

Besluit

Equivalentie- en accreditatiebesluiten met positief eindoordeel voor 2 bachelor- en 10 masteropleidingen in de ingenieurswetenschappen aan de Katholieke Universiteit Leuven

datum	Oordeel van de accreditatieorganisatie
19 juni 2017	De Commission des Titres d'Ingénieur (CTI) heeft vastgesteld dat de volgende opleidingen in de ingenieurswetenschappen van de Katholieke Universiteit Leuven voldoen aan de generieke kwaliteitswaarborgen:
onderwerp	
Definitief Equivalentie- en accreditatiebesluiten BSc & MSc in de ingenieurswetenschappen van de Katholieke Universiteit Leuven	
bijlagen	
2	<ul style="list-style-type: none">– Bachelor of Science in de ingenieurswetenschappen (academisch gerichte bachelor) (005514);– Bachelor of Science in de ingenieurswetenschappen: architectuur (academisch gerichte bachelor) (005515);– Master of Science in de ingenieurswetenschappen: architectuur (master) (005516);– Master of Science in de ingenieurswetenschappen: biomedische technologie / Master of Science in Biomedical Engineering (master) (005517);– Master of Science in de ingenieurswetenschappen: bouwkunde (master) (005518);– Master of Science in de ingenieurswetenschappen: chemische technologie / Master of Science in Chemical Engineering (master) (005519);– Master of Science in de ingenieurswetenschappen: elektrotechniek / Master of Science in Electrical Engineering (master) (005521);– Master of Science in de ingenieurswetenschappen: energie / Master of Science in Engineering: Energy (master) (005522);– Master of Science in de ingenieurswetenschappen: materiaalkunde / Master of Science in Materials Engineering (master) (005523);– Master of Science in de ingenieurswetenschappen: werktuigkunde / Master of Science in Mechanical Engineering (master) (005524);– Master of Science in de ingenieurswetenschappen: wiskundige ingenieurstechnieken / Master of Science in Mathematical Engineering (master) (005525);– Master of Science in de nanowetenschappen, nanotechnologie en nano-engineering / Master of Science in Nanoscience, Nanotechnology and Nanoengineering (master) (005526).

De CTI-accreditatie van bovenvermelde masteropleidingen in de ingenieurswetenschappen geeft de afgestudeerden van deze opleidingen tevens het recht om de Franse titel Ingénieur diplômé te voeren (zie bijlage 1). Daarnaast krijgen deze masteropleidingen van CTI het label EUR-ACE Master.

General presentation

KU Leuven is one of the oldest universities in Europe. The research-oriented school was established in 1425 as the "Studium generale Lovaniense." In 1833, it was reformed and renamed "Katholieke Universiteit Leuven" and included a large French-speaking section. Following a political crisis, the francophone sections of Leuven split from the university in 1968 and the "Université Catholique de Louvain" was established on the new campus in Louvain-la-Neuve. "Katholieke Universiteit Leuven" later adopted the official name "KU Leuven".

During the 2014-2015 academic year, 25,220 students were enrolled in Bachelor's programmes and 18,770 students in Master's studies in KU Leuven's 15 faculties. The university has a total of 57,284 students, 19% of which are from abroad. Enrolment in the Faculty of Engineering Science (FES) stands at approximately 3,400 (2013-2014, SER). The university also has a Faculty of Science, a Faculty of Bioscience Engineering, a Faculty of Architecture and a Faculty of Engineering Technology.

This accreditation process only applies to the FES programmes:

- 2 Bachelor's programmes (180 ECTS credits): Bachelor of Engineering (1,262 students) and the Bachelor of Engineering: Architecture (315 students). The teaching language is Dutch.
- 12 Master's programmes (120 ECTS credits) with a total of 1579 students. These programmes must be primarily taught in Dutch (in compliance with Flemish Law) but may be supplemented by English options.
- 6 Master's programmes (60 ECTS credits) with a total of 254 students ("Master na Master" in Dutch), offering specialisations theoretically for students with Master of Engineering degrees, but in reality open to students with a much broader profile, in particular foreign students.

These programmes are all delivered on the main campus of Leuven (Heverlee)

The Faculty of Engineering Technology at KU Leuven offers "Masters of Industrial Engineering" degrees, which were formerly 4-year programmes offered by independent institutions throughout the country.

In comparison with the "Masters of Engineering" degrees of the FES, "Masters of Industrial Engineering" have kept their strong professionally-focussed approach with less theory. Opportunities are often provided to enable students or graduates in "Industrial Engineering" to transfer to FES programmes.

General characteristics

Like other faculties at KU Leuven, the FES manages its human and financial resources with a great degree of independence. It is made up of seven departments that are "responsible for their own research and for managing their own human resources and administration office" (SER page 5). Research is the backbone of the faculty. Teaching is a cross-cutting activity managed by education committees chaired by a programme director who relies on the human and equipment resources provided by the departments.

The general policy of the FES is to "bring the intellectual and human capital of each individual student to a higher level by offering him or her a research based education in scientific and engineering fundamentals" (SER page 3). The research based education strategy is clearly emphasised, with a bottom-approach to programme development.

Pagina 3 van 20 This approach is based on the skills of research teams and can lead to problems managing non-scientific and cross-cutting issues.

In addition to the strong focus on research, the Faculty of Engineering Science (supported by KU Leuven) is highly involved in education science and quality assurance:

- Strong emphasis is placed on student success, with several important initiatives: monitoring student pathways, staff (6 or 7 people) dedicated to individually supporting Bachelor's students, teacher training for new teachers, academic committees involving teachers and students, etc.
- Through its own initiative or in implementing the national strategies of the Flemish Interuniversity Council (VLIR) and the Accreditation Organisation of the Netherlands and Flanders (NVAO), the faculty has established a remarkable framework for implementing the "Learning outcomes" approach. The general ACQA framework defines academic competencies and methods for evaluating study programmes. The description of competencies is completely in line with the Dublin Descriptors for the three cycles of the Bologna Process, and largely consistent with the competencies in the CTI and EUR-ACE standards. The competencies for learning units and teaching methods have been mapped out for each programme.

However, coordination between this outcome-based strategy and the content-based approach described above can be improved. There is a potential imbalance in the arbitration between the portion dedicated to scientific skills required by research needs and resources, and the portion dedicated to "soft skills".

- The self-evaluation report reflects a clear culture of quality assurance. It contains the strategic objectives, a SWOT analysis for the whole institution and for each programme, references to internal surveys (KONDOR) and action plans.

General analysis

Strengths

- KU Leuven is a research-driven university, which provides a first-rate scientific environment (in terms of both staff and equipment) for engineering studies.
- With the support of the university, the Faculty has a well-defined training policy centred on student competencies, with outstanding initiatives, such as the ACQA framework for learning outcomes or the Problem-solving and Design (PS&D) approach.
- Through the bottom-up, research-driven approach to designing programmes, graduates achieve a high level of scientific competency
- The overall structure of engineering education seems coherent with the Bachelor's degree, providing a strong common basis for all students and a Major/Minor system preparing students for the Master's programmes at the end of the Bachelor's degree.
- The Self-evaluation Report and the documents provided for the visit demonstrate a good culture of quality assurance in the area of teaching.

- The Faculty relies strongly on the research departments, and therefore lacks a comprehensive view and proper management of non-scientific learning outcomes.
- The considerable independence of the programmes' departments leads to inconsistent implementation of Faculty policies (e.g. the industrial advisory boards, which is a priority action).
- There seems to be some reluctance to involve all stakeholders (society, alumni, employers) in the formal supervision of programme content and outcomes.
- The high demand for engineers in Flanders does not motivate the staff to invest deeply in the employability of graduates (such as graduate follow-up, internship policies).
- The Faculty does not take full advantage of its geographical position and international reputation for the outbound mobility of its students and to attract the best foreign students.

Risks and opportunities

- The legal framework regulating the use of languages in higher education in Flanders is a limiting factor for the international development of the Faculty.
- The staff's involvement in preparing the international accreditation deserves mention. Efforts need to be made to continue their involvement in order to achieve long-term benefits.

Evaluation synthesis per programme

Bachelors of Engineering

The Bachelor's degree has no professional orientation, but is a step in the Master's curriculum. The Bachelor's programme is therefore not eligible for the EUR-ACE accreditation. These 2 degrees constitute a 5-year integrated programme.

Bachelor en sciences de l'ingénieur: architecture - Bachelor of Science in de ingenieurswetenschappen: architectuur (VL) - Bachelor of Science in Engineering: Architecture (EN)

180 ECTS credits, taught in Dutch, 315 students (2013)

The aim of the programme is to deliver graduates through an engineering approach to architecture. The growing technical complexity of architecture requires an in-depth knowledge of basic sciences and the application of this knowledge in building technology, without neglecting humanities (history and theory of architecture) and creative skills in design. Students should therefore become familiar with three areas, all three rooted in up-to-date research: (1) in-depth knowledge of technical aspects of architecture; (2) insight into theory and history of architecture and urbanism; (3) a design approach that combines an analytical attitude and creative steps, integrating technical aspects as well as knowledge of architecture (SER, page 51).¹

¹ Here and in the following, the short descriptions of the programme are generally extracted from the Selfevaluation report

Pagina 5 van 20 To allow for the tight integration of design throughout the programme, the Bachelor of Engineering: Architecture is structured in a way that is fundamentally different from the other engineering programmes. Architectural design plays an important integrating role in each of the six semesters. Specific to our programme compared to other programmes of architecture is the focus on science and technology (SER, page 73).

Analysis (specific to the department):

- The programme is broad, well rooted in basic sciences and progressively opens up to all aspects of building throughout the curriculum, it generally corresponds roughly to equivalent programmes in other countries.
- The design studios which constitute an important part of the curriculum are run by practitioners who are part-time staff members. They have a limited amount of interaction with the full-time research-oriented academic staff.
- The department has many relations with its stakeholders, but they lack a more formal basis. The Industrial Advisory Board in particular could be activated more and networking with alumni is not systematic.
- Issues of heavy workloads and potentially related low student success rates should be fully analysed and addressed.
- Low student enrolment should be addressed by the department with actions to promote the curriculum to students in secondary education.
- Outbound international mobility needs to be promoted.
- As well as the exposure to a non-academic work environment.

Bachelor en sciences de l'ingénieur – Bachelor of Science in de ingenieurwetenschappen (VL) - Bachelor of Science in Engineering (EN)

180 ECTS credits, taught in Dutch, 1262 students (2013)

The Bachelor of Engineering programme aims to deliver engineers who are well grounded in the basics of mathematics, sciences and technology, and are trained in a multidisciplinary curriculum. This three-year programme provides students with the primary knowledge, skills and attitudes of an academic engineer. The programme contains substantial theoretical knowledge, which is positively evaluated by 91% of the students.

The multidisciplinary character is achieved through a combination of a Major and Minor in two different disciplines, after being introduced to all the options during the first three general semesters. (...). During the Bachelor's programme, students acquire basic skills that are developed further in the Master's programme, such as analytical, practical and creative skills.

They also get an introduction to the principles of business and management, and a selection of topics from the humanities, as expressed by strategic objective S2.

It is the Faculty of Engineering Science's belief that the Bachelor of Engineering can only realise its full promise and potential when combined with a subsequent Master of Science in Engineering degree. A specialisation in a specific engineering discipline is obtained in the Master's studies; knowledge, skills and attitudes are deepened with emphasis on research, development and innovation. For this reason, the Bachelor's programme is designed as part of a complete curriculum of 10 semesters (SER page 59).

Pagina 6 van 20 Analysis (specific to the programme):

- The Bachelor's programme is intended to provide a broad and high level in the basic sciences, with a Major/Minor system which prepares students for their future Master's programme
- Teaching methods are designed to improve students and help them develop innovation skills
- The Faculty provides tutorial services and student guidance, in particular to cope with the high drop-out levels during the first year.
- Little room is left for non-scientific courses, such as optional courses that students are able to choose themselves. This aspect of the learning outcomes is less managed than the scientific aspect.
- Although the programme seems too focussed on individual work (few students and lecturers' exchanges with other programmes), there is a shared culture of continuous improvement and of student care.

Masters of Engineering

Master en sciences de l'ingénieur: architecture - Master of Science in de ingenieurswetenschappen: architectuur (VL) - Master of Science in Engineering: Architecture (EN)

120 ECTS credits, taught in Dutch and English, 219 students (2013)

The aim of the programme is to deliver graduates with an engineering approach to architecture. The growing technical complexity of architecture requires an in-depth knowledge of basic sciences and the application of this knowledge in building technology, without neglecting humanities (history and theory of architecture) and creative skills in design. Students should therefore become familiar with three areas, all three rooted in up-to-date research:

- (1) in-depth knowledge of technical aspects of architecture;
- (2) insight into theory and history of architecture and urbanism;
- (3) a design approach that combines an analytical attitude and creative steps, integrating technical aspects as well as knowledge of architecture.

Master en sciences de l'ingénieur en génie civil - Master of Science in de ingenieurswetenschappen: bouwkunde (VL) - Master of Science in Civil Engineering (EN)

120 ECTS credits, taught in Dutch and English, 110 students (2013)

The aim of the Master of Civil Engineering is to train engineers with a broad knowledge on the many themes related to the built environment, and with specialised knowledge in either civil construction and hydraulic engineering, or in building physics and services. The 'Civil Construction and Hydraulic Engineering' option focusses on larger infrastructure for transport (roads, bridges, tunnels, waterways, etc.) and on infrastructure and system knowledge for water management in urban, non-urban and coastal areas. The 'Building Science and Services' option is specifically aimed at building physics and services with respect to the durability and sustainability of buildings and the comfort (thermal comfort, acoustics, etc.) and health (air quality, fire safety, etc.) of occupants (SER, page 69).

Pagina 7 van 20 Analysis (specific to the programme):

- The programme should be more proactive in formalizing its relations with its stakeholders (e.g. IAB)
- The panel pointed out that the two existing options have to undergo significant changes in order to offer up to date knowledge expected from the graduates in the job market.
- A more varied range of elective courses should be offered to students.
- Internships should be promoted as along with international mobility.

Master en sciences de l'ingénieur en génie électrique - Master of Science in de ingenieurwetenschappen: elektrotechniek (VL) - Master of Science in Electrical Engineering (EN)

120 ECTS credits, taught in Dutch and English, 149 students (2013)

The programme aims to train engineers who can design (based on fairly generally formulated needs) complex electronic circuits and systems and advanced algorithms for signal and dataprocessing in information and telecommunication systems.

In this problem-solving process, the graduate takes into account technological constraints and constraints inherent to the industrial environment, both in terms of hardware and software.

Depending on the chosen option, the graduate has an in-depth knowledge of one of the following areas: electronics and integrated circuits (with emphasis on designing electronic components and systems) or embedded systems and multimedia (with emphasis on designing applications of electronic systems). In the option 'Electronics and Integrated Circuits' (EIC), the graduate has learned to design integrated analogue, digital and high frequency circuits as well as building blocks and platforms for different applications and with the necessary knowledge of sensors, antennas and the underlying semiconductor technology. In the option 'Embedded Systems and Multimedia' (ESM), the graduate has learned to develop and evaluate applications in telecommunications, cryptography, and in audio, image and signal processing in the light of an optimal implementation (hardware / software) (SER, page 85).

Analysis (specific to the programme):

- The scientific programme with mandatory courses ensures the acquisition of scientific and technical skills
- The core courses, optional courses and optional specific courses are highly connected to high level research work from the six teams of the KU Leuven electrical department
- The English-speaking programme supports the internationalisation policy and improves the attractiveness of the school. The international student rate must be positively noted.
- Efforts are still needed to open the programme to its stakeholders and to society; the Industrial Advisory Board is almost entirely made up of alumni.
- The context and soft skills are not fully considered; they are mainly offered as optional or elective courses.

Pagina 8 van 20 Master en sciences de l'ingénieur en nanoscience, nanotechnologie et en nanogénie - Master of Science in de nanowetenschappen, nanotechnologie en nano-engineering (VL) - Master of Science in Nanoscience, Nanotechnology and Nanoengineering (EN)

120 ECTS credits, taught in Dutch and English, 160 students including the Erasmus Mundus Master (2013).

The general objective of this science, technology and engineering oriented educational programme is to provide students with the fundamental knowledge and necessary practical skills and attitudes necessary for their role as academically trained professionals in nanoscience, nanotechnology and nano-engineering, and this in a strong international context. The graduates will also be part of the important and challenging task of transforming today's nanoscience into tomorrow's nanotechnology. They will have to combine groundbreaking findings within physics, chemistry, biology, biotechnology, electronics, and material science and put them into practice in useful well-engineered products (SER, page 89).

Analysis (specific to the programme):

- This multidisciplinary programme is well established, offers a good balance between deep fundamental knowledge and a broad vision of the topic.
- The programme offers various attractive specializations.
- As pointed out by the alumni, there is a lack of opportunities to acquire real working experience during the studies. Industrial experience and the exposure to industrial issues should be developed.
- The low rate of graduates employed in the Nano technology industry should be analysed.
- The international programme is quite attractive thanks to the Erasmus Mundus label (at least until 2018), but the local programme should develop outbound mobility and intercultural activities.
- The IAB would help to define the place given to international and industrial student mobility.

Master en sciences de l'ingénieur en génie biomédical - Master of Science in de ingenieurswetenschappen: biomedische technologie (VL) - Master of Science in Biomedical Engineering (EN)

120 ECTS credits, taught in Dutch and English, 91 students (2013)

The Master of Science in Biomedical Engineering (BME) was created to respond to the increased technological needs in healthcare. These needs result, among others, from the ageing population, the challenge to provide more and better care with less people and to obtain cost-effectiveness in our healthcare system. Industry, government, hospitals and social insurance companies need engineers with specific training in the multidisciplinary field of biomedical engineering. These engineers are biomedical engineers that can integrate technological knowledge (e.g. in mechanical engineering, electrical engineering and material sciences) with medical knowledge.

The BME Master's degree aims to deliver interdisciplinary-trained biomedical engineers that can act as integrators between medical specialists and technological specialists by understanding medical needs and translating them into engineering requirements.

Pagina 9 van 20 Conversely, these biomedical engineers are able to design and produce medical devices and procedures that can effectively solve problems through their integration in clinical practice. Biomedical engineering is not to be understood as a 'light' version of engineering, rather it is state-of-the-art technology used in a medical context (SER, page 97). This Master's degree has been designed in a cooperative way between Medicine and Engineering, which makes it very relevant.

There is no major or minor at the Bachelor's level at KU Leuven leading up to this programme, which makes it difficult to attract KU Leuven's students, and could be an opportunity.

The process to recruit international students should be improved with interviews to ensure the level of the students recruited. Grants should be allocated by companies or institutions because this programme clearly fits with tomorrow's engineers and because some other European countries also have this kind of programme and could attract more students than this one.

The Faculty should keep follow-up information about the alumni.

Analysis (specific to the programme):

- The programme offers a good balance between engineering skills and medical knowledge; which is attractive for students.
- The programme provides skills strongly needed in developing countries; although some tuition fee waivers and grants from a special fund are available for students from these countries, the cost of the studies and of life remains a limiting factor.
- Quality control for international recruitment must also be improved (possibly by pooling with the other departments).
- The link with the KU Leuven Bachelor of Engineering should be improved (no Minor/Major leading to this Master).
- Follow-up of graduate employment should be organised (for example, there is no tracking of alumni getting into the industry after obtaining the Master's degree).

Master en sciences de l'ingénieur en génie énergétique - Master of Science in de ingenieurwetenschappen: energie (VL) - Master of Science in Engineering: Energy (EN)

120 ECTS credits, taught in Dutch and English, 117 students including the EIT-KIC Master (2013)

The Master of Engineering: Energy (and its Dutch variant) is organised by the Faculty of Engineering Science of KU Leuven, with the collaboration of the departments of Mechanical and Electrical Engineering. The programme aims at educating engineering students in the field of energy technology, covering a broad range of topics in electrical, mechanical, and other engineering disciplines. The programme combines an in-depth approach to the different fields with an integrative systems approach to energy engineering. It also takes into account environmental consequences, and economic and regulatory aspects. The Master in Energy programme is therefore highly multidisciplinary, with outflow possibilities to research & development, policy & management and various branches of industry (SER, page 105).

Pagina 10 van 20 Analysis (specific to the programme):

- Broad multidisciplinary programme based on the Mechanical and Electrical departments.
- Environmental issues are taken into account.
- There is a preparatory programme for Bachelor's students coming from other universities, however only taught in Dutch; international students must follow a selfstudy programme, which is not very attractive for them.
- The share of "soft skills" in the curriculum is low (7%) which does not draw remarks from the IAB
- As pointed out by the alumni, there is a lack of opportunities to acquire real working experience during the Master's programme.
- The IAB strongly emphasises the importance of international experience and mobility. In this context, they promote the shift of the classical industrial internship to an international internship.
- The programme is highly relevant to industrial and societal needs

Master en sciences de l'ingénieur en génie mécanique - Master of Science in de ingenieurswetenschappen: werktuigkunde (VL) - Master of Science in Mechanical Engineering (EN)

120 ECTS credits, taught in Dutch and English, 268 students (2013)

The Master of Mechanical Engineering is a general training programme integrating all disciplines of basic sciences, engineering and technology. An essential element of the mechanical engineering curriculum at KU Leuven is the direct training of each student in a real-life industrial or research setting (...) There are three generic options:

- (1) Manufacturing and Management: modern techniques for the design and production of discrete components, CAD and computer integration in production, management techniques, maintenance and logistics of a production company
- (2) Mechatronics and Robotics: construction, sensing, actuation and control of machinery synergies are concurrently defined and geared towards optimum integration;
- (3) Thermo-technical Sciences: physical principles and analysis, design, construction and operation of combustion engines and thermal and flow machines, cooling machines, power plants, etc.

and two application oriented options: Aerospace technology and Vehicle technology (SER, page 113)

Analysis (specific to the programme):

- The programme provides students with an excellent scientific and innovation environment, broad and dynamic networking with industry, and easy entry into the job market for graduates.
- It attracts many students which makes it complex for foreign students to be selected.
- The programme strongly relies on the research contracts of the department to maintain quantitatively and qualitatively – in terms of topics that need to be covered - the teaching assistants' workforce available for teaching, and to meet the challenges of heterogeneity and diversity of the student body.

- The creation of an IAB would allow for a more formal regular consultation procedure with industry and with alumni. It would help the programme management team define the appropriate level of student exposure to non-academic work environments and the balance between practical and theoretical skills.
- The programme should better define its policy for outbound international mobility and the recruitment of foreign students

Master en sciences de l'ingénieur en génie mathématique - Master of Science in de ingenieurwetenschappen: wiskundige ingenieurstechnieken (VL) - Master of Science in Mathematical Engineering (EN)

120 ECTS credits, taught in Dutch and English, 35 students (2013)

The Mathematical Engineering programme was created in 2007 as an 'interdepartmental programme' by the departments of Computer Science and Electrical Engineering (ESAT), and the English-language programme has been in place since 2014. The aim of the programme is to bring together advanced mathematical engineering topics based on research by the two departments. The goal is to prepare students for a multidisciplinary context, i.e., the design of solutions for technical problems in a multidisciplinary environment, where mathematics plays an important role. In particular, the focus lies on technical skills in the context of process control, numerical simulation, data mining, cryptography, and visualization.

The emphasis is not on mathematical theory but the design, analysis, implementation and use of mathematical models and algorithms in order to solve mathematical problems from industry (SER, page 129)

Analysis (specific to the programme):

- The strong assets of this programme are high scientific quality, engineering background of the recruited students, a dynamic and concerned programme management team, an efficient IAB and demand for the graduates' profile.
- In a field which is on the borderline of traditional "engineering" studies, the programme management team makes significant efforts to define an outcome profile for the graduates that better fits with professional expectations.
- The programme delivers graduates appreciated in several niches in the job market which are not fulfilled by pure mathematicians or computer scientists.
- Enrolment remains below the targeted 25 owing to the lack of the visibility of the field for potential candidates. However, the capacity for growth is limited by the reliance of the programme on the human resources of different departments.
- Many efforts remain to be made to increase the job relevance of the curriculum, to increase the students' awareness of the needs and contexts of their future careers.
- Finally, in reference to international standards, it will remain difficult (but not impossible) for this programme to cover all the graduate outcomes expected for engineers (in particular the "engineering practice").

Pagina 12 van 20 Master en sciences de l'ingénieur en génie chimique - Master of Science in de ingenieurswetenschappen: chemische technologie (VL) - Master of Science in Chemical Engineering (EN)

120 ECTS credits, taught in Dutch and English, 117 students (2013)

The Master of Chemical Engineering programme is aimed at applying chemical engineering principles to develop products and to design, control and improve industrial processes, taking into account environmental, safety and economical aspects. With a focus on process, product and plant engineering, the programme guarantees a solid classical chemical engineering background.

In addition, it focuses on modern aspects of chemical engineering such as process and product intensification, energy efficient and sustainable processing routes, biochemical processes and product-based thinking. The programme has been optimised in close contact with industrial stakeholders, represented by the Industrial Advisory Board of the Department of Chemical Engineering. The Department was the first of the Faculty of Engineering Science in establishing such an Advisory Board (founded in 2004) (SER, page 133).

Analysis (specific to the programme):

- Programme designed to respond to the strong and evolving needs of the Belgium Chemical Industry
- The department has a long-established IAB and organises initiatives to establish relationships between teachers, students and industry.
- The choice, fully endorsed by the IAB, is to focus more on a core curriculum than on options.
- It is attractive for students, although the recruitment of foreign students could be improved in quantity and in quality (selection process)
- Alumni relations should be organised on a more formal basis.

Master en sciences de l'ingénieur en génie des matériaux - Master of Science in de ingenieurswetenschappen: materiaalkunde (VL) - Master of Science in Materials Engineering (EN)

120 ECTS credits, taught in Dutch and English, 80 students (2013)

The programme aims at educating engineers who will be able to design new materials and/or processes to manufacture them, and who can make sustainable choices in materials selection problems, both in industrial and academic environment. These capabilities will be based on a thorough understanding and sovereign use of the relationships between the internal structure (crystal structure, microstructure, architecture, etc.) of materials and their properties (mechanical, electrical, chemical, etc.), and the processes that shape them (the 'materials triangle'). Materials Science is an interdisciplinary subject at the crossroads of Physics, Chemistry, Mechanics and Thermodynamics.

As an academic programme, the Master of Materials Engineering focuses on teaching the knowledgeable application of generic principles to a broad gamut of materials challenges rather than on transferring encyclopaedic knowledge on specific material families. The economic and societal context is considered both in engineering and in general interest courses. Scarcity, sustainable materials management in closed materials loops ('cradle to cradle'), life cycle analysis and recycling processes are broadly covered in both research and teaching (SER, page 137).

Pagina 13 van 20 Analysis (specific to the programme):

- The programme has been revised recently with the wide involvement of teachers, students and the IAB
- There are international mobility opportunities offered to the students with high level European universities
- More attention should be focused on soft skills and on the internship organization
- The number of students is relatively low and may weaken the programme's future.

Recommendations

For the Faculty of Engineering Science at KU Leuven:

- Draw on the work already carried out to prepare for the accreditation in order to establish the long-term culture of quality assurance within the faculty, with the involvement of all stakeholders.
- Develop learning outcome standards that serve not only to describe study programmes, but as a tool for design and continuous improvement.
- Define and implement a Faculty-wide soft skills policy that is then adapted to each programme. Recruiting cross-disciplinary human resources responsible for this aspect could be a possibility.
- Take advantage of the university's geographical position and international reputation to develop an ambitious policy for the outbound mobility of its students and to attract the best foreign students. Efforts must be made to pool resources between the various departments with the help of the University.
- Improve ties with alumni to gather their opinions on their studies and to accurately monitor graduate employment and careers.

The recommendations for each programme are as follows.

Bachelors of Engineering

Bachelor en sciences de l'ingénieur: architecture - Bachelor of Science in de ingenieurswetenschappen: architectuur (VL) - Bachelor of Science in Engineering: Architecture (EN)

- Take into account problems related to heavy student workloads and low success rates, which could be interrelated.
- Improve the position of the programme with respect to the architecture and civil engineering programmes, and
- Define an action plan to promote the programme in secondary schools to deal with low recruitment numbers.

Bachelor en sciences de l'ingénieur – Bachelor of Science in de ingenieurswetenschappen (VL) - Bachelor of Science in Engineering (EN)

- Improve organisation of the programme for non-scientific aspects and increase the time spent on them.
- Work to make the major/minor system more flexible and adapt it to changes to the range of Master's programmes.

Master en sciences de l'ingénieur: architecture - Master of Science in de ingenieurswetenschappen: architectuur (VL) - Master of Science in Engineering: Architecture (EN)

- Increase interaction between professionals involved in the programme and full-time research-focused teaching staff.
- Give the Industrial Advisory Board a more active role and encourage ties with alumni.
- Promote international mobility and the exposure of students to a non-academic environment.

Master en sciences de l'ingénieur en génie civil - Master of Science in de ingenieurswetenschappen: bouwkunde (VL) - Master of Science in Civil Engineering (EN)

- Update the programmes for the two options to correlate with the expectations of the job market.
- Organise more formal relations with stakeholders.

Master en sciences de l'ingénieur en génie électrique - Master of Science in de ingenieurswetenschappen: elektrotechniek (VL) - Master of Science in Electrical Engineering (EN)

- Open the programme up more to stakeholders and society.
- Open up the Industrial Advisory Board to people outside the alumni circle.

Master en sciences de l'ingénieur en nanoscience, nanotechnologie et en nanogénie - Master of Science in de nanowetenschappen, nanotechnologie en nano-engineering (VL) - Master of Science in Nanoscience, Nanotechnology and Nanoengineering (EN)

- Analyse graduate employment (especially in the nanotechnologies sector).
- Develop opportunities for students to acquire professional experience and be exposed to industrial problems.
- Prepare to organise study programmes in nanotechnologies at the end of the Erasmus Mundus contract.

Master en sciences de l'ingénieur en génie biomédical - Master of Science in de ingenieurswetenschappen: biomedische technologie (VL) - Master of Science in Biomedical Engineering (EN)

- Improve quality control for international recruitment.
- Organise monitoring for graduate employment.

Master en sciences de l'ingénieur en génie énergétique - Master of Science in de ingenieurswetenschappen: energie (VL) - Master of Science in Engineering: Energy (EN)

- Improve the preparation of international students online alongside what is done for Dutchspeaking students from other universities.
- Develop opportunities for students to obtain industry experience and be exposed to industrial issues.

Pagina 15 van 20 Master en sciences de l'ingénieur en génie mécanique - Master of Science in de ingenieurswetenschappen: werktuigkunde (VL) - Master of Science in Mechanical Engineering (EN)

- Quickly establish an Industrial Advisory Board to formalise the participation of stakeholders in the programme.
- Work with stakeholders to define the programme's policy in terms of exposure to the nonacademic job environment and international mobility (incoming and outgoing).
- *Improve quality control for international recruitment.*

Master en sciences de l'ingénieur en génie mathématique - Master of Science in de ingenieurswetenschappen: wiskundige ingenieurstechnieken (VL) - Master of Science in Mathematical Engineering (EN)

- Work to define outcomes for graduates that correlate better with professional expectations.
- *Raise student awareness about the needs and context of their future careers.*

Master en sciences de l'ingénieur en génie chimique - Master of Science in de ingenieurswetenschappen: chemische technologie (VL) - Master of Science in Chemical Engineering (EN)

- Improve the international recruitment process.
- Formalise relations with alumni.

Master en sciences de l'ingénieur en génie des matériaux - Master of Science in de ingenieurswetenschappen: materiaalkunde (VL) - Master of Science in Materials Engineering (EN)

- Draw attention to dropping student numbers.
- Draw attention to the organisation of soft skills in the curriculum.

Aanbevelingen

De NVAO onderschrijft alle aanbevelingen geformuleerd door deze accreditatieorganisatie.

Bevindingen NVAO

De NVAO verklaart de accreditatiebesluiten van CTI equivalent op basis van de volgende vaststellingen:

- De buitenlandse accreditatieorganisatie geeft een positieve beoordeling van de kwaliteit van de betrokken opleidingen;
- De buitenlandse accreditatiebesluiten zijn voldoende actueel;
- De buitenlandse accreditatiebesluiten zijn gebaseerd op een openbare externe beoordeling;
- De buitenlandse accreditatieorganisatie is EQAR-geregistreerd;
- De buitenlandse accreditatieorganisatie heeft een methodologische aanpak vergelijkbaar met de Vlaamse.

betreffende de Equivalentie- en accreditatiebesluiten met positief eindoordeel voor 2 bachelor- en 10 masteropleidingen in de ingenieurswetenschappen aan de Katholieke Universiteit Leuven.

De NVAO,
Na beraadslaging,
Besluit:

Met toepassing van de Codex Hoger Onderwijs, in het bijzonder de artikel II.149, besluit de NVAO accreditatie te verlenen aan de volgende opleidingen:

- Bachelor of Science in de ingenieurswetenschappen (academisch gerichte bachelor) (005514);
- Bachelor of Science in de ingenieurswetenschappen: architectuur (academisch gerichte bachelor) (005515);
- Master of Science in de ingenieurswetenschappen: architectuur (master) (005516);
- Master of Science in de ingenieurswetenschappen: biomedische technologie *Master of Science in Biomedical Engineering (master) (005517)*;
- Master of Science in de ingenieurswetenschappen: bouwkunde (master) (005518);
- Master of Science in de ingenieurswetenschappen: chemische technologie / *Master of Science in Chemical Engineering (master) (005519)*;
- Master of Science in de ingenieurswetenschappen: elektrotechniek / *Master of Science in Electrical Engineering (master) (005521)*;
- Master of Science in de ingenieurswetenschappen: energie / *Master of Science in Engineering: Energy (master) (005522)*;
- Master of Science in de ingenieurswetenschappen: materiaalkunde / *Master of Science in Materials Engineering (master) (005523)*;
- Master of Science in de ingenieurswetenschappen: werktuigkunde / *Master of Science in Mechanical Engineering (master) (005524)*;
- Master of Science in de ingenieurswetenschappen: wiskundige ingenieurstechnieken / *Master of Science in Mathematical Engineering (master) (005525)*;
- Master of Science in de nanowetenschappen, nanotechnologie en nano-engineering / *Master of Science in Nanoscience, Nanotechnology and Nanoengineering (master) (005526)*.

2 Het ontwerp van accreditatiebesluit werd aan de instelling bezorgd voor eventuele opmerkingen en bezwaren. Bij e-mail van 12 juni 2017 heeft de instelling van de gelegenheid gebruik gemaakt om te reageren. Dit heeft geleid tot enkele tekstuele aanpassingen.

Pagina 17 van 20 De accreditatie geldt, overeenkomstig de door CTI aangegeven periode van zes jaar, van 1 september 2016 tot en met 31 augustus 2022.

Den Haag, 19 juni 2017

De NVAO
Voor deze:



Marc Luwel
(bestuurder)

Naam instelling	Katholieke Universiteit Leuven
Adres instelling	Naamsestraat 22 – bus 5000 B-3000 LEUVEN
Aard instelling	ambtshalve geregistreerd
Naam associatie	Associatie KU Leuven
Naam opleidingen	<ul style="list-style-type: none"> – Bachelor of Science in de ingenieurswetenschappen (005514); – Bachelor of Science in de ingenieurswetenschappen: architectuur; – Master of Science in de ingenieurswetenschappen: architectuur (005516); – Master of Science in de ingenieurswetenschappen: biomedische technologie / Master of Science in Biomedical Engineering (005517); – Master of Science in de ingenieurswetenschappen: bouwkunde (005518); – Master of Science in de ingenieurswetenschappen: chemische technologie / Master of Science in Chemical Engineering (005519); – Master of Science in de ingenieurswetenschappen: elektrotechniek / Master of Science in Electrical Engineering (005521); – Master of Science in de ingenieurswetenschappen: energie / Master of Science in Engineering: Energy (005522); – Master of Science in de ingenieurswetenschappen: materiaalkunde / Master of Science in Materials Engineering (005523); – Master of Science in de ingenieurswetenschappen: werktuigkunde / Master of Science in Mechanical Engineering (005524); – Master of Science in de ingenieurswetenschappen: wiskundige ingenieurstechnieken / Master of Science in <i>Mathematical Engineering</i> (005525); – Master of Science in de nanowetenschappen, nanotechnologie en nanoengineering / Master of Science in Nanoscience, Nanotechnology and Nanoengineering (005526).
Niveau en oriëntatie	<ul style="list-style-type: none"> – Bachelor; – Master
Bijkomende titel	<ul style="list-style-type: none"> – Master of Science: Burgerlijk ingenieur(-architect) – Ingénieur diplômé

<p>Opleidingsvarianten: – Afstudeerrichtingen:</p> <p>– Studietraject voor werkstudenten</p>	<p>Bachelor of Science in de ingenieurwetenschappen:</p> <ul style="list-style-type: none"> – elektrotechniek; – chemische technologie; – bouwkunde; – computerwetenschappen; – geotechniek en mijnbouwkunde; – materiaalkunde; – werktuigkunde; <p>geen</p>
<p>Onderwijsstaaf</p>	<p>Nederlands met Engelstalige variant</p> <p><i>Met uitzondering van:</i></p> <ul style="list-style-type: none"> – Bachelor of Science in de ingenieurwetenschappen (005514), – Bachelor of Science in de ingenieurwetenschappen: architectuur (005515), – Master of Science in de ingenieurwetenschappen: architectuur (005516); <p>Nederlands</p>
<p>Studieomvang (in studiepunten)</p>	<ul style="list-style-type: none"> – Bachelor variant: 180 studiepunten – Master variant: 120 studiepunten
<p>Studiegebied(en)</p>	<ul style="list-style-type: none"> – Toegepaste Wetenschappen – Toegepaste biologische wetenschappen – Wetenschappen
<p>ISCED benaming studiegebied</p>	<p>05: Natural sciences, mathematics and statistics 052: Environment</p> <p>06: Information and Communication Technologies (ICTs) 061: Information and Communication Technologies (ICTs)</p> <p>07: Engineering, manufacturing and construction 071: Engineering and engineering trades 072: Manufacturing and processing 073: Architecture and construction</p>

Voorzitter:

- B. (Bernard) Remaud, CTI expert, chair;
- A. (Anne-Marie) Jolly, CTI member and co-chair;
- G. (Gabriel) Hemrist, CTI member and co-chair;

Leden:

- J. (Jean-Claude) Arditti, CTI expert;
- A. (Aris) Avdelas, CTI international expert;
- L. (Laurent) Bedat, CTI expert;
- H. (Hugo) Curto, CTI engineering student expert;
- J. (Jeanne) Duvallet, CTI member;
- D. (David) Elbaze, CTI engineering student expert;
- D. (Denis) LeMaitre, CTI expert;
- J. (Jean) Le Quenven, CTI expert;
- J. (Jean-Jacques) Maillard, CTI expert;
- S.J. (Sape J.) Mullender, CTI international expert;
- P. (Pascal) Ray, CTI member;
- W. (Wim) van den Bergh, CTI international expert.