KU LEUVEN

BLUEPRINT

Master of Electromechanical Engineering Technology

Faculty of Engineering Technology

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FACULTY OF ENGINEERING TECHNOLOGY
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Blueprint Master of Electromechanical Engineering Technology

Part 1: The programme's profile and vision on education

1A Objectives

The Master programme of Electromechanical Engineering Technology (ET) is an **advanced programme with an academic orientation**. The master's programme primarily elaborates on the multidisciplinary Bachelor programme of ET. Whereas the bachelor's programme is characterized by a broad scientific and technological training, the master's programme brings students to an advanced level of knowledge and skills in the chosen domain of expertise.

The **final profile** of the master degree holder in ET is an **academic, technically capable and implementation-oriented engineer** who may employ the professional title of engineering technologist (Ing., short for 'industrieel ingenieur' in Dutch). For the master in Electromechanical ET in particular these are engineering technologists with expertise in the full design and development cycle (including choice of materials, machine building, drive systems and manufacturing techniques), or in automation and mechatronics (including control theory, applied electronics, artificial intelligence and Industry 4.0), in diverse settings: in production processes, robotics, automotive and aeronautical engineering, logistics and biomedical technology, ... The programme aims to deliver engineers for the future: with a critical mind, with creative ideas and a taste for innovative development, with attention to sustainability and societal impact.

The **learning outcomes and educational aims** of the Master of Electromechanical Engineering Technology are *(Figure 1)*:

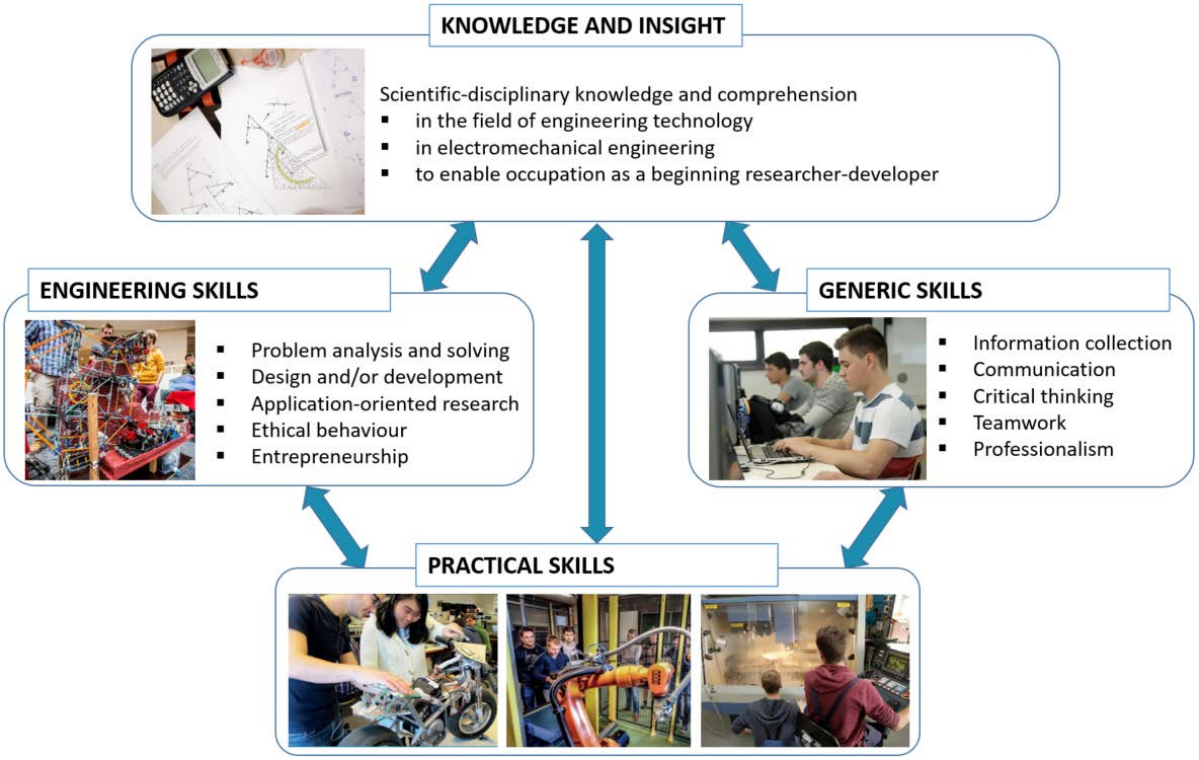

Figure 1: Overview of the programme's learning objectives.

Additional information about the learning outcomes and educational aims: https://iiw.kuleuven.be/personeel/ects/handleiding/leerresultaten (in Dutch).

1B Context

The Faculty of Engineering Technology (FET) is part of the Science, Engineering and Technology Group at KU Leuven and unites **multiple campuses** throughout Flanders.

The Master of Electromechanical ET is organized in Dutch at Bruges Campus, De Nayer Campus, Diepenbeek Campus[1], Geel Campus, Group T Campus and Ghent Technology Campus[2] *(Figure 2)*. Alternatively, students can follow the full trajectory in English at Group T Leuven Campus.

[1] The programme at Diepenbeek Campus is a mutual programme of KU Leuven and the university of Hasselt (UHasselt). It is a distinct programme by decree operating under the quality assurance system of UHasselt. Therefore the programme will not be discussed in detail in this blueprint.

[2] Students can moreover follow the first semesters at Aalst Campus and subsequently transfer to a campus of their choice for the remainder of the bachelor's programme.

Figure 2: Campuses within FET organizing the Master of Electromechanical Engineering Technology.

The regional positioning and intensive collaboration within the Faculty of Engineering Technology provide students with the opportunity to pursue quality education in their own region, as well as to broaden their horizons and to specialize in a domain that is not present on their starting campus. For example, within the multi-campus model, students can choose to follow their master's programme at a different campus upon obtaining the bachelor's degree, so as to achieve a better fit between the campus's research focus and their own interests and ambitions.

The organisation, planning and follow-up of programmes fall under the authority of programme committees:

- At **each campus**, there is a teaching committee (OC) for the common core of the bachelor's programme and one for each subsequent specialisation in electromechanical, energy and polymer processing engineering. All colleagues involved in teaching the OC's courses are members of this committee as well as student representatives, and the committee is chaired by the programme coordinator. The OC implements the vision on education; takes care of organizing the programme; provides opportunities to strengthen the programme's profile through master's theses and regional networking with the professional field; takes own initiatives and follows the guidelines of the POC as well as those resulting from the quality assurance system; and reports to and advises the POC.

- The overarching **programme committees (POC) Electromechanics-Polymer Processing and Energy** brings together the relevant programme coordinators of all campuses as well as student representatives, and is chaired by a programme director. The POC designs the educational framework, the programme content and the didactical approach, based on the advice of the OCs and of the fPOC; follows up on the initiatives of the OCs and fPOC as well as the results of the quality management system; and reports to and advises the fPOC.

1C Educational vision

The programme is designed based on the guiding principles described in KU Leuven's vision statement on education (http://www.kuleuven.be/english/education/policy/vision-and-policy-plan) and in FET's mission statement (https://iiw.kuleuven.be/overfiiw/missie-en-onderwijsvisie – in Dutch).

In particular, the programme aims to provide a **broad scientific-technological training and specialisation in a chosen domain,** combined with attention to communication, management and entrepreneurship. The programme is distinctly **application-oriented**, which distinguishes the programme from other engineering and science programmes. This is apparent in the blend of learning formats combining lectures, exercises, lab sessions and project work. Likewise, reflection on practical applications is stimulated through guest lectures, company visits, project work in collaboration with companies, and in the application-oriented research conducted at each campus.

In addition, students develop research skills through **integrated lab sessions** and application-oriented **project work** with authentic research questions and business cases. These formats train students to explore and design applications and at the same time help them to develop professional competencies (e.g. critical reflection, working in a team, communicating). This way students gain a better understanding of their own strengths, weaknesses and ambitions.

1D Student profile

The Master of Electromechanical ET is aimed at students who have completed the **Bachelor of ET with specialization in electromechanical engineering and a relevant option**. Additionally, students from professional bachelor's degrees such as automotive technology, electromechanics, design and production technology, or marine engineering can apply after successful completion of a bridging trajectory.

1E Career perspectives

Most engineering technologists opt for a career in the private sector, ranging from small not-for-profit associations and medium businesses to multinationals, in (non-)profit organisations or in governmental institutions. Alumni end up in a **wide variety of sectors**, from automotive to chemical industry and from construction to manufacturing.

The **positions** they have are equally diverse. Examples for electromechanical engineers include typical scientific-technical functions[3] such as designer of machines and vehicles, process or quality engineer, safety engineer or maintenance engineer. Engineering technologists are also active in management

[3] These scientific-technical functions correspond to what is denoted in scientific literature with 'operational excellence', 'customer intimacy' and 'product leadership'.

positions, consultancy, as supervisor, as CEO, in policy preparation and boards of directors, in customer relationship management, and in research and education institutions.

Some alumni opt for further specialisation by means of an **advanced programme** or a **PhD**.

Part 2: Implementation

2A Structure of the programme

The **model route** leading to a degree in engineering technology encompasses a three-year bachelor's programme followed by one year master's programme *(Figure 3)*.

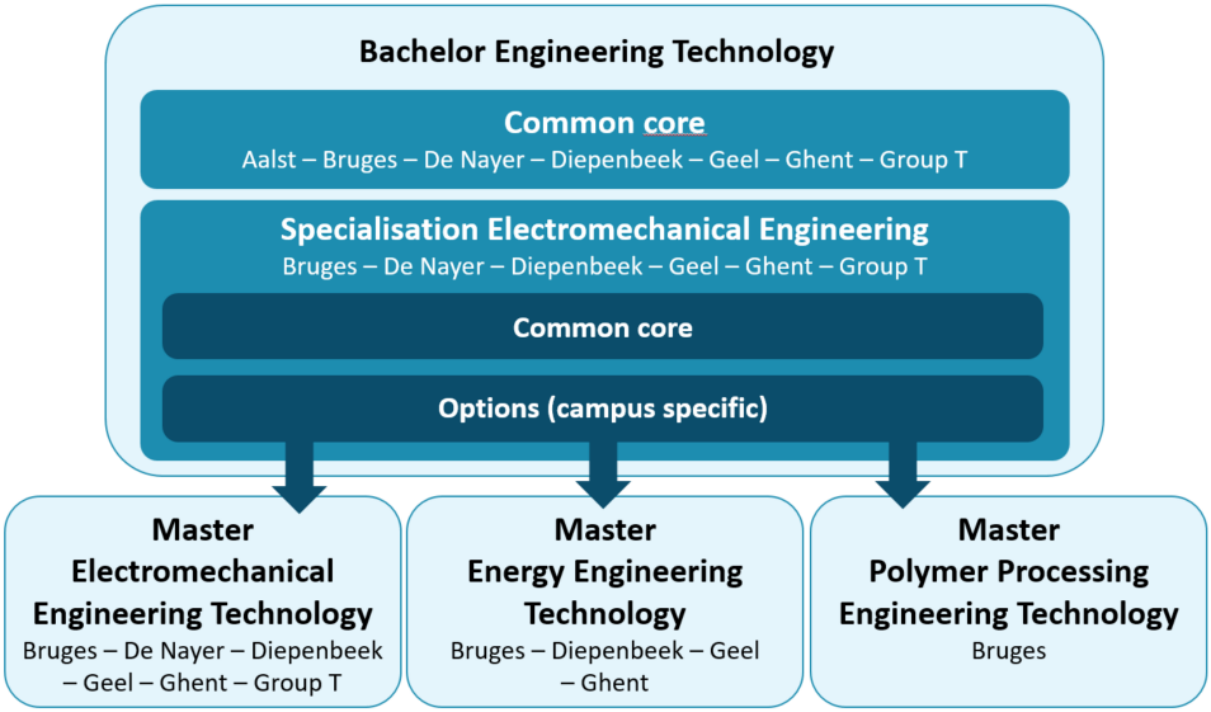

Figure 3: Structure of the programme.

The Master of Electromechanical Engineering Technology consists of 60 ECTS credits and provides **in-depth disciplinary specialization**. It is structured according to **five disciplinary learning tracks**:

1. 'Automation & applied electronics' includes control theory supported by measuring systems and instrumentation, applied electronics and ICT.
2. 'Electrotechnics' consists of all aspects of electric energy management: from the production to transport and distribution to application and transformation of electrical energy, including electrical propulsion.
3. 'Manufacturing techniques & materials science' deals with diverse manufacturing techniques, quality control and the relationship between geometrical design and execution. The students moreover learn to select optimal materials based on mechanical properties and sustainability.
4. 'Applied thermodynamics' treats technological applications of thermodynamics and fluid mechanics such as pumps, fans, compressors, heat transfer, heat exchange units, air treatment

(HVAC: Heating, Ventilating, Air Conditioning), and combustion machines (burners, combustion motors and turbines).

5. 'Mechanical design' teaches students to design a mechanical system, using common design rules and techniques, to represent the design as a graphical prototype, and to correctly select and dimension the related mechanical components.

The last but equally important building block of the programme is the **general learning tracks**. The courses making up these tracks provide students with the necessary generic skills to be able to function in a variety of roles and contexts, with broad responsibilities. We distinguish three tracks within the programme: the engineer in society, the engineer as a researcher/developer, and the engineer as an entrepreneur. In addition to broadening topics such as economics, business policy, presentation and communication techniques, and philosophy and research methodology, they include courses with interdisciplinary assignments or project work.

Programme reforms 'ING2020'

This blueprint describes the programme in academic year 2019-2020. As of 2020-2021 a thoroughly redesigned engineering curriculum will gradually be implemented so as to continue to deliver a distinctive and attractive engineering profile in the future. The profile of the bachelor programme and its progression track to other programmes are retained, yet new accents and learning trajectories will be integrated, in anticipation of developments in technology, economy and society. This marks the beginning of a reform towards engineering technologists new style graduating as of academic year 2023-2024. Additional information is available in the brochures and at http://iiw.kuleuven.be.

Studying abroad

In addition to Erasmus+ student exchanges, the programmes offer several opportunities to add an international dimension through scholarships, internships and research projects linked to the master's theses. More information: www.iiw.kuleuven.be/studenten/buitenland (in Dutch)

Higher distance education and flexible tracks

Ghent Technology Campus also offers students the possibility to follow the bridging and master's programme by means of **higher distance education**. This makes it easier for them to combine work, family and studies thanks to the concept of guided individual learning. These students join the regular students on campus for the laboratory practices and examinations, while all other teaching activities are replaced by self-study with the necessary guidance, in interaction with fellow students and lecturers through the online learning platform Toledo. The master's thesis, lastly, can be effected at the student's own work place under certain conditions. The bridging and master's programme, combined consisting of 120 ECTS credits, can be spread over several years, depending on the desired time to obtain the degree and the possible study load. More information: http://iiw.kuleuven.be/hogerafstandsonderwijs (in Dutch)

At other campuses at well, adjusted arrangements are possible to help students to combine work and studies, by allowing students to study the theory at their own pace or by providing alternative assignments for certain laboratory practicals.

2B Teaching formats

The application-oriented focus of the master's programme in ET is reflected in its **teaching formats**. The programme has fine-tuned the standard learning formats defined within the university to create the best possible fit with its learning objectives:

- Lecture: lectures (including activating and interactive formats), guest lectures
- Practical: lab sessions, exercise sessions, computer exercises
- Assignment: individual assignments, group assignments, design assignments, project work
- Field trip: company visits
- Master's thesis: master's thesis in collaboration with the professional field or a research unit

Learning formats are often combined within one and the same course, for example to illustrate theoretical concepts with potential applications or to gather new insights based on authentic cases.

The **master's thesis** is the culmination of the study programme. It is a research project that is grafted to application-oriented research and relates to the chosen specialization. The master's thesis can take place both within an academic environment and within the future professional field, focusing in both cases on the relevance for the professional field as well as the scientific approach. Various processes related to automation, mechanical design, electrotechnics, materials, mechanical production, applied thermodynamics or optimisation of business processes can be the topic of the master's thesis.

2C Assessment and feedback

The programme uses **several assessment formats** to achieve the best possible fit with each course's learning objectives.

Continuous assessment during the academic year can take various forms. On the one hand, students are assessed on their approach for assignments (process evaluation), for example based on a logbook, portfolio, pilot run, research methodology, collaboration during contact moments, or participation in

group work. On the other hand, assessments look at output (product evaluation), for example based on a report, paper, presentation or poster. Some courses use formative or summative peer assessment by fellow students.

Feedback is considered an essential part of the learning process. Students are split up into smaller groups for lab sessions, exercises and projects, allowing lecturers to assist them more closely in their learning process. The feedback given on lab reports, exercises, project work, tests, designs or presentations helps students to gain insight in their strengths and weaknesses. At some campuses, students present their project work to a broad external audience and in this way gain feedback from third parties. In addition, lecturers encourage questions from students. The open interaction between students and lecturers is a strong asset to the programme.

During the exam periods, students are assessed by means of a written and / or oral **exam**. Most examinations consist of open questions, sometimes combined with closed or multiple choice questions. Students can look into the exam after it has been graded and can discuss their grades with the lecturer.

The assessment of the **master's thesis** is based on an evaluation matrix used by all master's programmes and campuses of FET. The assessment is based on three components: the process, the paper and scientific abstract, and the presentation and jury defence. Each of the components is evaluated with regard to 'form' and 'content and product'. The procedures for the assessment of the master's thesis are described in detail in the faculty supplement to the Regulations on Education and Examinations.

2D Student support

FET opts for a structured offer of **study and student guidance at each campus**, supplemented with student support on demand. Students are encouraged to make use of these services, but the responsibility to do so is their own.

During each phase of the program, students are free to ask lecturers and assistants questions about subject matter. Personal **assistance by the lecturer** is possible during contact hours thanks to the small group sizes for practical sessions.

The campuses further provide **student support** on topics such as fear of failure and study planning, in collaboration with the student support and social services on campus. Students with a disability can contact the campus care coordinator. Academic advisers counsel students on their ISP's (Individual Study Program), applying tolerances, recognition of prior learning and prior qualifications, learning account, switching between campuses, etc.

Finally, for issues relating to teaching or examinations, students can seek help from an **ombudsperson**.