

Purpose:

Application G: 1st application for State admission of the following 21 study programmes from 1 September 2016:

- *Bachelor en sciences de l'ingénieur – Bachelor of Science in de ingenieurswetenschappen (VL) - Bachelor of Science in Engineering (EN)*
- *Bachelor en sciences de l'ingénieur : architecture - Bachelor of Science in de ingenieurswetenschappen: architectuur (VL) - Bachelor of Science in Engineering: Architecture (EN)*
- *Master en sciences de l'ingénieur : architecture - Master of Science in de ingenieurswetenschappen: architectuur (VL) - Master of Science in Engineering: Architecture (EN)*
- *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)*
- *Master en sciences de l'ingénieur en génie civil - Master of Science in de ingenieurswetenschappen: bouwkunde (VL) - Master of Science in Civil Engineering (EN)*
- *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)*
- *Master en sciences de l'ingénieur en génie informatique - Master of Science in de ingenieurswetenschappen: computerwetenschappen (VL) - Master of Science in Engineering: Computer Science (EN)*
- *Master en sciences de l'ingénieur en génie électrique - Master of Science in de ingenieurswetenschappen: elektrotechniek (VL) - Master of Science in Electrical Engineering (EN)*
- *Master en sciences de l'ingénieur en génie énergétique - Master of Science in de ingenieurswetenschappen: energie (VL) - Master of Science in Engineering: Energy (EN)*
- *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)*
- *Master en sciences de l'ingénieur en génie mécanique - Master of Science in de ingenieurswetenschappen: werktuigkunde (VL) - Master of Science in Mechanical Engineering (EN)*
- *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)*
- *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)*
- *Master en sciences de l'ingénieur : trafic, logistique et systèmes de transport intelligents - Master of Science in ingenieurswetenschappen: verkeer, logistiek en intelligente*

transportsystemen (VL) - Master of Science in Engineering: Traffic, Logistics and Intelligent Transportation Systems (EN)

- *Master en sciences EIT-KIC : énergie - EIT-KIC Master of Science in Energy (EN)*
- *Master en sciences Erasmus Mundus en nanoscience et nanotechnologie - Erasmus Mundus Master of Science in Nanoscience and Nanotechnology (EN)*
- *Master avancé en sciences en urbanisme et planification stratégique - Advanced Master of Science in Urbanism and Strategic Planning (EN)*
- *Master avancé en sciences de l'ingénieur en génie nucléaire – Advanced Master of Science in Nuclear Engineering (EN)*
- *Master avancé en sciences de l'ingénieur en génie de la sûreté – Advanced Master of Science in Safety Engineering (EN)*
- *Master avancé en sciences en urbanisme et aménagement humain – Advanced Master of Science in Human Settlements (EN)*
- *Master avancé en sciences en conservation des monuments et des sites – Advanced Master of Science in Conservation of Monuments and Sites (EN)*

- Having regard to the French Education Code, particularly Articles L.642-7 and R642-9,
- Having regard to the request submitted by the Vice Minister-President of the Flemish Government and the Flemish Minister for Education
- Having regard to the report prepared by: Bernard REMAUD, CTI expert and panel chair, Anne-Marie JOLLY, Gabriel HENRIST, members of CTI and co-chairs Jeanne DUVALLET, Pascal RAY, members of CTI Jean-Claude ARDITTI, Laurent BEDAT, Denis LEMAITRE, Jean LE QUENVEN, Jean-Jacques MAILLARD, CTI experts Aris AVDELAS, Sape J. MULLENDER, Wim VAN DEN BERGH, international experts Hugo CURTO, David ELBAZE, engineering student experts and presented in CTI plenary session held on 13 and 14 September and 11 October 2016,

*3 Belgian universities (higher education institutions) asked to be audited by CTI in order to have their degrees recognised in France via the State admission procedure. This was their first application. These “**Master of Science in Engineering**” degrees are issued upon completion of a 5-year programme involving a 3-year general science and technology undergraduate degree followed by a 2-year specialisation resulting in the Master’s degree. The first cycle ends with the issuance of a “transitional” bachelor’s degree. 55 study programmes were examined based on the CTI R&O 2012 international standards, 2009 ESGs and EAFSG (EUR-ACE Master’s degree) standards.*

The Commission des Titres d’Ingénieur (French engineering accreditation body) adopted the following decision:

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-up approach to programme development. 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.

Weaknesses

- 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.

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 of “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 abroad¹. 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. The innovation process is very active and many start-ups have been created by the teachers.

This accreditation process only applies to the FES programmes:

- 2 Bachelor’s programmes (180 ECTS credits): Bachelor of Engineering (1262 students) and Bachelor of Engineering: Architecture (315 students). The teaching language is Dutch.
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Global 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. This approach is based on the skills of research teams and can lead to problems managing non-scientific and cross-cutting issues.

¹ Source: KU Leuven [data](#).

- 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 top 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 noteworthy 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 education.

Weaknesses

- 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, systematic exposure of students to a non-academic work environment).
- 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 ingenieurwetenschappen: 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).²

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.*

² Here and in the following, the short descriptions of the programme are generally extracted from the Self-evaluation report

- *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 ingenieurswetenschappen (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).

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)

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 ingenieurswetenschappen: 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 data processing 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.*

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 ground-breaking 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 Erasmus Mundus en nanoscience et nanotechnologie - Erasmus Mundus Master of Science in Nanoscience and Nanotechnology (EN)

120 ECTS credits, taught in English, 160 students including the Master of Nanoscience (2013)

The Erasmus Mundus programme: Nanoscience and nano-technology is a European integrated programme based on a curriculum jointly developed by four leading European universities in the field of nanoscience and nanotechnology. The programme fills the need for an education in this discipline at the European level, with a broad multidisciplinary scope which can compete with the highest excellence programmes organised outside Europe, and which attracts both students from outside Europe as well as European students with international scope. The partner universities offering the programme are: KU Leuven (Belgium), which acts as the coordinator, Chalmers Tekniska Högskola, Göteborg (Sweden), Technische Universität Dresden (Germany) and Joseph Fourier Université Grenoble (France).

The Master's programme awards a common (joint) degree to graduate students of the programme. The consortium has developed a common set of standards and mechanisms for applications, admissions, student selection, individual study programme selection, scoring and score registration, thesis guidelines, examination of the students, etc. These mechanisms, criteria and procedures are transparent to the students and are available at the consortium's website (see <http://www.emm-nano.org>) (SER, page 93).

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, all at a high scientific level thanks to the quality of the partners.*
- *The programme is quite attractive for international students and the consortium has developed strong links.*
- *This Erasmus Mundus Master's degree is recognised until 2018. What will the consortium decide to do at that time? The tuitions fees for Master's programmes will be more expensive for non-European students and the impact is difficult to anticipate.*
- *Like all Erasmus Mundus programmes, it is difficult to ascertain that all learning objectives are equally shared by all the partners.*
- *Industrial experience during the studies should be developed.*

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. 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 ingenieurswetenschappen: 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).

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 self-study 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 EIT-KIC: énergie - EIT-KIC Master of Science in Energy (EN)

120 ECTS credits, taught in English, 160 students including the Master of Eng. Energy (2013)

The Master in Energy for Smart Cities programme addresses internationally-oriented and entrepreneurial engineering students who wish to implement modern energy technologies for end-users of the electrical value chain: citizens, companies and cities. Graduates of this custom-developed programme will be truly multi-disciplinary smart city experts: well qualified to work in industry or research, or to take on policy-making roles in energy issues related to secure, sustainable urban living and working.

The Master in Energy for Smart Cities programme balances exciting technological opportunities in energy with environmental and socio-economic aspects of smart cities, such as energy efficiency in buildings, electric transportation, energy economics, smart lighting and other city services. Students receive a broad education in electrical and mechanical energy systems, allowing them to participate fully in the design and operation of advanced energy solutions. They will also learn how to construct and employ contemporary energy conversion technologies and secure energy supply in general, while taking into account overriding technical limitations, environmental consequences and economic considerations (SER, page 109).

Analysis (specific to the programme):

- *The programme is internationally and entrepreneurially oriented, with close relationships with industry in joint activities and project-based courses.*
- *This programme is unique in Belgium and plays a pioneering role in Europe. It will benefit from the creation of the New Energy Research Centre "EnergyVille".*
- *The partnerships with European universities (France, Spain, Sweden) offer students the possibility to obtain a double degree.*
- *However, the number of students is low, with a significant dropout rate. Such a potentially attractive Master's degree deserves more promotion in Belgium and abroad.*
- *A preparatory programme is available, but only taught in Dutch. International students must follow a self-study programme, which is not very attractive for them.*
- *It opens up to various career opportunities*
- *Most students get a job contract in the industry before they officially get their degree*

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:

- 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
- Mechatronics and Robotics: construction, sensing, actuation and control of machinery synergies are concurrently defined and geared towards optimum integration;
- 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: trafic, logistique et systèmes de transport intelligents - Master of Science in ingenieurswetenschappen: verkeer, logistiek en intelligente transportsystemen (VL) - Master of Science in Engineering: Traffic, Logistics and Intelligent Transportation Systems (EN)

120 ECTS credits, taught in Dutch and English, 25 students (2013)

The Master of Engineering: Traffic, Logistics and Intelligent Transportation Systems, is a relatively new Master's degree and admitted students for the first time in the 2011-2012 academic year. The programme was created to meet a societal need, i.e., the demand for engineers to solve interrelated problems in the area of traffic, mobility and logistics (etc.).

Since societal support for new transportation infrastructure is nearly non-existent, we especially need to use and manage it in a smart and efficient manner e.g. proper management techniques, technical skills, and intelligent transportations systems. In this way the programme is unique in Belgium (SER page 117).

Analysis (specific to the programme):

- *The strongest assets of this programme are high scientific quality, broad content, dynamic and committed teaching staff and management team, and demand for the graduates' profile.*
- *However, one may regret its lack of visibility and low admissions numbers.*
- *A more formal organization of relations with stakeholders (particularly with the creation of an IAB) would help the management position this programme in the broader European context on the basis of a benchmark for similar programmes*

- *A structured action plan should be set up with objectives such as the total target number of incoming students and the distribution of their backgrounds, in relation with potentially available human resources*
- *The IAB would help the management to define the appropriate balance between scientific and non-scientific skills and the place given to international and/or industrial student mobility.*

Master en sciences de l'ingénieur en génie informatique - Master of Science in de ingenieurwetenschappen: computerwetenschappen (VL) - Master of Science in Engineering: Computer Science (EN)

120 ECTS credits, taught in Dutch and English, 208 students (2013)

The programme trains engineers specialised in the field of computer science. Within the programme, central key aspects are the acquisition of expert knowledge in one or more sub-disciplines of computer science, a scientific approach towards modelling the real world, problem-solving and design, and the development of various intellectual skills (law, economy, privacy, etc.) that relate to the specific role of software engineers in society. The main objective of the programme is to teach students how to specify, design, implement, test and maintain advanced software systems. Also, it teaches how to handle complexity and how to deal with various requirements such as functionality, reliability, user friendliness, security, efficiency and cost; all major aspects in today's software design (SER, page 125).

Analysis (specific to the programme):

- *Well-balanced programme which, after a broad scientific culture, offers students six specializations linked to the active research areas of the department*
- *The programme is one of few FES programmes which have not yet established an Industrial Advisory Board. Networking with alumni needs to be established on a systematic basis.*
- *The above features seem to confirm some reluctance of the programme management team to improve the students' exposure to non-academic work environments*

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").*

Master en sciences de l'ingénieur en génie chimique - Master of Science in de ingenieurwetenschappen: 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 ingenieurwetenschappen: 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).

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.*

Advanced Masters (“Master na Master”)

These “Masters-after-Master” offer specializations in engineering education, generally to Master’s degree holders. However, they are open to holders of Master’s degrees other than engineering Master’s degrees and to holders of (foreign) Bachelor’s degrees. Therefore, at the end of these programmes, the engineering competence (ACQA, CTI reference framework, EUR-ACE standards) of all graduates is difficult to ascertain.

Master avancé en sciences en urbanisme et aménagement humain – Advanced Master of Science in Human Settlements (EN)

60 ECTS credits, taught in English, 30 students (2013)

The Master of Science in Human Settlements (MaHS) addresses rapid urbanization in the developing world and contemporary urban transformations within the scope of sustainable development. This intensive, one-year programme focuses on issues of housing, building and urban transformation in a context of development with scarce resources and pressing social and environmental constraints. Architecture, urbanism and spatial planning are the core disciplines of the programme.

Indeed, the discipline of Human Settlements emerged from concerns about the built environment in relation to the global urban development agenda of the UN formulated at the first Habitat Conference (Vancouver 1976). The programme aims to provide insight into the problems of Human Settlements as related to rapid change and to the interaction between modernity and tradition, formal and informal city-making. It also aims to strengthen capacities to tackle the growth of spontaneous settlements, the design of large scale housing projects, the development of appropriate building materials and techniques, the systematic approach to complex programmes (e.g. hospitals, schools) and the planning of neighbourhoods, villages, and towns with up-to-date techniques. Its graduates have a thorough understanding of the dynamic and multi-functional aspects of the built environment, they have the skills to devise interventions that are context-responsive and sustainable and are at ease in moving back-and-forth between academic theory and day-to-day professional practice (SER page 77).

Analysis (specific to the programme):

- *This programme is well established, relevant, has a strong rooting in research, adequate international partnerships and an excellent reputation.*
- *The actions planned are qualitatively adequate but not fully structured in an action plan with clearly defined and measurable objectives. For instance, revamping the website is just one of many well-connected actions required to reinforce the marketing culture of the staff. The targeted number of incoming students is not defined, etc.*
- *The programme should reinforce its governance, define a combined strategy and assess the resources needed to implement it.*
- *The long-term sustainability of the programme would need more support from the University; as well as extra funding at all levels, including government funding.*

**Master avancé en sciences en urbanisme et planification stratégique -
Advanced Master of Science in Urbanism and Strategic Planning (EN)**

120 ECTS credits, taught in English, 33 students (2013)

The Master of Science in Urbanism and Strategic Planning (MaUSP) is a four-semester academic programme, developing a critical understanding of contemporary conditions and challenges of both cities and urbanizing regions. It aims to cultivate innovative concepts and strategies for high-quality interventions in urban territories through design, planning, and policy-formulation. The MaUSP programme is part of the European Postgraduate Masters in Urbanism (EMU), and students can apply to attend one or two semesters abroad at one of the partner universities - UPC Barcelona, TU Delft, or IUAV Venezia - to obtain the additional degree.

The aim of the MaUSP programme is to deliver graduates who are able to work in a critical and independent way in the disciplines of urbanism and spatial planning. They are knowledgeable about urban developments in an array of different contexts, in Europe and in the world, and can address urban problems on different scales. They are familiar with design methods based upon thorough analysis of spatial phenomena, taking into account social forces and societal challenges. They are capable of intervening by way of strategic projects that are politically and economically feasible and that have structuring effects beyond their immediate impact.

Graduates are recognised in Flanders as urban planners, if they comply with certain rules pertaining to their choice of design studios and courses, thus being eligible for certain positions as public servants. The Master of Human Settlements (MaHS) and the Master of Urbanism and Strategic Planning (MaUSP) overlap and complement each other – mandatory courses and studios in one programme constitute elective courses and studios in the other. Hence graduates of MaHS (a one-year programme) can, under certain conditions, be admitted into the second year of MaUSP (SER page 81)

Analysis (specific to the programme):

- *This relatively new programme is well established, relevant, has a strong rooting in research, adequate international partnerships and an excellent reputation.*
- *The actions planned are qualitatively adequate and some of them are described in a concrete, although not quantified manner: e.g. more regular meetings of the EC, LinkedIn alumni group follow-up, more collaboration with other Masters. However, these actions are not fully structured in an action plan with clearly defined and measurable objectives.*
- *The programme should reinforce its governance, define a combined strategy in liaison with its stakeholders – teaching staff, students, other Master's degree holders,*

alumni, employers, international partners - and assess the resources needed to implement it in a structured action plan.

- *The long-term sustainability of the programme would need more support from the University; as well as extra funding at all levels, including government funding.*

Master avancé en sciences en conservation des monuments et des sites – Advanced Master of Science in Conservation of Monuments and Sites (EN)

90 ECTS credits, taught in English, 61 students (2013)

The Advanced Master's programme in Conservation in Monuments and Sites aims at educating young professionals in the conservation and restoration of immovable heritage (buildings, structures and sites), both into the tradition of the discipline and into new scientific methods. At the end of the programme, the participants will have acquired and developed sufficient knowledge in all basic fields of conservation and restoration; acquired specialised knowledge in those conservation and restoration subjects which are closest to the student's own (first) discipline; acquired the necessary common language needed for interdisciplinary communication in a restoration team or heritage management project, so as to advance professional practice and/or scientific research in the heritage preservation field.

The new programme of the Master in Conservation of Monuments and Sites started at the University of Leuven, Faculty of Engineering Science in the 2014-2015 academic year. It is a revised programme of the famous Raymond Lemaire International Centre for Conservation (RLICC) as a response to the self-evaluation process and to the advice given by the last visitation commission in 2011. The new programme maintains the international and interdisciplinary character of its Advanced Master's programme, while strengthening its major assets (SER page 101).

Analysis (specific to the programme):

- *This new programme is already well established, relevant, has a strong rooting in research, extended partnerships with international organisations and foreign universities, an efficient alumni network and an excellent reputation as a continuation of the previous programme. It is truly interdisciplinary and internationalised.*
- *With its strong assets, the main threat seems to be the limitation of resources.*
- *The actions planned are qualitatively adequate and some of them are described in a concrete, although not quantified, manner.*
- *These actions point to a possible strategic approach. However, they are not fully structured in a prioritised action plan with clearly defined and measurable objectives.*
- *The programme should reinforce its governance, define a complete and combined strategy in liaison with its stakeholders – teaching staff, students, other Masters, alumni, employers, international organisations and academic partners - and assess the resources needed to implement it in a structured action plan.*
- *The long-term sustainability of the programme would need more support from the University; as well as extra funding at all levels, including government funding.*

Master avancé en sciences de l'ingénieur en génie nucléaire – Advanced Master of Science in Nuclear Engineering (EN)

60 ECTS credits, taught in English, 9 students (2013)

The interuniversity BNEN programme is the outcome of an (...) interuniversity collaboration in a highly specific scientific & technological area and in a Belgian context. The programme Master in Nuclear Engineering is organised by a consortium of six universities and one national research centre, in alphabetical order, Katholieke Universiteit Leuven (KU Leuven), Université Catholique de Louvain (UCL), Université de Liège (ULg), Université Libre de

Bruxelles (ULB), Universiteit Gent (UGent) and Vrije Universiteit Brussel (VUB), as universities, and the Studiecentrum voor Kernenergie – Centre d'étude de l'Énergie Nucléaire (SCK•CEN), a nuclear research centre. This consortium was established in 2002 under the name Belgian Nuclear Higher Education Network (BNEN), originally with five partners as the ULB joined only in 2006.

The primary objective of the BNEN programme is to educate young engineers in nuclear engineering and its applications and to develop and maintain high-level nuclear expertise in Belgium and abroad. To be admitted to this programme, students must already hold a university degree in engineering (5-year Master) or equivalent. For students not fulfilling this requirement, special entrance considerations apply based on the specific background of each candidate. (...) The programme relies on knowledge, skills and competencies in mathematics, fluid mechanics, thermodynamics, heat transfer, general physics, chemistry and electromagnetism that were acquired in students' initial Master's programme in engineering. But clearly, the tools, knowledge and competencies acquired in previous studies are further intensively developed in the nuclear-related lectures, exercises, laboratory sessions and Master's thesis comprising the BNEN programme, as such defining the discipline-specific competencies. (SER page 121).

Analysis (specific to the programme):

- *A high academic quality programme with experts from various backgrounds (industry, research labs)*
- *A major threat to the nuclear academic programme is the changing attitude towards nuclear electricity generation by the authorities, nationally and internationally, leading to a fluctuating inflow of new students, which may lead to less involvement by the 6 university faculties.*
- *The need for a very complex organization with many partners is questionable, considering the low number of students*

Master avancé en sciences de l'ingénieur en génie de la sûreté – Advanced Master of Science in Safety Engineering (EN)

60 ECTS credits, taught in English, 36 students (2013)

Our modern society is being confronted with safety-related problems in many different areas, such as traffic and transport, logistics, consumer products, workplace and environment. At the European level there are a growing number of rules and regulations with respect to health and safety issues. Also for industry it is becoming increasingly difficult and more complex to correctly manage industrial processes due to the different aspects of safety, quality, reliability, efficiency, and technical and regulatory constraints that need to be considered.

The Master of Safety Engineering meets this existing need and growing demand for safety experts from society and from industry. To this end, the programme offers a university-level education that gives the participants a broad overview and a scientifically based understanding of professional expertise in the various fields of safety. Attention is paid to the development and acquisition of competencies that are of importance to safety: from the identification, analysis and evaluation of hazards and risks associated with products and processes, to the implementation of safety systems in an industrial context where people-related, organisational and management aspects also need to be considered. The graduates are thus well prepared to function professionally as safety officers in a work environment that is most often technical-industrial in nature (SER, page 141).

Analysis (specific to the programme):

- *Attractive programme which fills an employment niche, but needs to be further promoted to attract more students and to be more selective.*

- *The experts noted the involvement of the stakeholders in the design of the programme and the contributions of external lecturers from industry.*
- *The role of “human behaviour” as well as more real-life and hands-on exercises in safety matters should be developed in the curriculum, in particular with the support of external guest speakers.*
- *The follow-up of alumni should be improved to gain better feed-back on careers opportunities and to improve the programme.*
- *The diversity of inbound student profiles does not ensure that every graduate has acquired the outcomes expected for an engineer (CTI and EUR-ACE outcomes)*

Therefore,

Firstly, the Commission des Titres d'Ingénieur hereby issues a favourable opinion concerning the State admission of the following 10 degrees awarded by the Faculty of Engineering Science at KU Leuven (Belgium), **for a maximum period of 6 years**, from 1 September 2016:

- ***Master en sciences de l'ingénieur: architecture*** - Master of Science in de ingenieurwetenschappen: architectuur (VL) - Master of Science in Engineering: Architecture (EN)
- ***Master en sciences de l'ingénieur en génie civil*** - Master of Science in de ingenieurwetenschappen: bouwkunde (VL) - Master of Science in Civil Engineering (EN)
- ***Master en sciences de l'ingénieur en génie électrique*** - Master of Science in de ingenieurwetenschappen: elektrotechniek (VL) - Master of Science in Electrical Engineering (EN)
- ***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)
- ***Master en sciences de l'ingénieur en génie biomédical*** - Master of Science in de ingenieurwetenschappen: biomedische technologie (VL) - Master of Science in Biomedical Engineering (EN)
- ***Master en sciences de l'ingénieur en génie énergétique*** - Master of Science in de ingenieurwetenschappen: energie (VL) - Master of Science in Engineering: Energy (EN)
- ***Master en sciences de l'ingénieur en génie mécanique*** - Master of Science in de ingenieurwetenschappen: werktuigkunde (VL) - Master of Science in Mechanical Engineering (EN)
- ***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)
- ***Master en sciences de l'ingénieur en génie chimique*** - Master of Science in de ingenieurwetenschappen: chemische technologie (VL) - Master of Science in Chemical Engineering (EN)

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

This opinion is issued with the following 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.

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

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

Master en sciences de l'ingénieur en génie mécanique - Master of Science in de ingenieurwetenschappen: 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 non-academic 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 ingenieurwetenschappen: 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 ingenieurwetenschappen: 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 ingenieurwetenschappen: 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.

The institution shall prepare a **report**, due 15 September 2019, detailing how these recommendations have been taken into account.

EUR-ACE Master accreditation may be **attributed to the 10 degrees stated above**, upon the institution's request, for the same period.

Secondly, CTI is in favour of **accreditation** of the following degrees, which generally comply with evaluation standards:

Master en sciences de l'ingénieur: trafic, logistique et systèmes de transport intelligents - *Master of Science in ingenieurswetenschappen: verkeer, logistiek en intelligente transportsystemen (VL)* - *Master of Science in Engineering: Traffic, Logistics and Intelligent Transportation Systems (EN)*

Master en sciences de l'ingénieur en génie informatique - *Master of Science in de ingenieurswetenschappen: computerwetenschappen (VL)* - *Master of Science in Engineering: Computer Science (EN)*

After evaluation, CTI issues the following recommendations for these two programmes:

- ***Master en sciences de l'ingénieur: trafic, logistique et systèmes de transport intelligents*** - *Master of Science in ingenieurswetenschappen: verkeer, logistiek en intelligente transportsystemen (VL)* - *Master of Science in Engineering: Traffic, Logistics and Intelligent Transportation Systems (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 to establish a balance between scientific and non-scientific (soft) skills and to develop international mobility (incoming and outgoing)
 - Develop a structured action plan to increase student numbers.

- ***Master en sciences de l'ingénieur en génie informatique*** - *Master of Science in de ingenieurswetenschappen: computerwetenschappen (VL)* - *Master of Science in Engineering: Computer Science (EN)*
 - Quickly develop a structured action plan for involving stakeholders and the Industrial Advisory Board in the development and implementation of a policy to expose students to a non-academic job environment
 - In general, open up specialisations to subjects that are not solely related to research.

CTI may re-examine the request for State admission of these two master's degrees in 3 years, based on the changes made in response to CTI recommendations.

EUR-ACE Master accreditation may be **attributed to these 2 degrees**, upon the institution's request, for a period of 6 years, from 1 September 2016.

Thirdly, CTI evaluated the two "Transitional Bachelor" programmes and determined that they are compliant with evaluation standards. These degrees do not qualify for State admission or a EUR-ACE Master accreditation.

After evaluation, CTI issues the following recommendations for these two programmes:

- ***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 ingenieurwetenschappen (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.

Fourthly, CTI examined master's programmes that do not qualify for State admission due to the fact that they are specific one or two year programmes. Like other master's degrees, CTI examined these master's programmes based on ESG 2009 and EAFSG (EUR-ACE Master) standards.

The *Commission des Titres d'Ingénieur* hereby issues a **favourable opinion concerning attribution of EUR-ACE Master accreditation** to the following 3 degrees awarded by the Faculty of Engineering Science at KU Leuven (Belgium), **for a period of 6 years, from 1 September 2016:**

- **Master en sciences Erasmus Mundus en nanoscience et nanotechnologie - Erasmus Mundus Master of Science in Nanoscience and Nanotechnology (EN)**
- **Master en sciences EIT-KIC: énergie - EIT-KIC Master of Science in Energy (EN)**
- **Master avancé en sciences de l'ingénieur en génie nucléaire – Advanced Master of Science in Nuclear Engineering (EN)**

EUR-ACE Master accreditation may be attributed to the 3 degrees stated above, upon the institution's request.

EUR-ACE Master accreditation is not attributed to the following degrees due to the fact that they are not engineering programmes or because of their research focus:

- **Master avancé en sciences en urbanisme et aménagement humain – Advanced Master of Science in Human Settlements (EN)**
- **Master avancé en sciences en urbanisme et planification stratégique - Advanced Master of Science in Urbanism and Strategic Planning (EN)**
- **Master avancé en sciences de l'ingénieur en génie de la sûreté – Advanced Master of Science in Safety Engineering (EN)**
- **Master avancé en sciences en conservation des monuments et des sites – Advanced Master of Science in Conservation of Monuments and Sites (EN)**

This opinion will be forwarded to the French Ministry of Higher Education and Research, which will make a decision regarding the applications for State admission.

The list of all accredited French or foreign degrees accepted by the State is published each year in the Official Journal of the French Republic. If applicable, these degrees may be included on the list for the years indicated.

Graduates awarded these degrees during the period covered by the State admission will be authorised to carry the French engineering graduate title.

Discussed during plenary sessions held on 13 and 14 September and 11 October 2016

Approved during the plenary session held on 8 November 2016

The President
Laurent MAHIEU

A handwritten signature in blue ink, appearing to read 'L. Mahieu', with a horizontal line drawn through the middle of the signature.