UCLouvain

GBIO2M

2020 - 2021

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 English: **YES** - Activities in other languages : **YES**
Activities on other sites : **optional**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Louvain School of Engineering (EPL)**
Programme acronym: **GBIO2M** - Francophone Certification Framework: 7

Table of contents

Introduction 2
Teaching profile 3
- Learning outcomes 3
- Programme structure 4
- Detailled programme 6
  - Programme by subject 6
  - Course prerequisites 20
  - The programme's courses and learning outcomes 20
Information 21
- Access Requirements 21
- Teaching method 23
- Evaluation 23
- Mobility and/or Internationalisation outlook 23
- Possible trainings at the end of the programme 23
- Contacts 23

GBIO2M - Introduction

Introduction

Introduction

This Master's degree programme educates 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.

A series of video portraits of young engineers in biomedical engineering wants to be discovered on the "job description" page of the faculty.

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 a dual master's degree (diploma granted jointly by UCLouvain and the institution where you studied abroad).

GBIO2M - Teaching profile

Learning outcomes

Nowadays, more and more engineers are bringing their ingenuity and analytical skills to the healthcare field. The objective of the Master's degree programme in biomedical engineering is to graduate engineers being capable of meeting the scientific and technological challenges of biomedical engineering in an ever-changing global and European context. Inherently multidisciplinary, this programme builds upon a strong collaboration between the sector of Sciences and Technologies, and the sector of Health Sciences.

Building up on students' existing knowledge in basic sciences (physics, chemistry, mathematics) and life science (biology, anatomy, biochemistry and physiology), this Master's degree programme offers the opportunity to develop multidisciplinary skills in a wide range of topics. Graduated students will be able to understand and model living systems and ultimately be able to design analytical or therapeutic tools (for example, developing new biomedical technologies).

Graduated students will have fundamental knowledge of the main fields of biomedical engineering: bioinstrumentation, biomaterials, imaging and medical physics, mathematical modelling, artificial organs and rehabilitation, bioinformatics and biomechanics. They will further acquire advanced training in one or more of these fields of expertise.

By choosing among several elective courses, students can opt either for polyvalent profile or one being 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 (i.e. engineering jobs 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:

- a core curriculum (35 credits) including a Master thesis and an additional industrial project;
- a set of courses in the Professional focus (30 credits);
- one or more major courses;
- elective courses to round out the programme

A project with an industrial focus (5 credits) is completed at the beginning of the programme (1st year) while the Master thesis is normally completed at the end of the programme (2nd year). It is recommended that students take courses from the Professional focus (30 credits) at the beginning of their Master’s programme (1st year). However, students may take these 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 former education, he or she already followed a course being part of the programme (either mandatory or elective) or followed an equivalent activity (pending approval by the programme jury), he or she may replace this activity by elective courses (pending the fullfillment of the programme rules). The student will also verify that he/she has obtained the minimum number of credits required for the approval of the diploma as well as for the approval of their major (in order to include their academic distinctions in the diploma appendix).

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

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-2020-gbio2m-tronc_commun]*

Liste au choix de finalités GBIO2M

> Professional Focus *[en-prog-2020-gbio2m-lgbio200s]*

> List of electives *[en-prog-2020-gbio2m-options]*

Majors in biomedical engineering

> Major in Clinical Engineering *[en-prog-2020-gbio2m-lgbio221o]*
> Major in acquisition and processing of biomedical data *[en-prog-2020-gbio2m-lgbio222o]*
> Major in Biomaterials *[en-prog-2020-gbio2m-lgbio226o]*
> Major in Biomechanics and medical robotics *[en-prog-2020-gbio2m-lgbio227o]*
> Major in Medical physics and medical imaging *[en-prog-2020-gbio2m-lgbio232o]*

Majors in business creation and management

> Business risks and opportunities *[en-prog-2020-gbio2m-lgbio230o]*
> Major in small and medium sized business creation *[en-prog-2020-gbio2m-lgbio231o]*

Elective courses

> Elective courses in Genetic engineering *[en-prog-2020-gbio2m-lgbio250o]*
> Elective courses in biochemical engineering *[en-prog-2020-gbio2m-lgbio251o]*
> Elective courses in pharmaceutical engineering *[en-prog-2020-gbio2m-lgbio252o]*
> Elective courses in statistics *[en-prog-2020-gbio2m-lgbio253o]*
> Elective courses: transversal skills and contacts with industry *[en-prog-2020-gbio2m-lgbio955o]*
> Elective courses available for Master students in Biomedical Engineering *[en-prog-2020-gbio2m-lgbio952o]*

Preparatory Module *(only for students who qualify for the course via complementary coursework)*

> Master [120] in Biomedical Engineering *[en-prog-2020-gbio2m-module_complementaire]*

GBIO2M Detailled programme

Programme by subject

CORE COURSES [35.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

						Year 1	2
O LGBIO2990	Master Thesis			28 Credits			x
O LGBIO2220	Industrial project in biomedical engineering	Sophie Demoustier Philippe Lefèvre Renaud Ronsse	30h+30h	5 Credits	q1+q2	x	x

O Religion courses for students in exact sciences (2 credits)

The students select one course between:
The student shall select

⊠ LTECO2100	Sociétés, cultures, religions : Biblical readings	Hans Ausloos	15h	2 Credits	q1	x	x
⊠ LTECO2300	Societies, cultures, religions : Ethical questions	Marcela Lobo Bustamante	15h	2 Credits	q1	x	x
⊠ LTECO2200	Societies-cultures-religions : Human Questions	Régis Burnet Dominique Martens	15h	2 Credits	q1 or q2	x	x

PROFESSIONAL FOCUS [30.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	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.

O Content:

						Year 1	Year 2
O LGBIO2010	Bioinformatics	Pierre Dupont	30h+30h	5 Credits	q1	x	x
O LGBIO2020	Bioinstrumentation	André Mouraux Michel Verleysen	30h+30h	5 Credits	q1	x	x
O LGBIO2030	Biomaterials	Sophie Demoustier Christine Dupont	30h+30h	5 Credits	q1	x	x
O LGBIO2040	Biomechanics	Greet Kerckhofs	30h+30h	5 Credits	q2	x	x
O LGBIO2050	Medical Imaging	Greet Kerckhofs John Lee Benoît Macq Frank Peeters	30h+30h	5 Credits	q1	x	x
O LGBIO2060	Modelling of biological systems	Philippe Lefèvre	30h+30h	5 Credits	q1	x	x

OPTIONS

Students MUST choose at least one major from the 5 biomedical engineering majors. They MAY further choose one or more other majors from those in biomedical engineering, or management and business creation.He completes his program by choosing from a list of elective courses.

Majors in biomedical engineering

> Major in Clinical Engineering *[en-prog-2020-gbio2m-lgbio221o]*
> Major in acquisition and processing of biomedical data *[en-prog-2020-gbio2m-lgbio222o]*
> Major in Biomaterials *[en-prog-2020-gbio2m-lgbio226o]*
> Major in Biomechanics and medical robotics *[en-prog-2020-gbio2m-lgbio227o]*
> Major in Medical physics and medical imaging *[en-prog-2020-gbio2m-lgbio232o]*

Majors in business creation and management

> Business risks and opportunities *[en-prog-2020-gbio2m-lgbio230o]*
> Major in small and medium sized business creation *[en-prog-2020-gbio2m-lgbio231o]*

Elective courses

> Elective courses in Genetic engineering *[en-prog-2020-gbio2m-lgbio250o]*
> Elective courses in biochemical engineering *[en-prog-2020-gbio2m-lgbio251o]*
> Elective courses in pharmaceutical engineering *[en-prog-2020-gbio2m-lgbio252o]*
> Elective courses in statistics *[en-prog-2020-gbio2m-lgbio253o]*
> Elective courses: transversal skills and contacts with industry *[en-prog-2020-gbio2m-lgbio955o]*
> Elective courses available for Master students in Biomedical Engineering *[en-prog-2020-gbio2m-lgbio952o]*

MAJORS IN 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 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

Students selecting this major may choose
From 20 to 30 credits

O *Content:*

O Required courses (8 credits)

						Year 1	Year 2
O LGBIO2110	Introduction to Clinical Engineering	Benoit Delhaye Philippe Lefèvre	30h	3 Credits	q2	x	x
O LMECA2711	Quality management and control.	Nicolas Bronchart	30h+30h	5 Credits	q2	x	x

⊠ Elective courses

LSTAT2330 and WESP2123 are mutually exclusive, so as WFSP2218 and LBIRA2101
From 12 to 22 credits

						Year 1	Year 2
⊠ LBIRA2110B	Applied Econometrics	Xavier Draye Frédéric Gaspart Bernadette Govaerts	27.5h +7.5h	3 Credits	q1	x	x
⊠ LINGI2172	Databases	Siegfried Nijssen	30h+30h	6 Credits	q2	x	x
⊠ LSTAT2110	Data Analysis	Johan Segers	30h+7.5h	5 Credits	q1	x	x
⊠ LSTAT2310	Statistical quality control.	Bernard Francq	15h+5h	4 Credits	q1	x	x
⊠ LSTAT2330	Statistics in clinical trials.	Catherine Legrand Annie Robert	22.5h +7.5h	5 Credits	q2	x	x
⊠ LDATS2360	Seminar in data management: basic	Céline Bugli	15h+10h	5 Credits	q1	x	x
⊠ WESP2123	Principes des essais cliniques	Diego Castanares Zapatero Philippe Lysy Annie Robert (coord.) Françoise Smets	20h+10h	4 Credits	q1	x	x
⊠ WESP2234	Strategy of the medical decision	Andrea Penaloza-Baeza Annie Robert (coord.)	30h	3 Credits	q1	x	x
⊠ WFSP2218	Analyse longitudinale : régression linéaire, logistique et de Poisson	Annie Robert	20h+20h	4 Credits	q1	x	x
⊠ WFSP2260	Management humain et comportement organisationnel	Pierre Meurens Sophie Thunus (coord.)	40h+30h	5 Credits	q2	x	x

MAJOR IN ACQUISITION AND PROCESSING OF BIOMEDICAL DATA

The objective of this major is to provide students with the necessary body of knowledge to acquire and analyze biomedical data, i.e. either raw signal data or large bases of pre-processed data. This major is especially well-suited for students holding a bachelor in computer science, electricity or applied mathematic

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

Students selecting this major may choose
From 20 to 30 credits

O Content:

O Required courses (10 credits)

						Year 1	Year 2
O LELEC2531	Design and Architecture of digital electronic systems	Jean-Didier Legat	30h+30h	5 Credits	q1	x	x
O LELEC2900	Signal processing	Laurent Jacques Benoît Macq Luc Vandendorpe	30h+30h	5 Credits	q2	x	x

⊠ Elective courses

The classes LSTAT2320 and LBIRC2106 are mutually exclusive as are the classes LSTAT 2120 and LBIRA2101.
From 10 to 20 credits

⊠ LELEC2532	Design and Architecture of analog electronic systems	David Bol Denis Flandre	30h+30h	5 Credits	q2	x	x
⊠ LELEC2811	Instrumentation and sensors	David Bol (coord.) Laurent Francis	30h+30h	5 Credits	q1	x	x
⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LINGI2251	Software Quality Assurance	Charles Pecheur	30h+15h	5 Credits	q2	x	x
⊠ LINGI2261	Artificial intelligence	Yves Deville	30h+30h	6 Credits	q2	x	x
⊠ LINGI2262	Machine Learning :classification and evaluation	Pierre Dupont	30h+30h	5 Credits	q2	x	x
⊠ LINMA2361	Nonlinear dynamical systems	Pierre-Antoine Absil	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2370	Modelling and analysis of dynamical systems	Jean-Charles Delvenne (coord.) Denis Dochain	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2471	Optimization models and methods II	François Glineur	30h +22.5h	5 Credits	q1	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	q2	x	x
⊠ LSTAT2320	Design of experiment.	Patrick Bogaert Bernadette Govaerts	22.5h +7.5h	5 Credits	q2	x	x
⊠ LSTAT2110	Data Analysis	Johan Segers	30h+7.5h	5 Credits	q1	x	x
⊠ LBIRA2110B	Applied Econometrics	Xavier Draye Frédéric Gaspart Bernadette Govaerts	27.5h +7.5h	3 Credits	q1	x	x
⊠ LSTAT2120	Linear models	Christian Hafner	30h+7.5h	5 Credits	q1	x	x
⊠ LGBIO2072	Mathematical models in neuroscience	Frédéric Crevecoeur	30h+30h	5 Credits	q1	x	x

MAJOR IN BIOMATERIALS

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

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

Students selecting this major may choose
From 20 to 30 credits

O Content:

O Required courses KIMA students

KIMA students must enrol in LGBIO2030 and LBIR1250 except if they took these courses during their undergraduate programme.
From 5 to 10 credits

					Year 1	Year 2
O LGBIO2030	Biomaterials	Sophie Demoustier Christine Dupont	30h+30h	5 Credits	q1	x	x
O LBIR1250	Biochemistry I	Michel Ghislain Yvan Larondelle (coord.)	30h+15h	4 Credits	q1	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.
From 5 to 10 credits

O LMAPR1805	Introduction to materials science	Jean-Christophe Charlier Pascal Jacques Bernard Nysten Thomas Pardoen (coord.)	30h+30h	5 Credits	q2	x	x
O LMAPR2481	Deformation and fracture of materials	Hosni Idrissi Thomas Pardoen	30h+30h	5 Credits	q1	x	x

O Recommended courses

From 10 to 26 credits

⊠ LBIR1355	Métabolisme microbien et synthèse de biomolécules	Michel Ghislain (coord.) Yvan Larondelle	22.5h +15h	3 Credits	q2	x	x
⊠ LBIO1237	Immunology : basis and applications in biology	Jean-Paul Dehoux	25h+15h	3 Credits	q1	x	x
⊠ LELEC2560	Micro and Nanofabrication Techniques	Laurent Francis (coord.) Benoît Hackens Jean-Pierre Raskin	30h+30h	5 Credits	q2	x	x
⊠ LMAPR2012	Macromolecular Nanotechnology	Sophie Demoustier Karine Glinel Karine Glinel (compensates Bernard Nysten) Jean-François Gohy	45h+15h	5 Credits	q2	x	x
⊠ LMAPR2019	Polymer Science and Engineering	Sophie Demoustier Alain Jonas (coord.) Evelyne Van Ruymbeke	45h+15h	5 Credits	q1	x	x
⊠ LGBIO2071	Tissue Engineering	Greet Kerckhofs	30h+30h	5 Credits	q2	x	x

⊠ Elective courses

Maximum 15 credits

⊠ LBIRC2101A	Analyse biochimique et notions de génie génétique: analyse biochimique	Pierre Morsomme	18.5h +22.5h	4 Credits	q1	x	x
⊠ LBIRC2108	Biochemical and Microbial Engineering	Iwona Cybulska	30h +22.5h	5 Credits	q2	x	x
⊠ LGBIO2020	Bioinstrumentation	André Mouraux Michel Verleysen	30h+30h	5 Credits	q1	x	x
⊠ LMAPR2013	Science and engineering of metals and ceramics	Pascal Jacques	30h+30h	5 Credits	q1	x	x

						Year 1	Year 2
⊠ LMAPR2014	Physics of Functional Materials	Xavier Gonze Luc Piraux Gian-Marco Rignanese	37.5h +22.5h	5 Credits	q1	x	x
⊠ LMAPR2018	Rheology	Evelyne Van Ruymbeke	30h+30h	5 Credits	q2	x	x
⊠ LMAPR2631	Surface Analysis	Arnaud Delcorte Bernard Nysten	30h+15h	5 Credits	q2	x	x

MAJOR IN BIOMECHANICS AND MEDICAL ROBOTICS

The goal of this major is to provide students with the necessary body of knowledge to understand and develop technologies related to biomechanics (fluids and solids) and medical robotics (surgical assistance and rehabilitation). This major is particularly well-suited for students holding a bachelor in mechanics.

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

Students selecting this major may choose
From 20 to 30 credits

O Content:

O Required courses (10 credits)

						Year 1	Year 2
O LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	30h+30h	5 Credits	q1	x	x
O LMECA2355	Mechanical design in biomedical engineering	Greet Kerckhofs Ann Vankrunkelsven (compensates Benoît Raucent)	30h+30h	5 Credits	q1	x	x

⊠ Elective courses

From 10 to 20 credits

						Year 1	Year 2
⊠ LINMA2671	Advanced control and applications	Julien Hendrickx	30h+30h	5 Credits	q1	x	x
⊠ LINMA2875	System Identification	Julien Hendrickx	30h+30h	5 Credits	q2	x	x
⊠ LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye (coord.) Vincent Legat Jean-François Remacle	30h+30h	5 Credits	q2	x	x
⊠ LMECA2660	Numerical methods in fluid mechanics	Grégoire Winckelmans	30h+30h	5 Credits	q2	x	x
⊠ LMECA2732	Robot modelling and control	Renaud Ronsse	30h+30h	5 Credits	q2	x	x
⊠ LMECA2755	Industrial automation	Bruno Dehez Paul Fisette Renaud Ronsse	30h+30h	5 Credits	q1	x	x
⊠ LMECA2802	Multibody system Dynamics	Paul Fisette	30h+30h	5 Credits	q2	x	x
⊠ LMECA2840	Project in Mechanical Design II	Bruno Dehez Christophe Everarts (compensates Benoît Raucent) Renaud Ronsse	30h+30h	6 Credits	q1+q2	x	x
⊠ LMECA2335	Biorobotics	Renaud Ronsse	30h+30h	5 Credits	q2	x	x

MAJOR IN MEDICAL PHYSICS AND MEDICAL IMAGING

The goal of this major is to provide students with the necessary body of knowledge to understand and develop technologies related to medical physics and medical imaging. This major is particularly well-suited for students holding a bachelor in electricity or applied chemistry and physics.

○ Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	■ Activity with requisites

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

Students selecting this major may choose
From 20 to 30 credits

○ Content:

○ Required courses (10 credits)

						Year 1	Year 2
○ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	30h+30h	5 Credits	q1	x	x
○ LGBIO2070	Engineering challenges in protontherapy	Guillaume Janssens John Lee Edmond Sterpin	30h+30h	5 Credits	q2	x	x

⊠ Elective courses

From 10 to 20 credits

⊠ LMECA2645	Major technological hazards in industrial activity.	Denis Dochain	30h	3 Credits	q2	x	x
⊠ LPHYS2102	Detectors and sensors	Eduardo Cortina Gil Krzysztof Piotrzkowski	22.5h +7.5h	5 Credits	q1	x	x
⊠ LPHYS2504	Use, management and control of radio elements	Pascal Froment	22.5h	3 Credits	q2	x	x
⊠ LPHY2360	Physique atomique, nucléaire et des radiations	Krzysztof Piotrzkowski	22.5h	2 Credits		x	x
⊠ WMNUC2100	Master and compelmentary master	Véronique Roelants Thierry Vander Borght (coord.)	15h	2 Credits	q1	x	x
⊠ WRDTH3120	Dosimétrie en radiothérapie et contrôle de qualité	Edmond Sterpin	30h	3 Credits	q2	x	x
⊠ WRDTH3160	Dosimétrie informatisée en radiothérapie	Xavier Geets Carine Kirkove Laurette Renard Edmond Sterpin (coord.)	30h+60h	5 Credits	q2	x	x
⊠ WRPR2001	Notions de base de radioprotection	Pascal Carlier Michaël Dupont François Jamar (coord.) Renaud Lhommel	10h+5h	2 Credits	q1	x	x
⊠ WRPR2330	Utilisation des radioisotopes et des molécules marquées en biologie	Bernard Gallez (coord.) Thierry Vander Borght	15h+15h	3 Credits	q2	x	x

MAJORS IN BUSINESS CREATION AND MANAGEMENT

These two majors are exclusive. Students may choose only one.

BUSINESS RISKS AND OPPORTUNITIES

This major is not available in English and may not be taken at the same time as the major « Interdisciplinary program in entrepreneurship – CPME ».

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

From 17 to 20 credits

O *Content:*

						Year 1	Year 2
O LFSA1290	Introduction to financial and accounting management	Philippe Grégoire	30h+15h	4 Credits	q2	x	x
O LFSA2140	Elements of law for industry and research	Vincent Cassiers Werner Derijcke Bénédicte Inghels	30h	3 Credits	q1	x	x
O LFSA2210	Organisation and human resources	John Cultiaux Eline Jammaers	30h	3 Credits	q2	x	x
O LFSA2230	Introduction to management and to business economics	Benoît Gailly	30h+15h	4 Credits	q2	x	x
O LFSA2245	Environment and business	Jean-Pierre Tack	30h	3 Credits	q1	x	x

O One course between

From 3 to 5 credits

⊠ LFSA2202	Ethics and ICT	Axel Gosseries Olivier Pereira	30h	3 Credits	q2	x	x
⊠ LLSMS2280	Business Ethics and Compliance Management	Carlos Desmet	30h	5 Credits	q1	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 EPL Masters' degrees, the goal of this major is to familiarize the student with the specifics of entrepreneurship and business development in order to develop the necessary abilities, knowledge and tools to create a business. It is a truly interdisciplinary initiative where students from different faculties are brought together in cross-disciplinary teams to create an entrepreneurial project.

The Interdisciplinary program in entrepreneurship (CPME) is spread over two years and is integrated into more than 30 Masters (9 faculties). The program includes a collective and interdisciplinary master thesis focused on an entrepreneurial project (start-up or spin-off) and realized in teams of 3 to 4 students from 3 to 4 different faculties. The access is reserved for a small number of students by a selection procedure. Additional information may be found at www.uclouvain.be/cpme.

This major is not available in English and may not be taken at the same time as the major "Business risks and opportunities".

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

From 20 to 25 credits

O *Content:*

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	q1	x	
O LCPME2002	Managerial, legal and economic aspects of the creation of a company (in French)	Yves De Cordt Marine Falize	30h+15h	5 Credits	q1	x	x
O LCPME2003	Business plan of the creation of a company (in French) *Les séances du cours LCPME2003 sont réparties sur les deux blocs annuels du master. L'étudiant doit les suivre dès le bloc annuel 1, mais ne pourra inscrire le cours que dans son programme de bloc annuel 2.*	Frank Janssen	30h+15h	5 Credits	q2		x
O LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	q2	x	x

⊠ Prerequisite CPME courses

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

O LCPME2000	Venture creation financement and management I	Yves De Rongé Olivier Giacomin	30h+15h	5 Credits	q1	x	

ELECTIVE COURSES

ELECTIVE COURSES IN GENETIC ENGINEERING

- Mandatory
- Optional
- Courses not taught during 2020-2021
- Periodic courses not taught during 2020-2021
- Periodic courses taught during 2020-2021
- Activity with requisites

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

Content:

						Year 1	Year 2
LBIR1352	General genetics	Jacques Mahillon (compensates Philippe Baret)	45h+15h	5 Credits	q2	x	x
LBRMC2101	Genetic engineering	François Chaumont (coord.) Charles Hachez Melissa Page (compensates François Chaumont)	37.5h +15h	5 Credits	q1	x	x

ELECTIVE COURSES IN BIOCHEMICAL ENGINEERING

- Mandatory
- Optional
- Courses not taught during 2020-2021
- Periodic courses not taught during 2020-2021
- Periodic courses taught during 2020-2021
- Activity with requisites

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

Content:

						Year 1	Year 2
LBRAL2102	Physiological and nutritional biochemistry	Cathy Debier Yvan Larondelle (coord.)	37.5h+0h	4 Credits	q1	x	x
LBRAL2104	Food microbiology	Jacques Mahillon	30h +22.5h	4 Credits	q2	x	x
LBRMC2202	Cell culture technology	David Alsteens Charles Hachez (coord.) Pascal Hols	30h	3 Credits	q1	x	x
LBRNA2202	Nano-biotechnologies	Yves Dufrêne	30h	3 Credits	q2	x	x
LBRTE2201	Human and environmental toxicology	Cathy Debier (coord.) Philippe Hantson	30h+7.5h	4 Credits	q1	x	x

ELECTIVE COURSES IN PHARMACEUTICAL ENGINEERING

- Mandatory
- Optional
- Courses not taught during 2020-2021
- Periodic courses not taught during 2020-2021
- Periodic courses taught during 2020-2021
- Activity with requisites

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

Content:

					Year 1	Year 2
⊠ LINMA2300	Analysis and control of distributed parameter systems	Denis Dochain	30h+30h	5 Credits	q1	x	x
⊠ LMAPR2118	Fluid-fluid separations	Patricia Luis Alconero Denis Mignon	30h +22.5h	5 Credits	q2	x	x
⊠ LMAPR2330	Reactor Design	Juray De Wilde	30h+30h	5 Credits	q2	x	x
⊠ LMAPR2380	Solid-fluid separation	Tom Leyssens Patricia Luis Alconero	30h +22.5h	5 Credits	q1	x	x
⊠ LMAPR2430	Industrial processes for the production of base chemicals	Juray De Wilde	30h +22.5h	5 Credits	q1	x	x
⊠ WFARM1008	Design of the drug	Giulio Muccioli Véronique Préat (coord.)	15h+15h	2 Credits	q2	x	x
⊠ WFARM1232	General Pharmacology	Emmanuel Hermans	15h+7.5h	2 Credits	q1	x	x
⊠ WFARM1307	Physical pharmacy	Tom Leyssens	15h	2 Credits	q2	x	x

ELECTIVE COURSES IN STATISTICS

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

This module in statistics offers courses being useful for data processing (analysis laboratory, clinical research, quality management, etc.). Students taking at least 45 credits in this module and among courses in statistics from the majors of the Master (labels LBIRA, LBIRC, LSTAT, WESP, WFSP) will later get a direct access to the second year of the Master in Statistics: Biostatistics [120 credits]. More information about this program bridge via info-stat-actu@uclouvain.be

O Content:

						Year 1	Year 2
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	q1	x	x
⊠ LSTAT2040	Statistical analysis	Benjamin Colling (compensates Anouar El Ghouch)	30h+15h	5 Credits	q2	x	x
⊠ LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	15h+5h	4 Credits	q2	x	x
⊠ LSTAT2170	Times series	Rainer von Sachs	22.5h +7.5h	5 Credits	q2	x	x
⊠ LSTAT2210	Advenced linear models	Lieven Desmet (compensates Catherine Legrand)	15h+5h	4 Credits	q1	x	x
⊠ LSTAT2220	Analysis of survival and duration data	Ingrid Van Keilegom	15h+5h	4 Credits	q1	x	x

ELECTIVE COURSES: TRANSVERSAL SKILLS AND CONTACTS WITH INDUSTRY

O Mandatory	⊠ Optional
△ Courses not taught during 2020-2021	⊘ Periodic courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021	Activity with requisites

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

The student selects between 3 and 22 credits (max 27 if the student selects the intership) in this list below or in the courses of the major "business risks and opportunities". An alternative is to select the Major in small and medium sized business creation.

O Content:

O Transversal skills and contacts with industry

The student selects minimum 3 credits among the courses of the Majors "business risks and opportunities" and "small and medium sized business creation" and courses of professional integration activity specific to the program.

⊠ Internship

						Year 1	Year 2
⊠ LFSA2995	Company Internship	Jean-Pierre Raskin	30h	10 Credits	q1+q2	x	x

⊠ Communication

Students may select max. 8 credits of languages courses or group dynamics :
Maximum 8 credits

⊠ Languages

Students may select from any language course offered at the ILV. Special attention is placed on the following seminars in professional development:

						Year 1	Year 2
⊠ LALLE2500	Professional development seminar German	Caroline Klein (coord.)	30h	3 Credits	q1+q2	x	x
⊠ LALLE2501	Professional development seminar-German	Caroline Klein (coord.)	30h	5 Credits	q1+q2	x	x
⊠ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	30h	3 Credits	q1	x	x

						Year 1	2
⊠ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	30h	5 Credits	q1	x	x
⊠ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.) Marie-Laurence Lambrecht	30h	3 Credits	q1 or q2	x	x
⊠ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.) Dag Houdmont	30h	3 Credits	q1 or q2	x	x

⊠ Group dynamics

⊠ LEPL2351	Dynamique des groupes - Q1	Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz	15h+30h	3 Credits	q1	x	x
⊠ LEPL2352	Dynamique des groupes - Q2	Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz	15h+30h	3 Credits	q2	x	x

⊠ Other non-disciplinary courses

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

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN BIOMEDICAL ENGINEERING

The elective courses being recommended and available for Master students in biomedical engineering are listed here above, in the majors and other lists of elective courses. However, a student can further suggest other courses that would be relevant for his.her personal curriculum, pending that this is compliant with the rules for setting up a personal Master program.

Course prerequisites

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

The programme's courses and learning outcomes

For each UCLouvain training programme, a reference framework of learning outcomes specifies the 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?"*

GBIO2M - Information

Access Requirements

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

Decree of 7 November 2013 defining the landscape of higher education and the academic organization of studies.

The admission requirements must be met prior to enrolment in the University.

SUMMARY

- > Specific access requirements
- > University Bachelors
- > Non university Bachelors
- > Holders of a 2nd cycle University degree
- > Holders of a non-University 2nd cycle degree
- > Access based on validation of professional experience
- > Access based on application
- > Admission and Enrolment Procedures for general registration

Specific access requirements

This programme is taught in English with no prerequisite in French. The student is supposed to have at least a B2 level in the European Framework of Reference. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the Acces on the file.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		Direct access	Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted master programme.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in Engineering		Direct access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil engineering master degree may have an adapted programme.
Bachelier en sciences de l'ingénieur - orientation ingénieur civil		Direct access	L'étudiant n'ayant suivi au préalable ni la majeure, ni la mineure dans la discipline de son master ingénieur civil peut se voir proposer par le jury un adaptation de son programme de master.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering		Access with additional training	Students who have no specialisation in the field of their civil enginering master degree may have an adapted master programme with up to 60 additional credits.
Foreign Bachelors			
Bachelor in engineering	Bachelors degree of Cluster Institution	Direct access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field

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

Non university Bachelors

> Find out more about links (https://uclouvain.be/fr/etudier/passerelles) to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters	
Master in Engineering	Direct access

Holders of a non-University 2nd cycle degree

> Find out more about links to the university

Access based on validation of professional experience

> See the website Valorisation des acquis de l'expérience

It is possible to gain admission to all masters courses via the validation of professional experience procedure.

Access based on application

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

The first step of the admission procedure requires to submit an application online:https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html

Selection criteria are summarized here (epl-admission@uclouvain.be).

Admission and Enrolment Procedures for general registration

Teaching method

Methods that promote multidisciplinarity

The Master's degree programme in biomedical engineering is by nature interdisciplinary since it lies at the interface between engineering and biomedical sciences. It is grounded on a solid course programme that provides students with knowledge of the main areas in biomedical engineering as well as various majors in related disciplines.

Various teaching strategies

The teaching methods used in the Master's degree programme in biomedical 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 research laboratories (for class laboratories, case studies, projects, theses) exposing them to advanced methods and allowing them to learn by questioning. This process is very central for a research perspective.

Half of the student workload in the last year consists in the Master thesis fulfillment and offers students the possibility to deeply investigate. Given its size and context it provides a true 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 players 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 (https://uclouvain.be/fr/decouvrir/rgee.html). 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 (https://uclouvain.be/epl-international.html) that were put into place at the European level and beyond.

Possible trainings at the end of the programme

Accessible complementary Master's degrees: currently under examination.

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

Contacts

Curriculum Management

Entity

Structure entity	SST/EPL/GBIO
Denomination	(GBIO)
Faculty	Louvain School of Engineering (EPL)
Sector	Sciences and Technology (SST)
Acronym	GBIO
Postal address	Place du Levant 3 - bte L5.03.02 1348 Louvain-la-Neuve Tel: +32 (0) 10 47 25 86 - Fax: +32 (0) 10 47 25 98

Academic supervisor: Sophie Demoustier

Jury

- Jean-Didier Legat
- Sophie Demoustier

Useful Contact(s)

- Isabelle Dargent