REYKJAVIK UNIVERSITY

School of Science and Engineering

Mechanical and Energy Engineering BSc

Course Catalog
2006-2007

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HÁSKÓLINN Í REYKJAVÍK
REYKJAVIK UNIVERSITY

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ENGINEERING

The School of Science and Engineering offers programs in engineering in three disciplines rooted in traditional trades: Civil Engineering, Mechanical and Energy Engineering and Electrical Engineering. Students can take a final examination after 3,5 years and/or a master´s degree after 5 years. The goal is to provide specialized and practical knowledge so that graduates are well prepared for employment and participation in industry. A major emphasis is on the students working on practical, realistic projects that are based on the teachers´ knowledge from industry. By far the majority of the teachers have considerable experience of design, production or construction. The students enrolled are in many instances qualified tradesmen or have work experience in their field and the program enhances that background.

The programs open diverse employment opportunities in all three disciplines as there is a very high demand for individuals with this education, in Iceland as well as abroad. There are also numerous opportunities for further studies.

The admittance criteria is a matriculation examination with emphasis on mathematics and physics, or a comparable examination, as well as 6 months of practical work experience in the field. Students who do not have such experience at the start of their studies can obtain experience by work in the summer periods during the studies. Applicants not having the adequate theoretical basis are offered supplementary courses at RU´s preliminary studies program.

The final examination in Engineering BSc of 210 ECTS credits is completed in 3,5 years and gives very considerable professional competences seen in relation to the duration. Those graduating from this study program receive accreditation from the Icelandic Ministry of Industry to practice as fully qualified engineers, with the professional title of engineer (Icelandic: Tæknifræðingur) which is protected by law. At the same time it is easy to base studies for a MSc degree on the final examination, either in Iceland or at universities abroad.

In the study program, great emphasis is placed on the students´ work on practical projects in cooperation with engineering firms and research institutes. The students final project of 12 credits (24 ECTS) is a design and/or research project with emphasis on independent and goal oriented methods in practical project work in the industry.

On July 1st, 2005 Reykjavik University merged with the Technical University of Iceland where teaching in the engineering programs which form the basis for today´s programs in Civil Engineering, Mechanical and Energy Engineering and Electrical Engineering started in 1964. These programs have a strong tradition of practical orientation in cooperation with the industry. Practically oriented project work plays a large role in the students´ studies and most of the teachers have a background of practical experience in the industry. The department´s research focus is mainly on applied research in cooperation with specialized companies and institutions in the respective fields.

The first programs for the MSc degree in Engineering started in January 2006. These are for Civil Engineers, but in 2007-2008 it is planned to start MSc programs for Mechanical and Energy Engineers and Electrical Engineers. For those having completed the final examination in Engineering BSc at Reykjavik Univerisity or at the former Technical University of Iceland (210 ECTS) the master´s programs will take three semesters. For those having a bachelor´s degree in engineering of 180 ECTS the master´s programs will take four semesters.

Mechanical and Energy Engineering BSc

Mechanical and Energy Engineers work in various fields, such as management, inspection, consulting, design and development. They are employed with consulting engineering firms, in production enterprises and with energy producers. Future opportunities are, for example, to be found in renewable energy sources and sustainable development, including the harnessing of water power and geothermal energy, the utilization of hydrogen and biomass, and development for fuel cells.

The studies are based on theoretical courses and on the students work on actual projects related to the mechanical or energy industry, under the guidance of highly qualified teachers and experts from the industry. Key subjects are structural mechanics, computer aided design, mechanical design, thermodynamics and control systems. Automation, simulation and the optimisation of work and energy processes are also an important part in the studies and professional activities of mechanical engineers.

In the first 6 semesters, students generally take five courses per semester (6 ECTS each). Four courses are taught during the first 12 weeks of the semester (6 ECTS each), ending with written or oral examinations. After the examination period comes a three-week lab course (6 ECTS) or a three-week specialized course (6 ECTS). In the 7. semester students take a course in research methods (6 ECTS) and work on a specialized final project (24 ECTS).

During the 5. and 6. semesters students take elective subjects that offer a degree of specialization. Two fields of specialization are offered: Mechanical Design and Energy Technology. A student who choses at least 3 elective courses, as well as his final project, in the the same field of specialization gets a certificate of graduation inwhich his field of specialization is especially noted.

Instead of elective subjects in the field of mechanical and energy engineering, a final year student can choose two courses from other programmes at Reykjavik University or at another university. Any cost resulting from studying outside the RU is borne by the student.

Courses – Mechanical and Energy Engineering

	Mechanical and Energy Engineering	***210 ECTS credits***
1. semester		
	Mathematics	
	Physics	
	Structural Mechanics	
	Computer Aided Drawing	
	Computer Science	3 weeks
2. semester		
	Mathematics	
	Structural Mechanics	
	Dynamics	
	Materials Science	
	Computer Aided Design	3 weeks
3. semester		
	Mathematics	
	Maschine Elements	
	Materials Science	
	Thermodynamics and Hydraulics	
	Project Management	3 weeks
4. semester		
	Maschine Elements	
	Control Systems	
	Thermadynamics	
	Electrical and Digital Logic Design	
	Structural Engineering FEM	3 weeks
5. semester		
	Operations Research	
	Theory of Vibrations	
	Control Engineering	
	Elective course in energy technology or maschine design, see elective course descriptions.	
	Management and Innovation	3 weeks
6. semester		
	Refrigeration	
	Operations Research and Simulation	
	Two elective courses in energy technology or maschine design, see elective course descriptions.	
	Elective course	3 weeks
7. önn		
	Research Methods in Engineering	
	Final Project	15 weeks

STUDY PLANS IN MECHANICAL AND ENERGY ENGINEERING

Mechanical and Energy Engineering: A 7 Semester BSc Program

	Fall	Spring	Fall	Spring
	VT1 1. semester	**VT2** 2. semester	**VT3** 3. semester	**VT4** 4. semester
1. - 4. semester: Core Courses				
Computer Science	RT TLV 1003			
Physics	AT EÐL 1003			
Mathematics	AT STÆ 1003	AT STÆ 2003	AT STÆ 3003	
Computer Aided Drawing	VT TEI 1013	VT TEI 2013		
Structural Mechanics	BT BUÞ 1013	BT BUÞ 2013		
Dynamics		VT AFL 1003		
Materials Science		VT EFV 1003	VT EFV 2003	
Project Management			AT VST 1003	
Maschine Elements			VT VHF 1003	VT VHF 2003
Thermodynam/ Hydraulics			VT VAR 1003	VT VAR 2003
Structural Engineering				VT BUÞ 3003
El and Digital Log Design				IT RST 1003
Control Systems				VT REG 1003

	VT5 5. semester	**VT6** 6. semester	**VT7** 7. semester
5. – 7. semester: Core- and Elective Courses			
Core Courses:			
Management/Innovation	AT RSN 1003		
Control Engineering	VT STÝ 1003		
Operations Research	VT AÐG 1003		
Theory of Vibrations	VT SVF 1003		
Refrigeration		VT KÆL 1003	
Op. Research/ Simulation		VT AÐG 2003	
Final Project			VT LOK 1012
Research Methods in Eng.			AT AÐF 1003
Mechanical Design:			
Mechanical Design	VT HUN 1013		
El Masch/ Power Networks		RT RFR 1003	
Maschine Element Design		VT VHH 1003	
Elective course		3 credits	
Energy Technology:			
Energy Effciency	VT OTÆ 1003	VT OTÆ 2003	
Geothermal Energy		VT JAH 1003	
Elective course		3 credits	

COURSE DESCRIPTIONS IN MECHANICAL AND ENERGY ENGINEERING

RT TLV 1003 Computer Science 3 credits [ECTS:6]

Year of study: First year.
Semester: Fall.
Level of course: First cycle - Introductory.
Type of course: Core.
Prerequisites: None.
Schedule: 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Elín K. Sighvatsdóttir BS, MBA. Ágúst Valfells PhD, Assistant Professor.
Learning outcome: On completion of the course students should:

- be familiar with the computers´ structure and their main operating systems.
- be familiar with data structures, methods and operating commands and be able to program in Java.
- be able to use Matlab and Excel when solving actual problems and be able to program in Visual Basic.

Content: Fundamentals of computers, introduction to operating systems and computer net systems. Object oriented programming with Java: Data structures (primitive variables, constants, classes, objects, arrays and strings), methods, control statements and program flow, inheritance, interfaces, polymorphism. Graphical user interfaces, layoutmanagers, applets. Program structure and documentation. Introduction to Matlab and its use in solving mathmatical problems. Use of Excel in solving technical problems, programming in Visual Basic. During the course the emphasis is on solving practical problems.

Reading material: Daniel Liang, *Introduction to Java Programming*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination counts 70% and exercises 30% of final grade.
Language of instruction: Icelandic.

AT EÐL 1003 Physics 3 credits [ECTS:6]

Year of study: First year.
Semester: Fall.
Level of course: First cycle - Introductory.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks. 10 laboratory lessons.
Lecturer: Haraldur Auðunsson PhD, Associate Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of physics and be able to apply these to the solving of technical problems.
- have the necessary basic knowledge to be able to assimilate the contents of engineering subjects.

Content: Physical quantities and units. Motion in one, two and three dimensions. Newton's laws of motion. Work, kinetic and potential energy. Energy conservation. Momentum, impulse and collisions. Dynamics of rotational motion. Conditions for equilibrium. Elasticity. Gravitation. Periodic motion and waves. Fluid mechanics. Electromagnetic induction, inductance and alternating current. Magnetic circuits. Laboratory work (3 experiments) and weekly due exercises.

Reading material: Young og Freedman, *University Physics.*
Teaching and learning activities: Lectures, practical sessions and laboratory work.
Assessment methods: A 3 hour written exam counts for 80% of the final grade. Laboratory work and due exercises count for 20%.
Language of instruction: Icelandic.

AT STÆ 1003 **Mathematics I** 3 credits [ECTS:6]

Year of study: First year.
Semester: Fall.
Level of course: First cycle - Introductory.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Sæmundur Kjartan Óttarsson, PhD, Associate Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of mathematics and be able to apply these to solving technical problems.
- have the necessary basic knowledge to be able to assimilate the contents of engineering subjects.

Content: Vectors and geometry. Complex numbers. Functions of one variable: Limits and continuity. Inverse functions. Differentiation. Related rates of change. Extreme values. l'Hôpital's rule. Functions of more than one variable: Limits and continuity. Partial derivatives. Gradient. Chain rule. Directional derivatives. Linear approximation. Extreme values (for functions of two variables). Lagrange multipliers. Parametrized curves. Curves in polar coordinates. Basic integration of functions of one or two variables with applications. Transcendental functions.

Reading material: Sæmundur Kjartan Óttarsson, *Fyrirlestrar í stærðfræði I*. Murray Spiegel, *Schaum´s Mathematical Handbook of Formulas and Tables,* 2nd Edition. Robert A. Adams, *Calculus, A Complete Course,* 5th Edition.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination counts 90% and due exercises 10%.
Language of instruction: Icelandic**.**

VT TEI 1013 Computer Aided Drawing and Descriptive Geometry
3 credits [ECTS:6]

Year of study: First year.
Semester: Fall.
Level of course: First cycle - Introductory.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks. 10 projects.
Lecturer: Guðmundur Borgþórsson BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to use AutoCad and Inventor when preparing drawings in two and three dimensions.
- be able to use freehand scetches for explanation and communication on site.
- have developed their sense of spatial perception.

Content: Computer Aided Design 75%: The AutoCAD program. Computers and operating system, setting up, drawing-operations, blocks and dimensions. Layers, area limits, viewports, Paper Space, Model Space, X-ref. Printing and plotting. Rectangular, isometric and diametric projections. Drawing in 3-D with Autodesk Inventor. Introduction to simulation and modeling in 3-D. Completation of mechanical work drawings.
Descriptive geometry 25%: Sketching. Perspective drawing. Rectangular, isometric and diametric projections.

Reading material: Falk, Krause og Tiedt, *Töflubók fyrir málm- og véltækni.* Banach, Jones, Kalameja, *Autodesk Inventor 10 Essential Plus.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

BT BUÞ 1013 Statics 3 credits [ECTS:6]

Year of study: First year.
Semester: Fall.
Level of course: First cycle - Introductory.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Guðbrandur Steinþórsson, Cand.Polyt, Associate Professor.
Learning outcome: On completion of the course students should:

- be familiar with and able to analyse statical determinacy and/or indeterminacy of commonly occuring types of structures.
- be able to calculate support reactions and internal forces, i.e. bending moment, shear force and normal force, in statically determinate beams and frames and in common types of two- and three-dimentional trusses .

Content: Statics. Force systems in two and three dimensions. Equilibrium. Statically determinate structures. Beams, trusses and frames. Stability of structures. Distributed forces, internal effects.

Normal force, shear force and moment diagrammes. Centroids. Moments of inertia. 8 due exercises.

Reading material: Meriam og Kraige, *Engineering Mechanics - Volume 1, Statics,* 6th Edition. Material from teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination counts 100%.
Language of instruction: Icelandic.

AT STÆ 2003 Mathematics II 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Sæmundur Kjartan Óttarsson PhD, Associate Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of mathemastics and be able to apply these to solving technical problems.
- have the necessary basic knowledge to be able to assimilate the contents of engineering subjects.

Content: Integration techniques, including substitution, integration by parts and partial fractions. Improper integrals. Numerical integration. Continuous probability distributions. Statistics: estimates of parameters, tests of hypotheses. Vector-valued functions of one variable (curvature etc). Level curves and surfaces. Tangent planes of surfaces. Curl and divergence. Potential functions. Line integrals. Surface integrals. Sequences and series: convergence tests, power series, Fourier series.

Reading material: Sæmundur Kjartan Óttarsson, *Fyrirlestrar í stærðfræði II*. Murray Spiegel, *Schaum´s Mathematical Handbook of Formulas and Tables,* 2nd Edition. Robert A. Adams, *Calculus, A Complete Course,* 5th Edition. Erwin Kreyszig, *Advanced Engineering Mathematics,* 8th Edition.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination counts 90% and due exercises 10%.
Language of instruction: Icelandic.

VT TEI 2013 Computer Aided Drawing and Design 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: VT TEI 1013.
Schedule: 15 lectures and 15 practical lessons per week for 12 weeks.
Lecturer: Guðmundur Borgþórsson BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have adequate knowledge of computer aided design and maintenance management systems to be able to work out common and traditional tasks in machine design, treatment of materials and equipment.
- have sufficient knowledge to be able to analyse related problems.

Content: Technical drawing 67%: Auxilary views, machine drawings. ISO tolerances. Geometric tolerances of form. 3-D Autodesk design with Inventor.
Maintenance 33%: Maintenance management systems, introduction.

Reading material: Falk, Krause og Tiedt, *Töflubók fyrir málm- og véltækni.* Banach, Jones, Kalameja, *Autodesk Inventor 10 Essential Plus.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

BT BUÞ 2013 Mechanics of Materials 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: BT BUÞ 1013.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Guðbrandur Steinþórsson Cand.Polyt, Associate Professor.
Learning outcome: On completion of the course students should:

- be familiar with the elastic behaviour of commom structural materials.
- be able to identify and calculate section properties.
- be able to analyse stress and strain undir uniaxial and biaxial conditions and determine principal stresses and directions.
- be able to calculate deformations in common statically determinate beam type structures.
- be aquainted with elastic buckling and be able to calculate critical loads for simple columns.

Content: An introduction to mechanics of materials. Tension, compression and shear. Stresses in beams. Normal stresses in beams. Shear stresses in beams. Beams with axial loads. Built-up beams and shear flow. Torsion and torsional deformations of circular bars. Bending of unsymmetric beams. Analysis of stress and strain. Principal stresses and maximum shear stress. Deflections of beams. Differential equations of the deflection curve. Moment-area method. 8 due lessons.

Reading material: Gere og Timoshenko, *Mechanics of Materials*. Meriam og Kraige, *Engineering Mechanics - Volume 1, Statics.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT AFL 1003 Dynamics 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: BT BUÞ 2013.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Ármann Gylfason PhD.
Learning outcome: On completion of the course students should:

- have developed an understanding of the fundamental principles of dynamics and be able to apply these to the solution of technical problems.
- have sufficient basic knowledge to be able to assimilate subjects of engineering such as structural and mechanical design.

Content: Kinematics: Planar and spatial motion of particles. Planar and spatial motion of rigid bodies, including relative motion. Mass momens of inertia. Work-energy relations. Impulse-momentum relations. Introduction to vibrations: Free vibrations, free-damped vibrations. Forced vibrations, damped and undamped.

Reading material: Meriam og Kraige, *Dynamics, Engineering Mechanics.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT EFV 1003 Materials and Manufacturing Processes 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks.
Lecturer: Ingólfur Þorbjörnsson MSc.
Learning outcome: On completion of the course students should:

- have developed an understanding of the fundamental principles of materials science and manufacturing processes and be able to apply these to the solution of technical problems.
- have obtained sufficient basic knowledge to be able to assimilate subjects of engineering such as structural design.

Content: Production of steel. Atomic structure. Imperfections in the atomic arrangement. Phase diagrams. Principles of solidification strengthening and processing. Deformation of metals. Mechanical testing and properties. Standards. Recrystallization. Deformation of metals. Technical properties of metals. Corrosion and corrosion protection. Due assignments.

Reading material: William D. Callister, *Materials Science and Engineering - An Introduction.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination.

Language of instruction: Icelandic.

AT STÆ 3003 Mathematics III 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Sæmundur Kjartan Óttarsson PhD, Associate Professor.
Learning outcome: On completion of the course students should:

- understand the fundamental principles of mathematics
- be able to apply these to the solution of technical problem.
- have sufficient basic knowledge to be able to assimilate subjects of engineering such as structural design.

Content: Continuation of probability and statistics. Linear algebra, including vector spaces, matrices, systems of linear equations, determinants, eigenvalues and eigenvectors. Differential equations. Laplace transform.

Reading material: Sæmundur Kjartan Óttarsson, *Fyrirlestrar í stærðfræði III*. Murray Spiegel, *Schaum´s Mathematical Handbook of Formulas and Tables*, 2nd Edition. Robert A. Adams, *Calculus, A Complete Course*, 5th Edition. Erwin Kreyszig, *Advanced Engineering Mathematics*, 8th Edition.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 4 hours written examination.
Language of instruction: Icelandic.

VT EFV 2003 Metals and Manufacturing Processes 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks.
Lecturer: Ingólfur Þorbjörnsson MSc.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of materials science and manufacturing processes and be able to apply these to the solution of technical problems.
- have sufficient basic knowledge to be able to assimilate subjects of engineering.

Content: Iron. (Fe). Heat treatment of steels. Alloying elements. Types of steel.Stainless steel. Surface treatment. Cast Iron. Aluminium and its alloys. Copper and its alloys. Welding and weldabilty of steel. Polymer structures.

Reading material: William D. Callister, *Materials Science and Engineering - An Introduction.* Páll Árnason, *Plast, 2. útgáfa*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination.
Language of instruction: Icelandic.

AT VST 1003 **Project Management** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Eðvald Möller MSc, MBA. Part-time lecturers.
Learning outcome: On completion of the course students should:

- be familiar with the methodology of project management and have obtained skills in applying these to his field of discipline.
- be able to prepare tender documents, offers, workschedules and cost estimates for common and traditional projects and evaluate plans made by others.
- be able to apply the knowledge to the administraton of construction and inspection on site.

Content: Methodology of project management and application. Defining the project, project life cycle, schedule, execution, progress and performance, report and sharing informations. Project networks, Gantt, CPM, PERT etc. Contracting documents, making bids and contracts, surveillance, project meetings. Cost planning and estimating, legal concern regarding projects and implementation of projects. Exercises with Microsoft Project. Students do a large project in construction.

Reading material: Gray and Larson, *Project Management*. Eðvald Möller, *Verkefnastjórnun með Microsoft Project*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 2 hour written examination counts 40%, grade for project work and oral examination counts 60% of final grade.
Language of instruction: Icelandic.

VT VHF 1003 **Machine Elements** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: BT BUÞ 1013.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Karl Lúðvíksson PhD.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of maschine elements and be able to apply these to the solution of technical problems.

- have sufficient basic knowledge to be able to assimilate subjects of engineering such as structural and mechanical design.

Content: Design of machine elements. Calculation of strength. Steady and variable loading. Fatigue strength and stress concentration. Axles and shafts. Bolts and screws. Bolted connections. Mechanical springs. Rolling contact bearings. Brakes and clutches. Due assignments.

Reading material: Roloff, Matek o.fl., *Maschinenelemente.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT VAR 1003 **Thermodynamics and Transport Processes** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Jens Arnljótsson BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamental principles of thermodynamics, hydraulics and transport processes and be able to apply these to the solution of technical problems.
- have sufficient basic knowledge to be able to assimilate subjects of engineering.

Content: Thermodynamic systems and state variables. Thermodynamic properties of pure substance. Thermodynamical processes , reversible and irreversible. The first and second law of thermodynamics. Thermodynamical cycles. Entropi. Isentropic efficiencies. Flow of fluids: Continuity equation, conservation of momentum and energy, the Bernoulli equation. Flow in two directions, non viscous fluids, laminar and turbulent flow, frictional loss and friction factors.Heat transfer: Heat transfer by conduction, radiation and convection. Dimensionless coefficents, material properties. Heat exchangers, effectiveness and heat transfer coefficents. Heat insulataing. Piping systems. Due exercises.

Reading material: Moran og Sharpiro, *Fundamentals of Engineering Thermodynamics*. Geankoplis, *Transport Prosesses and Unit Operations*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT VHF 2003 **Machine Elements** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.

Prerequisites: VT VHF 1003, BT BUÞ 2003.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have developed an understanding of the fundamental principles of machine elements and be able to apply these to the solution of technical problems.
- have obtained sufficient basic knowledge to be able to assimilate subjects of engineering such as structural and mechanical design.

Content: Hydrodynamic bearings, theoretical background and design basis for steady loading. Various types of springs, their mechanics and design. Geometry of involute gearing. Design of spur-, helical-, bevel- and worm gearing in accordance with design standards. Brakes and friction clutches, their mechanics and design. Rigid couplings. Belt- and chain drives, their mechanics and design. Wire ropes and their use in lifting equipment. Design of machine shafting.

Reading material: Roloff, Matek o.fl., *Maschinenelemente.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination counts 70% and exercises 30% of final grade.
Language of instruction: Icelandic.

VT VAR 2013 **Thermodynamics II** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: VT VAR 1003.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Jens Arnljótsson BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to use thermodynamics in analysing different systems.
- be familiar with heat pumps and cooling systems.
- have knowledge of stable and unstable heat and mass transfer.
- have knowledge of the construction and effect of heat exchangers.

Content: Exergi, anergi. Vapour power systems. Gas power systems. Air standard Otto, Diesel and Brayton cycle. Reheat and intercooling. Compressible flow trough nozzles and diffusers. Refrigeration and hea tpump systems. Mixing of ideal gases. Psychrometric systems and applications. Reacting mixtures and combustion. Due exercises.

Reading material: Moran og Sharpiro, *Fundamentals of Engineering Thermodynamics.* Geankoplis, *Transport Prosesses and Unit Operations.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT BUÞ 3003 Structural Engineering 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: BT BUÞ 2013, VT AFL 1003.
Schedule: 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to analyse statically indeterminate beam type structures and know the method of displacement, energy methods and virtual work.
- know FEM and be able to use it in solving problems.
- have obtained training in the use of software in structural analysis and vibrations.
- haave developed the necessary basic knowledge to be able to assimilate the contents of engieering courses.

Content: Deflections of beams. Statically indeterminiate beams. Method of superposition (Flexibility method). Bukling of steel columns and frames. Energy methods. Principle of virtual work. The finite element method and its use in analysis of structural strength in two and three dimentional constructions and machine elements. Training in use of the ANSYS program. Forces and strsses in beams. Stress consetrations. Stresses in engine foundings. Heat deformations and stresses in machine element. Methods of teaching: 60 lessons. Exercises and design projects. Teaching material: Gere/Timoshenko, Mecahanics of Materials. Standards: DS412 Lectures notes. Saeed Moaveni: Finite Element Analysis. Theory and Application with ANSYS Examples from ANSYS program workbook.

Reading material: Gere , *Mecahanics of Materials.* DS412. Saeed Moaveni, *Finite Element Analysis. Theory and Application with ANSYS* .
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

IT RST 1003 Electrical and Digital Logic Design 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Kristinn Sigurjónsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have solid basic knowledge of electrical and control technology and have acquired a sound basis in bipolar theory.
- have solid knowledge and skills in dealing with different electrical and computer control systems**.**

Content: Boole Fundamentals of dc circuits: Nodal voltage- and current mesh analysis, controlled sources, principle of superposition, Thevenin and Norton equivalent circuits, maximum power transfer, non linear circuit elements and the graphical (load line) analysis of non linear circuits.. De Morgan. AND, OR, NAND, NOR, NOT, X-OR gates. Comp. Mechanical and pneumatics systems. Flow- diagrams. Laboratory work and due problem sets.

Reading material: Grob, *Basic Electronics 8.útg.* Alm, *Styreteknik.* Johannesson, *Digitalteknik steg for steg.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination.
Language of instruction: Icelandic.

VT REG 1003 Control Systems 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be familiar with different control and regulatory systems, calculation methods and the most common design methods.
- be able to use Matlab and Simulink in the simulation of control systems.

Content: Feedback control systems. Block diagrams and block diagram algebra. Development of transfer functions. Laplace transform. Time and frequency response. Stability. Different kind of control and regulator systems. P , PD, PI and PID compensators. Design methods for compensators. Root locus. The Bode diagram.

Reading material: C.L Phillips, R.D. Harbor, *Feedback Control Systems*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination counts 70% and exercises 30% of final grade.
Language of instruction: Icelandic.

AT RSN 1003 Management and Innovation 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Páll Kr. Pálsson Dipl.Ing.
Learning outcome: On completion of the course students should:

- have sufficient knowledge in management, administration and finance of companies to lead the operation of smaller industrial enterprises, with emphasis on innovation.

Content: The course will give an overview of the running and managing business entities, including planning, cost analysis, human resource management and the role of managers and directors. The importance of continueous innovation is emphasised and related to the corporate lifecycles. As a practical project the students will develop a full business plan for a start-up or mature company.

Reading material: *Harvard Business Review, Entrepreneurship*. Material from teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination counts 40% and projects 60%.
Language of instruction: Icelandic.

VT STÝ 1003 Control Engineering 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle – Intermediate.
Type of course: Core.
Prerequisites: IT RST 1003.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have developed an understanding of the basic principles of control technology and acquired skills to apply them to actual problems.
- be able to simulate and design systems where power relays, fluid systems, air systems and electrical systems work in unison, and use design software for that purpose.

Content: Linkages. Simulations of lincage motion with help of a computer program. The use of ANSYS and AutoCAd in motion simulation. Hydraulic systems. Pnaumatic systems. Hydraulic and pnaumatic control. Actuators, transmissions, transportsystems and fish prosessing machines. Electronic control. Design of equipment where linkages, hydraulic, pnaumatic and electronic systems are used together in one unit and control of such equipment. Design projects. Exercises in pnaumatic control.

Reading material: Manuals and other material from teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

VT AÐG 1003 Operations Research 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Sigurður Óli Gestsson CSc.
Learning outcome: On completion of the course students should:

have developed skills in different methods of optimisation and simulation and be able to use optimisation software to solve actual problems.

Content: Production problems and common operations research models. Linear programming, the simplex method, dual problems, sensitivity analysis. Distribution methods, network planning. Integer programming, Queuing theory. Inventory Management and case study of real problems regarding Inventory management and optimisation of fleet management.

Reading material: Hillier og Lieberman, *Introduction to Operations Research.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 4 hours written examination counts 70% and projects 30%.
Language of instruction: Icelandic.

VT SVF 1003 Theory of Vibrations 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the basic principles of vibration theory and know methods to reduce disturbances and vibrations.
- be familiar with the method of beams in vibration analysis and be able to use Matlab and ANSYS analysing vibrations in solving actual problems.

Content: Free, damped and excited vibrations in linear systems. Nonlinear vibrations. Two-degree-of-freedom systems. Design for vibration suppression. Mesurement and analysis of vibrations. The use of the ANSYS program for vibration analysis. Due exercises.

Reading material: Daniel J. Inman, *Engineering Vibration 2nd edition.* Saeed Moaveni, *Finite Element Analysis. Theory and Application with ANSYS.* Instructions Manual for the ANSYS program.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination counts 70% and exercises 30% of final grade.
Language of instruction: Icelandic.

VT HUN 1013 Mechanical Design 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor.

Learning outcome: On completion of the course students should:

- be able to use systematic solution methods to solve problems in the field of machine elements, and utilise design software in that process.

Content: Design of machine elements with respect to function, shape, material and viability. Emphasis on idea impregnation, systematic methods and use of design software and reability of the design.

Reading material: Ertas, Jones, *The Engineering Process*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

VT OTÆ 1003 **Energy Efficiency I** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor.
Learning outcome: On completion of the course students should:

- be familiar with the main energy sources, production, transport and storage of energy.
- be familiar with different energy systems, equipment and structures.
- be able to assess energy reqierements and the economy of different systems, locally as well as globally.

Content: Energy need, energy resources. Various combustion equipment and fuels. Various energy systems, processes and equipment. Efficiency and feasibility. Wind energy. Solarenergy, heat and solar cells. Geothermal energy. Hydropower, use of hydropower. Biomass as energizer. Energy transport and storage. Nuclear energy. Project work with EES equation solver.

Reading material: Eastop og Croft, *Energy Efficiency for Engineers and Technologists*. *ECR handbook of Energy Efficiency.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Grade for projects count 100%.
Language of instruction: Icelandic.

VT KÆL 1003 **Refrigeration** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Core.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor.
Learning outcome: On completion of the course students should:

- have knowledge of refrigeration systems and parts thereof,
- be able to assess the need for refrigeration and knows the use of different types of cooling liquids.
- be able to design cooling and refrigeration systems.
- be familiar with different pump types and pumping systems and be able to select the most efficient pump for a given project.

Content: Part 1 (80%): Refrigeration systems, principles, units, property diagrams. Refrigerants, control, safety. Sytem design. Compressors, condensers, evaporators, oil separators, liquid separators, vessels. Two stage systems, intercoolers, pump systems. Piping, safety equipment, regulating. Humidity, moisture protection, isolation, subcooling. Freezing layout, food handling, cooling, freezing, preservation and storaging.
Part 2 (20%): Rotary pumps, types, characteristic curves, use. Reciprocating pumps types, characteristic curves, use. Theoretical background of rotary pumps, similarity laws. Pipe flow and piping systems, suctionability of pumps and design, system flowcontrol. The pumping of viscous fluids. Pump selection.

Reading material: Roy J. Dossat, *Principles of Refrigeration*, SI version.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 4 hour written examination.
Language of instruction: Icelandic.

VT AÐG 2003 **Operations Research and Simulation** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Intermediate.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Sigurður Óli Gestsson CSc.
Learning outcome: On completion of the course students should:

- have developed knowledge and skills in the application of the methodology of optimisation and simulation.
- be able to design simulation models.
- have obtained skills in forecasting and the use of forecasting software.
- be able to evaluate the quality of forecasts.

Content: Systems, models and analysis. Simulation models and methodology. Time tracking methods. Event models. Discrete simulation, queueing systems, random variable hending. Forecasts and forecast methods and the use of regression analysis in forecast modelling. Forecast evaluation and error estimation.

Reading material: Hillier og Lieberman, *Introduction to Operations Research*. Nhamias, *Production and Operation Analysis*. Hauge and Paige, *Learn Simul8, the complete guide*. *Simulation Modeling &Analyses.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 2 hour written examination counts 50% and project and oral defense counts 50% in final grade.
Language of instruction: Icelandic.

RT RFR1003 Electrical Machines and Power Networks 3 credits [ECTS:6]

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Kristinn Sigurjónsson MSc, Assistant Professor. Baldur Jónasson MSc, Associate Professor. Part-time lecturer.
Learning outcome: On completion of the course students should:

- have knowledge of electrical power systems and electrical machines, and of their connections and regulation.
- have knowledge of production of electricity, transport and distribution.
- know the details of circuits, phasing and control.

Content: NA.
Reading material: Theodore Wildi, *Electrical Maschines, Drives and Power Systems, 6th Edition.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination.
Language of instruction: Icelandic.

VT VHH1003 Machine Element Design 3 credits [ECTS:6**]**

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks or 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor.
Learning outcome: On completion of the course students should:

- be able to design mechanical equipment in relation to efficiency and appearances and in the process use varied design software.

Content: Design of spring and shock absorbers. Damping. Balancing of machine elements. Vibration. Design of pressure vessels. Resonance calculations, etc. Project work.

Reading material: From teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

VT OTÆ2003 **Energy Efficiency II** 3 ein (6 ECTS)

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks or 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor.
Learning outcome: On completion of the course students should:

- be able to assess varied energy choices, energy requirements, efficiency, systems and eqipment in relation to overall efficiency.
- be able to coordinate energy use with regard for the environment and ecology.
- be able to work out energy plans for different systems.

Content: Energy use, energy efficiency, energybalance energy processes, systems and machinery in industry, fishery and acricultur. Energizers, heat pumps. Energy management, enrgy schedule. Environmental economi and sustainability. Quality and environmental control. Ergonomics. EES edicts. Energytechnical project work in various industries. Project work.

Reading material: Eastop og Croft, *Energy Efficiency for Engineers and Technologists*. Bowers, *Sustainability and Environmental Economy, an alternative text.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

VT JAH1003 **Geothermal Energy** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks or 15 lectures and 15 practical lessons per week for 3 weeks.
Lecturer: Baldur Jónasson MSc, Associate Professor. Árni Ragnarsson Dr.Ing. Benedikt Steingrímsson. Sverrir Þórhallsson.
Learning outcome: On completion of the course students should:

- have an understanding of the structure of geothermal systems and be familiar with their main components, implements and equipment.
- be able to assess reserves and utilisation of geothermal heat.
- know the main possibilities of use of geothermal heat.
- be able to evaluate the cost effectiveness of different possible solutions.
- have an overview over the main equipment of geothermal power plants and be able to design simple systems.

Content: Geothermal systems. The mining of geothermal heat. Boreholes. Research, drilling, wells, measurement and testing of boreholes, grouping of geothermal systems, resource models, supply models. The role of geothermal heat in the energysystem. The multifarious use of geothermal use in Iceland and abroad. Direct use of geothermal heat in district heating, swimming pools, greenhouses, snow melting and in industry. Design of geothermal power systems, strength, control and safety equipment. Design of direct and indirect heat exchangers. Selection of steam turbines, cooling towers, condencers and pumps.

Reading material: Material from teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade 100%.
Language of instruction: Icelandic.

AT AÐF 1003 **Research Methods in Engineering** 3 credits [ECTS:6]

Year of study: Fourth year.
Semester: Fall.
Level of course: Second cycle - Introductory.
Type of course: Core.
Prerequisites: The first 6 semesters (90 credits = 180 ECTS) of an engineering programme.
Schedule: 4 lectures and 3 practical lessons per week for 12 weeks.
Lecturer: Haraldur Auðunsson PhD, Associate Professor. Ingunn Sæmundsdóttir, Associate Professor.
Learning outcome: On completion of the course students should:

- be able to organize a research project, exploit the data aquired and write a thesis, an article and a presentation to account for the results of the project.

Content: Planning research work, aims and goals. The search for and use of literature and information. Writing a thesis. Codes of ethics. The use of statistics in research.

Reading material: From teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Project grade and exercises count 100%.
Language of instruction: Icelandic.

VT LOK 1012 **Final Project** 12 credits [ECTS:24]

Year of study: Fourth year.
Semester: Fall.
Level of course: Second cycle - Introductory.
Type of course: Core.
Prerequisites: 180 ECTS in Mechanical Engineering (VT1-VT6).
Schedule: Independent work by students for 15 weeks in consultation with an instructor.
Lecturer: Baldur Jónasson MSc, Associate Professor. Indriði Sævar Ríkharðsson MSc, Assistant Professor. Various instructors from the industry.
Learning outcome: On completion of the course students should:

- have trained himself in the use of independent and goal oriented methods in research work and/or practical project work in the industry.

- have obtained a broad overview through the interaction of courses where he applies knowledge from all the subjects previously studied in the Mechanical Engineering programme.

Content: Final project under the guidance of a mentor. The student is required to show his capability to work independently. Projects are drawn from the mechanical engineering aspects of the Icelandic production industry, in cooperation with firms and companies in the indurstry. The main emphasis is on an organized technical approach to the problem and it´s definition, gathering of information, synthesis, analysis and optimisation, evaluation and presentation. The student is allotted 15 weeks to complete the project. The project is presented orally and assessed by faculty members and an external assessor.

Reading material: From instructors.
Teaching and learning activities: Meetings with instructors.
Assessment methods: Project work, oral presentation and oral examination counts 100%.
Language of instruction: Icelandic.