M.Sc. in Electrical Engineering

Electrical Engineering M.Sc. is a 2-year full-time graduate study programme of 120 ECTS credits (4 semesters, 30 ECTS each semester). Students can elect to take 90 ECTS in specialized courses and a 30 ECTS M.Sc. thesis, or 60 ECTS in courses and a 60 ECTS M.Sc. thesis with a stronger research focus. Students are required to: 1) Complete a 12 ECTS Integrated Project Course where the emphasis is on the application of theory to a real world design problem, 2) Complete 2 mandatory courses, 8 ECTS each, supporting the Integrated Project, and 3) Complete a mandatory 8 ECTS specialized engineering mathematics course in support of their studies.

Admission requirements are a B.Sc. degree in engineering. Minimum requirements in applied sciences (i.e. mathematics, physics) and in basic subjects fundamental to Electrical Engineering (i.e. circuits, electronics, computing) have to be fulfilled.

The degree Master of Science in Electrical Engineering provides education equivalent to the requirements for the professional title of Chartered Engineer (Icelandic: verkfræðingur), as defined by the Ministry of Industry and the Association of Chartered Engineers in Iceland.

On the completion of the M.Sc. programme in addition to relevant undergraduate studies, the following criteria shall be fulfilled, in addition to the criteria fulfilled at former levels. For further information, i.e. learning outcomes for each course see the Course Catalog www.ru.is.

KNOWLEDGE AND UNDERSTANDING

On completion of the M.Sc. programme, the student shall possess a systematic generalized understanding and knowledge of the following topics:

- An advanced knowledge of a broad range of modelling methodologies, and underlying electrical science, commonly used in the development and analysis of electrical engineering systems
- Working knowledge of a range of modern mathematical methods and tools used in the development and analysis of electrical engineering systems.
- An advanced understanding of computing theories and good knowledge of computer programming methods used in the development and analysis of engineering systems.
- Knowledge of fundamental design issues relevant to electrical engineering, and an understanding of how to formulate and analyse design solutions in various engineering contexts.
- In-depth knowledge of one or more of the following general themes: specific engineering systems, design methods, modelling techniques, mathematical and/or numerical techniques.
- Working knowledge of circuit and system simulation techniques as well as simulation-driven design.
- Understanding and knowledge of basic research and development principles and practices relevant to mainstream engineering industry.
- Knowledge of key professional, safety and ethical issues arising in modern engineering industry.
- Knowledge of time-management and work planning issues related to the organization, implementation and successful completion and reporting of an individual Masters level research project.
- Research methodology, including the fundamentals of scientific writing, literature search, how to give a scientific presentation, how to evaluate a

scientific paper, and research ethics.

TYPE OF KNOWLEDGE

The general knowledge expected for an entrant is that of an undergraduate in electrical engineering. This includes general knowledge in the following:

- Technology: Engineering systems, linear circuits, electronics, control theory, digital circuits, signal processing.
- Computing: Algorithms and data structures.
- Mathematics: Multivariate calculus, linear algebra and geometry, ordinary differential equations, numerical analysis and statistics.

Entrants from different engineering fields who lack any of the above topics are required to cover them before the completion of the course.

On completion of the M.Sc. programme, the student shall possess the skill and knowledge in two or more of the following areas, depending on selected specialization courses:

- Specific electrical engineering systems
- Design methods and/or modelling techniques
- Engineering optimization methods
- Mathematical and/or numerical techniques
- Circuit/System simulation and simulation-driven design techniques

At the time of graduation the student will have adopted a theme of specialization within Electrical Engineering. This could include:

- Mechatronics
- Microwave engineering
- Machine Learning
- Control Theory
- Solid-state electronics
- Electrical power engineering
- Signal Processing
- Physical Electronics
- Communications Systems

PRACTICAL SKILLS

On completing the programme students should be able to:

- Propose, plan and manage well defined research projects involving a team of individuals. Prioritise, organise and schedule work activities effectively. Work effectively in a team of individuals.
- Interpret and critically assess existing theories, models, methods and results, both qualitatively and quantitatively, within a broad engineering and physical science framework.
- Analyze complex real-world problems and devise efficient and well-documented computer-based solutions for those.
- Use mathematical models and their associated analysis techniques in the

design and evaluation of solutions for problems.
- Recognize and appreciate problems inherent in a given engineering system or approach, and be able to synthesise, and propose evaluation methods or develop alternative solution strategies.
- Have the ability to assess engineering projects, identify the key factors in a given situation, and develop an approach to a solution.
- Work with technical uncertainty.
- Apply engineering techniques taking account of a range of commercial and industrial constraints.

THEORETICAL SKILLS

On completion of the M.Sc. programme, the students shall have sufficient, comprehensive understanding to be able to assimilate and integrate their knowledge, make assessments and use their knowledge and understanding in solving relevant problems. The student should be able to:

- Identify, adapt and develop models appropriate to the study of a wide-range of different electrical engineering type systems, applications and products.
- Apply standard scientific principles to develop engineering solutions to a range of practical problems.

COMMUNICATION SKILLS AND INFORMATION LITERACY

On completion of the M.Sc. programme, the student should be able to:

- Communicate effectively and professionally both in writing and by means of presentations using appropriate technical language.
- Find information that is relevant to research using search engines, on line libraries and repositories. Effectively use modern information resources and technologies.
- Analyse and communicate statistical data.
- Report on their work, and that of others, both to a specialist and a general audience.
- Discuss ethical issues in research work with their peers in an informed and reasoned fashion. Understand use of technical literature and other information sources.

LEARNING SKILLS

On completion of the M.Sc. programme, the student should be able to:

- Solve non-trivial problems independently using the acquired skills or knowledge.
- Ask new questions based on available information and knowledge and use known facts to create new ones.
- Make creative use of known information, methods, concepts and theories in new situations.
- Generalize from a collection of specific instances.
- Interpret facts by comparing them and contrasting them with one another, drawing conclusions and predicting possible outcomes.
- Infer possible causes from the available data, discovering patterns in the available information.

- Make choices based on reasoned arguments, and evaluate the outcomes of those choices by comparing them with alternative solutions.
- Undertake the self-study required to keep up with evolving technology.
- Continue studies within this field towards an advanced degree i.e. at PhD level, having developed the necessary personal autonomy and knowledge to do so.