REYKJAVIK UNIVERSITY

School of Science and Engineering

Electrical Engineering

Course Catalog
2006-2007

HÁSKÓLINN Í REYKJAVÍK
REYKJAVÍK 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 Engineering and Electrical Engineering. Students can complete a BS degress in 3,5 years and/or a master´s degree in 5 years. The goal is to provide specialised and practical knowledge that enables the graduate to make an immediate contribution in industry. A major emphasis is on the students working on practical, realistic projects that are based on the teachers´ experience from industry. Most of the teachers have considerable experience in design, production or construction. Each student is required to have a vocational degree from an accredited trade school or attain 6 months of practical industrial experience before they graduate.

The program opens diverse job 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 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. The students are required to have solid knowledge in mathematics, sciences, Icelandic and English. It is desirable that they have completed 21 points in mathematics and 6 points in physics (Explanatory note: These are secondary school points not comparable to credits for academic studies). Applicants that don´t have adequate theoretical basis are offered supplementary courses at the preparatory studies program.

The final examination in Engineering BSc of 105 credits (210 ECTS) is completed in 3,5 years and gives very considerable professional competences in relation to the duration of study. 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 the graduate is well prepared to study towards an advanced degress such as an MSc degree, 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 Construction, Mechanical 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 practical experience from industry. The department´s research focus is mainly on applied research in cooperation with specialized companies and institutions in the respective fields.

Programs for the MSc degree in engineering started in January 2006. The first MSc program offered is for civil engineers, but later also for mechanical and electrical engineers. For those having completed the final examination in engineering BSc at Reykjavik Univerisity or at the former Technical University of Iceland (105 credits, 210 ECTS) the master´s program will take three semesters. For those having a bachelor´s degree in engineering of 90 credits (180 ECTS) it will take 4 semesters.

Electrical Engineering BSc

Electrical engineers work in various fields, such as electric power distribution, electronics design, industrial robots, embedded systems, telecommunications, and management. They are employed at electric power companies, consulting engineering firms, in production enterprises, telecommunication companies, to name just a few. Their responsibilities include the design and analysis of power distribution equipment, the design of electronic devices, the design and installation of automation equipment for manufacturing, the design of lighting, and security equipment for buildings.

The goals of the BSc in Electrical Engineering are the following: To cover the basic theory of mathematics, physics, computer science, electric circuit theory, and electronics. To provide the students with the knowledge and skills in selected areas of electrical power systems theory, electronics and computer systems, that is developed from a base of electric circuit theory, electronics, computer science, mathematics and physics. To allow the student to specialize in Electrical Power Systems, Electronics, or Computers, by selecting elective courses from Electrical and Electronic Engineering, from Computer Science, or from the School of Mechatronics Engineering.

The students are encouraged to develop an investigative approach to problem solving and to develop independent study skills. Develop good written and oral communications skills. Develop management, teamwork, problem-solving, and design skills through a combination of directed practical projects, and independent projects. Further, the goal is to provide the students with the knowledge and skills that will give them the option to continue their studies towards an advanced degree. Finally, the goal is to produce graduates with the theoretical and practical knowledge and skills that enables them to make an immediate contribution in the electrical and electronic industries.

Each of the first six semesters students take five courses, which are divided into four 12 -week academic courses (6 ECTS) and one three-week intensive course (6 ECTS). In the seventh semester each student is then required to complete a final project that is (24 ECTS) and complete a course that covers research methods in engineering (6 ECTS). During the 5^{th} and 6^{th} sememsters the students can choose two elective courses at Reykjavik University or at another university. Any cost resulting from studying outside the RU is borne by the student.

Courses – Electrical Engineering

Electrical Engineering 105 credits (210 ECTS)

1. semester		
	Mathematics	
	Physics	
	Electric Circuits	
	Operating Systems and Computer Technology	
	Computer Science	3 weeks
2. semester		
	Mathematics	
	Computer Science	
	Electronics	
	Digital Logic Design and Microcontrollers	
	Practical Project	3 weeks
3. semester		
	Mathematics	
	Computer Science	
	Electrical Systems	
	Databases	
	Project Management	3 weeks
4. semester		
	Control Engineering	
	Power Electronics	
	Electromagnetic Theory	
	Computer Networks and Communication	
	Instruments and Measuring methods	3 weeks
5. semester		
	Operations Research	
	Three courses focusing on Power Distribution and Electric Machinery or Electronics	
	Management and Innovation	3 weeks
6. semester		
	Four courses focusing on Power Distribution and Electric Machinery or Electronics	
	Elective course	3 weeks
7. önn		
	Research Methods in Engineering	
	Final Project	15 weeks

STUDY PLANS IN ELECTRICAL ENGINEERING

Electrical Engineering: A 7 Semester BSc Programme

	Fall	Spring	Fall	Spring
	RT1 1. semster	**RT2** 2. semster	**RT3** 3. semster	**RT4** 4. semster
Physics	AT EÐL 1003			
Electric Circuits	RT RAF 1003			
Mathematics	AT STÆ 1003	AT STÆ 2003	AT STÆ 3003	
Operating Systems and Computer Technology	RT TST 1003			
Computer Science	T-103-TOLV	RT TLV 2003	RT TLV 3003	
Digital Logic Design and Microcontroller		RT STA 1003		
Electronics		RT RAT 1003		
Practical Project		RT HVR 1003		
Electrical Systems			RT RAK 1003	
Database			UT GAG 1003	
Project Management			AT VST 1003	
Control Engineering				VT REG 1003
Power Electronics				RT PWR 1003
Instruments and Measuring methods				RT MAL 1003
Electromagnetic Theory				RT EXH 1003
Computer Networks and Communication				UT NET 1003

	RT5 5. semster	**RT6** 6. semster	**RT7** 7. semster
Core Courses			
Management and Innovation	AT RSN 1003		
Operations Research	VT AÐG 1003		
Final Project			RT LOK 1012
Research Methods in Engineering			AT AÐF 1003
Specialization: Electric Power			
Electronics	RT RAT 2003		
Electrical Machines	RT RVE 1003		
Integrated Circuits	RT SMR 1003		
Energy Efficiency	VT OTÆ 1003		
Electrical Systems	RT RAK 2003		
Signal Analysis		UT MER 1003	
Bioinformatics		UT LÍF 1003	
Communication Systems		RT FSK 1003	
Industrial Controllers		RT IDN 1003	
Operations Research and Simulation		VT AÐG 2003	
Elective course		6 ECTS	
Specialization: Electronics			
Electronics	RT RAT 2003		
Integrated Circuits	RT SMR 1003		
Energy Efficiency	VT OTÆ 1003		
Signal Analysis		UT MER 1003	
Communication Systems		RT FSK 1003	
Industrial Controllers		RT IDN 1003	
Microprocessors		RT CPU 1003	
Operations Research and Simulation		VT AÐG 2003	
Elective course		6 ECTS	

COURSE DESCRIPTIONS IN ELECTRICAL ENGINEERING

T-TOLV-103 Computer Science 1 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.
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** 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: Dot product. Cross product. Equations for straight lines, planes, spherical areas a.s.on. Polar coordinates. Complex numbers: Arithmetics. Length. Polar form. Complex roots. Polynominal equations. Complex equations and inequations covering curves and areas. One variable functions: Limits. Continuity. Inverse functions. Differentiation. Implicite differentiation. Chain rule. Relative rates of growth. Maxima and minima. L´Hopitals rule. Parametric curves. Curves in polar coordinates. Exponential, natural logarithmic and related functions. Trigonometric, hyperbolic functions. And their inverses. Functions with more than one variable: Continuity. Partial differntials. Gradient. Chain rule and directional derivatives. Maxima and minima for functions of two variables. Integration: Length of a curve. Calculation of areas and volums. Partial integration, change of variables, and decomposition into partial fractions. Improper integrals. Double integrals. Change of variables in polar coordinates.

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 100%.
Language of instruction: Icelandic**.**

RT RAF 1003 Electric Circuits 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: Ágúst Valfells PhD, Assistant Professor.
Learning outcome: On completion of the course students should:

- be familiar with the basic variables of linear circuits.
- know the basic methods of linear circuit analysis.
- be exposed to experiments and computer aided circuit analysis.

Content: The following material will be covered in the course: Circuit diagrams and parameters; Circuits in equilibrium, Kirchoff's current and voltage laws; mesh and nodal analysis; Thévenin and Norton equivalent circuit theorems, superposition; Energy storage in electric and magnetic fields, capacitors and inductors. Response of RL, RC, and RLC circuits. AC-circuits, phasors, power in transforms.Δcircuits, Three-phase circuits, Y-to-ΔAC circuit transforms. Complex numbers and elementary differential equations are used a fair amount. Students will be helped to brush up on those subjects as needed.

Reading material: Dorf og Svoboda, *Introduction to Electric Circuits.*
Teaching and learning activities: Lectures and exercise sessions (discussion groups and lab).
Assessment methods: Written final exam (50%); two mid-terms (15% each); exercises (20%).
Language of instruction: Icelandic.

RT TST 1003 Operating Systems and Computer Technology 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
Lecturer: Ásgeir Þór Eiríksson PhD, Associate Professor.
Learning outcome: On completion of the course students should be familiar with:

- the basic hardware components that make up a computer system
- the basic components of operating systems
- the basic concepts used to describe operating systems and the interaction of the operating system with the basic hardware componenets

Content: This course focuses on the following topics: History of the Computer and Operating Systems. The Hardware Components of a Computer and how they form a working system. The students will disassemble and assemble a PC. Build a RJ-45 network cables and form a working network. Installing various Operating Systems and describe in written assignments the differense

in their development (DOS 6.22, Win 3.11. Win 95/98 and Windows 2000 Professional. The course will also focus on the following topics: Computer-System Structures, Operating-System Structures, Processes, Threads, CPU-Scheduling and Process Synchronization.

Reading material: Silberschatz, Galvin, Gagne, *Operating System Concepts* (7th edition). Teacher´s notes.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination, counting for 50 of the final grade. Written assignments count for 50%..
Language of instruction: Icelandic.

AT STÆ 2003 **Mathematics** 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: Vector functions of one variable. Equivalens sets for functions of two or three variables. Tangent planes to three dimensional surfaces. Roots and divergence of vector functions. Potential functions for vector functions. Functional integrals. Areal integrals. Linear algebra: Vector spaces linear dependance of vectors. Basis for vector spaces. Matrix calculation. Linear mapping. Linear systems of equations. Gauss elimination. Rank and zero dimension. Inverse matrices. Determinants. Eigenvalues and vectors. Similar matrices. Matrices similar diagonal matrices. Sequences and series. Test for convergence. Power series. Taylor series. Fourier series. Laplace transforms. Differential equations.

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 100%.
Language of instruction: Icelandic.

RT TLV 2003 **Computer Science** 3 credits [ECTS:6]

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

Prerequisites: T-103-TOLV.
Schedule: 4 lectures, and 2 practical lessons a week, and programming projects
Lecturer: Stefán Arnar Kárason BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to write a program in an object orientated language, here Java
- be able to write a consol program, and a program with a graphical user interface
- understand inheritance and polymorphism and be abel to use this knowledge in building class collections

Content: Object orienated programming in Java, Structure of data, classes, objects, methods, inheritance, polymorphism. Control commands and program flow, arrays and strings. Console programs and programs with graphical user interfaces, Java applets, the html language. Exceptions, disk input and output.

Reading material: Y. Daniel Liang. *Introduction to Java Programming.*
Teaching and learning activities: 72 teaching hours (48 lectures + 24exercizes). Home assignments
Assessment methods: 3 hours written exam 70% home assignments 30%
Language of instruction: Icelandic.

RT STA 1003 Digital Logic Design and Microcontroller 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Introductory
Type of course: Core.
Prerequisites: None
Schedule: 4 lectures, 2 practical lessons a week, and 1-2 projects. During the 10-12 week students will build a digital component that will be graded.
Lecturer: Gunnar Magnússon MSc, Adjunct.
Learning outcome: On completion of the course students should:

- have a basic understanding of digital components
- have a basic understanding of digital controllers

Content: Numbering systems and binary codes. Arithmetic operations. Logic gates, combinational and sequential logic circuits. Boolean algebra. Karnaugh Map. Logic families. Various Application circuits. Counters, Registers, Memories and Programmable Logic Devices. An introduction to the HC11 Microcontroller from Motorola Assembly language program structure of HC11 Interfacing the HC11 to different I/O devices.

Reading material: Sedra/Smith, *Microelectronic Circuits, 5th ed*. Oxford University Press.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 hour written examination.
Language of instruction: Icelandic.

RT RAT 1003 Electronics 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.

Level of course: First cycle - Introductory
Type of course: Core.
Prerequisites: RT RAF 1003
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks.
Lecturer: Gunnar Magnússon MSc, Adjunct.
Learning outcome: On completion of the course students should:

- be able to analyze, troubleshoot and design the the most common types of multistage amplifiers.

Content: Design of simple electronic circuits using diodes, transistors (MOSFETs and BJT) and Op-Amps. Biasing, eficiency, common subcircuits and configurations. Design techniques of small-signal amplifiers (CS, CE and difference amps) and their uses in multistage amplifiers.

Reading material: Sedra/Smith, *Microelectronic Circuits.*
Teaching and learning activities: 72 lessons. Written homework. Lab exercises.
Assessment methods: A 3 hour written examination.
Language of instruction: Icelandic.

RT HVR 1003 **Practical Project** 3 credits [ECTS:6]

Year of study: First year.
Semester: Spring.
Level of course: First cycle - Introductory
Type of course: Core.
Prerequisites: None.
Schedule: 15 lectures and 15 pracial lessons per week for 3 weeks. Course project that will be graded.
Lecturer: Stefán Arnar Kárason BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- know how to obtain and utilize technical information from the internet, about electronic components.
- be familiar with using measuring equipment and construction of electronic devices.
- be able to draw electronic circuit diagrams with a computer program and use a specialized equipment for making printed circuit prototypes.
- be able to write a clear and concise report on their work.

Content: Design and construction of electronic equipment. Students work in groups of 3 to 4 where they design and build electronic equpment and write a report on the project.

Reading material: Notes and references provided by teacher
Teaching and learning activities: 90 class hours consisting of: lectures, laboratory work, searching for information and data sheets on the internet, design, construction and report-writing.
Assessment methods: Evaluation of project-report, design and construction.
Language of instruction: Icelandic.

AT STÆ 3003 **Mathematics** 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: Probability, estimates, discrete distributions, binomial distribution, Poisson distribution, continuous distributions, normal distribution, exponential distribution, t-distribution, confidence intervals, non parametric tests, t-test, F-test, X(2) test, linear and curvelinear regression, polynomial regression, logarithmic regression, correlation, analysis of variance, measurements, propagation of error, quality control, control charts, time-series. Excel and statistical programmes used for calculations. Student must solve and deliver 80% of exercises to be accepted for examination.

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.

RT TLV 3003 **Computer Science** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Fall.
Level of course: First cycle - Intermediate.
Type of course: Core.
Prerequisites: T-103-TOLV.
Schedule: 4 lectures, and 2 practical lessons a week, and programming projects.
Lecturer: Stefán Arnar Kárason BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to write a program in an object orientated language, here Java
- be able to write a consol program, and a program with a graphical user interface
- understand inheritance and polymorphism and be abel to use this knowledge in building class collections

Content: Object orienated programming in Java, Structure of data, classes, objects, methods, inheritance, polymorphism. Control commands and program flow, arrays and strings. Console programs and programs with graphical user interfaces, Java applets, the html language. Exceptions, disk input and output.

Reading material: Y. Daniel Liang. *Introduction to Java Programming.*
Teaching and learning activities: 72 teaching hours (48 lectures + 24exercizes). Home assignments.
Assessment methods: 3 hours written exam 70%, home assignments 30%.
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.

RT RAK 1003 **Electrical Systems** 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: Kristinn Sigurjónsson, MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- know how electrical power is transformed to mechanical power.

- know how ac electricity and power flows in transmission lines.
- know how transformers are used for measurements and control of power flow.

Content: Fundaments in electrical power, dc generators and motors. Phasor diagrams, active, reactive and apparent power. 1- and 3-phase circuits, equivalent circuit. Autotransformers, tap-changing transformers and voltage, current and phase-shift transformers. Asynchronous motors, synchronous generators. Use of 1-phase equivalent circuit instead of 3 phase circuit.

Reading material: Wildi, *Electrical Machines, Drives, and Power Systems*, 6. ed.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 3 hours written examination.
Language of instruction: Icelandic.

RT GAG 1003 **Databases** 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: Elín K. Sighvatsdóttir BS, MBA.
Learning outcome: On completion of the course students should:

- have theoretical and professional approach to relational database systems.
- understand the Database management system environment and planning.
- have knowledge of database design: ERD, normalization and physical design
- have basic skills in using database objects and capacity in manipulating data.
- have basic skills in using metadata and Data Dictionary.
- have knowledge of database Security.
- have understanding of database management the role of DBA, indexes and transaction control.

Content: Introduction to Databases. Relational Algebra and relational Calculus. Logical Design of Database system and Entity Relationships Diagrams. Normalization, Physical design (table schema) and objects in databases(triggers, sequences, views, synonims etc.). Working with Metadata, SQL DML and DDL (and introduction to PL/SQL). Transaction control and Indexes. The focus is on transactional systems but we will also cover Data Warehouses.

Reading material: Connolly and Begg, *Database Systems*, 4.ed.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 3 hours written examination.
Language of instruction: Icelandic.

VT REG 1003 **Control Engineering** 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.

RT PWR 1003 **Power Electronics** 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: Sukumar PhD, Adjunct Professor.
Learning outcome: On completion of the course students should:

- have a good overview of various kinds of semiconductor devices used in the power electronics.
- learn about methods for control of converters and inverters.

Content: The course is intended to give overview of devices broadly used in power electronics. The course will cover electronic devices such as diodes, thyristors, triacs a.o. Special attention will be drawn to the use of power electronic in motor control, in the heavy industry and in the electrical transmission system (HVDC, FACTS). The conversion between AC and DC will be covered. The teaching will be based on lectures, examples, question and problems. A project in building a power electronic device will be part of the course.

Reading material: M. Rashid, *Power Electronics: Circuits, devices, and applications* (3rd edition), Prentice Hall.
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: English.

RT MAL 1003 **Instruments and Measuring Methods** 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
Level of course: First cycle – Intermediate.
Type of course: Core.
Prerequisites: None.
Schedule: 90 Class hours (30L + 60Ex).
Lecturer: Stefán Arnar Kárason BSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- have an understanding of the fundamentals of instruments and measuring techniques
- be able to select a suitable instrument and measurement technique for each measuring task.
- be able to analyse the measurement records and write a through report on the results

Content: Mesurements in DC and AC systems, on analog- and digital circuits and communications circuits. Handling of measuring instruments and their use in the lab, laboratory exercises. Introduction to the LabView programming language and its use in measurement systems, exercises with LabView

Reading material: Notes and references provided by teacher. In addition the students will be using LabView and examples and material from the National Instruments (www.ni.com) home page**.**
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 15 exercises with written reports.
Language of instruction: Icelandic.

RT EXH 1003 **Electromagnetic Theory** 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: Ágúst Valfells PhD, Assistant Professor
Learning outcome: On completion of the course students should:

- become familiar with the fundamental ideas of electromagnetics and its applications.
- be able to solve basic electromagnetic problems and have a sound basis for more specialized courses.

Content: The fundamentals of electromagnetic theory will be addressed: Electric and magnetic fields; transmission lines; electro- and magnetostatics; Maxwells equations; electromagnetic waves and their propagation; radiation and antennas.

Reading material: Ulaby, *Fundamentals of Applied Electromagnetics.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Written final exam (70%). Two mid-terms (15% each).

Language of instruction: Icelandic.

UT NET 1003 Computer Networks and Communication 3 credits [ECTS:6]

Year of study: Second year.
Semester: Spring.
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: Sigurbrandur Dagbjartsson BS.
Learning outcome: On completion of the course students should:

- have a good understanding of the TCP/IP protocol.
- have knowledge on major organization and design of network solutions and major rules on network traffic.
- have good knowledge on various network services.

Content: Basic elements of network environment are covered. Client server solutions will be covered. Network design, method, protocols and access protocols. Network services http, ftp, dns. OSI model will be covered.

Reading material: *Computer Networks* ISBN 0-13-038488-7. *CCNA Cisco Certified Network Associate* ISBN 0-7821-4391-1
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 3 hours written exam.
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 AÐG 1003 **Operations Research** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Introductory
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.

RT RAT 2003 **Electroncis** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Advanced
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 3 exercise classes a week for 12 weeks.
Lecturer: Gunnar Magnússon MSc, Adjunct.
Learning outcome: On completion of the course students should:

- have good insight into more advanced amplifier circuits, analog filters and oscillators, and
- will be able to use the acquired knowledge to design and construct equipment that can be used in larger context.

Content: Feedback amplifiers, Filters, Oscillators, Amplifier bandwidth and distortion, high frequency transistor models. Classes of amplifiers and application. A/D converters and voltage regulators.

Reading material: Sedra/Smith, *Microelectronic Circuits*, 5th edition.
Teaching and learning activities: Lectures and exercises.
Assessment methods: 3 hour written exam.
Language of instruction: Icelandic.

RT RVE 1003 **Electrical Machines** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle – Intermediate.
Type of course: Core.
Prerequisites: RT RAK 1003.
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks.
Lecturer: Sukumar PhD, Adjunct Professor.
Learning outcome: On completion of the course students should:

- be able to understand synchronous and asynchronous generators and motors
- know how ac electricity and power flows in impedances
- know single phase, linear induction and stepper motors

Content: Asynchronous motors and generators, synchronous motors and generators, linear induction motor. Single phase motors and stepper motor. Electrical power production and transmission.

Reading material: Theodore Wildi, *Electrical machines, drives, and power sytems*, 6th edition, Pearson International.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 3 hours written examination.
Language of instruction: English.

RT SMR 1003 **Integrated Circuits** 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 exercise classes a week for 12 weeks.
Lecturer: Gunnar Magnússon MSc, Adjunct. Halldór Guðfinnur Svavarsson PhD, Assistant Professor.
Learning outcome: On completion of the course students should:

- should have a basic knowledge of semiconductor physics.
- should have acquired a good working knowledge of construction and production techniques of IC's.
- should know well digital and analogue integrated circuits.

Content: Solid state physics: Crystal structures and electrical- and transport properties of common semiconducting materials. IC design: Basic NMOS an CMOS circuits. Production techniques of transistors as well as of passive components. Scaling, testing, packaging, models and optimizing, cost and efficiency.

Reading material: Saint, *IC Layout Basics 1. ed.* Saint, *IC Mask Design, 1. ed*. Streetman, Banerjee, *Solid State Electronic Devices.*
Teaching and learning activities: Lectures and exercises.
Assessment methods: 3 hour written exam.

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.

RT RAK 2003 **Electrical Systems** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Fall.
Level of course: First cycle - Advanced
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 2 practical lessons per week
Lecturer: Örvar Ármannsson, part-time lecturer.
Learning outcome: On completion of the course students should:

- have a basic understanding of electric power distribution systems: their analysis and control

Content: The analysis of power distribution systems, their steady state behavior, and computing short circuit currents. The control and analysis of power distribution systems, their stability, transient behavior, circuit breakers, etc. Computer modeling will be employed and there will be practical projects.

Reading material: Theodore Wildi, *Electrical machines, drives, and power sytems,* 6th edition, Pearson International.

Teaching and learning activities: Lectures and practical sessions.
Assessment methods: 3 hour written exam.
Language of instruction: Icelandic.

UT MER 1003 **Signal Analysis** 3 credits [ECTS:6]

Year of study: Third year.
Semester: Spring
Level of course: First cycle – Introductory.
Type of course: Elective.
Prerequisites: None.
Schedule: 4 lectures and 2 practical lessons per week for 12 weeks.
Lecturer: Jón Bjarnason, CSc, Adjunct.
Learning outcome: On completion of the course students should:

- know the fundamentals of signal processing.

Content: Fundamental mathematical methods in signal processing. Sampling of analog signals. Timeseries, discrete Fourier transform (DFT), fast Fourier transform (FFT), z transform and theirs inverse transforms. Convolution, cross-correlation and auto-correlation. FIR and IIR filters.

Reading material: Ifeachor, Jervis, *Digital Signal Processing A Practical Approach*. Kristján Jónasson, *MATLAB Forritunarmál fyrir vísindalega útreikninga* (ítarefni). McClellan, Schafer, Yoder, *Signal Processing Firs.*
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: A 3 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 FSK 1003 **Communication Systems** 3 credits [ECTS:6**]**

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 6 weekly lectures for 12 weeks. Four research topics for students for which they write a short paper and hold a presentation every three weeks.
Lecturer: Sæmundur E. Þorsteinsson Dipl.Ing.
Learning outcome: On completion of the course students should:

- have a basic insight into telecommunications networks and systems including:
- theoretical basis for communications, such as Shannon's law on channel capacity.
- transmission media (fibre, coax, twisted pair).
- wireless communications incl. WiFi, WiMAX, Bluetooth, mobile systems, satellite communications,
- PSTN, trunks, switching, multiplexing,
- Core, Access and Home networks.
- have a basic knowledge on the layered model of communications.
- physical, data link, network, transport and application layers.
- data link functions, various data link protocols such as Ethernet.
- network layer functions, routing protocols, QoS, IP
- transport protocols TCP, UDP.
- have gained knowledge on the utilization of communication technologies.
- distributed information systems, home networking, teleworking, e-learning, social inclusion, Peer-to-Peer networking, IPTV and VoD, social implications.

Content: History of communications, fixed and wireless transmission, analogue and digital modulation, multiplexing and multiple access methods, communication systems and networks, packet and circuit switching, core and access networks, PAN, LAN, MAN, WAN, SDH, ATM, Ethernet, MPLS, IP, TCP, UDP, xDSL, CATV and DOCSIS, Power line Communications, POTS; ISDN, VoIP, High Speed Internet, mobile communications, NMT, GSM/GPRS/EDGE, UMTS B3G, Satellite communications, LEO, MEO, GEO, Iridium, Inmarsat, Intelsat, GPS, Galileo, WiFi, Bluetooth, WiMAX, microwaves, distributed information systems, home networking, services including e-learning, e-care, home automation and entertainment, social implications of communications.

Reading material: Tanenbaum, *Computer Networks*.
Teaching and learning activities: Lectures, students' research, paper writing and presentation.

Assessment methods: Teachers' and peer review of papers and presentation, verbal examination.
Language of instruction: Icelandic.

RT IDN 1003 **Industrial Controllers** 3 ein (6 ECTS)

Year of study: Third year.
Semester: Spring.
Level of course: First cycle - Advanced.
Type of course: Elective.
Prerequisites: None.
Schedule: 6 exercise classes a week for 12 weeks.
Lecturer: Gunnar Magnússon MSc, Adjunct. Indriði Sævar Ríkharðsson MSc, Assistant Professor.
Learning outcome: On completion of the course students should:

- be able to program a PLC with digital and analog variables.
- be able to connect sensors of different types to PLC.
- be able to program and control an industrial robot with application software and specially designed tools.

Content: Programmable logic controllers (PLC's). Programming with digital and analog variables. Industrial applications. Robots controlled by PLC algorithm (PL7 Junior) or a computer program (Active-X or Lab View).

Reading material: *Active Robot Training*.
Teaching and learning activities: Initially lectures, then practical exercises.
Assessment methods: Practical exercises account for approx. 35% of final grade, a 3 hour written exam for approx. 65%.
Language of instruction: Icelandic.

RT CPU 1003 **Microprocessors** 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: Kristófer Arnar Einarsson MSc, part-time lecturer.
Learning outcome: On completion of the course students should:

- recognize the basic structure of computer hardware and software, and the interface.
- use microcomputers to solve real world problems.

Content: Fundamentals of computer organization. Addressing methods, machine programming and instruction sets. The processing unit, microprogramming, I/O-organization and arithmetic operations. The main memory and peripherals. Microprocessors. Multiprocessors and computer communications. Laboratory exercises are based on the M68000 and PIC microprocessors.

Reading material: Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, 5th edition.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Home project counts 20%, exercises 20%, 3 hour written examination 60%.
Language of instruction: Icelandic.

AT AÐF1003 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. Agúst Valfells PhD, Assistant 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. Statistics.

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

RT 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 Electrical Engineering (RT1-RT6).
Schedule: Independent work by students for 15 weeks in consultation with an instructor.
Lecturer: Ágúst Valfells PhD, Assistant Professor
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 Elextrical 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 electrical and electronic 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.