MSc in Engineering

The program leading to an MSc degree in Engineering is a 5 year full time graduate study program of 300 ECTS credits (10 semesters, 30 ECTS each semester), which can be divided into a 180 ECTS BSc degree and a 120 ECTS MSc degree.

Students will receive the degree MSc in Engineering upon completion of the program. The degree Master of Science in Engineering provides education fulfilling the requirements of the Association of Chartered Engineers in Iceland for the professional title of chartered engineer (Icelandic: verkfræðingur), as defined and authorized by the Ministry of Industries and Innovation in Iceland.

Students take 12 ECTS in mandatory courses. The final thesis is normally 30 ECTS but may be 60 ECTS, if defined requirements are fulfilled. The student takes a total of 78 ECTS in electives; 54 ECTS in restricted electives, at least 32 ECTS of which must be intermediate/advanced graduate level courses (4rd/5th year engineering courses), as well as the appropriate mandatory prerequisites; and 24 ECTS in free electives. The course plan for each student is developed in cooperation with the program director and approved by the graduate studies assessment board (Icelandic: námsmatsnefnd) of the Department of Engineering.

The general program leading to a MSc in engineering is designed to meet the needs of students that have interests that wider than those represented by the more specific fields of engineering (e.g. mechanical, biomedical or electrical engineering) and wish to tailor their education accordingly. It draws on the principles of engineering, and the physical sciences to create a broad knowledge base that equips students to deal with a range problems and challenges including the design, analysis, operation and maintenance of engineered systems. The student must have an advanced understanding of the core concepts of engineering and be able to apply these to the design and analysis of diverse devices and systems. The students shall be able to effectively communicate their findings in an appropriate format and be cognisant of the ethical and professional responsibilities of engineers.

On the completion of the MSc program, the following criteria shall be fulfilled:

1. KNOWLEDGE

On completion of the MSc program the student will have learnt how to define, understand and use:

1.1. Mathematical analysis common to most engineering disciplines, multivariable calculus, including differentiation and integrals, differential equations.

1.2. Complex numbers and exponentials, Laplace and Fourier transforms.

1.3. Principles of linear algebra, vectors, matrices, determinants, eigenvalues and eigenvectors, and of solving systems of linear equations.

1.4. Linear algebra applied to linear dynamical systems, least-squares, least-norm solutions of undetermined equations, solution of linear dynamical systems via Laplace transform and matrix exponential, controllability and observability.

1.5. Basic probability theory and statistics including data analysis, error analysis, hypothesis testing and linear regression.

1.6. Calculus based physics common to most engineering disciplines, including a practical foundation in classical dynamics, electromagnetism, thermodynamics, fluid dynamics.

1.7. Basic understanding of engineering programming in common languages, such as Matlab, Python, C++, and spreadsheet applications.

1.8. Basic project management methods, how projects arise and the different stages in the life-cycle of a project.

1.9. Basic understanding of innovation and entrepreneurship, techniques of idea generation, launching a new company and business plans.

1.10. Sustainable development; interplay of human enterprise and the environment on society; key tools for assessing sustainability of projects, products and processes; agents for change and policy development.

1.11. Engineering methodology and product design techniques; planning, concept development, customer requirements, system level design, detailed design prototyping and testing.

1.12. Concepts from at least 18 ECTS of advanced engineering courses and their prerequisites, e.g. fluid dynamics, electronics, risk management, logistics, medical imaging, computer vision, or precision machine design.

1.13. Data mining and machine learning methods.

1.14. Concepts from at least 32 ECTS of intermediate/advanced graduate level engineering courses (4^{th}/5^{th} year engineering courses) and their prerequisites, directly related to the student's thesis project.

2. DISCIPLINARY SKILLS

On completion of the MSc program the student should be able to:

2.1. Apply methods from mathematics, science, and computation to model systems.

2.2. Use mathematical methods and tools in the analysis and development of engineering systems.

2.3. Plan, manage and analyse projects, using current best-practice methods.

2.4. Devise experiments, collect and analyse data from physical and simulated test systems and use the results to solve technical problems.

2.5. Design system elements and systems or processes to meet or exceed a set of performance specifications, standards and codes.

2.6. Use lab equipment effectively and safely to analyse properties of system elements and systems.

2.7. Use appropriate computational tools and packages in component design, process design and planning.

2.8. Analyse and communicate experimental, numerical and statistical data.

2.9. Planning and supervision of industrial processes.

2.10. Design dynamical systems, and carry out system identification.

2.11. Apply project management methods to the planning of projects and apply business administration methods to industrial enterprises.

2.12. Carry out risk assessment as an integral part of the design process.

3. PERSONAL SKILLS

On completion of the MSc program, the student should be able to:

3.1. Apply engineering methods to projects, i.e. have the ability to assess engineering projects, identify the key factors in a given situation, and develop an approach to a solution.

3.2. Formulate and work on open-ended problems, including creative thinking.

3.3. Apply research methodology, including the fundamentals of technical writing and information finding, including literature search.

3.4. Apply standard scientific principles to develop engineering solutions to a range of practical problems.
3.5. Realize the limits of his/her expertise and know when it is necessary and appropriate to seek specialist advice.

4. INTERPERSONAL SKILLS

On completion of the MSc program, the student should be able to:

4.1. Read and write in English, and in Icelandic if a native student.

4.2. Communicate effectively and professionally and formulate sound arguments, both in writing and by means of presentations, using appropriate professional language, including statistics, figures, illustrations, equations, tables and video.

4.3. Understand how to search, survey and select appropriate literature for formulating and resolving a problem; know which information to accept and which to reject; plans, structure and write a scientific paper or report; formulate arguments in writing for a variety of readerships; appreciate when the style of writing is appropriate or inappropriate.

4.4. Use time management and work planning related to the organization, implementation and successful completion and reporting of a project.

4.5. Be an effective team member and contribute to the management of team projects.

5. COMPETENCE

On completion of the MSc program, the student should be able to utilize the knowledge and skills he/she has aquired to:

5.1. Apply analytical skills and modelling methodologies to recognize, analyze, synthesize and implement operational solutions to engineering problems.

5.2. Apply standard scientific principles to develop engineering solutions to a range of practical problems.

5.3. Appreciate the importance of keeping up with evolving technologies and research, and of lifelong learning to maintain and expand professional competence.

5.4. Use design standards and safety codes as an integral part of the design and the implementation process.

5.5. Complete a satisfactory master´s thesis based on independent research or a substantial engineering problem.

5.6. Undertake further studies towards an advanced academic degree, i.e. at PhD level, having developed the necessary personal autonomy and knowledge to do so.