# Master in industrial engineering: health engineering

# Academic year 2021-2022

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## 1. Identification of the training

| | |
|---|---|
| Grade | Master in industrial engineering |
| Orientation | Health engineering |
| Cycle | 2d cycle |
| Grade | Master |
| ECTS credits | 120 |
| Level | Initial training |
| Organisation | On campus |

## 2. Specificities of the training in industrial engineering

The ECAM training in industrial engineering aims first to give students a solid scientific and technical basis oriented towards a particular professional sector, and second to develop the following values and soft skills:

- Capacity for analysis and critical thinking
- Autonomy and responsibility
- Taking into account and respecting the constraints related to economic, normative and legal, human and environmental aspects
- Ability to adapt and update knowledge
- Respect for people and teamwork
- Ability to communicate
- Ability to organize and manage time

This training in industrial engineering allows students to acquire this knowledge and skills through various educational activities combining theory and practice (theoretical courses, exercise sessions, laboratories, design offices and projects, integration situations, internships, graduation work).

In particular, the training in industrial engineering enables students, as future engineers, to acquire skills and knowledge that are job-oriented and specific to one of the specialisations organized within the institution: electromechanics, automation, civil engineering, surveying, IT, electronics, health

engineering. Additionally, a transversal training base, common to the various specialisations, as well as numerous exchange partnerships abroad, give a versatile international character to the future ECAM engineers.

## 3. Specificities of the orientation in health engineering

The medical technology sector is one of the fastest growing sectors. An increasing number of technologies and applications of medical equipment and devices, as well as the medical needs of an aging population, will require the services of engineers specializing in health technologies.

Companies (SMEs as well as large companies) employing engineers in the health sector are active in many fields such as the design and manufacture of medical devices, the pharmaceutical industry, health consulting and auditing, installation and maintenance of medical equipment, IT engineering, research and development, the hospital function (public or private) as well as the public service (regulations, reimbursement, etc.). The jobs of the engineer specializing in the health sector are numerous: R&D, design, production, maintenance, project management, consulting, regulatory affairs, quality, application, technical sales, clinical, hospital, information systems, instrumentation / electronics / IT / embedded systems, etc.

Based on consultations with the main professional actors from the health sector, the ECAM training in health engineering is positioned in addition to the training in biomedical engineers and bioengineers provided by universities. With a unique educational approach, specific to high education, concrete and pragmatic, in close connection with current socio-professional needs, the new ECAM training in health engineering aims to develop a profile of engineers capable of investing at the interface between all stakeholders in the world of health care: clinicians, patients, authorities, as well as manufacturers and researchers, including biomedical engineers and bioengineers active in the health sector.

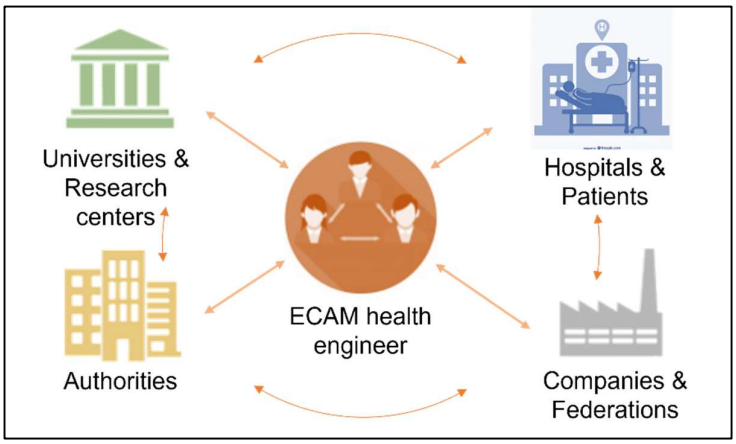


**Figure**: The ECAM engineer in health engineering will be capable of investing at the interface between all stakeholders in the world of health care

The consultations with the main professional actors from the health sector make it possible to define the problematic, emblematic and specific professional situations that the future ECAM engineer in health engineering must be able to manage effectively, and to identify the key skills areas that this engineer in health engineering must master when entering the professional world. As a result, the future ECAM engineer in health engineering meets a socio-economic need. It must be versatile and its assets within the socio-professional world can be defined in three axes.

**Table**: Assets of the ECAM engineer in health engineering within the socio-professional world

| Assets of the ECAM engineer in health engineering within the socio-professional world | |
|---|---|
| **Axis 1 – Knowledge** | Combined knowledge of engineering techniques, project management tools, regulatory framework and economic aspects for a better definition of user needs, better support for health professionals, integrated design of innovative technologies, objective evaluation of project results, decision-making support, efficient search for financial and logistical resources, etc. |
| **Axis 2 – Know-how** | Ability to work, operate and communicate according to collaborative, transversal and multidisciplinary approaches with the various stakeholders in the world of health care (engineers, clinicians, patients, industrials, authorities, etc.) in order to implement effective processes of innovation, creation and entrepreneurship. |
| **Axis 3 – Interpersonal skills** | Continuous motivation to improve the quality of health care, the clinical effectiveness of treatments and patient safety while respecting human, economic, environmental, ethical values and safety rules, and with a concern for continuous, personal and professional development. |

The ECAM training in health engineering is co-organized with ULB (Université Libre de Bruxelles), which also has extensive experience and a competent academic body in the disciplines taught. The collaboration between ECAM and ULB facilitates the obtaining of internship locations, the organization of graduation works, the development of shared research projects, the pooling of laboratory equipment, etc. Students also benefit from the research collaborations of industrial as well as clinical partners, especially with the Saint-Luc and Erasme University Hospitals in Brussels. Finally, the international aspect of the socio-professional networks of ECAM and ULB as well as their desire to jointly develop research activities contribute to the international recruitment of future industrial engineers in health engineering.

## 4. Learning outcomes

The learning outcomes of the training in health engineering define what students will actually be able to demonstrate as abilities on their own at the end of their training. Indeed, the main function of the industrial engineer in health engineering consists in solving problems related to the design, production, implementation and evaluation of products, systems or services relative to the medical technology sector. The engineer in health engineering is required to organize and manage the work of his teams in order to complete a medical technology development project taking into account the defined needs and objectives, the allocated resources, the deadlines and economic and legal constraints. He must be able to take important decisions quickly and to make strategic and ethical choices. To do this, he must have a body of scientific, technical, economic, social and human knowledge based on a broad scientific (life sciences) and technological (engineering techniques) culture. He must keep aware of the various scientific and technological advances. It also takes into account concerns for the protection of human, life and the environment, and more generally collective well-being.

**Table**: Learning outcomes of the ECAM training in health engineering

| **Learning outcomes (LO) of the ECAM training in health engineering** | |
|---|---|
| At the end of the ECAM training in health engineering, students will be able to: | |
| • Use the methods, techniques and tools of modern engineering to develop (design, prototype, size and test) a new health technology that meets the specified needs and taking into account the risks related to safety, regulatory aspects and economic, environmental and social impacts.<br>• Use the methods, techniques and tools of functional analysis to determine the technological needs of an institution active in the health sector (company, laboratory, hospital, authority, public organization) and formulate development or improvement strategies in their research and development or production activities, marketing, quality management. | LO 1<br>**« Design and development of health technologies within a regulated framework »** |
| • Apply the methods, techniques and tools related to the deployment of an existing technology within a healthcare institution: selection, purchase, installation and maintenance of the technology, user training, evaluation of the technology and processes, clinical and technical support. | LO 2<br>**« Integration of health technologies within a healthcare institution »** |
| • Apply the methods, techniques and tools of scientific research to an applied research project or the development of a new health technology: documentary research, formulation of hypotheses, carrying out experiments, analysis of results, formulation of conclusions . | LO 3<br>**« Applied research - experimental and clinical investigation »** |
| • Use the methods, techniques and tools of written and oral communication to interact with health specialists or non-specialists: writing technical reports (design, test, research, etc.), presentation of technical or popularized oral presentations. | LO 4<br>**« Written and oral communication »** |
| • Act as active partners with various members of a multidisciplinary team or other network players (customers, employees, manufacturers, suppliers, etc.) within the framework of the engineer role assigned to them (project manager, R&D, regulatory affairs, quality, marketing, purchasing, clinical investigations, IP). | LO 5<br>**« Autonomous and team work »** |
| • Evaluate their own strengths and weaknesses with a view to maintaining and updating their knowledge and skills in the field of health technologies, in particular through the definition of new training needs. | LO 6<br>**« Self-assessment of skills »** |

## 5. Content of the training

The ECAM training in health engineering is divided into three areas: tools and techniques in health engineering, industry culture, and practical training (projects, internships, graduation work…).

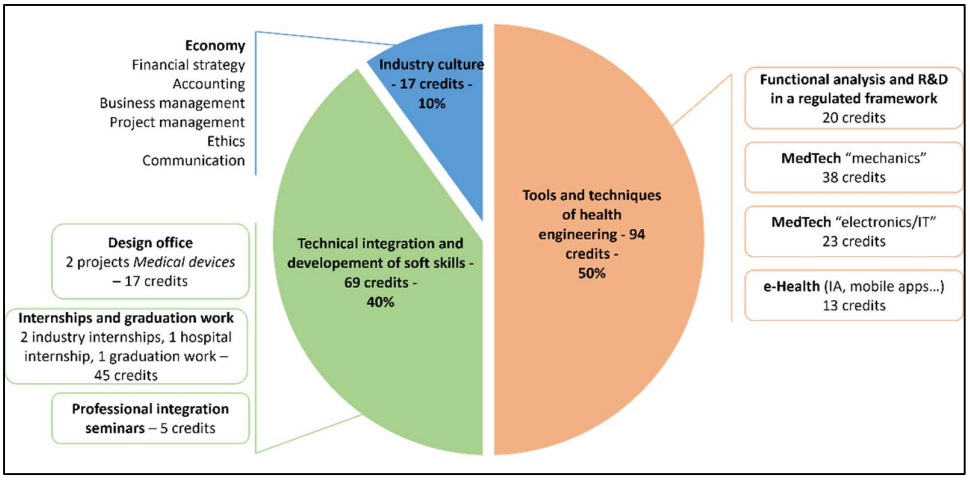


**Figure**: Content of the ECAM training in health engineering

## 6. Training program

The ECAM training in health engineering takes place over two years and consists of a structured set of teaching units corresponding to the three training areas presented in the previous figure. To this is added upstream the Bachelor in Industrial Sciences, pre-orientation in health training, taking place over three years and also consisting of a structured set of teaching units.

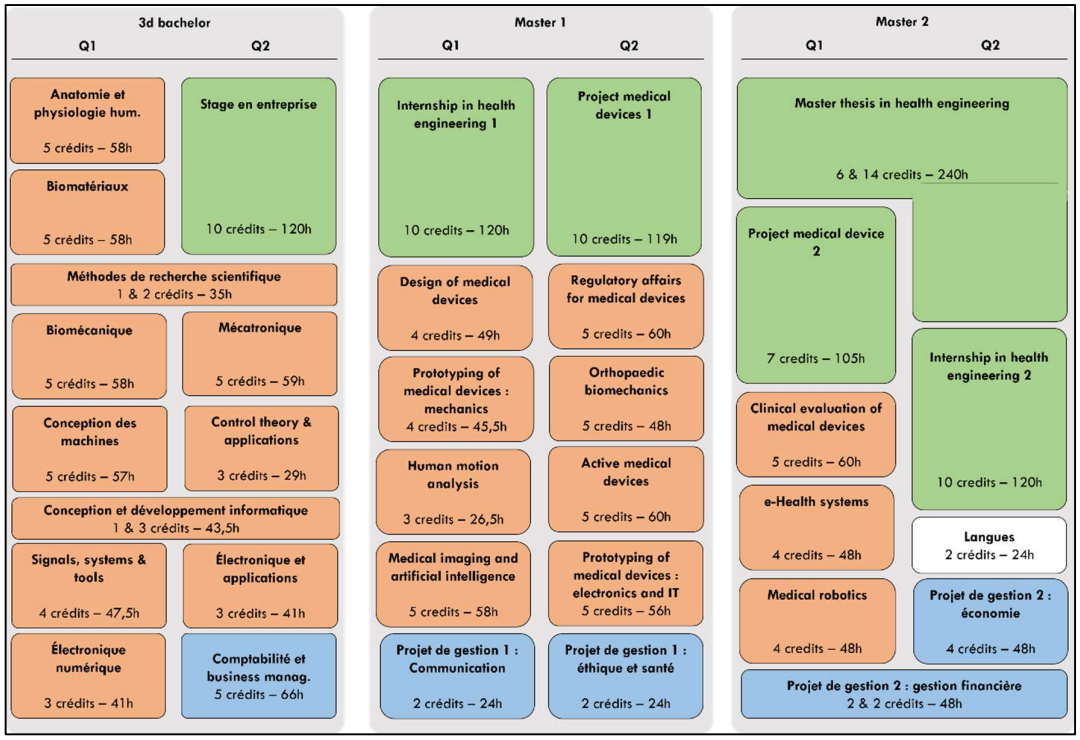


**Figure :** Structure set of teaching units for comprehensive training in health engineering