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# Electrical Engineering

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Fields of education: Engineering and Information Technologies

## 1. Professional qualification

### Professional career outline

Graduates of the Master's degree in Electrical Engineering are engineers with an advanced technical skill-set and the potential to be project and technical department managers. They are equipped with the necessary skills to be able to contribute to the advancement of the state of the art in their chosen fields. They are able to analyse problems and specify electrical and electronic solutions, especially in interdisciplinary do-mains and in conjunction with colleagues from those industrial and business domains.

The application-domains to which the electrical engineer is expected to contribute cover an astonishing range from spectrometers to pace makers to power plants, from mobile applications to Internet routers to radar systems and communication satellites, from elevators to robots to electric cars in smart cities.

### Professional skills

The Master's program in Electrical Engineering equips graduates to work on complex tasks in applied research, industry relevant development, production and operation of electrical devices and systems.

In particular they independently define requirements, determine and apply the appropriate technologies and procedures to meet those requirements. If necessary they will perform applied research, simulations and will develop, specify and be able to manage the manufacture, operation and maintenance of electrical components and systems.

The Master's graduate will be expected to keep abreast of, and apply, the latest developments in his field as well as contributing to the advancement of the state of the art.

### Entry skills

Specific skills are required to enrol in this profile. Students holding one of the following Bachelor degrees generally fulfil these entry requirements.

- BSc in Electrical Engineering
- BSc in Electronic Engineering

The assessment of the entry skills is part of the enrolment process of the respective school. Students who do not hold one of the above mentioned Bachelor degrees will be individually assessed for their suitability by the respective University of Applied Sciences.

### Differentiation to bachelor level

Masters of Electrical Engineering will show that they can independently advance the state of the art by performing applied research and development in their chosen field. The MSE graduate will be able to develop innovative concepts and explain and exercise technical oversight of their designs and technological innovations to Bachelor graduates carrying out the actual implementation. The graduate will be able to assess the work of their Bachelor colleagues and apply corrective actions if necessary.

## 2. Profile contents

The profile covers the following content:

We expect all our graduates to have a solid grasp of the elements of electronic systems, a high degree of competence in his/her chosen sub-specialisation and general competence in a number of other fields.

“Electronic Systems” focuses on the specification, design and verification of analogue and digital electronic circuits with discrete components and of integrated circuits. Some students will prefer to focus on analogue and digital integrated circuit design, for instance analogue ASICs or FPGA/SoC development. Others will gain advanced skills in PCB-based circuit design in specialised areas such as analogue signal conditioning, energy harvesting circuits and/or sensor systems.

“Embedded Systems” is fundamentally applied computer-system design. Whether applied to near-real-time low power IoT bare-metal systems or hard-real-time system control or signal processing systems using real-time-operating systems, computer design covers aspects of microcontroller, digital signal processor, graphics processing units and systems on chip using field programmable gate arrays. Software engineering of these systems is also an important part. The student can expect to learn the fundamentals of HW-SW co-design as well as distributed, networked technologies, both wired and wireless and the associated security.

The area of “Signal Processing” treats problems in the domains of time-series and stochastic signals and images. In addition the student will be expected to approach advanced themes such as sensor fusion, optimisation and machine learning whilst some may wish to explore further topics such as high resolution spectral analysis and microwave imaging.

Students may also be interested in the field of “Control”. The MSE student will then master the methods of modelling, identification, simulation and control with the aim of improving the performances in various systems, for instance drive systems, MIMO processes and autonomous systems. They can measure, condition and fuse signals from sensors in order to integrate them into the control system, and use advanced control methods like model based design, robust and optimal control, model predictive control, Kalman filters, in continuous and discrete time domains.

The area of “Communication and Information Systems” is built on the pillars of information theory, high frequency electronics and antenna design. Knowledge of advanced information theory, source and channel coding and information security is expected. Analogue and digital transmission systems knowledge, from LF to microwaves, signal modulation and antenna design is also expected. On a higher level the student may choose to occupy themselves with state-of-the-art commercial and industrial communication and synchronisation protocols.

“Power Electronics Systems” is a broad reaching subject matter including topics on “Electrical Machines and Drive systems”. The focus is on advanced themes in topics like power supply, inverter design, modulation methods and other challenging aspects of power applications. Topics in electrical machines and drive systems includes consideration of material selection, structure identification, winding characteristics and energy optimisation. In particular value is placed on modelling, simulation and associated tools and methodologies. Finally relevant issues in electromagnetic compatibility will enhance the skills of MSE student in this field.

Some electrical engineers may wish to focus on the area of “Electrical Power Transportation and Distribution”, which covers aspects of energy conversion, storage and distribution and demand side management. Here also students will gain a deeper understanding of advanced aspects of major components and modelling methodologies and tools for high, medium and low voltage technologies.