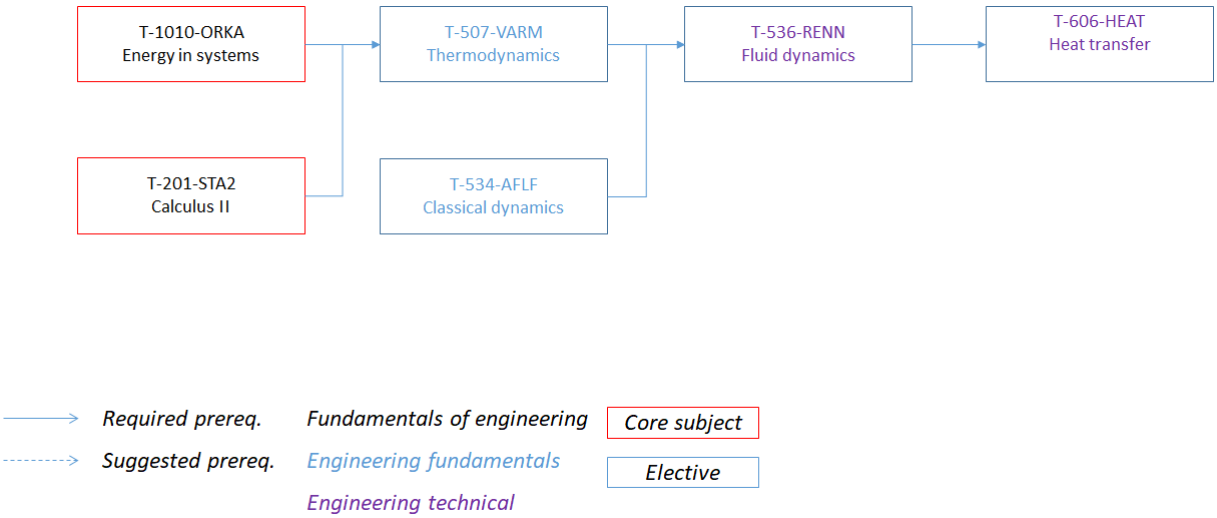
BSc in Engineering

The program leading to a BSc degree in Engineering is a 3 year full time undergraduate study program of 180 ECTS credits (6 semesters, 30 ECTS each semester); cycle 1.2. Students will receive the degree BSc in Engineering upon completion of the program.

Students take 84 ECTS credits in fundamental courses that are the same for all three-year BSc engineering programs, 12 ECTS in an engineering capstone project course. They take a total of 84 ECTS in electives; 60 ECTS in restricted electives,18 ECTS of which must engineering courses at advanced undergraduate level and the remainder of which are the appropriate prerequisites for those courses (see description of course chains below). The remainder of their credits, 24 ECTS, may be taken in elective courses. The course plan for each student is developed in cooperation with the program director and approved by the undergraduate studies assessment board (Icelandic: námsmatsnefnd) of the Department of Engineering. The main aim of the program is to prepare students for studies in engineering at the MSc level. A secondary aim of the program is to give students that want to pursue a career or further education in other fields (such as business, law or policy) a solid foundation to understand the scientific and technological underpinnings of modern society.

The general program leading to a BSc 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 a firm understanding of the core concepts of engineering including mathematical description of static and dynamical systems, Newtonian physics, electricity, energy and material balance in systems, programming, probability and statistics, project management and sustainability, 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.

Course chains are a logical procession of courses leading to an advanced engineering topic. As an example, one may consider the course chain in thermal- and fluid engineering shown in the figure below:



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

1. KNOWLEDGE

On completion of the BSc program the student should possess knowledge and understanding of the following:

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.

2. DISCIPLINARY SKILLS

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

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

5. COMPETENCE

On completion of the BSc 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. Undertake further studies towards a graduate level degree, i.e. at MSc level, having developed the necessary personal autonomy and knowledge to do so.