technologies, quality control, etc

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Students selecting this major may choose
De 20 à 30 credits parmi

O Required courses (8 credits)

						Year 1	Year 2
O LGBIO2110	Introduction to Clinical Engineering	Frédéric Crevecoeur, Philippe Lefèvre	30h	3 Credits	2q	x	x
O LMECA2711	Quality management and control.	Nicolas Bronchart	30h+30h	5 Credits	2q	x	x

O Elective courses

De 12 à 22 credits parmi

⊠ LINGE1222	Multivariate Statistical Analysis	Johan Segers	30h+15h	4 Credits	2q	x	x
⊠ LINGI1341	Computer networks	Olivier Bonaventure	30h+30h	5 Credits	1q	x	x
⊠ LINGI2172	Databases	Bernard Lambeau	30h+30h	6 Credits	2q	x	x
⊠ LSTAT2310	Statistical quality control.	Bernadette Govaerts	15h+5h	4 Credits	1q	x	x
⊠ LSTAT2330	Statistics in clinical trials.	Catherine Legrand, Annie Robert	22.5h +7.5h	5 Credits	2q	x	x
⊠ WESP2234	Strategy of the medical decision	Laurence Habimana, Fati Kirakoya (compensates Laurence Habimana), Annie Robert (coord.)	30h	3 Credits	1q	x	x
⊠ WESP2123	Principes des essais cliniques	Laurence Habimana, Fati Kirakoya (compensates Laurence Habimana), Annie Robert (coord.), Françoise Smets	20h+10h	4 Credits	1q	x	x

						Year 1	2
⊠ WFSP2218	Analyse longitudinale : régression linéaire, logistique et de Poisson	Annie Robert	20h+20h	4 Credits	1q	x	x
⊠ WFSP2260	Management humain et comportement organisationnel	John Cultiaux, Pierre Meurens (coord.)	40h+30h	5 Credits	2q	x	x
⊠ WMDS1107	Epidémiologie et santé publique	Benoît Boland, Jean Macq (coord.)	30h+20h	4 Credits	2q	x	x

MAJOR IN BIOMEDICAL DATA ANALYSIS

The objective of this major is to provide students with a fundamental body of knowledge necessary to acquire and analyse biomedical data whether raw signal data or large bases of pre-processed data. This major is especially well-suited for students who have already studied computer science, electricity or applied mathematic

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Students selecting this major may choose
De 20 à 30 credits parmi

O Required courses (10 credits)

						Year 1	Year 2
O LELEC2870	Machine Learning : regression, dimensionality reduction and data visualization	John Lee (compensates Michel Verleysen), Michel Verleysen	30h+30h	5 Credits	1q	x	x
O LELEC2900	Signal processing	Benoît Macq, Luc Vandendorpe	30h+30h	5 Credits	2q	x	x

O Elective courses

De 10 à 20 credits parmi

⊠ LELEC2811	Instrumentation and sensors	David Bol, Laurent Francis	30h+30h	5 Credits	1q	x	x
⊠ LINGE1222	Multivariate Statistical Analysis	Johan Segers	30h+15h	4 Credits	2q	x	x
⊠ LINGI2251	Software engineering: development methods	Charles Pecheur	30h+30h	5 Credits	2q	x	x
⊠ LINGI2261	Artificial intelligence: representation and reasoning	Yves Deville	30h+30h	6 Credits	1q	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	2q	x	x
⊠ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2370	Modelling and analysis of dynamical systems	Jean-Charles Delvenne, Denis Dochain (coord.)	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2471	Optimization models and methods	François Glineur	30h +22.5h	5 Credits	1q	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	x	x
⊠ LSTAT2320	Design of experiment.	Patrick Bogaert, Bernadette Govaerts	22.5h +7.5h	5 Credits	2q	x	x

MAJOR IN BIOMATERIALS

The goal of this major is to provide students with a basic body of knowledge to understand and develop technology related to biomaterials (implants, biocompatibility, etc.) This major is particularly well-suited for students who have already majored or minored in applied chemistry and physics AND biomedical engineering.

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Students selecting this major may choose
De 20 à 30 credits parmi

O Required courses KIMA students

KIMA students must enrol in LGBIO2030 and LBIR1220A except if they took these courses during their undergraduate programme.
De 5 à 10 credits parmi

					Year 1	Year 2
O LBIR1220A	Biochimie I (partim EPL)	Michel Ghislain, Yvan Larondelle	30h+15h	5 Credits	2q	x	x
O LGBIO2030	Biomaterials	Sophie Demoustier, Christine Dupont, Gaëtane Leloup	30h+30h	5 Credits	1q	x	x

O Required courses GBIO students

GBIO students must enrol in LMAPR2481 and LMAPR1805 unless they took these courses during their undergraduate (BAC) programme.
De 5 à 10 credits parmi

O LMAPR1805	Introduction to materials science	Jean-Christophe Charlier, Pascal Jacques, Bernard Nysten, Thomas Pardoen (coord.)	45h+15h	5 Credits	2q	x	x
O LMAPR2481	Deformation and fracture of materials	Thomas Pardoen	30h+30h	5 Credits	1q	x	x

O Recommended courses

De 10 à 21 credits parmi

⊠ LBIR1321	Biochemistry II : metabolic pathways and their regulation	Michel Ghislain (coord.), Yvan Larondelle	30h+15h	3 Credits	1q	x	x
⊠ LBIO1335	Immunology	Jean-Paul Dehoux	25h+15h	3 Credits	1q	x	x
⊠ LELEC2560	Micro and Nanofabrication Techniques	Laurent Francis, Benoît Hackens, Jean-Pierre Raskin	30h+30h	5 Credits	2q	x	x
⊠ LMAPR2012	Macromolecular Nanotechnology	Sophie Demoustier, Karine Glinel, Jean-François Gohy, Bernard Nysten	45h+15h	5 Credits	2q	x	x
⊠ LMAPR2019	Polymer Science and Engineering	Sophie Demoustier, Alain Jonas, Evelyne Van Ruymbeke	45h+15h	5 Credits	1q	x	x

O Elective courses

max=15 credits parmi

⊠ LBIRC2101A	Analyse biochimique et notions de génie génétique: analyse biochimique	Marc Boutry, François Chaumont, Charles Hachez, Pierre Morsomme	18.5h +22.5h	4 Credits	1q	x	x
⊠ LBIRC2108	Biochemical and Microbial Engineering	Benoît Stenuit	30h +22.5h	5 Credits	2q	x	x

						Year 1	Year 2
⊠ LGBIO2020	Bioinstrumentation	André Mouraux, Michel Verleysen	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2010	Polymer Materials	Christian Bailly, Bernard Nysten	45h+15h	5 Credits	1q	x	x
⊠ LMAPR2013	Physical Chemistry for Metals and Ceramics	Pascal Jacques	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2014	Physics of Functional Materials	Xavier Gonze, Luc Piraux, Gian-Marco Rignanese	37.5h +22.5h	5 Credits	1q	x	x
⊠ LMAPR2018	Rheometry and Polymer Processing	Christian Bailly, Evelyne Van Ruymbeke	30h +22.5h	5 Credits	2q	x	x
⊠ LMAPR2631	Surface Analysis	Arnaud Delcorte, Bernard Nysten	30h+15h	5 Credits	2q	x	x

MAJOR IN BIOMECHANICS AND MEDICAL ROBOTICS

The goal of this major is to provide students with a basic body of knowledge to understand and develop technology related to biomaterials (fluids and solids) and medical robotics (surgical assistance and rehabilitation). This major is particularly well-suited for students who have already majored or minored in mechanics

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Students selecting this major may choose
De 20 à 30 credits parmi

O Required courses (10 credits)

						Year 1	Year 2
O LMECA2170	Numerical Geometry	Vincent Legat, Jean-François Remacle	30h+30h	5 Credits	1q	x	x
O LMECA2355	Mechanical design in biomedical engineering	Olivier Cartiaux, Olivier Cartiaux (compensates Emilie Marchandise), Benoît Herman (compensates Benoît Raucent), Emilie Marchandise, Benoît Raucent	30h+30h	5 Credits	1q	x	x

O Elective courses

De 10 à 20 credits parmi

⊠ LINMA2671	Automatic : Theory and implementation	Julien Hendrickx	30h+30h	5 Credits	1q	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	2q	x	x
⊠ LMECA2300	Advanced Numerical Methods	Philippe Chatelain, Christophe Craeye, Vincent Legat, Jean-François Remacle	30h+30h	5 Credits	2q	x	x
⊠ LMECA2330	Machine components	Laurent Delannay, Benoît Raucent, Renaud Ronsse, Thomas Servais (compensates Benoît Raucent)	30h+30h	5 Credits	2q	x	x
⊠ LMECA2660	Numerical methods in fluid mechanics	Grégoire Winckelmans	30h+30h	5 Credits	2q	x	x
⊠ LMECA2732	Introduction to robotics	Renaud Ronsse	30h+30h	5 Credits	2q	x	x
⊠ LMECA2755	Industrial automation	Bruno Dehez, Paul Fisette, Renaud Ronsse	30h+30h	5 Credits	1q	x	x
⊠ LMECA2802	Multibody system Dynamics	Paul Fisette	30h+30h	5 Credits	2q	x	x
⊠ LMECA2840	Project in Mechanical Design II	Bruno Dehez, Benoît Herman, Benoît Raucent, Renaud Ronsse	30h+30h	6 Credits	1 + 2q	x	x

MAJOR IN MEDICAL PHYSICS AND MEDICAL IMAGING

The goal of this major is to provide students with a basic body of knowledge to understand and develop technology related to medical physics and medical imaging. This major is particularly well-suited for students who have already majored or minored in electricity or applied chemistry and physic

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Students selecting this major may choose
De 20 à 30 credits parmi

O Required courses (10 credits)

						Year 1	Year 2
O LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer, Laurent Jacques	30h+30h	5 Credits	1q	x	x
O LPHY2236	Ionizing radiation measurement: detectors and Nuclear electronics.	Eduardo Cortina Gil	37.5h +55h	5 Credits	1q	x	x

O Elective courses

De 10 à 20 credits parmi

⊠ LMECA2645	Major technological hazards in industrial activity.	Denis Dochain, Alexis Dutrieux	30h	3 Credits	2q	x	x
⊠ LPHY2340	Use, management and control of radio elements	Pascal Froment	22.5h	3 Credits	2q	x	x
⊠ LPHY2360	Physique atomique, nucléaire et des radiations	Krzysztof Piotrzkowski	22.5h	2 Credits		x	x
⊠ WMNUC2100	Master and compelmentary master	François-Xavier Hanin, Thierry Vander Borght (coord.)	15h	2 Credits	1q	x	x
⊠ WRDTH3120	Dosimétrie en radiothérapie et contrôle de qualité	Stefaan Vynckier	30h	3 Credits		x	x
⊠ WRDTH3131	Radiobiologie	Vincent Grégoire, Pierre Scalliet (coord.)	22.5h	2 Credits		x	x
⊠ WRDTH3160	Dosimétrie informatisée en radiothérapie	Vincent Grégoire, Pierre Scalliet, Stefaan Vynckier (coord.)	30h+60h	5 Credits		x	x
⊠ WRPR2001	Notions de base de radioprotection	Vincent Grégoire (coord.), Patrick Smeesters	10h+5h	2 Credits	2q	x	x
⊠ WRPR2330	Utilisation des radioisotopes et des molécules marquées en biologie	Bernard Gallez (coord.), Thierry Vander Borght	15h+15h	3 Credits		x	x

MAJOR IN BUSINESS CREATION AND MANAGEMENT

These two majors are exclusive. Students may not choose only one.

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 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	🟨 Activity with requisites

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

This major may not be taken at the same time as the major in small and medium sized business creation. Students selecting this major may choose
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	André Nsabimana (compensates Gerrit Sarens), Gerrit Sarens	30h+15h	4 Credits	2q	x	x
⊠ LFSA2202	Ethics and ICT	Axel Gosseries, 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	2q	x	x

⊠ *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.

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 familiarise the civil engineering student with the specifics of small and medium sized businesses, entrepreneurship, and business development in order to develop the necessary abilities, knowledge and tools to create a business. This major is reserved for a small number of students and selection is based on a written application and individual interview. The written application must be submitted before the start of the academic year for Master's 1.

Applications may be sent to:

Secrétariat CPME-Place des Doyens, 1

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

Selected students will replace their Master's thesis in the common core curriculum with a thesis related to business creation (the number of credits remaining the same).

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

Further information about this major may be found at http//www.uclouvain.be/cpme. This major may not be taken at the same time as a major in management. Students in this major may choose 20-25 credits from the following courses:

De 20 à 25 credits parmi

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

						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, Marine Falize (compensates Régis Coeurderoy)	30h+15h	5 Credits	1q	x	x
O LCPME2004	Advanced seminar on Enterpreneurship (in French)	Roxane De Hoe (compensates Frank Janssen), Frank Janssen	30h+15h	5 Credits	2q	x	x

⊠ Prerequisite CPME courses

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

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

ELECTIVE COURSES

All major courses in the GBIO Master's degree programme may be taken as electives. In addition, the courses listed below are particularly suitable for biomedical engineering students and may be taken as electives to complete the programme.

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

max=35 credits parmi

⊠ Company internships (10 credits)

When the company internship is completed at the same time as the graduation project, it is possible to enrol in LFSA2996 for 5 credits

					Year 1	Year 2	
⊠ LFSA2995	Company Internship	Claude Oestges, Jean-Pierre Raskin	30h	10 Credits	1 + 2q	x	x
⊠ LFSA2996	Company Internship	N.		5 Credits	1 + 2q	x	x

⊠ Elective courses in Genetic engineering

⊠ LBIR1322	General genetics	Philippe Baret	45h+15h	4 Credits	2q	x	x
⊠ LBIRC2101B	Analyse biochimique et notions de génie génétique: Notions de génie génétique	Marc Boutry, François Chaumont, Charles Hachez, Pierre Morsomme	18.5h +22.5h	4 Credits	1q	x	x
⊠ LBRMC2101	Genetic engineering	Marc Boutry, Charles Hachez (compensates Marc Boutry)	30h+7.5h	3 Credits	1q	x	x

⊠ Elective courses in biochemical engineering

⊠ LBRAL2102	Physiological and nutritional biochemistry	Yvan Larondelle (coord.), Yves-Jacques Schneider	52.5h	5 Credits	1q	x	x
⊠ LBRAL2104	Food microbiology	Jacques Mahillon	30h +22.5h	5 Credits	2q	x	x
⊠ LBRMC2202	Cell culture technology	Marc Boutry (coord.), Pascal Hols, Yves-Jacques Schneider	30h	3 Credits	1q	x	x
⊠ LBRNA2202	Nano-biotechnologies	Yves Dufrêne	30h	5 Credits	2q	x	x
⊠ LBRTE2201	Human and environmental toxicology	Alfred Bernard, Cathy Debier (coord.)	45h+7.5h	5 Credits	1q	x	x

⊠ Elective courses in pharmaceutical engineering

⊠ LINMA2300	Process Control	Denis Dochain	30h+30h	5 Credits	1q	x	x
⊠ LMAPR2118	Fluid-fluid separations	Patricia Luis Alconero, Denis Mignon	30h +22.5h	5 Credits	2q	x	x
⊠ LMAPR2330	Reactor Design	Juray De Wilde	30h+30h	5 Credits	2q	x	x
⊠ LMAPR2380	Solid-fluid separation	Pierre Adam, Tom Leyssens	30h +22.5h	5 Credits	1q	x	x
⊠ LMAPR2430	Industrial processes for the production of base chemicals	Juray De Wilde	30h +22.5h	5 Credits	1q	x	x
⊠ WFARM1008	Design of the drug	Olivia Dalleur, Véronique Préat (coord.), Françoise Van Bambeke	15h+15h	2 Credits	2q	x	x
⊠ WFARM1232	General Pharmacology	Emmanuel Hermans	15h+7.5h	2 Credits	1q	x	x

						Year 1	2
⊠ WFARM1307	Physical pharmacy	Tom Leyssens	15h	2 Credits	1q	x	x

⊠ Tutoring training (3 credits)

⊠ 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

⊠ Languages

Students may select from any language course offered at the ILV for a maximum of 3 credits out of the 120 core credits needed for their Master¿s degree. Special attention is placed on the following seminars in professional development:
Students may include in their electives any language course of the Institute of Modern Languages (ILV) for a maximum of 3 credits within the 120 basic credits of their Master?s. Their attention is drawn to the following professional insertion seminars:

⊠ LNEER2500	Professional development seminar: Dutch - intermediate level	Isabelle Demeulenaere (coord.), Mariken Smit	30h	3 Credits	1 ou 2q	x	x
⊠ LNEER2600	Professional development seminar: Dutch - upper-intermediate level	Isabelle Demeulenaere (coord.), Marie-Laurence Lambrecht	30h	3 Credits	1 ou 2q	x	x
⊠ LALLE2500	Professional development seminar German	Caroline Klein, Ann Rinder	30h	3 Credits	1 + 2q	x	x
⊠ LALLE2501	Professional development seminar-German	Caroline Klein, Ann Rinder	30h	5 Credits	1 + 2q	x	x
⊠ LESPA2600	Professional development seminar- Spanish	Carmen Vallejo Villamor	30h	3 Credits	1 ou 2q	x	x
⊠ LESPA2601	Professional development seminar- Spanish	Begona Garcia Migura, Paula Lorente Fernandez (coord.)	30h	5 Credits	1q	x	x

⊠ Other possible courses

Students may select up to 6 credits of university courses offered in these disciplines.
A list of interesting humanities courses is avaibles at the secretariat of the diploma committee. Students may choose a maximum of 6 credits. This possibility is however not offerred to students who have choose to specialize in Management or Company launching.

⊠ Short-term exchanges (2 credits)

Students may include in their curriculum any BEST or ATHENS course subject to approval by the programme committee. These courses are worth 2 credits.
Students may include in their curriculum any BEST or ATHENS subject to approval by the Diploma committee. These courses are worth 2 credits

Course prerequisites

A document entitled en-prerequis-2015-gbio2m.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 UCL 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.

GBIO2M - Information

Admission

Decree of March 31st 2004 defining higher education, favoring its integration in the European framework of higher education and refinancing universities.
The admission requirements have to be met at the time of enrolment at the university.

All information can be obtained from the University's Enrolment Office (Service des inscriptions – SIC).

General conditions
Special conditions
Language examination: knowledge of the French language (Pedagogical Master's degree)

General conditions

Students with one of the following qualifications have access to studies leading to the award of a Master's degree:

- an undergraduate (first-cycle) degree in the same field of study;
- the same Master's (second-cycle) degree, but with a different specialization;
- a university degree, in accordance with a decision by the academic authorities and subject to the additional conditions that they lay down;
- a "long-type" degree that gives access to Master's studies, in accordance with a decision by the Government and subject to the additional conditions that it lays down;
- a degree comparable to those mentioned above, issued under the same conditions by the Flemish Community of Belgium, the German Community of Belgium or the Royal Military Academy;
- a degree obtained abroad and deemed equivalent to those mentioned above.

By way of derogation, Master's programmes are also open to students who, in order to obtain their undergraduate degree in the same field of study, still have to gain no more than 12 credits and are registered for those courses. However, students admitted on these terms cannot be passed by the Master's Examination Board until they have met the admission requirements in full and have obtained the necessary undergraduate degree.

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- Access to the 2nd cycle on the basis of a "short-cut":
  - Access to the 2nd cycle of university for those students who have a short-type non-university higher education degree
  - Access to the 2nd cycle of university for those students who have a long-type non-university higher education degree
- Access to the 2nd cycle on the basis of the enhancement of the knowledge and competence acquired by personal and professional experience:

With the aim of acceding 2nd-cycle studies, the jury of these studies can enhance the knowledge and competence acquired by their personal and professional experience.

This useful experience must correspond to at least 5 years of activities, without taking into account the years of higher-education study that were not passed successfully. At the end of an evaluation procedure organized by the academic authorities, the jury will decide whether the skills and knowledge of the student are sufficient to be able to follow these studies successfully (*).

- For those students who have an academic grade from a Belgian university or a foreign title or grade (which does not give access to studies in this particular year on the basis of the general conditions mentioned above), access to the 2nd basic cycle on the basis of a enhancement of 180 ECTS credits by the admissions jury (personalized admission on the basis of a file). (*)

(*) At the end of the admissions procedure organized by the competent jury and subject to the conditions fixed by the academic authorities, the student may follow complementary studies that make up a maximum of 60 supplementary credits. In case the supplementary workload of this student exceeds 15 credits, this training is considered to be a preparatory year. It does not lead to a degree and is considered to be the last year of a 1st cycle that gives access to the studies aimed at.

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No student can be admitted to any one year of a Pedagogical Master's degree if they have not passed an examination attesting to a sufficient knowledge of the French language .

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

- 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

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University Bachelors

Diploma	Special Requirements	Access	Remarks
UCL Bachelors			
Bachelor in engineering [180.0]	Minor in biomedical engineering	Direct access	
Bachelor in engineering [180.0]		Access with additional training	Students who have neither majored nor minored in the field of their civil engineering Master's degree, must submit a written application in which they list their detailed course curriculum (list of course work and marks year by year) to the programme commission. The commission will then suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.
Bachelor in chemical sciences [180.0] Bachelor in physics [180.0] Bachelor in mathematics [180.0] Bachelor in biology [180.0] Bachelor in geography, main stream [180.0] Bachelor in bioengineering [180.0]		Access with additional training	The jury may admit candidates with excellent academic records and training on the basis of their written application provided that they integrate a maximum of 60 additional credits into their Master's degree programme. A minor in engineering sciences (biomedical engineering) is considered an advantage for candidates seeking this type of admission.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to biomedical engineering	Direct access	
Bachelor in engineering		Access with additional training	Students with a Bachelor's degree in engineering sciences (with a focus on civil engineering) who have not taken the equivalent of a minor in biomedical engineering must submit a written application to the biomedical programme commission in which they list their detailed course curriculum (list of course work and marks year by year). The jury will suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.
Bachelor in chemistry, physics, mathematics, biology or geography Bachelor in bio-engineering	With specific options in former institution related to biomedical engineering	Access with additional training	The jury may admit candidates with excellent academic records and training on the basis of their written application provided that they integrate a maximum of 60 additional credits into their Master's degree programme.

			A minor in engineering sciences (biomedical) is considered an advantage for candidates seeking this type of admission.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering	With specific options in former institution related to biomedical engineering	Direct access	
Bachelor in engineering		Access with additional training	Students who have no specialisation in biomedical engineering must submit a written application to the programme commission in biomedical engineering in which they list their detailed course curriculum (list of course work and marks year by year). The jury will suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental 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 biomedical engineering	Access with additional training	Students without a Bachelor's degree in engineering sciences (with a focus on civil engineering) must submit a written application to EPL in which they list their detailed course curriculum (list of course work and marks year by year). The jury will determine whether the student may be admitted (based solely on the common Bachelor's degree training for engineering sciences with a focus on civil engineering) and their decision will be in keeping with the rules pertaining to bridge years. When necessary, the jury may suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental 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	Students will submit a written application for admission to EPL in which they list their detailed course curriculum (list of course work and marks year by year). The jury will determine whether the candidate may be admitted according to the regulations. Where necessary the jury may suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental 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 ajout de maximum 60 crédits d'enseignements supplémentaires obligatoires au programme. Voir 'Module complémentaire'	Type long

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
Engineers 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 www.uclouvain.be/en-vae

Tous les masters peuvent être accessibles selon la procédure de valorisation des acquis de l'expérience.

Personalized access

Reminder : all Masters (apart from Advanced Masters) are also accessible on file.
Students may submit an application for admission to the Louvain School of Engineering in which they list their detailed course curriculum (list of course work and marks year by year). The School in collaboration with the relevant programme commission will determine whether the student may be admitted and their decision will respect the programme rules. When necessary, they may suggest an individualised programme consisting of a part of the elective courses in the relevant Master's degree programme in civil engineering with the possible addition of a maximum of 15 supplemental credits.

The School in collaboration with the relevant programme commission will determine whether the student may be admitted and their decision will respect the programme rules. When necessary, the jury may suggest a programme in keeping with the student's previous course of study with the possible addition of a maximum of 15 supplemental credits.

Admission and Enrolment Procedures for general registration

Supplementary classes

To enrol for this Masters, the student must have a good command of certain subjects. If this is not the case, they must add preparatory modules to their Master's programme.

O Mandatory	⊠ Optional
△ Courses not taught during 2015-2016	⊘ Periodic courses not taught during 2015-2016
⊕ Periodic courses taught during 2015-2016	Activity with requisites

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

O	Supplementary classes	N.		Credits	

Teaching method

Methods that promote multidisciplinary studies

The Master's degree programme in biomedical engineering is by nature interdisciplinary because it acts as an interface between the art of engineering and biomedical sciences. It is founded on a versatile course programme that provides students with knowledge of the main areas in biochemical engineering as well as major fields of study in other disciplines.

Various teaching strategies

The teaching methods used in the Master's degree programme in civil engineering are 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.

Half of the students' workload in the last year consists of the graduation project and offers students the possibility to deal in-depth with a given subject, which given its size and context, provides a real initiation into the working life of an engineer or researcher.

Diverse learning situations

Learning is achieved by various pedagogical methods such as internships, case studies, classes, projects, exposure to cutting edge research and meetings with key industrial actors in the field.

This variety of teaching techniques allows students to learn in an iterative and progressive way.

The business creation major is based on an interactive teaching method and is oriented toward problem-based learning. Throughout the program, students work in multidisciplinary teams to participate in group projects. The Master's thesis is multidisciplinary in nature so that groups of three students, ideally from different academic departments, can work on a business creation project.

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. Professors provide details about evaluation methods used in their courses at the beginning of each semester.

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

To obtain a passing grade, the marks received for the teaching units are offset by their respective credits.

Mobility and/or Internationalisation outlook

Since its creation, the Louvain School of Engineering (EPL) has participated in diverse exchange programs that were put into place at the European level and beyond.

Possible trainings at the end of the programme

Accessible complementary Masterâ€™s degrees: currently under examination.

Accessible PhD curricula : by virtue of its training towards and via research, the Masterâ€™s in biomedical engineering gives its students an excellent preparation towards PhD studies. Instructors involved in the Masterâ€™s are members of various doctoral schools, which are there to welcome students who wish to further their studies via a PhD.

Contacts

Curriculum Managment

Entite de la structure GBIO

Acronyme	**GBIO**
Dénomination	Commission de programme- Ingénieur civil biomédical
Adresse	Place du Levant 3 bte L5.03.02 1348 Louvain-la-Neuve Tél 010 47 25 86 - Fax 010 47 25 98
Secteur	Secteur des sciences et technologies (SST)
Faculté	Ecole Polytechnique de Louvain (EPL)
Commission de programme	Commission de programme- Ingénieur civil biomédical (GBIO)

Academic Supervisor : Renaud RONSSE

Jury:
Président du Jury : Jean-Didier LEGAT
Secrétaire du Jury : Renaud RONSSE

Usefull Contacts

Secrétariat : Isabelle DARGENT