UCLouvain

BIRE2M

2021 - 2022

Master [120] in Environmental Bioengineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In French
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **NO**
Activities on other sites : **NO**
Main study domain : **Sciences agronomiques et ingénierie biologique**
Organized by: **Faculty of bioscience engineering (AGRO)**
Programme acronym: **BIRE2M** - Francophone Certification Framework: 7

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Learning outcomes

Master in Environmental Bioengineering students must endeavour to diagnose and solve complex and original issues in bioengineering through a multidisciplinary approach in order to develop and implement innovative and sustainable solutions.

This Master's programme aims to train experts in the field of management, conservation and the responsible use of natural renewable resources (land and water) as well as natural and man-made ecosystems.

The future bioengineers acquire the knowledge and skills required to become:

• professionals able to tackle and diagnose environmental problems: the management and use of resources (soil, water, plants) and ecosystems, land management;

• scientists able to understand complex processes on different scales, used to multidisciplinary approaches and able to collaborate with other specialists;

• innovators tasked with developing new resource management methods that respect the environment.

Highly versatile and multidisciplinary in character, the course dispensed by the Faculty of Biological, Agricultural and Environmental Engineering focuses on acquiring skills which combine theory and practice to train "bioengineers" mastering a broad base of scientific and technological knowledge and skills allowing them to understand and conceptualise biological, agricultural and environmental systems.

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

1. To explore an integrated body of knowledge (knowledge, methods and techniques, models and processes) in natural and human sciences which serves as the foundation from which to operate with expertise in the field of environmental science and technology.

1.1 To build an advanced knowledge base in the field of environmental science and technologies and more specifically in the following disciplines[1].

- Soil and water sciences and quality
- Ecology
- Geomatics applied to the environment
- Analysis of natural and agrarian systems
- Statistics and data analysis

1.2 To build highly specialised (cutting-edge) scientific knowledge in one of the [2] following bioengineering specialisations:

- Environmental technology: water-soil-earth
- Land management
- Water and land resources
- Information analysis and management in biological engineering

1.3 To master procedural skills in conducting experiments[3] in a controlled or natural environment, and in the observation and monitoring of natural and man-made systems at different scales using specific techniques related to their choice of specialisation.

1.4 To apply their knowledge critically to tackle a complex environmental problem, by incorporating processes at different scales ranging from the mineral and living organism scale, to landscape and biosphere.

1.5 To apply multiple strands of knowledge to resolve a multidisciplinary environmental problem in order to develop relevant and innovative solutions.

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[1] Refers to the choice of the Master (core subjects and professional focus). The knowledge of some of these disciplines will have been partially acquired in the Bachelor's degree (in the advanced minor).

[2] Refers to the option / module choice in the Master.

[3] Refers to mastering all the laboratory and field techniques used for the characterisation or monitoring of a system.

2. To explore an integrated body of "engineering and management knowledge" which serves as the foundation from which to operate with expertise in the field of environmental sciences.

2.1 To build an advanced knowledge base (e.g.: concepts, laws, technologies) and tools (e.g. modelling, programming) in engineering sciences:

- Geomatics applied to the environment
- Hydrology
- Applied soil sciences
- Topometry and photogrammetry
- Ecological and environmental diagnosis
- Environmental statistical data analysis
- Support for decision-making and project management

2.2 To build and master highly specialised knowledge and tools in one of the following bioengineering specialisations:

- Environmental technology: water-soil-earth
- Land management
- Water and land resources
- Information analysis and management in biological engineering

2.3 To master the operational use of specialised tools in engineering sciences (e.g.: systems analysis, statistical analysis, programming, modelling, etc.)[1] :

- Measurement techniques
- Environmental statistical data analysis
- Specific tools in relation to the choice of specialisation

2.4 To activate and apply their knowledge of engineering with a critical mind and using a quantitative approach to tackle a complex problem in the environmental field by incorporating processes at different scales ranging from the mineral and living organism scale, to landscape and biosphere.

2.5 To locate and understand how companies and organisations operate, including the role of the different players, their financial and social realities and responsibilities and the challenges and constraints which characterise their environment.

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[1] The tools are explained on the basis of the radioscopy of the programme and courses.

3. To design and execute a research project, implementing an analytical scientific and, if applicable, systematic approach, to further understanding of an original research problem in their field of specialisation, incorporating several disciplines.

This skill set will develop throughout the 5 years. Amongst others it requires the use of a set of skills as described below. These skills correspond in fact to the different stages of the scientific approach.

The majority of these skills are developed in the Bachelor and Master programmes, with differentiation predominately on 3 levels:

- the level of detail and complexity applied to the scientific problem/research studied;
- the degree of innovation shown by the student;
- the degree of autonomy demonstrated by the student throughout the process.

3.1 To summarise the state of knowledge on a complex research problem which relates to their choice of specialisation: to research information, to select and validate its reliability based on the nature of the source of the information and comparing several sources.

3.2 To specify and define the research question.

3.3 To examine the research question using conceptual abstraction and formulate hypotheses.

3.4 To develop and implement a rigorous methodology to answer the research question.

3.5 To master and apply statistical data analysis tools in the context of a complex scientific issue.

3.6 To analyse and interpret the results to produce a substantiated critique on a complex scientific question.

3.7 To demonstrate an ability to summarise and formulate conclusions on a complex scientific question.

3.8 In each of the skills mentioned above, to demonstrate rigour, precision and the critical thinking essential for any scientific method.

3.9 To demonstrate innovation in at least one of the skills mentioned above.

4. To formulate and resolve a complex environmental engineering problem related to new situations presenting a degree of uncertainty. The student will be able to design appropriate, sustainable and innovative solutions through a systematic approach. This problem may be related to the management and use of resources (soil, water, plant) and ecosystems, to land management, to the impact of human activities on the capacity of the environment to provide goods and services to humanity.

4.1 To strategically differentiate the key elements from the less critical elements relating to a complex environmental engineering problem, in order to define and determine the field of action for this problem.

4.2 To identify the knowledge acquired and that to be acquired to resolve the complex environmental engineering problem.

4.3 To analyse a complex environmental engineering problem using a systematic and multidisciplinary approach in order to carry out diagnostics and formulate the specifications.

4.4 To demonstrate an ability for conceptual abstraction and formalisation in analysing and resolving the complex environmental engineering problem.

4.5 To develop scientifically and technologically relevant and innovative solutions, through a multidisciplinary (integration and articulation of knowledge) and quantitative approach, making it possible to develop products, systems, processes or services in the field of environmental sciences and technologies.

4.6 To test solutions and evaluate their impact in relation to an economic, environmental, social and cultural context.

4.7 To formulate concrete and responsible recommendations to encourage sustainable development in relation to the efficient operational and sustainable implementation of the solutions proposed.

5. To design and implement a multidisciplinary project, alone and in a team, with the stakeholders concerned while taking the objectives into account and incorporating the scientific, technical, environmental, economic and human factors.

5.1 To know and understand the principles and factors of group dynamics (including the constructive role of conflict).

5.2 To know and understand the project management process (project cycles): formulation and definition of the project, project management, monitoring and evaluation of the project.

5.3 To situate a multidisciplinary project within its environment and identify the issues, constraints and stakeholders and to clearly define its objectives.

5.4 To plan and develop all the stages of a multidisciplinary project, alone and in a team, and to work together after having allocated the tasks.

5.5 To involve key players at appropriate stages in the process.

5.6 To work within a team and collaborate effectively to achieve common objectives.

5.7 To take and assume the decisions required for the effective project management either alone or in a team in order to achieve the intended objectives.

5.8 To recognise and take into consideration the diversity of opinions and ways of thinking of team members and to manage conflict constructively to work towards a consensual decision.

5.9 To lead a team (demonstrate leadership): to motivate team members, to develop a collaborative climate, to guide them to cooperate in the achievement of a common objective, to manage conflict.

6. To communicate, interact and convince in a professional manner, in French and English at level C1 (Common European Framework of Reference for Languages published by the Council of Europe), both verbally and in writing, adapting to their conversational partners and the context.

6.1 To understand and use scientific articles and advanced technical documents in French and English.

6.2 To communicate information, ideas, solutions and conclusions as well as the knowledge and underlying principles, in a clearly structured, substantiated, concise and comprehensive way (as appropriate) both verbally and in writing according to the standards of communication specific to the context and by adapting their presentation according to the level of expertise of the audience.

6.3 To develop logic diagrams to concisely pose complex global questions.

6.4 To communicate the state of knowledge in a specific field concisely and critically.

6.5 To communicate results and conclusions, and to support a message, in an appropriate manner using scientific tables, graphs and diagrams.

6.6 To communicate effectively and respectfully with various stakeholders, demonstrating listening skills, empathy and assertiveness.

6.7 To argue and convince: to understand the points of view of various stakeholders and present their arguments accordingly.

6.8 To master the IT and technological tools essential for professional communication.

6.9 To learn English to level C1 according to the European Framework.

7. To act critically and responsibly by taking account of sustainable development issues and operating with a humanistic outlook.

7.1 To demonstrate intellectual independence of thought, to examine knowledge and professional practices and trends critically.

7.2 To make decisions and act in society with respect for ethical values and in compliance with laws and conventions.

7.3 To make decisions and act responsibly by factoring in sustainable development values.

7.4 To make decisions and act with respect for humanistic values, cultural openness and solidarity, especially in North–South relations.

7.5 To assume professional responsibilities and act in a managerial capacity vis-à-vis their colleagues.

8. To demonstrate independence and be proactive in acquiring new knowledge and developing new skills in order to adapt to changing or uncertain situations and to grow, to build a professional project within a continuing development approach.

8.1 To manage their work independently: to set priorities, anticipate and plan all the activities in time, including in the face of changing, uncertain or urgent situations.

8.2 To manage stress and frustrations in urgent, changing, inconsistent or uncertain situations.

8.3 To question and know themself: to undergo self-assessment, by analysing their successes and failures, to identify strengths and weaknesses and their personal performance in relation to the context.

8.4 To grow personally and professionally: to build a professional project in line with their own values and aspirations, to manage their motivation and involvement in bringing the project to fruition, to persevere in complex situations.

8.5 To independently identify and absorb new knowledge and skills essential for learning to understand new contexts quickly.

8.6 To commit to the lifelong learning which will allow them to grow socially and professionally.

Programme structure

This programme comprises a series of activities totalling 120 credits spread over two years worth 60 credits each. It is structured as follows :

- **core subjects programme of 40 credits** (compulsory) with the opportunity to do an internship of 40 days in a company;
- **professional focus programme** 30 credits (compulsory)
- **choice of one option course for 30 credits from four available and its complement(s) of 20 credits to choose amongst 4 possibilities.** The fifth complement called "CPME" is generalist in nature and may be taken to follow on from any option course.

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.

> Tronc commun *[en-prog-2021-bire2m-tronc_commun]*

Liste au choix de finalités BIRE2M

> Professional Focus *[en-prog-2021-bire2m-lbire200s]*

> List of electives *[en-prog-2021-bire2m-options]*

Option 4E - Pollution management

> Option 4E - Pollution management *[en-prog-2021-bire2m-lbire204o]*
> Complement to the option 4E : Pollution management *[en-prog-2021-bire2m-lbire214o]*

Option 5E - Land Use Planning

> Option 5E - Land Use Planning *[en-prog-2021-bire2m-lbire205o]*
> Option's complement 5E - Land Use Planning *[en-prog-2021-bire2m-lbire215o]*

Option 7E - Water and Soil ressources

> Option 7E- Water and Soil Resources *[en-prog-2021-bire2m-lbire207o]*
> Option's complement 7E - Water and soil resources *[en-prog-2021-bire2m-lbire217o]*

Option 10E - Data sciences

> Option 10E - Data science *[en-prog-2021-bire2m-lbire210o]*
> Option's complement - Data science *[en-prog-2021-bire2m-lbire111o]*

Option 12A - Sustainability engineering

> Option 12E : Sustainability engineering *[en-prog-2021-bire2m-lbire212o]*
> Option's complement - Sustainability engineering *[en-prog-2021-bire2m-lbire120o]*

Option 13E- Business Creation

> Business Creation (13E) *[en-prog-2021-bire2m-lbire250o]*

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

> Master [120] in Environmental Bioengineering *[en-prog-2021-bire2m-module_complementaire]*

BIRE2M Detailled programme

Programme by subject

CORE COURSES [47.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2021-2022
⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022
Activity with requisites

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

						Year 1	2
O LBIRE2200	Master thesis			27 Credits	q1+q2		x
O LBIRE2210	Master thesis' accompanying seminar	Charles Bielders Patrick Bogaert (coord.) Pierre Delmelle Caroline Vincke	30h	3 Credits	q1+q2		x

O Ethics (2 credits)

The students will opt firstly for the course LTECO2300. Two other choices are also available.

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

O Courses to be chosen for 5 credits (5 credits)

O For 10 credits : either a socio-professional internship neither an alternative program that is related to the chosen option

⊠ LBIR2004	Masters Internship		20h	10 Credits	q2		x

⊠ Alternative program of the stage for option 4E (10 credits)

⊠ Choose 7 ECTS minimum within the following courses : (7 credits)

⊠ LBIR1381	Principles of Biorefining	Damien Debecker (coord.)	30h	3 Credits	q1		x
⊠ LBRES2102	Engineering of the water and the pollutants in grounds and groundwaters	Marnik Vanclooster	22.5h +22.5h	4 Credits	q2		x
⊠ LEPL1804	Développement durable et transition	David Bol Hervé Jeanmart Patricia Luis Alconero Xavier Marichal Jean-Pierre Raskin	22.5h +15h	3 Credits	q1		x
⊠ LGCIV2073	Hydrogeology and Geoenvironment	Pierre-Yves Bolly	30h	5 Credits	q1		x
⊠ LMAPR2001A	Project "chemical & materials engineering for a sustainable future"		22.5h +30h	5 Credits	q2		x

⊠ 3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)

⊠ LBIRA2109	Agrarian systems and farm	Pierre Bertin	30h+0h	3 Credits	q1		x
⊠ LENVI2007A	Renewable energy sources		30h	3 Credits	q1		x

⊠ Alternative program of the stage for option 5E (10 credits)

⊠ 10 crédits minimum à choisir parmi les unités d'enseignement suivantes : (10 credits)

						Year 1	2
⛒ LBRES2101B	Smart technologies for environmental engineering		22.5h +15h	3 Credits	q1		x
⛒ LBRES2105	Soil erosion and conservation	Charles Bielders	22.5h +22.5h	4 Credits	q2		x
⛒ LBRES2206	Advanced Hydrology for Engineers	Mathieu Javaux	22.5h +15h	3 Credits	q1		x
⛒ LBRTE2201	Human and environmental toxicology	Cathy Debier (coord.) Philippe Hantson	30h+7.5h	4 Credits	q1		x
⛒ LBRTI2101A	Data Science in bioscience engineering		22.5h +15h	3 Credits	q1		x
⛒ LDROP2062	Urban Planning Law	Charles-Hubert Born Damien Jans	30h	5 Credits	q2		x

⛒ Alternative program of the stage for option 7E (10 credits)

⛒ LBRAT2104A	Land monitoring by advanced earth observation		22.5h +15h	3 Credits	q2		x

⛒ 3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)

⛒ LBIRA2109	Agrarian systems and farm	Pierre Bertin	30h+0h	3 Credits	q1		x
⛒ LENVI2007A	Renewable energy sources		30h	3 Credits	q1		x

⛒ 4 crédits minimum à choisir au sein de l'un des masters BIRA, BIRC, BIRE, BIRF, ENVI (4 credits)

⛒ Alternative program of the stage for option 10E (10 credits)

⛒ 3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)

⛒ LBIRA2109	Agrarian systems and farm	Pierre Bertin	30h+0h	3 Credits	q1		x
⛒ LENVI2007A	Renewable energy sources		30h	3 Credits	q1		x

⛒ 7 crédits minimum à choisir au sein de l'un des masters BIRA, BIRC, BIRE, BIRF, ENVI (7 credits)

⛒ Alternative program of the stage for option 12E (10 credits)

⛒ 10 crédits minimum à choisir au sein de l'un des masters BIRA, BIRC, BIRE, BIRF, ENVI (10 credits)

PROFESSIONAL FOCUS [30.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

Content:

Finalité spécialisée

O LBIRE2102	Applied Geomatic	Pierre Defourny	30h +22.5h	4 Credits	q1	x	
O LBIRE2104	Applied soil sciences	Yannick Agnan Pierre Delmelle (coord.)	22.5h +22.5h	4 Credits	q1	x	
O LBIRE2105	Water - soil - air quality's Evaluation	Henri Halen Philippe Maetz Xavier Rollin (coord.)	30h+0h	3 Credits	q1	x	
O LBIRE2205A	Decision tools and project management - Decision tools		22.5h +7.5h	3 Credits	q1		x

O Disciplinary project (10 credits)

O LBIRE2130	Évaluation d'impact environnemental: projet et introduction à la gestion de bases de données	Yannick Agnan Charles Bielders (coord.) Patrick Bogaert Pierre Defourny Nathalie Kruyts Guillaume Lobet Quentin Ponette	47.5h +30h	7 Credits	q2	x	
O LBIRE2131	Evaluation d'impact environnemental: diagnostic et indicateurs	Charles Bielders Pierre Defourny (coord.)	22.5h	3 Credits	q2	x	

O Statistiques - 3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)
L'étudiant·e des options 4E, 10E et 12E suit obligatoirement l'unité d'enseignement LBRTI2101A.

⊠ LBRTI2101A	Data Science in bioscience engineering		22.5h +15h	3 Credits	q1	x	
⊠ LSTAT2110A	Analyse des données		15h+7.5h	3 Credits	q1	x	

O 3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)
L'étudiant·e de l'option 12E suit obligatoirement l'unité d'enseignement LBIRA2109.

⊠ LBIRA2109	Agrarian systems and farm	Pierre Bertin	30h+0h	3 Credits	q1	x	
⊠ LENVI2007A	Renewable energy sources		30h	3 Credits	q1	x	

OPTIONS

Students in this programme have a choice of 5 options followed by a complement to the chosen option in the second year of the programme.

Students who wish to take the CPME module have to enrol in their first year of the master programme. It will be considered however as a complement to the option chosen in the first year.

Students have also the opportunity to take optionnal courses either from a suggested list or from another programme at UCL. In this case, the choice has to be validated by the Study Counsellor. Prior to that, the student must obtain an authorization from the lecturer of the course.

Option 4E - Pollution management

> Option 4E - Pollution management *[en-prog-2021-bire2m-lbire204o]*
> Complement to the option 4E : Pollution management *[en-prog-2021-bire2m-lbire214o]*

Option 5E - Land Use Planning

> Option 5E - Land Use Planning *[en-prog-2021-bire2m-lbire205o]*
> Option's complement 5E - Land Use Planning *[en-prog-2021-bire2m-lbire215o]*

Option 7E - Water and Soil ressources

> Option 7E- Water and Soil Resources *[en-prog-2021-bire2m-lbire207o]*
> Option's complement 7E - Water and soil resources *[en-prog-2021-bire2m-lbire217o]*

Option 10E - Data sciences

> Option 10E - Data science *[en-prog-2021-bire2m-lbire210o]*
> Option's complement - Data science *[en-prog-2021-bire2m-lbire111o]*

Option 12A - Sustainability engineering

> Option 12E : Sustainability engineering *[en-prog-2021-bire2m-lbire212o]*
> Option's complement - Sustainability engineering *[en-prog-2021-bire2m-lbire120o]*

Option 13E- Business Creation

> Business Creation (13E) *[en-prog-2021-bire2m-lbire250o]*

OPTION 4E - POLLUTION MANAGEMENT

OPTION 4E - POLLUTION MANAGEMENT [23.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

This option will be followed by the corresponding option complement OR by "the Business Creation".

O Content:

					Year 1	Year 2
O LBIR1346	Surface and colloid chemistry	Christine Dupont	30h	3 Credits	q2	x	
O LBRES2101B	Smart technologies for environmental engineering		22.5h +15h	3 Credits	q1	x	
O LBRES2103	Soil physics applied to Agronomy and Environment	Charles Bielders (coord.) Mathieu Javaux	30h+15h	4 Credits	q1	x	

						Year 1	2
LBRES2218A	Séminaires professionnels en gestion des ressources en eau et sol et technologies environnementales		20h+0h	2 Credits	q1		x
LBRTE2102	Integrated exercises in environmental science and technology	Patrick Gerin (coord.) Mathieu Javaux Marnik Vanclooster	45h	5 Credits	q2	x	
LBRTE2201	Human and environmental toxicology	Cathy Debier (coord.) Philippe Hantson	30h+7.5h	4 Credits	q1		x
LBRTI2101B	Data Science in bioscience engineering		30h	2 Credits	q1	x	

COMPLEMENT TO THE OPTION 4E : POLLUTION MANAGEMENT [20.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2021-2022
⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022
Activity with requisites

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

Content:

						Year 1	Year 2
O LBIRC2109	Process engineering : unit operations	Damien Debecker	52.5h +15h	5 Credits	q2	x	
O LBRES2102	Engineering of the water and the pollutants in grounds and groundwaters	Marnik Vanclooster	22.5h +22.5h	4 Credits	q2	x	

Integrated project : Option 4E (11 credits)

O LBIRE2205B	Decision tools and project management - Project Management		15h	1 Credits	q1		x
O LBIRE2231	Projet intégré en gestion de la pollution	Yannick Agnan Pierre Delmelle (coord.)	50h+10h	6 Credits	q1		x
O LBRTE2101	Applied hydro-biogeochemistry - Applied hydro-biogeochemistry	Pierre Delmelle Patrick Gerin (coord.)	30h+15h	4 Credits	q1		x

OPTION 5E - LAND USE PLANNING

OPTION 5E - LAND USE PLANNING [23.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2021-2022
⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022
Activity with requisites

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

Content:

						Year 1	Year 2
O LBIRA2105	Agricultural and rural policies		30h	3 Credits	q1	x	
O LBRAT2101	Suburban and rural space development	Pierre Defourny (coord.) Yves Hanin Marie Pairon	45h+15h	5 Credits	q1	x	
O LBRAT2103	Sociology of the actors and the rural territories	Yves Hanin	30h	3 Credits	q1	x	
O LBRAT2104A	Land monitoring by advanced earth observation		22.5h +15h	3 Credits	q2	x	
O LENVI2011	Méthodes d'évaluation et de gestion environnementale	Jean-Pierre Tack	30h	3 Credits	q2	x	
O LICAR2901A	Droit de l'espace bâti et non bâti (partie1)		25h	2 Credits	q1	x	

Courses to be chosen for 4 credits minimum (4 credits)

⊠ LBRES2105	Soil erosion and conservation	Charles Bielders	22.5h +22.5h	4 Credits	q2		x
⊠ LBRES2204	Integrated water management of water resources	François Jonard Marnik Vanclooster (coord.)	22.5h +22.5h	4 Credits	q1		x
⊠ LBRES2206	Advanced Hydrology for Engineers	Mathieu Javaux	22.5h +15h	3 Credits	q1		x
⊠ LBRTI2101A	Data Science in bioscience engineering		22.5h +15h	3 Credits	q1		x
⊠ LDROP2062	Urban Planning Law	Charles-Hubert Born Damien Jans	30h	3 Credits	q2		x

OPTION'S COMPLEMENT 5E - LAND USE PLANNING [20.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

Content:

						Year 1	Year 2
O LBIRF2106A	Management of ecological habitat and species conservation		22.5h +22.5h	4 Credits	q2	x	
O LBRAT2102	Spatial modelling of land dynamics	Pierre Defourny	15h+15h	3 Credits	q2	x	

Projet intégré en aménagement du territoire (10 credits)

O LBIRE2205B	Decision tools and project management - Project Management		15h	1 Credits	q1		x
O LBIRE2232	Projet intégré en aménagement du territoire	Pierre Defourny (coord.) Anne-Laure Jacquemart	57.5h +17.5h	7 Credits	q1		x
O LBIRF2213	Fieldtrip - Forest, natural areas and land use	Anne-Laure Jacquemart Quentin Ponette (coord.) Caroline Vincke	30h	2 Credits	q2		x

3 crédits minimum à choisir parmi les unités d'enseignement suivantes : (3 credits)

⊠ LBIRA2109	Agrarian systems and farm	Pierre Bertin	30h+0h	3 Credits	q1		x
⊠ LENVI2007A	Renewable energy sources		30h	3 Credits	q1		x

OPTION 7E - WATER AND SOIL RESSOURCES

OPTION 7E- WATER AND SOIL RESOURCES [23.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

Content:

					Year 1	Year 2
O LBRES2101B	Smart technologies for environmental engineering		22.5h +15h	3 Credits	q1	x	
O LBRES2103	Soil physics applied to Agronomy and Environment	Charles Bielders (coord.) Mathieu Javaux	30h+15h	4 Credits	q1	x	
O LBRES2104	IRRIGATION AND DRAINAGE	Mathieu Javaux	22.5h +22.5h	4 Credits	q2	x	
O LBRES2105	Soil erosion and conservation	Charles Bielders	22.5h +22.5h	4 Credits	q2	x	
O LBRES2204	Integrated water management of water resources	François Jonard Marnik Vanclooster (coord.)	22.5h +22.5h	4 Credits	q1		x
O LBRTE2101	Applied hydro-biogeochemistry - Applied hydro-biogeochemistry	Pierre Delmelle Patrick Gerin (coord.)	30h+15h	4 Credits	q1	x	

OPTION'S COMPLEMENT 7E - WATER AND SOIL RESOURCES [20.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

Content: (20 credits)

					Year 1	Year 2
O LBRES2102	Engineering of the water and the pollutants in grounds and groundwaters	Marnik Vanclooster	22.5h +22.5h	4 Credits	q2	x	
O LBRES2203	Soil management and planning in warm regions	Charles Bielders (coord.)	22.5h +7.5h	3 Credits	q2	x	
O LBRES2218	Séminaires professionnels en gestion des ressources en eau et sol et technologies environnementales + excursions	Charles Bielders Marnik Vanclooster (coord.)	22.5h +15h	3 Credits	q1+q2		x

Projet intégré en ressources en eau et sol (10 credits)

O LBIRE2205B	Decision tools and project management - Project Management		15h	1 Credits	q1		x
O LBIRE2233	Projet intégré en gestion des ressources en eau et en sol	Charles Bielders (coord.) Mathieu Javaux Marnik Vanclooster	50h+10h	6 Credits	q1		x
O LBRES2206	Advanced Hydrology for Engineers	Mathieu Javaux	22.5h +15h	3 Credits	q1		x

OPTION 10E - DATA SCIENCES [23.0]

OPTION 10E - DATA SCIENCE [23.0]

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

Content:

						Year 1	Year 2
O LBRAI2219	Systems Biology Modelling	Xavier Draye (coord.) Mathieu Javaux Guillaume Lobet	30h	3 Credits	q2	x	
O LBRAT2102	Spatial modelling of land dynamics	Pierre Defourny	15h+15h	3 Credits	q2	x	
O LBRTI2101B	Data Science in bioscience engineering		30h	2 Credits	q1	x	
O LINFO1104	Concepts des langages de programmation	Peter Van Roy	30h+30h	5 Credits	q2	x	
O LSTAT2110A	Analyse des données		15h+7.5h	3 Credits	q1	x	

Courses to be chosen for 7 credits minimum (7 credits)

						Year 1	Year 2
⊠ LBIRA2110B	Applied Econometrics		27.5h +7.5h	3 Credits	q1		x
⊠ LBRAT2104A	Land monitoring by advanced earth observation		22.5h +15h	3 Credits	q2		x
⊠ LBRAT2104B	Land monitoring by advanced earth observation - Sustainable food production monitoring		7.5h+7.5h	1 Credits	q2		x
⊠ LDATS2350	Data Mining	Robin Van Oirbeek	15h+15h	5 Credits	q2		x
⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	30h+30h	5 Credits	q1		x
⊠ LELEC2920	Communication networks	Sébastien Lugan Benoît Macq	30h+15h	5 Credits	q1		x
⊠ LINFO2172	Databases	Siegfried Nijssen	30h+30h	5 Credits	q2		x
⊠ LPHYS2162	Introduction to the physics of the climate system and its modelling	Hugues Goosse Jean-Pascal Van Ypersele De Strihou	22.5h +22.5h	5 Credits	q1		x
⊠ LINFO2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	q2		x
⊠ LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	15h+15h	4 Credits	q1		x
⊠ LSTAT2320	Design of experiment.	Patrick Bogaert Bernadette Govaerts	22.5h +7.5h	5 Credits	q2		x

OPTION'S COMPLEMENT - DATA SCIENCE [20.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2021-2022
⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022
Activity with requisites

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

						Year 1	Year 2
Content:							
O LBRTI2102	Process-based modelling in bioscience engineering	Emmanuel Hanert	30h+15h	5 Credits	q1	x	
O LINMA2472	Algorithms in data science	Vincent Blondel Jean-Charles Delvenne (coord.)	30h +22.5h	5 Credits	q1	x	
Projet intégré en Data science (10 credits)							
O LBIRE2205B	Decision tools and project management - Project Management		15h	1 Credits	q1		x
O LBIRE2234	Data Science and Sustainability Engineering projects	Patrick Bogaert (coord.) Pierre Defourny Emmanuel Hanert	50h+10h	6 Credits	q1		x
O LCOMU2600	Scientific popularisation		30h	3 Credits	q1		x

OPTION 12A - SUSTAINABILITY ENGINEERING

OPTION 12E : SUSTAINABILITY ENGINEERING [23.0]

O Mandatory
⊠ Optional
△ Courses not taught during 2021-2022
⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022
Activity with requisites

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

						Year 1	Year 2
Content:							
O LBRAI2213	Impact evaluation in agriculture	Goedele Van den Broeck	30h+8h	4 Credits	q2	x	
O LBRES2101	Smart technologies for environmental engineering	François Jonard Sébastien Lambot (coord.)	32.5h +20h	4 Credits	q1		x
O LBRTI2101B	Data Science in bioscience engineering		30h	2 Credits	q1	x	
O LENVI2007	Renewable energy sources	Emmanuel De Jaeger Patrick Gerin (coord.) Hervé Jeanmart	45h+15h	5 Credits	q1	x	
Courses to be chosen for 8 credits minimum (8 credits)							
⊠ LBIRC2109A	Génie des procédés : Opérations unitaires		30h+7.5h	3 Credits	q2	x	x
⊠ LBOE2120	Conservation de la biodiversité	Nicolas Schtickzelle	36h+12h	4 Credits	q1	x	x
⊠ LBRAT2102	Spatial modelling of land dynamics	Pierre Defourny	15h+15h	3 Credits	q2	x	x
⊠ LBRAT2104A	Land monitoring by advanced earth observation		22.5h +15h	3 Credits	q2	x	x
⊠ LBRES2204	Integrated water management of water resources	François Jonard Marnik Vanclooster (coord.)	22.5h +22.5h	4 Credits	q1	x	x
⊠ LBRTE2201	Human and environmental toxicology	Cathy Debier (coord.) Philippe Hantson	30h+7.5h	4 Credits	q1	x	x

						Year 1	2
⛒ LGEO1322	Human and economic geography 2	Marie-Laurence De Keersmaecker	22.5h +15h	3 Credits	q1	x	x
⛒ MLSMM2251	Modelling of Transport Systems	Bart Jourquin	30h	5 Credits	q1	x	x
⛒ LLSMX2001	Regenerative Economy	Yves De Rongé Emmanuel Mossay	30h	5 Credits	q1	x	x
⛒ LPHYS2162	Introduction to the physics of the climate system and its modelling	Hugues Goosse Jean-Pascal Van Ypersele De Strihou	22.5h +22.5h	5 Credits	q1	x	x

OPTION'S COMPLEMENT - SUSTAINABILITY ENGINEERING [20.0]

- O Mandatory
- △ Courses not taught during 2021-2022
- ⊕ Periodic courses taught during 2021-2022
- ⊠ Optional
- ⊘ Periodic courses not taught during 2021-2022
- Activity with requisites

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

Content:

						Year 1	Year 2
O LBRTI2102	Process-based modelling in bioscience engineering	Emmanuel Hanert	30h+15h	5 Credits	q1	x	
O LINFO2275	Data mining & decision making	Marco Saerens	30h+15h	5 Credits	q2	x	

Projet intégré pour l'option 12A (10 credits)

O LBIRE2205B	Decision tools and project management - Project Management		15h	1 Credits	q1		x
O LBIRE2234	Data Science and Sustainability Engineering projects	Patrick Bogaert (coord.) Pierre Defourny Emmanuel Hanert	50h+10h	6 Credits	q1		x
O LBIRE2235	Innovative system management for sustainability		22.5h +7.5h	3 Credits	q1		x

OPTION 13E- BUSINESS CREATION

This option complement can be taken whatever option is taken.

BUSINESS CREATION (13E) [20.0]

- O Mandatory
- △ Courses not taught during 2021-2022
- ⊕ Periodic courses taught during 2021-2022
- ⊠ Optional
- ⊘ Periodic courses not taught during 2021-2022
- Activity with requisites

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

Content:

						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	
O LCPME2003	Business plan of the creation of a company (in French)	Frank Janssen	30h+15h	5 Credits	q2	x	x
O LCPME2004	Advanced seminar on Entrepreneurship (in French)	Frank Janssen	30h+15h	5 Credits	q2	x	

Course prerequisites

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

The programme's courses and learning outcomes

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

BIRE2M - Information

Access Requirements

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

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

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

SUMMARY

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Bioengineering	Additionnal module in Environment	Direct access	
Autre Bachelier UCL du domaine des sciences et technologies		Access based on application	Le/la futur·e étudiant·e rencontrera obligatoirement le Conseiller aux études pour déterminer le programme à suivre.
Others Bachelors of the French speaking Community of Belgium			
Bachelier en sciences de l'ingénieur, orientation bioingénieur		Direct access	Enseignements supplémentaires à déterminer selon le programme suivi antérieurement (max.15 crédits). Prendre obligatoirement contact avec le Conseiller aux études.
		Access based on application	
Bachelors of the Dutch speaking Community of Belgium			
Bachelor of Science in de bio-ingenieurswetenschappen		Direct access	Enseignements supplémentaires à déterminer selon le programme suivi antérieurement (max.15 crédits). Prendre obligatoirement contact avec le Conseiller aux études.
		Access based on application	
Foreign Bachelors			
Bachelier en sciences de l'ingénieur, orientation bioingénieur		Access based on application	Sous réserve d'acceptation du dossier. Enseignements supplémentaires à déterminer selon le programme suivi antérieurement (max.60 crédits). Prendre

		obligatoirement contact avec le Conseiller aux études.
	Access based on application	

Non university Bachelors

> Find out more about links to the university

Diploma	Access	Remarks
BA en agronomie (techniques et gestion agricoles) - EPS - crédits supplémentaires entre 45 et 60 BA en agronomie (toutes orientations) - HE - crédits supplémentaires entre 45 et 60 BA en chimie (biochimie, biotechnologie, chimie appliquée) - EPS - crédits supplémentaires entre 45 et 60 BA en chimie (biochimie, biotechnologie, chimie appliquée, environnement) - HE - crédits supplémentaires entre 45 et 60	Les enseignements supplémentaires éventuels peuvent être consultés dans le module complémentaire.	Type court

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters		
Master Bioingénieur (autre finalité que sciences et technologies de l'environnement) Master en sciences biologiques Master en Biochimie et biologie moléculaire et cellulaire Master en Biologie des organismes et écologie Master en sciences chimiques Master en Sciences géographiques	Access based on application	
	Access based on application	
	Access based on application	

Access based on validation of professional experience

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

Access based on application

Admission on the basis of a submitted dossier may be granted either directly or on the condition of completing additional coursework of a maximum of 60 ECTS credits, or refused.

Admission and Enrolment Procedures for general registration

Supplementary classes

To access this Master, students must have a good command of certain subjects. If this is not the case, they must add supplementary classes at the beginning of their Master's programme in order to obtain the prerequisites for these studies.

O Mandatory	⊠ Optional
△ Courses not taught during 2021-2022	⊘ Periodic courses not taught during 2021-2022
⊕ Periodic courses taught during 2021-2022	Activity with requisites

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

O Cours passerelle pour le master en bioingénieur, orientation chimie gestion des forêts et espaces naturels ET sciences et technologies de l'environnement (44 credits)

O LANGL2480	English Communication Skills for Bioengineers	Ahmed Adrioueche Dominique François Sandrine Meirlaen Katherine Opello Charlotte Peters Adrien Pham (coord.) Anne-Julie Toubeau	30h	2 Credits	q2
O LBIR1315	Probability and statistics II	Patrick Bogaert	22.5h+22.5h	3 Credits	q1
O LBIR1325A	Transfer of fluids and energy for Bio-engineer		37.5h+22.5h	5 Credits	q1
O LBIR1325B	Transfer of fluids and energy for Bio-engineer		0h+30h	2 Credits	q2
O LBIR1328	Climatology and hydrology applied to agronomy and the environment	Charles Bielders Hugues Goosse Marnik Vanclooster (coord.)	45h+22.5h	6 Credits	q1
O LBIR1334	Introduction to forestry sciences	Quentin Ponette (coord.) Caroline Vincke	22.5h+15h	3 Credits	q2
O LBIR1336	Sciences du sol et excursions intégrées	Yannick Agnan (coord.) Richard Lambert Caroline Vincke	30h+37.5h	5 Credits	q2
O LBIR1349	Chimie analytique I	Christine Dupont (coord.) Yann Garcia	30h+15h	3 Credits	q1
O LBIR1350	General Microbiology	Jacques Mahillon	37.5h+15h	4 Credits	q2
O LBIR1351	Introduction to systems analysis	Philippe Baret	10h+20h	3 Credits	q1
O LBIR1354	Biologie des interactions	Anne-Laure Jacquemart (coord.) Anne Legrève	22.5h+15h	3 Credits	q2
O LBIR1360	Firm management and organisation	Pierre De Muelenaere	30h+7.5h	3 Credits	q1
O LBIR1362	Environmental Economics	Frédéric Gaspart	30h+7.5h	3 Credits	q2

O Cours spécifiques (11 credits)

O LBIR1260	Principles of economics	Goedele Van den Broeck	30h+15h	4 Credits	q1

O Courses to be chosen for 7 credits (7 credits)
Activités au choix libre dans l'un des programmes de bachelier du Secteur des Sciences et Technologies : https://uclouvain.be/fr/etudier/les-facultes.html
Minimum 7 credits

Teaching method

The overall structure of the programmes for the Bachelor of Science in Engineering (Bioengineering) and the Master in Bioengineering clearly reflect the

concepts of specialization, gradual choice and individualization of the courses.

1st cycle (Bachelor) :

- programme designed for the BIR students starting from Year 1
- special programme in second year for all the BIR students
- distinct programme with 30 credits for option courses in third year : three advanced subsidiary subjects available : chemistry , agronomy , environment.

2nd cycle (Master) :

- choice of four Masters in Bioengineering with a professional focus, together with a number of options which partly overlap, optional subjects (either free choice or from the lists) and a final individual dissertation.

  This overall structure gives students the opportunity to have a highly individualized programme whilst at the same time retaining both the **comprehensive nature** of the training and the foundation elements of university education : **independence, competence**, **open-mindedness and interest in research**.

The options, which partly overlap at the level of the four Masters in Bioengineering, correspond to fields of activity identified on the basis of a wide-ranging survey of graduates of the Faculty working professionally and of contacts with potential employers.

The interdisciplinarity and the integrated approach are key dimensions in the training of **bioengineers in environmental science and technology**. This is reflected by :

- availability of courses organized by other faculties ;
- grouping of training activities : combined exercises, joint project, analysis of real situations, simulations ;
- the perception, analysis, diagnosis and content of the course specifications (e.g. management, remediation and development) combine different kinds of tools (e.g. field observation, laboratory analysis, databases and information systems) and various scales in space (e.g. from the molecular to the hydrographic basin or from a region to a sub-continent) and in time ;
- teaching teams with a wide range of expertise ;
- learning how best to work in groups of students to develop a real, independent capacity for intellectual work.

Training for research. through research, which is essential for conceptual and innovative awareness and developing intellectual rigour, is reflected by different types of activities :

- producing a final dissertation and taking part in dissertation seminars ;
- participation in subject seminars providing direct contact with young researchers working in the field of environment science and land development;
- presentation of seminars by students from an outside research group or groups and the production of a dissertation.

The application of skills, knowledge and techniques that students have acquired and how they use them together is taken into account in an integrated project in environmental science and technology. This is an important learning activity supplements the dissertation which, in the view of the Faculty, remains the most important part of training for research.

Through the close connection between the teaching and research, the development of new tools and new approaches is the subject of advanced training from the beginning of the 2nd cycle and is therefore central to this Master programme. All this enables graduates of this programme to be able to make rapid use of new techniques and approaches in their early professional experience.

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".

Students are assessed according to the activities in the programme : this can take the form of written and/or oral examinations as well as individual and/or group work.

Further details about how the assessment is done can be found in the course specifications.

Possible trainings at the end of the programme

The Master in Bioengineering programme follows on directly from the Bachelor in Engineering Science : Bioengineering with an option course in Environment. Successful completion of this programme enables direct entry to other training programmes in the second and third cycles.

- **Advanced Masters** : The Advanced Masters in the filed authorized by regulations in addition to those established by the ARES-CCD
- **Doctoral programmes** : doctorates in Agronomic Sciences and Biological Engineering.

Contacts

Curriculum Management

Faculty

Structure entity	SST/AGRO
Denomination	Faculty of bioscience engineering (AGRO)
Sector	Sciences and Technology (SST)
Acronym	AGRO
Postal address	Croix du Sud 2 - bte L7.05.01 1348 Louvain-la-Neuve Tel: +32 (0) 10 47 37 19 - Fax: +32 (0) 10 47 47 45
Website	http://www.uclouvain.be/agro

Mandate(s)

- Dean : Philippe Baret
- Administrative director : Christine Denayer

Commission(s) of programme

- Commission de programme - Master Bioingénieur-Sciences agronomiques (BIRA)
- Commission de programme - Master Bioingénieur-Chimie et bioindustries (BIRC)
- Commission de programme - Master Bioingénieur-Sciences & technologies de l'environnement (BIRE)
- Commission de programme - Bachelier en sciences de l'ingénieur, orientation bioingénieur (CBIR)
- Commission de programme interfacultaire en Sciences et gestion de l'environnement (ENVI)
- Fermes universitaires de Louvain (FERM)

Academic supervisor: Charles Bielders

Jury

- Président: Charles Bielders
- Secrétaire de jury de la 2ième année de master: Quentin Ponette

Useful Contact(s)

- Information pour les étudiants par le Conseiller aux études: Eric Gaigneaux