UCLouvain

BIRE2M

2024 - 2025

BIRE2M - Introduction

Introduction

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 1 0 0 -1 0 2740185Dm [(4.4oebne, sustaandteam a set tems, -1 0 b896rmnto th1 0 0 o4.)] Tm s40185lasterbebnentinalysis

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.

				Year 1	2
⊠ LMAPR2001A	Project "chemical & materials engineering for a sustainable future"	Juray De Wilde Pascal Jacques Alain Jonas Patricia Luis Alconero Samuel Poncé	EN [q2] [22.5h+30h] [5 Credits] *> French-friendly*		x

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

⊠ LBIRA2109	Agrarian systems and farm	Guillaume Lobet	FR [q1] [30h+0h] [3 Credits] *> English-friendly*		x
⊠ LENVI2007A	Renewable energy sources	Emmanuel De Jaeger Patrick Gerin Hervé Jeanmart	EN [q1] [30h] [3 Credits] *> French-friendly*		x

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

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

⊠ LBIRA2113	Systèmes alimentaires du Futur	Marleen Abdel Massih Philippe Baret (coord.)	FR [q2] [42.5h] [5 Credits]		x
⊠ LBRES2101B	Smart technologies for environmental engineering	Sébastien Lambot	EN [q1] [22.5h+15h] [3 Credits] *> French-friendly*		

				Year 1	Year 2
⊠ LECSO2330	Economie sociale et transition écologique et sociale	Anaïs Perilleux	FR [q2] [30h] [3 Credits]		x

PROFESSIONAL FOCUS [30.0]

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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 INEO 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

				Year 1	2
LBRTE2201	Human and environmental toxicology	Cathy Debier	EN [q1] [30h+7.5h] [4 Credits] *> French-friendly*		x
LBRTI2101B	Data Science in bioscience engineering	Patrick Bogaert Emmanuel Hanert	FR [q1] [30h] [2 Credits] *> English-friendly*	x	

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

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

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Content:

				Year 1	Year 2
LBIRF2106	Analyse et gestion des habitats et des espèces	Anne-Laure Jacquemart (coord.) Marie Pairon	FR [q2] [30h+22.5h] [5 Credits]	x	
LBRAT2102	Spatial modelling of land dynamics	Pierre Defourny	EN [q2] [15h+15h] [3 Credits] > *French-friendly*	x	

Projet intégré en aménagement du territoire (10 credits)

LBIRE2205B	Decision tools and project management - Project Management	Raphaël Amory Frédéric Gaspart	EN [q1] [15h] [1 Credits] > *French-friendly*		x
LBIRE2232	Projet intégré en aménagement du territoire	Pierre Defourny (coord.) Anne-Laure Jacquemart	FR [q1] [47.5h+15.5h] [9 Credits]		x

2 crédits minimum à choisir parmi les unités d'enseignement suivantes : (2 credits)

LBIRA2109	Agrarian systems and farm	Guillaume Lobet	FR [q1] [30h+0h] [3 Credits] > *English-friendly*		

OPTION 7E- WATER AND SOIL RESOURCES [23.0]

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Content:

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

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

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
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				Year 1	2
LBIRE2233	Integrated project in water and soil resources management	Charles Bielders (coord.) Mathieu Javaux (coord.) Marnik Vanclooster	FR [q1] [40h+8h] [6 Credits]		x
LBRES2206	Advanced Hydrology for Engineers	Mathieu Javaux	EN [q1] [22.5h+15h] [3 Credits] *> French-friendly*		x

Year
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Unité d'enseignement obligatoire pour l'étudiant·e qui ne l'aurait pas créditée en Bachelier (2 credits)

LBIR1325B	Transfer of fluids and energy for Bio-engineer	Yann Bartosiewicz Quentin Goor (compensates Mathieu Javaux) Marnik Vanclooster	FR [q2] [0h+30h] [2 Credits]	x	

OPTION'S COMPLEMENT - SUSTAINABILITY ENGINEERING [20.0]

		Year 1	Year 2
LINEO2003	Plan d'affaires et étapes-clefs de la création d'entreprise		

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 higher education landscape and the academic organisation of courses.

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

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

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

SUMMARY

University Bachelors

Diploma	Special Requirements	Access	Remarks

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.