TÆKNI- OG VERKFRÆÐIDEILD
SCHOOL OF SCIENCE AND ENGINEERING

Applied Civil Engineering BSc - 210 ECTS

A BSc program of 210 ECTS credits

Course Catalogue
2017-2019

Updated February 15th 2018

Content may be subject to change, for newest updates see www.ru.is

REYKJAVIK UNIVERSITY
School of Science and Engineering www.ru.is

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APPLIED ENGINEERING BSc - 210 ECTS

The School of Science and Engineering offers programs in applied engineering of 210 ECTS credits in three disciplines rooted in traditional trades: civil engineering, mechanical and energy engineering, and electrical engineering. Students take a final examination after 3,5 years. The goal is to provide specialized and practical knowledge so that graduates are well prepared for employment in industry upon graduation. A major emphasis is placed on practical, realistic projects that are based on the teachers´ knowledge from industry. 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. Although preparation for further studies is not the major goal of these programs, there are numerous opportunities and the path towards an MSc degree in engineering is easily accessible.

The admittance criteria is a matriculation examination with emphasis on mathematics and physics, or a comparable examination. Students who do not have practical experience from the workplace at the start of their studies are encouraged to obtain experience by working in the summer breaks. Applicants not having the adequate theoretical basis are offered supplementary courses at RU´s preliminary studies program.

The final examination in BSc Applied Engineering 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 programs, an emphasis is placed on the students´ work on practical projects in cooperation with engineering firms and research institutes, and students have the option of taking up to 18 ECTS credits as internship with an industrial firm. The student's final project of 24 ECTS is a design and/or research project with emphasis on independent work and goal oriented methods in practical project work in the industry.

As a member of the CDIO network www.cdio.org Reykjavik University emphasizes curriculum being taught in the context of professional engineering. The teaching approach balances academic rigour with a practical understanding of work in a fast-changing industry and world. During the course of their studies graduates will have become accustomed to the process of design, implementation and operation which they will face in their future careers.

This course catalogue contains descriptions of courses offered fall semester 2016 to spring semester 2018. Course descriptions may be subject to change without notice. **For further information see** www.ru.is **or contact RU School of Science and Engineering´s programme administrator for applied engineering Hjördís Lára Hreinsdóttir** tvd@ru.is

BSc in APPLIED CIVIL ENGINEERING - 210 ECTS

Applied civil engineering deals with the design of structures such as buildings, road work and hydropower plants, as well as project planning and supervision. Most civil engineers are employed as structural designers with engineering firms or as leaders of construction projects with contractors or public authorities. Structural analysis, materials science, geotechnics, construction management and road design are key subjects in civil engineering.

The students are encouraged to develop an investigative approach to problem solving and to develop independent study skills, good writing skills and oral communications skills. Develop management, teamwork, problem-solving, and design skills through a combination of directed practical projects, and independent projects. Many of the students enrolled have work experience in the building sector and the program enhances that background. The goal is to produce graduates with the theoretical and practical knowledge and skills that enables them to make an immediate contribution in the building industry.

In the first 6 semesters, students generally take five courses per semester (6 ECTS each). Four of the courses are taught during the first 12 weeks of the semester, ending with written or oral examinations. After the examination period comes a three-week intensive, project-oriented courses. In the 7th semester, students work on a specialized final project (24 ECTS) and one elective course (6 ECTS). During the 5th, 6th and 7th semesters students take elective subjects that offer a degree of specialization. Instead of elective courses, they have the option of taking up to 18 ECTS credits as internship with an engineering firm. Three fields of specialization are offered; Structural Design, Construction Management and Installation Systems.
For further information see www.ru.is

STUDY PLAN IN APPLIED CIVIL ENGINEERING

For students who commence their studies in Fall Semester 2018:

	Fall	Spring	Fall	Spring
	BT1 **1st semester**	**BT2** **2nd semester**	**BT3** **3rd semester**	**BT4** **4th semester**
Brainstorming (1 ECTS)	T-100-HUGM			
Practical Programming in Matlab	AT FOR 1003			
Physics	AT EÐL 1003			
Mathematics	AT STÆ 1003	AT STÆ 2003	AT STÆ 3003	
Structural Mechanics I	BT BUÞ1013			
Mechanics of Materials and Structural Analysis		BT BUR 2003	BT BUR 3003	
Intro to Engineering Design / CAD	AT TÆK 1002			
Construction Materials Science		BT EFB 1003		
Statistics and Methods		AT AÐF 1013		
The Design Process		BT HVB 1003*		
Concrete Technology			BT EFN 2002*	
Environment, Health and Safety			BT UHÖ 1001*	
Soil Mechanics & Eng. Geology			BT JTÆ 1003	
Project Management			AT VST 1003*	
Actions and Safety of Structures				BT ÁLA 4002
Fire Resistant Design				BT BRU 1001
Design of Timber & Steel Structures				BT BYG 1003
Building Engineering Physics				BT BEÐ 1003*
Hydraulics				BT REN 1003
Surveying and GIS				BT LAM 1013*

	BT5 **5th semester**	**BT6** **6th semester**	**BT7** **7th semester**
Core: Mandatory courses			
Reinforced Concrete I	BT SST 1013		
Road Design – Urban and Rural	BT VEG 1013*		
Internship I	AT INT 1003		
Internship II	AT INT 2003		
Installation Systems		BT LAG 1013	
Sustainable Urban Development	BT UVB 1003*		
Geotechnical Engineering		BT JTÆ 2013*	
Practical Project in Structures & BIM		BT HVB 3003	
Final Project			BT LOK 1012
Management and Innovation			AT RSN 1003
Specialization: Structures, Construction or Installations			
Internship III		AT INT 3003**	
Earthquake Analysis of Structures		T-806-SVEI**	
Design of Timber & Steel Structures			BT BYG 2013**
Reinforced Concrete II		T-806-SST2**	
Traffic and Road Construction		T-806-UMFE**	
Construction Management I		BT FRK 1013**	
Heating, Ventilation, Airconditioning		BT LOF 1003**	
Water & Wastewater Disposal		BT LAG 3003**	

*Taught every other year, for a combined class of 1st and 2nd year students, or 2nd and 3rd year students.
** Recommended electives, other electives are also available. The student may choose a specialized internship instead of an advanced course in his/her field of specialization. Three week course.

STUDY PLAN IN APPLIED CIVIL ENGINEERING

For students who commence their studies in Fall Semester 2017:

	Fall	Spring	Fall	Spring
	BT1 **1st semester**	**BT2** **2nd semester**	**BT3** **3rd semester**	**BT4** **4th semester**
Brainstorming (1 ECTS)	T-100-HUGM			
Practical Programming in Matlab	AT FOR 1003			
Physics	AT EÐL 1003			
Mathematics	AT STÆ 1003	AT STÆ 2003	AT STÆ 3003	
Structural Mechanics I	BT BUÞ1013			
Mechanics of Materials and Structural Analysis		BT BUR 2003	BT BUR 3003	
Intro to Engineering Design / CAD	AT TÆK 1002			
Construction Materials Science		BT EFB 1003		
Statistics and Methods		AT AÐF 1013		
Surveying and GIS*		BT LAM 1013*		
Road Design – Urban and Rural*			BT VEG 1013*	
Soil Mechanics & Eng. Geology			BT JTÆ 1003	
Sustainable Urban Development*			BT UVB 1003*	
Actions and Safety of Structures				BT ÁLA 4002
Fire Resistant Design				BT BRU 1001
Design of Timber & Steel Structures				BT BYG 1003
Geotechnical Engineering*				BT JTÆ 2013*
Hydraulics				BT REN 1003
The Design Process*				BT HVB 1003*

	BT5 **5th semester**	**BT6** **6th semester**	**BT7** **7th semester**
Core: Mandatory courses			
Reinforced Concrete I	BT SST 1013		
Concrete Technology*	BT EFN 2002*		
Environment, Health and Safety*	BT UHÖ 1001*		
Internship I	AT INT 1003		
Internship II	AT INT 2003		
Installation Systems		BT LAG 1013	
Project Management*	AT VST 1003*		
Building Engineering Physics		BT BEÐ 1003*	
Practical Project in Structures & BIM		BT HVB 3003	
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Course Descriptions in BSc Applied Civil Engineering

Courses in the 1st year – Fall semester

BT BUÞ 1013 STRUCTURAL MECHANICS I 6 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week. Weekly support classes are also offered as part of this course.
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Jóhann Albert Harðarson.

Learning outcome: This course covers the fundamental concepts of structural mechanics with applications to civil and mechanical structures. The subject deals with statics of structures and the introduction of mechanics of materials.

Knowledge:

- Know and understand the laws of physics applied to a system of forces and their actions.
- Understand the difference between static determinacy and/or indeterminacy of commonly occurring structures, such as trusses and beams.
- Be familiar with the evaluation of reaction forces at structural boundaries, support points, of statically determined structures.
- Know and understand the evaluation of internal forces of statically determined truss structures.
- Know and understand the evaluation of internal forces of statically determined beam and shaft structures.
- Be familiar with relevant physical properties and fundamental laws governing the behaviour of materials and structures.
- Be familiar with the concepts of stress and strain, and their basic relation through Hook's law.
- Be able to evaluate normal stresses and shear stresses for simple line like structures such as trusses and beams.
- Know how to evaluated cross-sectional properties for basic cross-sectional geometries.

Skills:

- Be able to calculate the total force and moment for a system of forces.
- Be able to calculate support reactions and internal forces in common types of two dimensional and simple three-dimensional trusses.
- Be able to evaluated axial deformation in truss like elements.
- Be able to calculate support reactions and internal forces, i. e. bending moment, shear force and normal force, in statically determinate beams and frames.
- Be able to calculate cross sectional properties for common cross sectional geometries, such as area, centroid and moment of inertia.

- Be able to calculate normal and shear stresses in beams and frames for various actions.

Competence:

- Be able to evaluate determinacy or indeterminacy of a structural system.
- Understand the different bearing capacity of common structural elements such as, trusses, beams and frames.
- Understands the different deformation behaviour of common structural elements and structural systems.
- Understand the transfer of forces within simple structural systems, from external loads, through internal forces, to support reactions.
- Be aware of which properties determine the stiffness of common structural elements.
- Understand the key parts and properties of simple structural mechanics models.
- Understand how the different actions transform to stresses and strains within structural elements.
- Be able to test and proof basic calculation results in structural mechanics.

Content: The course deals with static analysis of structures. Topics addressed include: 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 diagrams. Definitions of strain and stress. Sectional properties such as centroids, area, shear area and moments of inertia.

Reading material: Megson, *Structural and Stress Analysis*, 3rd edition.
Teaching and learning activities: Lectures and excercises.
Assessment methods: A 4 hour written final examination counts 70%, a 2 hour mid-term exam 10%, Projects 10%, five exercises 10%. To pass the course, a minimum grade of 5.0 in the final exam is required.
Language of instruction: Icelandic.

AT EÐL1003 PHYSICS 6 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Taught for 12 weeks – 4 lectures and 2 problem-solving classes a week, with additional weekly tutorial sessions and 3 lab sessions.
Supervising teacher: Sigurður Ingi Erlingsson.
Lecturer: Vilhelm Sigfús Sigmundsson. Andrei Manolescu (labs).

Learning outcome: At the end of the course the student should know the concepts and solve problems related to:

- Motion in one dimension and using vectors to desribe motion in 2 and 3 dimensions
- Newtons laws of motion, force diagrams and decomposing forces into components
- Work and how it connects kinetic and potential energy
- Conservation of momentum and impulse and decribing simple collisions
- Kinematic of rotation, angular momentum and moment of inertia
- Statics and properties of static fluids and fluid motion
- Free, damped and driven oscillations
- Heat, temperature and simple heat flow
- Performing measurements, quantitative error analysis and report writing

Content: Physics is a cornerstone to the traditional engineering desciplines. In the course students will be trained in describing simple motion using Newtonian mechanics and the basics of thermodynamics. Special emphasis will be placed on understanding the various concepts in preparation for further studies in applied engineering.

Reading material: H.D Young and R.A Freedman, *University Physics with Modern Physics*.
Teaching and learning activities:. Lectures and practical sessions. Laboratory work (3 experiments with reports) and weekly due exercises.
Assessment methods: 3 hour written exam counts for 80% of the final grade. Laboratory work and due exercises count for 20%.
Language of instruction: Icelandic.

AT FOR1003 PROGRAMMING IN MATLAB 6 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Taught for 12 weeks - 6 hours a week.
Supervising teacher: Magnús Kjartan Gíslason.
Lecturer: Magnús Kjartan Gíslason.

Learning outcome: The aim is that students will:

- Know the basics of programming and understand the associated concepts.
- Be able to use the Matlab programming environment to solve mathematical problems and various other technical assignments.

Content: In this course students learn the basic principles of programming. Emphasis is on the students understanding of basic programming concepts, such as variables, calculations, assignment of variables, statements, loops, command scripts, subroutines or functions and algorithms. Students learn to program in the Matlab program environment and are trained in the use of Matlab as a tool for solving technical problems. Methods in handling data and reporting results through graphics using Matlab are also introduced.

Reading material: Stormy Attaway, *Matlab: A practical introduction to programming and problem solving.*
Teaching and learning activities: Lectures and exercise classes.
Assessment methods: 10%: 6 due exercises. 20%: 3 semester exams, the lowest grade is not counted. 30%: 1 larger programming assignment. 40%: Final exam. Students are required to pass the final exam.
Language of instruction: Icelandic.

T-100-HUGM BRAIN STORMING 1 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: An intensive project course taught for 3 days in September; Wednesday afternoon, and all day Thursday and Friday.
Supervising teacher: Haraldur Auðunsson.

Lecturer: Haraldur Auðunsson, and others.

Learning outcome: At the end of the course the student should:

- have experienced teamwork and understand the importance of cooperation and diversity in a group.
- have experienced situations where decisions and planning are based on uncertain information.
- have been introduced to diverse ways of presenting solutions.

Content: The course is based on brainstorming and group work. Students in the first semester of BSc Engineering, BSc Applied Engineering and BSc Sports Science work for three days on formulating a solution to a practical probelm proposed to them. Students must have completed the course before entering the third year of study.

Reading material: Handout from teachers.
Teaching and learning activities: Teachers give short presentations on teamwork, brainstorming and various methods of presenting ideas. Students work in groups of 5-6 under the guidance of teachers.
Assessment methods: The final grade is either “Pass” or “Failed” and is based on active participation in the course.
Language of instruction: Icelandic.

AT TÆK1002 INTRODUCTION TO ENGINEERING DESIGN 5 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: None.
Schedule: An intensive course taught every weekday for 3 weeks.
Supervising teacher: Haraldur Auðunsson.
Lecturer: Haraldur Auðunsson, and others.

Learning outcome: After completing the course the student should:

- have experienced an organized approach to brainstorming.
- be able to use design software, like Inventor, Revit and AutoCAD, to draw and design simple structural objects.
- have been introduced to good standard practice regarding technical drawings.
- be able to describe the engineering methods of work an and project management.
- be able to keep a workbook according to standard practice.
- be able to identify and to solve a problem in his field of study.
- have some experience with teamwork and understand the importance of cooperation and the benefits of diversity of group members.
- be able to make a well argumented decision on solutions to assignments and propose solutions.
- be familiar with various methods of presenting results, such as oral presentation, poster, a short film and a structural model.
- have been introduced to some ethitical issues in engineering.

Content: The course is based on brainstorming and teamwork were first year students in the BSc programs in engineering and applied engineering work on solving a practical project for three weeks. In the course, an emphasis is placed on computer-aided design, project management and presentations. At the end of the course, each group will submit drawings, a logbook and a short film about the project. To construct a model is optional.

Reading material: Material will be provided by teachers.
Teaching and learning activities: Lectures, assignments to be solved either by each student or by a group, and teamwork.
Assessment methods: The following will be evaluated: Projects using computer-aided design and drawing, participation and contribution in group work, workbooks, and presentation of the project results including presentations, posters and a short video.
Language of instruction: Icelandic.

AT STÆ1003 MATHEMATICS I 6 ECTS

Year of study: First year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Taught for 12 weeks – 4 lectures and 2 problem-solving classes a week, with additional weekly tutorial sessions.
Supervising teacher: Hlynur Arnórsson.
Lecturer: Hlynur Arnórsson.
Learning outcome: On completion of the course students should:

Knowledge:

- Know complex numbers and basic operations with complex numbers.
- Know polar representation and roots of complex numbers
- Know basic functions and their characteristics.
- Know limits and be familiar with continuity and differentiability.
- Know the Intermediate-value theorem.
- Know the Mean Value theorem.
- Know integrals and their graphical interpretation.
- Know inverse functions
- Know integration by parts, the method of substitution, partial fractions and finding the area between the curves of two functions.
- Know the fundamental theorem of Calculus.
- Know how to find extreme-values of functions.
- Know linear approximation.
- Know Taylor Polynomials.
- Know initial value problems.
- Know second order differential equations with constant coefficients and their solution.
- Be acquainted with mathematical reasoning.

Skills:

- Be able to calculate with complex numbers.
- Be able to write complex numbers in polar coordinates and draw them in the complex plane (Argand diagram).
- Be able to find the roots of a complex number on the form $z^n = w$.
- Be able to determine basic properties of functions.
- Be able to find the limit of a function.
- Be able to use the Intermediate-value theorem.
- Be able to evaluate integrals of basic functions.
- Be able to use integration by parts, the method of substitution, partial fractions to evaluate integrals.

- Be able to find the area between two curves of functions.
- Be able to use the fundamental theorem of Calculus.
- Be able to find functions extreme values.
- Be able to find the linear approximation of a function and evaluate the error term.
- Be able to find a functions Taylor polynomial and evaluate the Lagrange remainder.
- Be able to solve a initial value problem.
- Be able to find the solution of a second order differential equation with constant coefficients.
- Be able to use mathematical symbols and reasoning to show a solution in a clear and precise manner.

Competence:

- Be able to use mathematics to solve technical problems.

Content: In Calculus I we learn about functions of one variable. Complex numbers, roots and polar coordinates. Calculus of real-valued functions of one variable. Real numbers, functions and their graphs. Discussion of the most important functions and their properties. Limits, continuous functions, differentiation, anti-derivatives and integration, Taylor-polynomials and second order differential equations with constant coefficients.

Reading material: Adams, *Calculus, A complete course*. Teacher´s lecture notes.
Teaching and learning activities: Lectures and practical sessions, and problem-solving sessions with tutorial assistance.
Assessment methods: Written examination counts 80%, home projects 20%.
Language of instruction: Icelandic.

Courses in the 1st year – Spring semester

BT EFB1003 CONSTRUCTION MATERIALS SCIENCE 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory
Type of course: Core.
Prerequisites: None.
Schedule: Runs for 12 weeks – 6 hours in class each week, as well as lab exercises.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Eyþór Rafn Þóhallsson. Gísli Freyr Þorsteinsson (labs).

Learning outcome: Students who successfully complete this module should:
Knowledge:

- Understand the scientific reasons for the various aspects of the behaviour of building materials.
- Know the basic concepts in the elastic behaviour of steel, aluminium, timber and fiber materials.
- Know the manufacturing and processing techniques used to manufacture structural metals, timber and fibres.
- Know how to test the properties of materials.
- Be familiar with welding procedures.
- Have knowledge of carbon footprint of building materials

Skills:

- Be able to calculate main material characteristic factors.
- Have developed an understanding of stress and strain diagrams of building materials.
- Be able to undertake simple welding jobs.
- Be able to perform material testing with related documentation

Competence:
- Be able to select the appropriate material for a particular application.

Content: Metals: Steel, cast iron, aluminium and stainless steels. Production, properties and use. Introduction to plastics. Wood and wood products, timber and it´s properties as a building material. Glass and use in buildings. Students perform laboratory experiments and write reports.

Reading material: Michael S. Manlouk & Johan P. Zaniewski, *Materials for Civil and Construction Engineers*. Peter Domone and John Illston, *Construction Materials* (supplementary material).
Teaching and learning activities: Lectures, lab exercises and lab reports.
Assessment methods: A written examination counts 40%, lab work and reports 30%, due exercises 30%. To pass the course, a minimum grade of 5.0 in the written exam is required. Full participation in lab work and completion of lab reports is mandatory.
Language of instruction: Icelandic.

BT HVB1003 THE DESIGN PROCESS 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Introduction to Engineering – CAD (AT TÆK1003).
Schedule: Runs every week-day for 3 weeks as an intensive course. Taught every other year for a combined class of 1st and 2nd year students. *Next taught in spring semester 2019.*
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Ævar Harðarson.

Learning outcome: On completion of the course students should:

Knowledge:
- Be able to explain the structure and the main characteristics of the building envelope (climate envelope).
- Be familiar with the different layers of the building (climate) envelope and the role of individual layers.
- Know the historical development of building envelopes and how different solutions have evolved based on local conditions.
- Be familiar with solid and filigree climate envelopes and be able to explain the different technologies related to these two different concepts.
- Be able to explain the differences between the traditional and modern architecture.
- Be able to list and describe the main environmental actions affecting the building envelope.
- Be able to explain the most common type of wall- and roof systems used in modern building design.
- Be familiar with rain screen sealing of buildings and be able to explain the methods applied.
- Be aware of the main causes of building defects in the climate envelope of modern buildings.
- Be familiar with the methods for reducing the risk of building defects in the climate envelope.

Skills:

- Have obtained training in Computer Aided Design and be able to use CAD software to present detailing solutions.
- Be able to design simple details for walls, windows and roofs using rain screen sealing.

Competence:
- Be accustomed to work on projects in teams.
- Understand the key aspects of building envelope design and the importance of a collaboration between design professions, such as architects and engineers.
- Be able to perform simple technical analysis of details used for building envelop design and communicate the results in a short report.
- Be able to present ideas, design solutions and analysis thereof both graphically and orally.

Content: The course will introduce various aspects of the building envelope and its design. It is expected that students understand how the individual elements of the envelpe is built up, how they function and how the solutions used have evolved through history. Different building envelope design practices will be linked to the different local conditions as well as based on the historical development of building practices. Special emphasis is placed on technical analysis of building envelope design through studies of already built structures. Students will analyse the buildings based on several fundamental issues, especially the different construction details, and examine various technical problems related to the design and construction of the building envelope. Students will use computer aided drawing programs to redraw detailing solutions and communicate their findings in a short report and an oral presentation.

Reading material: Handouts from the lecturer.
Teaching and learning activities: Lectures and project work.
Assessment methods: Evaluation of project work and oral presentation/examination.
Language of instruction: Icelandic.

BT LAM1013 SURVEYING AND GEOGRAPHIC INFORMATION SYSTEMS 6 ECTS

Year of study: First year / Second year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs every week-day for 3 weeks as an intensive course. Taught every other year for a combined class of 1st and 2nd year students. *Next taught in spring semester 2018.*
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Rúnar Gísli Valdimarsson.

Learning outcome: On completion of the course students should:

Knowledge:
- Be familiar with surveying methods in civil and construction work
- Have knowledge to calculate errors in measurements
- Have knowledge of mapping for structures and civil works.

Skills:
- Be able to use appropriate measuring device for surveying and setting out.
- Be able to evaluate errors in the measurements.

Competence:
- Be able to perform customary measurements and setting out on site for building projects and earth works.

- Have sufficient knowledge in surveying and mapping to be able to analyse related problems, assess the need for assistance and seek specialist advice.

Content: Instruments, errors and calibration. The coordinate systems. Conventional methods of surveying. Measuring methods using electromagnetic waves. 5 practical surveying problems in the field (each 2 days surveying on the average). Triangulation, polygon, distance, levelling, optical square, various setting-out problems, line surveying and tacheometry. Practical use of different instruments and methods. Checking results, errors and accuracy valued. Calculation, mapping and reports.

Reading material:
Teaching and learning activities: Lectures, problem solving sessions and practical sessions.
Assessment methods: A written examination counts 50%, due assignments 30%, participation in classes and practical sessions 20%. The student must achieve a minimum grade of 5.0 in the written exam.
Language of instruction: Icelandic.

AT STÆ2003 MATHEMATICS II 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Mathematics I (AT STÆ1003).
Schedule: Taught for 12 weeks – 4 lectures and 2 problem-solving classes a week, with additional weekly tutorial sessions.
Supervising teacher: Hlynur Arnórsson.
Lecturer: Hlynur Arnórsson.

Learning outcome: On completion of the course students should:

Knowledge:

- Know basic matrix operations.
- Know how to solve a linear system of equations.
- Be familiar with vector operations and their utilization in geometry.
- Know methods for computing determinants, eigenvalues and eigenvectors.
- Know linear dependent and linear independent vectors.
- Know linear combination and be familiar with rank, basis and dimensions in R^n.
- Know matrixes and systems of linear equations.
- Know the reduced row echelon form.
- Know the parametric representation of basic curves, e.g. a line and a circle.
- Know how to describe a particle in 3 space by a parametric curve and find its speed, velocity and acceleration.
- Know how to find curve length and line integral.
- Know partial derivatives and directional derivatives and know how to interpret them graphically.
- Know the Jacobian matrix and the chain rule for functions of several variables.
- Know extreme values of functions of several variables.
- Know how to evaluate double integrals in Cartesian and polar coordinates.
- Know Cartesian, spherical and cylindrical coordinates.
- Know conservative vector fields and their potential.
- Be familiar with iteration.

Skills:

- Be able to solve a linear system of equations.
- Be able to find dot product, cross product and write the equations for lines and planes.
- Be able to find the determinant of a matrix.
- Be able to find eigenvalues and eigenvectors for a matrix.
- Be able to determine if vectors are linear dependent or independent.
- Be able to write a linear combination of vectors.
- Be able to write a matrix in a reduced row echelon form.
- Be able to find the parametric representation of basic curves.
- Be able to describe a particle in 3 space by a parametric curve and find its speed, velocity and acceleration.
- Be able to set up and evaluate a integral to find arc length and line integral.
- Be able to calculate partial derivatives and directional derivatives and know how to interpret them graphically.
- Be able to find the derivative of functions from m-space to n-space and use the chain rule.
- Be able to find extreme values of functions of several variables.
- Be able to set up and evaluate double integrals in Cartesian and polar coordinates.
- Be able to set up give the Cartesian, spherical and cylindrical coordinates for a point in 3-space.
- Be able to determine if vector fields are conservative and if so find a potential.

Competence:

- Be able to use linear algebra and multivariate calculus to solve technical problems.

Content: Vectors and matrices. Dot product, cross product, eigenvalues and eigenvectors. Systems of linear equations. Parametrization of curves. Position vector of a particle in space, velocity, speed and acceleration. Arc length and line integrals. Functions of several variables; limits, continuity, differentiability, partial derivative, directional derivative, Jacobi matrix, the chain rule, linear approximation and extreme values. Double integrals in cartesian and polar coordinates. Conservative vector fields, potential function.

Reading material: R.A.Adams, *Calculus, A complete course*, 7th or 8th edition. P.V. O'Neil, *Advanced Engineering Mathematics*, 6th or 7th edition**.** Lecture notes from teacher.
Teaching and learning activities: Lectures and practical sessions, and problem-solving sessions with tutorial assistance.
Assessment methods: Written examination counts 70%, home projects 10% and short exams 10%.
Language of instruction: Icelandic.

AT AÐF1013 STATISTICS AND METHODS 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Mathematics I (AT STÆ1003).
Schedule: Taught for 12 weeks – 6 hours a week: 4 hours statistics and 2 hours research methodology.
Supervising teacher: Hera Grímsdóttir.
Lecturer: Hera Grímsdóttir.

Learning outcome: The course is divided into two parts; statistics and research methodology.

After completion of the statistical part of the course the student should be able to:

- describe the extent to which a sample can describe the sampled population
- calculate descriptive statistics, i.e. average and standard deviation, median, quartiles and interpret the results
- evaluate measurement uncertainties and explain what it means for both single and repeated measurements
- calculate the uncertainty of a function of several random variables
- briefly describe the normal, lognormal, binomial and Poisson probability distributions
- calculate confidence intervals for the averages of large and small samples, and interpret the results
- set up a statistical test for the difference of two averages and interpretation of the results
- set up a statistical test for the difference between paired measurements, and interpret the results
- calculate the "best fit" for linearly correlated measurements, and explain what "best fit" means
- interpret the uncertainties of the coefficients of the “best fit” line, and evaluate the correlation coefficient
- use software, such as Excel, to compute descriptive statistics and the “best line”.

After completion of the research methodology part of the course the student should be able to:
- describe and follow the classical structure of research papers (IMRaD)
- prepare a list of references according to standards, focusing on the IEEE standard
- write a short essay, evaluate the quality of references and use databases
- give a short lecture.
- design a simple research project, carry it out, and present the results according IMRaD and with a poster.

Content: The aim of the course is to prepare students so that they can:
- apply statistical methods to organize a research project, perform statistical analysis of data, interpret and present the results, as well as evaluate statistical results from others.
- organize and manage a design or research project, and present the results in a report, in a lecture and by a poster.

Reading material: William Navidi, *Statistics for Engineers and Scientists*. Material from teacher.
Teaching and learning activities: Lectures, projects, exercises and presentations.
Assessment methods: There will be no final exam. The final grade is based on six exams during the semester in statistics (every other week), homework in statistics (to be turned in every other week), and several projects in research methodology. The statistics part counts for 2/3 of the final grade and the methodology part counts for 1/3.
Language of instruction: Icelandic.

BT BUR2003 MECHANICS OF MATERIALS AND STRUCTURAL ANALYSIS 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Structural Mechanics I (AT BUÞ1013), Physics I (AT EÐL1003), Mathematics I (AT STÆ 1003).
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week.
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Jónas Þór Snæbjörnsson.

Learning outcome: It is intended that a student of the course will gain the following knowledge, skills and competence:

Knowledge:

- Understand axial stress and strain.
- Be familiar with temperature effects on trusses
- Be familiar with elastic and inelastic behaviour of prismatic truss.
- Be familiar with torsional action and the relation between torsional stress and strain.
- Know how to evaluate the properties and internal forces for composite beams.
- Understand the shear centre concept and the shear stresses in thin walled open cross sections.
- Be familiar with inelastic behaviour of cross sections subjected to bending and able to determine the yield moment and plastic moment.
- Be familiar with, and able to analyse, biaxial stress conditions, principal directions and principal stresses, including maxima and minima of shear and normal stresses.
- Understand the relation between loading, bending moment and deformation of beams.
- Understand the basic concepts of buckling, such as the Euler buckling theory

Skills:

- Can analyse uniaxial stress state í prismatic members, including the effect of thermal effects and restraints.
- Can analyse stresses and deformations due to torsion, including non-uniform torsion and statically indeterminate torsion.
- Can determine normal stresses and shear stresses in built-up sections. Shear flow and connections.
- Can determine stresses in composite sections, i. e. normal stresses, shear stresses and shear flow.
- Can determine normal stresses in symmetrical and non- symmetrical sections under inclined load
- Can calculate deflections of statically determinate beams.
- Can determine support reactions and member forces in simple statically determinate three-dimensional trusses.
- Can determine critical load for simple slender columns, and is aware of the functioning of beam-columns.
- Competence:
- Be able to assess the function of a structure or a cross-section and which internal forces need to be considered in the analysis.
- Be able to assess the function of a combined cross section.
- Be able to assess the validity of results from calculation of stresses and deformation
- Be able to use formulae from handbooks for standard cases of structural analysis.
- Understand how different boundary conditions affect the evaluation of critical normal forces for simple columns.
- Be able to interpret structural behaviour based on deformation calculations.
- Know how to analyse reaction forces in statically determinate three-dimensional trusses.
- Know how to use the compatibility relations between action and deformation to determine the reaction and internal forces of simple statically indeterminate beams.

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 unsymmetrical beams. Analysis of stress and strain. Principal stresses and maximum shear stress. Deflections of beams. Differential equations of the deflection curve. Moment-area method.

Reading material: Gere & Goodno, *Mechanics of Materials*.
Teaching and learning activities: Lectures and excersises
Assessment methods: A 4 hour written final examination counts 70%, a 2 hour mid-term exam 10%, Projects 10%, five exercises 10%. To pass the course, a minimum grade of 5.0 in the final exam is required.
Language of instruction: Icelandic.

Courses in the 2nd year – Fall semester

BT BUR3003 THE FINITE ELEMENT METHOD AND STRUCTURAL ANALYSIS 6 ECTS

Year of study: Second year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Structural Mechanics I (BT BUÞ 1013), Mechanics of Materials and Structural Analysis (BT BUR 2003), Mathematics II (AT STÆ2003), Practical Programming (AT FOR 1003).
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week.
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Jónas Þór Snæbjörnsson.

Learning outcome: Upon completion of the course it is expected that students:

Knowledge:

- Know the key degrees of freedom in a structural system
- Know the concept of virtual work to analysis structures
- Know the difference between force methods and displacement methods and are able to use both methods for analysing truss, beam and frame systems
- Know the properties of a truss and beam element and are able to define a stiffness matrix for such an element in both local and global coordinates.
- Know and understand the connection between the stiffness method and the finite element method.
- Know how to create a stiffness matrix for three and four node plane elements and can utilise that to solve simple plane structures.
- Know the stress-strain relation for plane elements and can differentiate between plane-stress and plane-strain conditions
- Know the difference between the internal forces acting in a plane (membrane), plate and shell elements
- Understand and know how the force and stress distributions in plates for common boundary conditions.
- Know the most common yield line patterns in plates and know how the yield line theory can be used to analyse plates.
- Know how plastic analysis can be used in design to maximize the utilisation of cross sections at fracture.

Skills:

- Can define the key degrees of freedom in a structural system
- Can use the concept of virtual work to analysis structures
- Can use force methods and displacement methods and are able to use both methods for analysing truss, beam and frame systems
- Can define a stiffness matrix for a truss system and calculated displacements as well as internal and external forces using the stiffness method.
- Know the properties of a stiffness matrix and are able to set up a stiffness matrix for such an element in both local and global coordinates.
- Can define a stiffness matrix for a beam and frame systems and calculated displacements and rotations as well as internal and external forces using the stiffness method.

Competence:

- Are able to analyse statically determinate and indeterminate structures
- Can analysis simple statically indeterminate system using the finite element method.

- Are able to use the finite element method and associated software to analysis more complicated structures.

Content: In the course, the emphasis is on introducing methods that are used in structural analysis of statically determined and undetermined structures. Those are for instance: Energy methods, especially the principle of virtual work; the force method; the stiffness method. A core part of the course is the introduction of the finite element method (FEM), the programming of the FE method using Matlab and FEM based software for structural analysis, such as and SAP2000. In addition methods for simple plate analysis, both elastic and plastic, will be introduced, as well as plastic analysis of beams.

Reading material: Handouts and lectures. Supplamentary material: Selected chapters from e.g. T.H.G. Megson (2005), *Structural and Stress Analysis*, 2nd ed., Butterworth & Heinemann (Elsevier); R.C. Hibbeler (2012), *Structural analysis*, 8th ed., Pearson (Prentice Hall); G. R. Liu and S. S. Quek (2003), *The Finite Element Method, A practical course*, Butterworth & Heinemann.
Teaching and learning activities: Lectures and project work.
Assessment methods: Evaluation of prjects accounts for 50% of the grade and a final examination project 50%.
Language of instruction: Icelandic.

BT JTÆ1003 SOIL MECHANICS AND ENGINEERING GEOLOGY 6 ECTS

Year of study: Second year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Hydraulics (BT REN 1003).
Schedule: Runs for 12 weeks – 6 hours in class each week, with additional lab sessions and a field trip.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Aldís Ingimarsdóttir, Þorbjörg Hólmgeirsdóttir.

Learning outcome: On completion of the course, students should:

Knowledge:
- Know the properties of Icelandic rock and common Icelandic soil and be able to assess their applicability in construction.
- Know methods of research and testing of soil and rock, be able to perform simple tests and assess the need for further tests.
- Know the procedure of Soil Classification and how to interpret Soil Classification.
- Able to perform a simple testing in the field and know when there is need for further testing's.
- Know the purpose of soil Compaction and some common procedures of Compactions and testing's, both in a laboratory and in the field
- Be familiar to some concepts of the technology of explosives.

Skills:
- Know how to find the seepage in soil and know when soil is frost-susceptible.
- Knowing some basics about filtering in soil types.
- Know how to calculate stresses in að Soil Mass.
- Be able to evaluate consolidation and the effects thereof.
- Know how to calculate Shear strength of soil
- Know how to calculate Lateral earth pressure and know the pressures working on some retaining walls
- Knows the stipulations of tender documents for earthworks and be able to perform inspection and supervision of common types of earthworks.
- Be familiar with the structures made of soil and the choice of materials used in construction.

Competence:

- Be able to design common types of foundations
- Have basic knowledge of related problems usually solved by experts.

Content: The basics of geology incl. petrography, earthquakes, erosion. Applied geology, evaluation of quarry sites. Classification of soils. Applicability of different types of soils, material testing. Bearing capacity of earth fills, strength, compacting, permeability and susceptibility to freezing. Stress distributions in soils. Consolidation. Settlement and fills and foundations.

Reading material: Braja M. Das, *Fundamentals of Geotecnical Engineering*.
Teaching and learning activities: Lectures, problem solving sessions, lab sessions and a field trip.
Assessment methods: The grade in Engineering Geology counts 10% of the final grade, Assignments in Soil Mechanics count 20% of the final grade. A 3 hour written examination counts 70% of final grade. To pass the course the student must achieve at least 5,0 in the final examination.
Language of instruction: Icelandic.

BT EFN2002 CONCRETE TECHNOLOGY 4 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: None.
Schedule: Runs for 12 weeks – 4 hours in class each week, with additional lab sessions. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2019.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðni Jónsson, Helgi Hauksson.

Learning outcome: On completion of the course students should:
Knowledge:

- Have basic knowledge of the properties of fresh and hardened concrete.
- Have basic knowledge of concrete aggregate and admixtures.

Skills:

- The student should be able to explain the main factors affecting the strength and other properties of concrete.
- The students should be able to mix concrete that meets certain characteristics
- The student should be able to write reports on properties of concrete and repair and maintenance of concrete structures.

Competence:
The student have the ability to solve common tasks related to the preparation and properties of concrete, such as:

- Building control of concrete work
- Supervision and maintenance of concrete structures

Content: Concrete as a principal building material in Iceland. Raw materials and production, cement, aggregate and admixtures. Properties of concrete. Concrete work. Testing of concrete, inspection and quality control. Students perform laboratory experiments and write reports.

Reading material: A.M. Neville & J.J. Brooks, *Concrete Technology***.** *Steinsteypa - viðhald og viðgerðir* - Rb rit nr. 83.
Teaching and learning activities: Lectures, due exercises and lab sessions.
Assessment methods: A 3 hour written examination counts 70%, 4 projects 20% and lab work 10%. The student must achieve a minimum grade of 5.0 in the final exam to pass the course.
Language of instruction: Icelandic.

AT STÆ3003 MATHEMATICS III 6 ECTS

Year of study: Second year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Mathematics I (AT STÆ1003), Mathematics II (AT STÆ2003).
Schedule: Taught for 12 weeks - 6 hours a week.
Supervising teacher: Hlynur Arnórsson.
Lecturer: Hlynur Arnórsson.

Learning outcome:
On completion of the course students should:
Knowledge:

- Know the term general solution to a differential equation and particular solution to an Initial Value Problem (I.V.P.)
- Know differential equations with separable variables.
- Know 1. order linear differential equations.
- Know a fundamental set of solutions of a second order differential equation with constant coefficients and know how to calculate a Wronski determinant.
- Know the method of undermined coefficients and the method of variation of parameters.
- Know the Laplace transform and how to use it to solve a I.V.P.
- Know the Heaviside function and the Dirac delta function.
- Know Fourer series, Fourier Sine Series and Fourier Cosine Series.
- Know 1. order system of linear differential equations.
- Be acquainted with how to change a n-th order differential equation to a first order system of linear equations.
- Be acquainted with partial differential equations, e.g. the wave equation and the heat equation.

Skills:

- Be able to find a solution to a differential equation with separable variables.
- Be able to find a solution to a first order linear differential equation.
- Be able to determine which method above is suited to solve a first order differential equation.
- Be able to find a fundamental set of solutions of a second order differential equation with constant coefficients.
- Be able to use a Wronski determinant to determine if two solutions are linearly independent.
- Be able to use the method of undermined coefficients and the method of variation of parameters.
- Be able to solve I.V.P. using the Laplace transform, including I.V.P. with the Heaviside function and the Delta dirac function.
- Be able to find a solution to an I.V.P. using the Laplace-transform. Including problems with Heaviside functions and the Dirac Delta function.
- Be able to find a functions Fourer Series, Fourier Cosine Series and Fourier Sine Series.
- Be able to find solutions to systems of linear first-order differential equations.
- Be able to change a n-th order differential equation to a first-order system of differential equations.
- Be able to solve partial differential equations, e.g. the heat equation and the wave equation.

Competence:

- Be able to solve differential equations for simple dynamical systems.

Content: First order linear differential equations and differential equations with separable variables. Second order differential equations with constant coefficients. Method of variation of parameters and method of and the Method of undetermined coefficients. The Laplace transform, the Heaviside function and Diracs delta function. Fourier- Cosine- and Sine-series. Systems of first order linear differential equations. Partial differential equations.

Reading material: P.V. O'Neil, *Advanced Engineering Mathematics*, 6th or 7th edition**.** Lecture notes from teacher.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Written examination counts 60%, home projects 30%, short exams 10%.
Language of instruction: Icelandic.

BT UHÖ1001 ENVIRONMENT, HEALTH AND SAFETY 2 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: None.
Schedule: Runs for up to 12 weeks – a total of 24 hours in class. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2019.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: NN.

Learning outcome: On completion of the course students should:
Knowledge:

- Be familiar with the basic occupational health, safety and environmental issues.

Skills:

- To enhance students' understanding of the importance of safety and the work environment.

Competence:

- Be able to do a simple risk assessment for construction projects.

Content: The aim of the course is to increase the knowhow and understanding of students regarding the importance of a healthy and safe work environment.

A selection of "tools" will be presented that can be used to increase safety and improve working conditions. The relation between risk assessment and quality management will be discussed.

The course will cover the basic laws and rules of environmental and occupational health and safety at the workplace, as well as requirements presented by international standards such as ISO 14001, EMAS and OHSAS18001:2007.

The course will include a project where a risk assessment is devised for a typical construction project and a report written which gives an overview of the factors that need to be considered along with the suggested counter-measures.

Reading material: Handout from lecturer.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Exercises count 50% and final examination 50%.
Language of instruction: Icelandic.

BT UVB1003 SUSTAINABLE URBAN DEVELOPMENT 6 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs every week-day for 3 weeks as an intensive, project-oriented course. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2018.*
Supervising teacher: Hera Grímsdóttir.
Lecturer: Kristveig Sigurðardóttir.

Learning outcome: On completion of the course students should:

Knowledge:

- Have an understanding of the principles of environmental protection and planning
- Be able to demonstrate an understanding of the relationship between the goals of sustainability and the activities of built environment disciplines, including architecture, building construction, historic preservation, interior design, landscape architecture and urban and regional planning.
- Be able to apply the principles learned to the solution of technical problems within infrastructure development.
- Has the basics knowledge been relating to environmental management and sustainable operation of buildings, life-cycle cost, health and wellness in buildings, energy in buildings, transportation services for the users of buildings, water consumption, Waste Management, pollution, ecology of land and choice of the building materials.

Skills:

- Know whose benefit and purpose of the sustainable design and operation for buildings and civil works.
- Can use the above knowledge to design buildings and civil work structures.

Competence:

- Understand the purpose of urban planning.
- Understand the goals of sustainable development of the urban environment and how to connect the goals to the planning, design and construction.
- Have acquired the necessary basic knowledge to be able to assimilate the contents of other engineering subjects.

Content: The course covers two main topics, i.e. environmental planning for towns or individual construction projects and green solutions in building design.

Environmental planning: The focus will be on the general purpose of planning and the different planning stages defined in the Icelandic planning laws. The objectives and methods used in environmental impact assessments will be presented. Topics like the living quality in towns, various important social issues, transport issues, public health issues, green areas, resources and waste management will be discussed.
Green buildings: The focus will be on Ecological solutions for building design, construction and operation. Specialized topics covered will include environmental facility management, life cycle analysis and energy use, health and well-being of occupants, water usage, waste management and pollution, as well as the ecology of built land.

Reading material:
Teaching and learning activities:
Assessment methods: Particapation in discussions 5%; Project 1 on urban development 35%; Project 2 on sustainable buildings 30%; Exam 30%. The student must achieve a minimum grade of 5.0 in each part of the assessment.
Language of instruction: Icelandic.

BT VEG1013 ROAD DESIGN - URBAN AND RURAL 6 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Soil Mechancis and Engineering Geology (BT JTÆ 1003).
Schedule: Runs for up to 12 weeks – a total of 72 hours in class. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2018.*
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Aldís Ingimarsdóttir. Guest lecturers from industry.

Learning outcome: On completion of the course students should:

Knowledge:

- Have an understanding of the fundamental principles of road geometry and road profile design
- Know how to use road design guidelines
- Know how to do geometric road design, i.e. evaluated curves and curve connections for road layout, in both vertical and horizontal plan.
- Know the criterion for design of streets, road intersections and access lanes in traffic planning.
- Know the basics regarding the construction of road profiles, i.e. the purpose and properties of the different structural layers.

Skills:

- Be able to apply these to the solution of technical problems.
- Be able to design roads and minor traffic structures.
- Be able to calculate a road profile structure, i.e. all the different bearing layers.

Competence:

- Be able to generate design data and documentation for road constructions projects.

Content: The preparation, design and execution of roads and minor traffic structures. Standards and guidelines for road design both urban and rural, calculation of road geometry, crossings and access lanes. Design capacity of bearing layers, both the lower and upper layers. Software for road design is presented.

Reading material: Handbooks and guidelines available online.
Teaching and learning activities: Lectures and problem solving sessions.
Assessment methods: A 3 hour final exam counts 60% of the final grade, 8 smaller exams 40%.
Language of instruction: Icelandic.

AT VST1003 PROJECT MANAGMENT 6 ECTS

Year of study: Third year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: An intensive course, taught every weekday for 3 weeks.
Supervising teacher: Hera Grímsdóttir.
Lecturer: Hektor Már Jóhannsson, Kristinn Alexandersson, Ólafur Hermannsson.

Learning outcome: On completion of the course students should:

- Have a good understanding of the methodology of project management, the basic theories and methods that have been developed in the field of project management.
- Have a good understanding of the importance and different aspects of project work and project management in business operations.
- Be familiar with available software and technology that can be used in project management.
- Know how project management is practiced in local companies.
- Have obtained skills sufficient to apply project management methods within his field of discipline.
- Know how tender documents are structured and learn about the different forms of the bidding process.
- Be able to prepare tender documents, offers, work schedules and cost estimates for common and traditional projects and evaluate plans made by others.
- Be familiar with the basic principles and procedures in supervision of construction projects and the use of quality systems in construction.
- Attain a good understanding of the implementation of construction management methods in an actual construction project.
- Be able to apply the knowledge gain to administrate and oversee a construction project and on-site inspection.

Content: The course is on project- and construction management.

Project management:

Overview of project management methodology. Coordination of projects to attain direction and organizational management. Selecting and defining projects. Life cycle and characteristics of projects. Goals, work analysis, breakdown of work into components and creation of a flowchart. Planning, resource management, schedule, execution, progress and performance, report and sharing information. MS Project program - basis.

Optimization of the project time schedule, risk management. MS Project - inputs. Procurement, project management, project team, stakeholders. Prince2 and other methods, Gantt, CPM, PERT etc. How to choose between viable projects. MS Project - continuation.

Construction Management:

Contracting documents, design at various levels, project descriptions, specifying and registering material quantity. The bidding process and different bidding practices. Cost planning and estimating, assumptions, uncertainties, presentation. Making bids and contracts, advertising, bidding time, opening of tenders. Bidding, cost factors, data collection, structuring unit prices, estimating volume, risk, uncertainty, profits.

Contracting, evaluation of tenders, accepting a bid, rejecting a bid, negotiations. Project surveillance and control, project organization, project meetings, communication protocols, information sharing etc. Basic quality control, Project quality manual, examples of the use and benefits of the quality system. Legal concerns regarding implementation of projects, settlement and disagreement.

Reading material:
Teaching and learning activities: Lectures and practical sessions. A main construction project entails scrutinizing tender documents, making offers and organizing the project. Students deliver their offer and schedule and defend their work orally, working in groups of 3-4, teachers select students into groups.
Assessment methods: Small projects and quizzes counts 30%, grade for project work and oral examination counts 70% of final grade.
Language of instruction: Icelandic.

Courses in the 2nd year – Spring semester

BT ÁLA 4002 ACTIONS AND SAFETY OF STRUCTURES 4 ECTS

Year of study: Second year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Structural Mechanics I (BT BUÞ 1013), Mechanics of Materials and Structural Analysis (BT BUR 2003).
Schedule: Runs for up to 12 weeks – a total of 48 hours in class.
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Halldór Gunnar Daðason.

Learning outcome: The purpose of the course is to introduce to students how loads and other actions on structures are defined according to the Eurocodes. Also to introduce methods to evaluate structural reliability and the safety concept as used in the Eurocodes.

Students are expected to
Knowledge:

- Understand fundamental safety and load definitions, i.e. the basis of structural design.
- Know the partial coefficient approach and commonly used load combinations defined by Eurocode.

Skills:

- Be able to use the appropriate partial coefficients for load combinations.
- Be able to determine the appropriate self-weight, imposed loads, snow loads and wind loads.

Competence:

- Be able to utilize and adopt their knowledge on safety and structural actions to the curriculum of structural design courses on steel, timber and concrete.

Content: The objective of the course is to introduce structural loading and methods to estimate the type and magnitude of loading suitable for design of buildings and building elements. Loading definitions and methodologies will be according to the Eurocode. The key sources of structural loading, such as structural self-weight, imposed service loading, snow and wind, will be presented. The application of probabilistic methods to estimate structural safety and reliability will be introduced. The emphasis will be on the background and application of the Eurocodes EN1990 and EN1991 and the partial load factor method.

Reading material: Handouts and lecture notes. *European standards EN1990 and EN1991*.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Four exercises count 30%, a final project 40%, a final examination 30%. The student must achieve a minimum grade of 5.0 in the final exam to pass the course.
Language of instruction: Icelandic.

BT BRU 1001 FIRE RESISTANT DESIGN 2 ECTS

Year of study: Second year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: None.

Schedule: Runs for up to 12 weeks – a total of 24 hours in class (usually 4 class hours a week for 6 weeks).
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðmundur Gunnarsson.

Learning outcome: On completion of the course students should:
Knowledge: Have an understanding of the principles of fire resistant design.
Skills: Have the minimum level for solving technical problems in the field of fire resistant design.
Competence: Be able to apply his understanding to the solution of technical problems such as structural design of buildings.

Content: Fire resistant design. Thermal loads. Fire resistance of structural elements and structural systems.

Reading material: Hand-outs from lecturer
Teaching and learning activities: Lectures and problem solving sessions.
Assessment methods: Due assignments are graded as well as an oral exam. All assignments must be delivered.
Language of instruction: Icelandic.

BT BEÐ 1003 BUILDING ENGINEERING PHYSICS 6 ECTS

Year of study: Second year / Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in spring semester 2018.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðni Ingi Pálsson, Agnar Snædahl, guest lecturers.

Learning outcome: Upon completion of the course it is expected that students have

Knowledge:
- Can calculate thermal conductivity, temperature drop, moisture ratio and percentage of moisture in buildings and for building components at steady state in one-dimension
- Can estimate airflow through holes and slots in building elements, due to temperature effects.
- Be familiar with situations that can induce mold and dryrot forming within buildings or construction parts.
- Be familiar with the properties of sound and acoustics.

Skills:
- Can calculate sun radiation effects on horizontal and vertical building surfaces.
- Will have the ability to assess the impact of radiators and windows on perception temperature.
- Be familiar with how and why air and fluid flows through building elements.
- Be familiar with the basic tools to assess the physical condition of buildings, such as measurements of air tightness, thermal cameras, moisture sensors and pipe cameras.
- Be familiar with the sound absorption, -isolation and -damping properties of building materials.

Competence:
- Know the requirements and standards on acoustic comfort both inside and outside of residential buildings.

- Know the different categories and symbols used in acoustic design.
- Have sufficient knowledge to be support further studies and more advanced education within the field and in related disciplines of technology.

Content: The course provides theoretical knowledge on the flow of moisture, heat and sound through and within buildings, as well as connecting theory to practice through practical problem solving. The goal is that students gain an understanding of the principles of building physics, especially regarding moisture and thermal conductivity and will be able to apply them to analyse real situations and solve practical problems.

The topics covered include: Basic concepts in building physics; The building structure and the purpose of different material layers in the exterior walls and roofs; The effect of air leaks and airtightness; How to make buildings airtight. Basic principle in acoustic design will be discussed. Frequency range and hearing range, the distribution and transmission paths of sound waves. Sound absorption and sound proofing. Acoustic comfort Categories and sound isolation requirements. Acoustic symbols for design drawings.

Reading material: Hand-outs from lecturers.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Exercises count 35% and final examination 65%.
Language of instruction: Icelandic.

BT HVB1003 THE DESIGN PROCESS 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: Introduction to Engineering – CAD (AT TÆK1003).
Schedule: Runs every week-day for 3 weeks as an intensive course. Taught every other year for a combined class of 1st and 2nd year students. *Next taught in spring semester 2019.*
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Ævar Harðarson.

Learning outcome: On completion of the course students should:

Knowledge:
- Be able to explain the structure and the main characteristics of the building envelope (climate envelope).
- Be familiar with the different layers of the building (climate) envelope and the role of individual layers.
- Know the historical development of building envelopes and how different solutions have evolved based on local conditions.
- Be familiar with solid and filigree climate envelopes and be able to explain the different technologies related to these two different concepts.
- Be able to explain the differences between the traditional and modern architecture.
- Be able to list and describe the main environmental actions affecting the building envelope.
- Be able to explain the most common type of wall- and roof systems used in modern building design.
- Be familiar with rain screen sealing of buildings and be able to explain the methods applied.
- Be aware of the main causes of building defects in the climate envelope of modern buildings.
- Be familiar with the methods for reducing the risk of building defects in the climate envelope.

Skills:

- Have obtained training in Computer Aided Design and be able to use CAD software to present detailing solutions.
- Be able to design simple details for walls, windows and roofs using rain screen sealing.

Competence:

- Be accustomed to work on projects in teams.
- Understand the key aspects of building envelope design and the importance of a collaboration between design professions, such as architects and engineers.
- Be able to perform simple technical analysis of details used for building envelop design and communicate the results in a short report.
- Be able to present ideas, design solutions and analysis thereof both graphically and orally.

Content: The course will introduce various aspects of the building envelope and its design. It is expected that students understand how the individual elements of the envelpe is built up, how they function and how the solutions used have evolved through history. Different building envelope design practices will be linked to the different local conditions as well as based on the historical development of building practices. Special emphasis is placed on technical analysis of building envelope design through studies of already built structures. Students will analyse the buildings based on several fundamental issues, especially the different construction details, and examine various technical problems related to the design and construction of the building envelope. Students will use computer aided drawing programs to redraw detailing solutions and communicate their findings in a short report and an oral presentation.

Reading material: Handouts from the lecturer.
Teaching and learning activities: Lectures and project work.
Assessment methods: Evaluation of project work and oral presentation/examination.
Language of instruction: Icelandic.

BT JTÆ2013 GEOTECHNICAL ENGINEERING 6 ECTS

Year of study: Second year / Third year.
Semester: Spring.
Level of course: First cycle, advanced.
Type of course: Core.
Prerequisites: Engineering Geology and Soil Mechanics (BT JTÆ 1003).
Schedule: Runs for 12 weeks – 6 hours in class each week. Taught every other year, each time for a combined class of 2nd and 3rd year students. *Next taught in spring semester 2019.*
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Einar Helgason.

Learning outcome: On completion of the course students should:

Knowledge:

- Know the basis of structural design in accordance with applicable standards
- Know the characteristics of the soil and the basic aspects of the behavior of soil stress
- Be familiar with the methods for determining the strength of the soil, both drained and un-drained conditions
- Be able to calculate slope stability for simple conditions
- Be able to calculate stresses in soil due to weight and external pressures

Skills:

- Be able to draw a conclusion regarding the permeability of soil

- Be familiar with the methodology and limitations of methods of slices when calculating slope stability
- Be able to calculate structural integrity of shallow foundations
- Be able to calculate structural integrity of piles (deep foundations)
- Be able to calculate horizontal earth pressure and explain the methods used.
- Be able to calculate load and safety with respect to turnover and sliding for retaining walls

Competence:

- Be able to calculate main dimensions for steel sheet walls
- Be able to calculate flow in soils

Content: The course focuses on geotechnical design of traditional foundations, determination of loading on basement walls, retaining walls and other soil retaining structures as well as the evaluation of stability for landfills and slopes.

The course covers the basis of design, methods for determining characteristics values for soil, design methods according to European standards, addressing the use of safety and partial coefficients, load combinations and basic calculations methods.

Reading material: Braja M. Das, *Fundamentals of Geotecnical Engineering.*
Teaching and learning activities: Lectures, problem-solving sessions and project work.
Assessment methods: A 3 hour written examination counts 80%; project work 20%.
Language of instruction: Icelandic.

BT LAM1013 SURVEYING AND GEOGRAPHIC INFORMATION SYSTEMS 6 ECTS

Year of study: First year / Second year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs every week-day for 3 weeks as an intensive course. Taught every other year for a combined class of 1st and 2nd year students. *Next taught in spring semester 2018.*
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Rúnar Gísli Valdimarsson.

Learning outcome: On completion of the course students should:

Knowledge:

- Be familiar with surveying methods in civil and construction work
- Have knowledge to calculate errors in measurements
- Have knowledge of mapping for structures and civil works.

Skills:

- Be able to use appropriate measuring device for surveying and setting out.
- Be able to evaluate errors in the measurements.

Competence:

- Be able to perform customary measurements and setting out on site for building projects and earth works.
- Have sufficient knowledge in surveying and mapping to be able to analyse related problems, assess the need for assistance and seek specialist advice.

Content: Instruments, errors and calibration. The coordinate systems. Conventional methods of surveying. Measuring methods using electromagnetic waves. 5 practical surveying problems in the field

(each 2 days surveying on the average). Triangulation, polygon, distance, levelling, optical square, various setting-out problems, line surveying and tacheometry. Practical use of different instruments and methods. Checking results, errors and accuracy valued. Calculation, mapping and reports.

Reading material:
Teaching and learning activities: Lectures, problem solving sessions and practical sessions.
Assessment methods: A written examination counts 50%, due assignments 30%, participation in classes and practical sessions 20%. The student must achieve a minimum grade of 5.0 in the written exam.
Language of instruction: Icelandic.

BT REN1003 HYDRAULICS 6 ECTS

Year of study: First year.
Semester: Spring.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week, with additional lab sessions. Taught within the course *VT STV 1003 Hydraulics and Heat Transfer* in Applied Mechanical & Energy Engineerging for the first 8 weeks.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Einar Jón Ásbjörnsson (first 8 weeks) Brynjólfur Björnsson (last 4 weeks).

Learning outcome: On completion of the course students should:
Knowledge:

- Have developed an understanding and the basic principles of hydraulics.
- Know the basic measurement techniques in hydraulics.
- Know the criteria and methods used in the design of piping systems, dams, overflow weirs, road ditches and vortex structures.
- Be acquainted with the basis for assessing the effects of ground water and ground water flow

Skills:

- Have developed an understanding of the basic principles of hydraulics and be able to apply these to solving technical problems.
- Be able to assess loads on structures caused by fluid pressure and fluid flow
- Be able to dimension closed conduits and open channels and to evaluate the effects of changes in fluid pressure, velocity and roughness in closed conduits and open channels.
- Be able to calculate simple groundwater flow.

Competence:

- Have gain an understanding of how to use the fundamental laws stream engineer the solution of technical challenges.
- Have the necessary basic knowledge to assimilate the course contents of water supply and sewage systems, heating, ventilation, building physics, environmental science and hydropower works.

Content: Physical properties of water. Hydrostatics. Water pressure and water forces. Hydrodynamics. Water flow in pipes. Pipelines and pipe networks. Water hammer phenomenon in pipelines. Water pumps and turbines. Water flow in open channels. Hydraulic structures, dams weirs and spillways. Ground water hydraulics, permeability, flow nets. 8 due exercises.

Reading material: White. *Fluid Mechanics,* 7th edition (first 8 weeks). Material from teacher (last 4 weeks).

Teaching and learning activities: Lectures and homework assignments. Practical lab exercises in the first 8 weeks of the course.
Assessment methods: The grade for the first part of the course (8 weeks) counts 67% and for the latter part of the course (4 weeks) 33%.
Language of instruction: Icelandic.

BT BYG 1003 DESIGN OF TIMBER AND STEEL STRUCTURES I 6 ECTS

Year of study: Second year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Actions and Safety of Structures (BT ÁLA4002); Mechanics of Materials and Structural Analysis (BT BUR2003).
Schedule: Runs for 12 weeks – 6 hours in class each week. Timber structures is taught for 6 weeks and steel structures for 6 weeks.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Baldvin Einarsson, Jóhann Albert Harðarson.

Learning outcome: After the course the student shall:

Knowledge:

- Know general principles for limit state design of timber and steel structures, load combinations and partial safety factors.
- Know properties of timber, strength classes, effect of moisture content, and effect of duration of loads.
- Know various wood products, round wood, sawn and glued laminated timber, plywood, LVL-beams, particle boards etc.
- Know and be able to design the most common connections for wood structures, nails, screws, bolts, glued connections etc.
- Have knowledge on the durability and preservative treatment of timber.
- Familiar with basis in structural design of steel structures, load combinations and safety factors.

Skills:

- Be able to design structures for serviceability, instantaneous and long term deflections, vibrations etc.
- Be able to design timber and steel structures at ultimate limit state. Strength and stability, lateral buckling, column buckling.
- Be able to design straight beams, columns and roof trusses
- Be able to design horizontal stabilization of timber and steel structures.
- Know and be able to design most common welded and bolted connections in steel structures.

Competence:

- Be able to design load bearing structures according to serviceability recommendations
- Be able to design steel structures at ultimate limit state. Strength and stability, lateral buckling and column buckling.

Content: In the course the verification of structural elements is presented on the basis of ultimate limit state and of serviceability limit state according to Eurocode design norms and Icelandic building regulations. After the course the student shall be able to design simple timber and steel structures, beams, columns and connections.

Reading material: *Structural Design of Steelwork*, Lawrence Martin og John Purkiss. ISBN: 13:978-0-7506-5060-1
Teaching and learning activities: Lectures and problem solving sessions.

Assessment methods: A 4 hours examination counts 60%, evaluation of project work 40%.
Language of instruction: Icelandic.

Courses in the 3rd year – Fall semester

AT INT1003 INTERNSHIP IN APPLIED ENGINEERING I 6 ECTS

Year of study: Third year.
Semester: Fall/Spring.
Level of course: First cycle, advanced.
Type of course: Mandatory for students in the applied civil engineering program. Elective for students in the applied electrical engineering and applied mechanical and energy engineering programs.
Prerequisites: Two years of study in applied civil, electrical or mechanical and energy engineering.
Schedule: Runs for up to 12 weeks, according to a fixed schedule.
Supervising teacher: Ingunn Sæmundsdóttir.
Lecturer: Hera Grímsdóttir (civil), Indriði Sævar Ríkharðsson (mechanical and energy), Ragnar Kristjánsson (electrical), Ása Guðný Ásgeirsdóttir (administrative).

Learning outcomes: Learning outcomes should reflect what the student learns and the experience he/she gains during the internship period. Specific learning outcomes, points of emphasis, deliverables and other requirements will be defined by the supervisors for each individual project, with the following objectives in mind.

- Strengthen students´ ties to the relevant industry.
- Enhance students´ knowledge and understanding of their chosen field of study and their future profession.
- Enhance students´ understanding of processes and the importance of planning their tasks.
- Enhance students´ competence in working with given criteria and fulfilling set requirements.
- Strengthen students´ communication skills, both external and internal within a company.
- Give students the opportunity of solving real life problems under the supervision of experienced professionals.
- Prepare students for their future careers.
- Pave students´ way into the job market.

Content: The course *Internship in Engineering I (AT INT 1003)* is mandatory in the third year of the BSc in Applied Civil Engineering program. It is also offered as an elective in the third year of the BSc programs in Applied Electrical Engineering and Applied Mechanical and Energy Engineering. Students work on a designated project under the guidance of a supervisor in a company/institution and a supervisor in HR. The student´s contribution in the company/institution shall be a minimum of 120 working hours over a period of 10-12 weeks during the semester, as well as preparatory work, work on the final report and an oral presentation. The internship must be organized in such a way that working hours do not overlap with classes in other courses. For information see: *Guidelines on Internships in Applied Engineering*.

The project must be defined and delineated in consultation with the supervisors. Typically, the intern will work on a practical project in which he/she utilizes knowledge and skills from the curriculum of previous semesters. Before the start of the internship period, the student delivers a project description which must be approved by the supervisors.

Emphasis is placed on an organized, independent and technical approach. The student must initially define the project, i.e. goals and deliverables. During the internship the student will keep a journal so that progress can be monitored. At the end of the internship period, the student writes a project report which he/she presents orally.

If a student takes the course *AT INT 1003 Internship in Engineering I* as an elective (i.e. a student of Applied Electrical Engineering or Applied Mechanical and Energy Engineering) he/she may, subject to the supervisors permission, work on a number of smaller tasks during the internship period rather than one specific project for the whole period. The primary objective of such an internship is that the student become acquainted with the diverse activities of the workplace.

Reading material: As advised by supervisors.
Teaching and learning activities: Runs for up to 12 weeks according to a previously defined schedule. Students work on a designated project under the guidance of a supervisor in a company/institution, and a supervisor in RU. The student´s contribution in the company/institution shall be a minimum of 120 working hours. In addition, there is work on preparation, the final report and the presentation.
Assessment methods: The grade is Pass / Fail. The student´s performance in the workplace will be evaluated, as well as his/her project logbook, and the final report and presentation. The evaluation will take into account whether the student has fulfilled the learning outcomes which the supervisors defined at the beginning of the internship period.
Language of instruction: Icelandic.

AT INT2003 INTERNSHIP IN APPLIED ENGINEERING II 6 ECTS

Year of study: Third year.
Semester: Fall/Spring.
Level of course: First cycle, advanced.
Type of course: Elective for students in the applied civil engineering, applied electrical engineering and applied mechanical and energy engineering programs.
Prerequisites: Internship in Applied Engineering I (AT INT 1003).
Schedule: Runs for up to 12 weeks according to a fixed schedule, or as an all-day intensive course for 3 weeks.
Supervising teacher: Ingunn Sæmundsdóttir.
Lecturer: Hera Grímsdóttir (civil), Indriði Sævar Ríkharðsson (mechanical and energy), Ragnar Kristjánsson (electrical), Ása Guðný Ásgeirsdóttir (administrative).

Learning outcomes: Learning outcomes should reflect what the student learns and the experience he/she gains during the internship period. Specific learning outcomes, points of emphasis, deliverables and other requirements will be defined by the supervisors for each individual project, with the following objectives in mind.

- Strengthen students´ ties to the relevant industry.
- Enhance students´ knowledge and understanding of their chosen field of study and their future profession.
- Give students the opportunity to solve real-life problems under the supervision of experienced professionals.
- Enhance students´ understanding of processes and the importance of planning their tasks.
- Prepare students for their future careers.
- Enhance students´ competence in working with given criteria and fulfilling set requirements.
- Train students in working independently and in taking responsibility for their search for knowledge and professional priorities.

- Teach students independent and effective methods in practical design, analysis and/or research within the profession.
- Help students gain practical experience and an overview of the engineering profession by applying their knowledge and skills to solve practical, real-life projects.
- Help students develop their knowledge of the social, economic and moral aspects of the profession.
- Increase students´ knowledge and experience in the use of safety standards, and other technical standards and codes that are important in the profession.
- Improve the students´ competence in the reporting and presentation of technical solutions, and generally of the results of their work.
- Strengthen students´ communication skills, both external and internal within a company.

Content: The course *Internship in Engineering II (AT INT 2003)* is an elective in the third year of the BSc programs in Applied Civil Engineering, Applied Electrical Engineering, and Applied Mechanical and Energy Engineering. Students work on a designated project under the guidance of a supervisor in a company/institution and a supervisor in HR. The student´s contribution in the company/institution shall be a minimum of 120 working hours which can be scheduled over a period of 10-12 weeks, or as full work-days for an intensive period of 3 weeks. In addition the student does preparatory work, works on the final report and an oral presentation. The internship must be organized in such a way that working hours do not overlap with classes in other courses. For information see: *Guidelines on Internships in Applied Engineering*.

The project must be defined and delineated in consultation with the supervisors. Typically, the intern will work on a practical design-, analysis- or research-project in which he/she utilizes knowledge and skills from the curriculum of previous semesters. Before the start of the internship period, the students delivers a project description which must be approved by the supervisors.

The student must initially define the project, i.e. goals and deliverables. The project description shall provide information on what new knowledge and/or training the student will need to complete the project, with appropriate references to textbooks, specifications and/or other sources. Emphasis is placed on an organized, independent and technical approach. During the internship the student keeps a journal so that progress can be monitored. At the end of the internship period, the student writes a project report which he/she presents orally.

Reading material: As advised by supervisors.
Teaching and learning activities: Runs for up to 12 weeks according to a previously defined schedule, or as an all-day intensive course for 3 weeks. Students work on a designated project under the guidance of a supervisor in a company/institution, and a supervisor in RU. The student must initially define the project, i.e. goals and deliverables. The student´s contribution in the company/institution shall be a minimum of 120 working hours. In addition, there is work on preparation, the final report and the presentation.
Assessment methods: The grade is Pass / Fail. The student´s performance in the workplace will be evaluated, as well as his/her project logbook, and the final report and presentation. The evaluation will take into account whether the student has fulfilled the learning outcomes which the supervisors defined at the beginning of the internship period.
Language of instruction: Icelandic.

BT EFN2002 CONCRETE TECHNOLOGY 4 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.

Prerequisites: None.
Schedule: Runs for 12 weeks – 4 hours in class each week, with additional lab sessions. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2019.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðni Jónsson, Helgi Hauksson.

Learning outcome: On completion of the course students should:
Knowledge:

- Have basic knowledge of the properties of fresh and hardened concrete.
- Have basic knowledge of concrete aggregate and admixtures.

Skills:

- The student should be able to explain the main factors affecting the strength and other properties of concrete.
- The students should be able to mix concrete that meets certain characteristics
- The student should be able to write reports on properties of concrete and repair and maintenance of concrete structures.

Competence:
The student have the ability to solve common tasks related to the preparation and properties of concrete, such as:

- Building control of concrete work
- Supervision and maintenance of concrete structures

Content: Concrete as a principal building material in Iceland. Raw materials and production, cement, aggregate and admixtures. Properties of concrete. Concrete work. Testing of concrete, inspection and quality control. Students perform laboratory experiments and write reports.

Reading material: A.M. Neville & J.J. Brooks, *Concrete Technology***.** *Steinsteypa - viðhald og viðgerðir* - Rb rit nr. 83.
Teaching and learning activities: Lectures, due exercises and lab sessions.
Assessment methods: A 3 hour written examination counts 70%, 4 projects 20% and lab work 10%. The student must achieve a minimum grade of 5.0 in the final exam to pass the course.
Language of instruction: Icelandic.

BT SST1013 REINFORCED CONCRETE I 6 ECTS

Year of study: Third year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Actions and Safety of Structures (BT ÁLA4002); Mechanics of Materials and Structural Analysis (BT BUR2003).
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Eyþór Rafn Þórhallsson.

Learning outcome: On completion of the course students should:

Knowledge:

- Understand the fundamental principles of structural design in concrete.
- Be familiar with the properties of concrete and reinforcing steel and their interaction in reinforced concrete structures.
- Be familiar with the design methods for members with bending action and normal force.

- Be familiar with interaction diagrams.
- Be familiar with column design for buckling action.

Skills:

- Be able to evaluate elastic stresses.
- Be able to calculated size of tension cracks in beams under loading.
- Be able to calculate the time-dependent deformations of beams under loading.
- Be able to evaluate ultimate design forces.

Competence:

- Be familiar with the design methods for bending and shear actions.
- Be able to prepare and submit design documentation, including detail drawings of reinforced concrete beams.

Content: Emphasis is placed on students´ knowledge and skills of principles of the behaviour of reinforced concrete. The students should be able to design ordinary column, beam, frame structures. The criteria for design will be covered, including Eurocodes and Icelandic building regulations, design methods and calculations. Detailing of reinforced concrete with necessary documents will also be covered.

Reading material: Bill Mosley, John Bungey & Ray Hulse, *Reinforced Concrete Design*.
Teaching and learning activities: Lectures and problem solving sessions. Five design projects and one lab exercise.
Assessment methods: A 4 hour final exam counts for 60%, evaluation of project work for 40%.
Language of instruction: Icelandic.

BT UHÖ1001 ENVIRONMENT, HEALTH AND SAFETY 2 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: None.
Schedule: Runs for up to 12 weeks – a total of 24 hours in class. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2019.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: NN.

Learning outcome: On completion of the course students should:
Knowledge:

- Be familiar with the basic occupational health, safety and environmental issues.

Skills:

- To enhance students' understanding of the importance of safety and the work environment.

Competence:

- Be able to do a simple risk assessment for construction projects.

Content: The aim of the course is to increase the knowhow and understanding of students regarding the importance of a healthy and safe work environment.

A selection of "tools" will be presented that can be used to increase safety and improve working conditions. The relation between risk assessment and quality management will be discussed.

The course will cover the basic laws and rules of environmental and occupational health and safety at the workplace, as well as requirements presented by international standards such as ISO 14001, EMAS and OHSAS18001:2007.

The course will include a project where a risk assessment is devised for a typical construction project and a report written which gives an overview of the factors that need to be considered along with the suggested counter-measures.

Reading material: Handout from lecturer.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Exercises count 50% and final examination 50%.
Language of instruction: Icelandic.

BT UVB1003 SUSTAINABLE URBAN DEVELOPMENT 6 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs every week-day for 3 weeks as an intensive, project-oriented course. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2018.*
Supervising teacher: Hera Grímsdóttir.
Lecturer: Kristveig Sigurðardóttir.

Learning outcome: On completion of the course students should:

Knowledge:

- Have an understanding of the principles of environmental protection and planning
- Be able to demonstrate an understanding of the relationship between the goals of sustainability and the activities of built environment disciplines, including architecture, building construction, historic preservation, interior design, landscape architecture and urban and regional planning.
- Be able to apply the principles learned to the solution of technical problems within infrastructure development.
- Has the basics knowledge been relating to environmental management and sustainable operation of buildings, life-cycle cost, health and wellness in buildings, energy in buildings, transportation services for the users of buildings, water consumption, Waste Management, pollution, ecology of land and choice of the building materials.

Skills:

- Know whose benefit and purpose of the sustainable design and operation for buildings and civil works.
- Can use the above knowledge to design buildings and civil work structures.

Competence:

- Understand the purpose of urban planning.
- Understand the goals of sustainable development of the urban environment and how to connect the goals to the planning, design and construction.
- Have acquired the necessary basic knowledge to be able to assimilate the contents of other engineering subjects.

Content: The course covers two main topics, i.e. environmental planning for towns or individual construction projects and green solutions in building design.

Environmental planning: The focus will be on the general purpose of planning and the different planning stages defined in the Icelandic planning laws. The objectives and methods used in environmental impact assessments will be presented. Topics like the living quality in towns, various important social issues, transport issues, public health issues, green areas, resources and waste management will be discussed.

Green buildings: The focus will be on Ecological solutions for building design, construction and operation. Specialized topics covered will include environmental facility management, life cycle analysis and energy use, health and well-being of occupants, water usage, waste management and pollution, as well as the ecology of built land.

Reading material:
Teaching and learning activities:
Assessment methods: Particapation in discussions 5%; Project 1 on urban development 35%; Project 2 on sustainable buildings 30%; Exam 30%. The student must achieve a minimum grade of 5.0 in each part of the assessment.
Language of instruction: Icelandic.

BT VEG1013 ROAD DESIGN - URBAN AND RURAL 6 ECTS

Year of study: Second year / Third year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Soil Mechancis and Engineering Geology (BT JTÆ 1003).
Schedule: Runs for up to 12 weeks – a total of 72 hours in class. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in fall semester 2018.*
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Aldís Ingimarsdóttir. Guest lecturers from industry.

Learning outcome: On completion of the course students should:

Knowledge:
- Have an understanding of the fundamental principles of road geometry and road profile design
- Know how to use road design guidelines
- Know how to do geometric road design, i.e. evaluated curves and curve connections for road layout, in both vertical and horizontal plan.
- Know the criterion for design of streets, road intersections and access lanes in traffic planning.
- Know the basics regarding the construction of road profiles, i.e. the purpose and properties of the different structural layers.

Skills:
- Be able to apply these to the solution of technical problems.
- Be able to design roads and minor traffic structures.
- Be able to calculate a road profile structure, i.e. all the different bearing layers.

Competence:
- Be able to generate design data and documentation for road constructions projects.

Content: The preparation, design and execution of roads and minor traffic structures. Standards and guidelines for road design both urban and rural, calculation of road geometry, crossings and access lanes. Design capacity of bearing layers, both the lower and upper layers. Software for road design is presented.

Reading material: Handbooks and guidelines available online.
Teaching and learning activities: Lectures and problem solving sessions.
Assessment methods: A 3 hour final exam counts 60% of the final grade, 8 smaller exams 40%.
Language of instruction: Icelandic.

AT VST1003 PROJECT MANAGMENT 6 ECTS

Year of study: Third year.
Semester: Fall.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: An intensive course, taught every weekday for 3 weeks.
Supervising teacher: Hera Grímsdóttir.
Lecturer: Hektor Már Jóhannsson, Kristinn Alexandersson, Ólafur Hermannsson.

Learning outcome: On completion of the course students should:

- Have a good understanding of the methodology of project management, the basic theories and methods that have been developed in the field of project management.
- Have a good understanding of the importance and different aspects of project work and project management in business operations.
- Be familiar with available software and technology that can be used in project management.
- Know how project management is practiced in local companies.
- Have obtained skills sufficient to apply project management methods within his field of discipline.
- Know how tender documents are structured and learn about the different forms of the bidding process.
- Be able to prepare tender documents, offers, work schedules and cost estimates for common and traditional projects and evaluate plans made by others.
- Be familiar with the basic principles and procedures in supervision of construction projects and the use of quality systems in construction.
- Attain a good understanding of the implementation of construction management methods in an actual construction project.
- Be able to apply the knowledge gain to administrate and oversee a construction project and on-site inspection.

Content: The course is on project- and construction management.

Project management:

Overview of project management methodology. Coordination of projects to attain direction and organizational management. Selecting and defining projects. Life cycle and characteristics of projects. Goals, work analysis, breakdown of work into components and creation of a flowchart. Planning, resource management, schedule, execution, progress and performance, report and sharing information. MS Project program - basis.

Optimization of the project time schedule, risk management. MS Project - inputs. Procurement, project management, project team, stakeholders. Prince2 and other methods, Gantt, CPM, PERT etc. How to choose between viable projects. MS Project - continuation.

Construction Management:

Contracting documents, design at various levels, project descriptions, specifying and registering material quantity. The bidding process and different bidding practices. Cost planning and estimating, assumptions, uncertainties, presentation. Making bids and contracts, advertising, bidding time, opening of tenders. Bidding, cost factors, data collection, structuring unit prices, estimating volume, risk, uncertainty, profits.

Contracting, evaluation of tenders, accepting a bid, rejecting a bid, negotiations. Project surveillance and control, project organization, project meetings, communication protocols, information sharing etc. Basic quality control, Project quality manual, examples of the use and benefits of the quality system. Legal concerns regarding implementation of projects, settlement and disagreement.

Reading material:
Teaching and learning activities: Lectures and practical sessions. A main construction project entails scrutinizing tender documents, making offers and organizing the project. Students deliver their offer and schedule and defend their work orally, working in groups of 3-4, teachers select students into groups.
Assessment methods: Small projects and quizzes counts 30%, grade for project work and oral examination counts 70% of final grade.
Language of instruction: Icelandic.

Courses in the 3rd year – Spring semester

T-403-ADGE OPERATION RESEARCH 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core. It is mandatory for students to take either Computer-Aided Design II (VI TEI 2013) or Operation Research (T-403-ADGE).
Prerequisites: Mathematics I (T-101-STA1 or AT STÆ1003), Statistics (T-302-TOLF or AT AÐF1013).
Schedule: Taught for 12 weeks - 6 hours a week.
Supervising teacher: Hlynur Stefánsson.
Lecturer: Drífa Þórarinsdóttir.

Learning outcome: After the completion of this course students will be capable of using basic methods of Operations Research for analysing and solving complex decision problems. More specificly the student will be capable of:

- Using standardized processes to work on complex decision problems
- Applying systematic methods and algoirthms for analysing and solving decision problems
- Understand how to use data and quantitative methods for decision making
- Understand the importance and usefullness of linear optimization and its applications
- Applying commercial software to solve optimization models with particular emphasis on MS Excel and MPL
- Solving optimization models with Simplex method
- Understand the use of sensitivity analysis
- Understand integer programming and how it can used in decision making
- Identify traditional transportation and distribution problems and be able to solve problems with the relevant methods
- Understand the special properties of network models
- Formulate and solve network models from practical problems
- Apply methods from decision science to solve simple practical problems
- Present results in a clear and organized manner

Content: Introduction to standard Operations Research methods. Linear programming and sensitivity analysis, integer programming, dynamic programming, queuing theory, scheduling, networks. Using software for modelling and optimisation.

Reading material: Hillier & Lieberman, *Introduction to Operation Research*.
Teaching and learning activities: Taught for 12 weeks - 6 hours a week. Lectures and problem solving classes.
Assessment methods: A final exam counts 60%, two midterm exams 20% each. Permission to take the final exam is granted based on participation in problem based classes. See course website for further information.
Language of instruction: Icelandic.

BT BEÐ 1003 BUILDING ENGINEERING PHYSICS 6 ECTS

Year of study: Second year / Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: No prerequisites.
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week. Taught every other year for a combined class of 2nd and 3rd year students. *Next taught in spring semester 2018.*
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðni Ingi Pálsson, Agnar Snædahl, guest lecturers.

Learning outcome: Upon completion of the course it is expected that students have

Knowledge:

- Can calculate thermal conductivity, temperature drop, moisture ratio and percentage of moisture in buildings and for building components at steady state in one-dimension
- Can estimate airflow through holes and slots in building elements, due to temperature effects.
- Be familiar with situations that can induce mold and dryrot forming within buildings or construction parts.
- Be familiar with the properties of sound and acoustics.

Skills:

- Can calculate sun radiation effects on horizontal and vertical building surfaces.
- Will have the ability to assess the impact of radiators and windows on perception temperature.
- Be familiar with how and why air and fluid flows through building elements.
- Be familiar with the basic tools to assess the physical condition of buildings, such as measurements of air tightness, thermal cameras, moisture sensors and pipe cameras.
- Be familiar with the sound absorption, -isolation and -damping properties of building materials.

Competence:

- Know the requirements and standards on acoustic comfort both inside and outside of residential buildings.
- Know the different categories and symbols used in acoustic design.
- Have sufficient knowledge to be support further studies and more advanced education within the field and in related disciplines of technology.

Content: The course provides theoretical knowledge on the flow of moisture, heat and sound through and within buildings, as well as connecting theory to practice through practical problem solving. The goal is that students gain an understanding of the principles of building physics, especially regarding moisture and thermal conductivity and will be able to apply them to analyse real situations and solve practical problems.

The topics covered include: Basic concepts in building physics; The building structure and the purpose of different material layers in the exterior walls and roofs; The effect of air leaks and airtightness; How to make buildings airtight. Basic principle in acoustic design will be discussed. Frequency range and hearing

range, the distribution and transmission paths of sound waves. Sound absorption and sound proofing. Acoustic comfort Categories and sound isolation requirements. Acoustic symbols for design drawings.

Reading material: Hand-outs from lecturers.
Teaching and learning activities: Lectures and practical sessions.
Assessment methods: Exercises count 35% and final examination 65%.
Language of instruction: Icelandic.

BT FRK1013 CONSTRUCTION MANAGEMENT 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Elective.
Prerequisites: Project Management and Construction (AT VST 1003).
Schedule: Runs for 12 weeks – 6 hours in class each week.
Supervising teacher: Hera Grímsdóttir.
Lecturer: NN.

Learning outcome: Upon completion of the course, students should:

Knowledge:

- Have an understanding of project life cycle and role of construction management.
- Be able to define project and set up Work Breakdown Structure (WBS).
- Understand how to estimate hourly rates for labour, equipment and material.
- Understand the methodology of creating unit prices from basic rates, productivity and factors (e.g. location factors).
- Know three different methods to estimate contingency and understand advantages and disadvantages of each method.
- Have an understanding of cost distribution.
- Be able to understand project risk analysis.
- Be able to plan and understand the role of monitoring projects

Skills:

- Understand the relation between time schedule and cost estimate
- Be able to define work breakdown structure for projects.
- Understand earned value analysis.
- Be able to calculate net present value and future value with different types of cash flow.
- Understand internal rate of return and minimum acceptable rate of return.
- Know how to use internal rate of return to estimate project feasibility.
- Be acquainted with benefit-cost ratio and its application on simple projects.

Competence:

- Have sufficient basic knowledge to perform the day-to-day job of a project manager in the construction area.
- To be able to build simple financial models and sensitivity analysis to estimate project feasibility.

Content:
This is a practical course where the construction process is followed from the start to finish.
Conceptual phase: Needs analysis, scheduling and cost, risk, tender documents and contracts.
Implementation Phase: Supervision of construction, responsibility and the role of the project, risk analysis work phases, safety, health and environment, change management, communication, project meetings.
Termination: Final report and settlement.

The course final project incorporates all these topics and simulates actual construction project.

Reading material:
Teaching and learning activities: Leactures and project work.
Assessment methods: Multiple assignments over the 12 weeks period. Evaluation of project work counts for 100% of the final grade.
Language of instruction: Icelandic.

BT HVB3003 PRACTICAL PROJECT IN STRUCTURES AND BIM 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced.
Type of course: Core.
Prerequisites: Concrete Structures I (BT SST1013), Timber and Steel Structures I (BT BYG1003).
Schedule: Taught every week-day for 3 weeks as an intensive, project-oriented course.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Guðbrandur Steinþórsson.

Learning outcome: On completion of the course students should:
Knowledge:

- Be familiar with the building design process and the interaction of different fields of expertise, ranging from the introduction of a design concept up to the detailing design.
- Understand the context of structural members and how the forces are generated to the foundations.
- Familiar with methods to evaluate section forces and bending moments for two-way spanning slab.

Skills:

- Be able to apply the knowledge from previous studies such as structural reinforced concrete, timer structures and steel structures.
- Be able undertake the structural design of an ordinary building.
- Be able to deliver documentation, i.e. structural calculations, design report and completed drawings that are fit for submission to the relevant building authorities
- Be able to submit work breakdown plan and cost estimate plan for ordinary buildings.

Competence:

- Can analyse architect drawings and worked out from them the detailed structural drawings as part of the design project
- Can submit design report outlining all the criteria and methods used.
- Can explain and justify the design report and other written material presented.

Content: The coursework comprises a comprehensive design project, which has the aim to produce the appropriate design and tender documents for a residential building.

In parallel with the design work, students work in groups on an assignment on collecting and evaluation information on specific topics covering one or more areas of Civil Engineering related to structural design of buildings and the design project. The students write a report on the subject.

Reading material: Hand-outs from lecturer.

Teaching and learning activities: Two design projects.

Assessment methods: Evaluation of projects, presentation and oral examination counts 100%.
Language of instruction: Icelandic.

T-806-SVEI EARTHQUAKE ANALYSIS OF STRUCTURES 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced / Second cycle, introductory.
Type of course: Elective.
Prerequisites: The Finite Element Method and Structural Analysis (BT BUÞ 3003), Mathematics III (AT STÆ 3003).
Schedule: Runs for 12 weeks – 4 lectures and 2 problem solving classes each week.
Supervising teacher: Jónas Þór Snæbjörnsson.
Lecturer: Jónas Þór Snæbjörnsson.

Learning outcome: Students are supposed to be able to:

Knowledge:
- Know the fundamental aspects of dynamic analysis of structures and be able to apply them in structural design and analysis.
- Know the basic properties of damping and be able to account for damping in dynamic modelling of structures

Skills:
- Be able to determine natural frequency and mode shapes for single- and multi-degree of freedom structures.
- Be able to evaluate forced vibration response of linear systems.
- Be able to evaluate earthquake-induced response of structures.

Competence:
- Be able to interpret and present the vibration characteristics of structures and results of vibration analysis.
- Have gained the ability to use their knowledge in subjects related to the design of structures.
- Have developed competence for further study in the field of structural Engineering.

Content: The course introduces the fundamentals in structural dynamics. Emphasis is placed on the stiffness, mass and damping characteristics of simple structures and their response induced by time-dependent actions. The course will cover the following topics:

- Single degree of freedom (SDOF) systems, simulated by a mass, damper and spring.
- Inertia forces, damping forces and stiffness forces.
- Relations between response and excitation.
- The definition of the equation of motion.
- Undamped and damped free vibration response. Energy balance for free vibration.
- Response to forced vibration, undamped and damped systems. Energy balance for forced vibration. Transmission of forces and motion between system and foundation.
- The application of Fourier series to solve periodic excitation.
- Evaluation of response to impulse action, stepwise and ramp type forcing functions, using direct integration, Duhamel integration and Fourier analysis.
- Evaluation of response of dynamic systems to ground motion, i.e. displacements, base shear and base moments, estimation of peak response and definition of Response spectra.
- Multi-degree of freedom systems (MDOF), such as multi story buildings with distributed stiffness and mass.

- Free vibration of MDOF, stiffness and mass matrices, Rayleigh damping, modal analysis.
- Response to periodic vibration, impulse excitation, ground motion and general time-history analysis.

Reading material: Anil K. Chopra: *Dynamics of Structures - Theory and application to earthquake engineering*, Prentice Hall; along with handouts and lecturenotes.
Teaching and learning activities: Lectures, excersises and small projects.
Assessment methods: Evaluation of excersises and projects accounts for 50% of grade and a final examination project 50%.
Language of instruction: English.

BT JTÆ2013 GEOTECHNICAL ENGINEERING 6 ECTS

Year of study: Second year / Third year.
Semester: Spring.
Level of course: First cycle, advanced.
Type of course: Core.
Prerequisites: Engineering Geology and Soil Mechanics (BT JTÆ 1003).
Schedule: Runs for 12 weeks – 6 hours in class each week. Taught every other year, each time for a combined class of 2nd and 3rd year students. *Next taught in spring semester 2019.*

Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Einar Helgason.

Learning outcome: On completion of the course students should:

Knowledge:
- Know the basis of structural design in accordance with applicable standards
- Know the characteristics of the soil and the basic aspects of the behavior of soil stress
- Be familiar with the methods for determining the strength of the soil, both drained and un-drained conditions
- Be able to calculate slope stability for simple conditions
- Be able to calculate stresses in soil due to weight and external pressures

Skills:
- Be able to draw a conclusion regarding the permeability of soil
- Be familiar with the methodology and limitations of methods of slices when calculating slope stability
- Be able to calculate structural integrity of shallow foundations
- Be able to calculate structural integrity of piles (deep foundations)
- Be able to calculate horizontal earth pressure and explain the methods used.
- Be able to calculate load and safety with respect to turnover and sliding for retaining walls

Competence:
- Be able to calculate main dimensions for steel sheet walls
- Be able to calculate flow in soils

Content: The course focuses on geotechnical design of traditional foundations, determination of loading on basement walls, retaining walls and other soil retaining structures as well as the evaluation of stability for landfills and slopes.

The course covers the basis of design, methods for determining characteristics values for soil, design methods according to European standards, addressing the use of safety and partial coefficients, load combinations and basic calculations methods.

Reading material: Braja M. Das, *Fundamentals of Geotecnical Engineering.*
Teaching and learning activities: Lectures, problem-solving sessions and project work.
Assessment methods: A 3 hour written examination counts 80%; project work 20%.
Language of instruction: Icelandic.

BT LAG1013 INSTALLATION SYSTEMS 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Core.
Prerequisites: Hydraulics (BT REN 1003).
Schedule: Runs for 12 weeks – 6 teaching hours each week.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Heiðar Jónsson, Árni Þór Steinarsson.

Learning outcome: On completion of the course students should:

Knowledge:
- Be familiar with piping design criteria for dwellings
- Be familiar with the main types of piping systems for residential buildings
- Be familiar with primary energy sources for heating, such as district heating, electrical heating and heat pumps.
- Be familiar with the characteristics of a heat source, such as floor-, radiation- and oven heating.
- Be able to assess the energy consumption of residential buildings.
- Be able to calculate heating requirements according to building regulations.
- Be familiar with the different types of piping materials

Skills:
- Be able to calculate pipe sizes for heating system, drinking water and drainage piping
- Be able to establish criteria for the balancing of heating systems
- Be able to calculate pressure and flow and select pumps for heating systems
- Be familiar with the common types of control and heat pump equipment and for domestic water
- Be familiar with energy simulation methods for buildings

Competence:
- Be able to prepare and submit design documents including drawings of residential plumbing systems and documents relating to their use and operation.

Content: The course emphasis is on the basics in the design of heating, sewage and freshwater systems for housing. Also, on increasing students´ understanding of the design process of buildings, design parameters, and the importance of interaction in the design of buildings.
A discussion of the design criteria, standards and building codes, design methods and calculations.
Drawings for Heating systems, domestic water and plumbing will be presented.
Techniques for simulating energy use in smaller buildings will be demonstrated as well as software for designing piping systems.

Reading material: *Varmeanlæg, Afløbsinstallationer og Vandinstallationer*, published by DTU. Also IST 66:2008, IST67:2003 og IST68:2009 (DS418, DS439 og DS432).
Teaching and learning activities: Lectures, problem-solving sessions and project work
Assessment methods: A 3 hour written examination counts 50%; project work 40%, and assignments 10 %.
Language of instruction: Icelandic.

BT LOF1003 HEATING, VENTILATION AND AIR-CONDITIONING 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, intermediate.
Type of course: Elective.
Prerequisites: Hydraulics (BT REN 1003).
Schedule: Runs for 12 weeks – 6 hours in class each week.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: NN.

Learning outcome: Upon completion of the course, students should be able to:

Knowledge:

- Be able to determine the need for ventilation depending on requirements set forward in building regulations on indoor air comfort both in terms of air quality and cooling needs for the inside temperature.
- Know different type of mechanical ventilation system that suits the subject and its components.
- Know the the characteristics and use the use of I-x graph. (Mollier)

Skills:

- Draft a control system for an air-conditioning system.
- Choose and dimension a ventilation system for mechanical air conditioning that meets the building regulation and standards for energy use.
- Describe the use of I-x graph (Mollier)
- Calculate the need for fresh air and cooling air for air quality and cooling requirements of buildings.
- Draft methods to verify and describe the functionality of the air-conditioning systems and their design criteria's.
- Draft operational guidelines for air conditioning.

Competence:

- Students should be able to design mechanical and natural air ventilation system in buildings with regard to the requirements of comfort, indoor air quality and energy consumption

Content: The course is on air-conditioning technology with an emphasis on mechanical and natural air conditioning for cooling of buildings and to improve air quality. The aim of the course is to enable students to design mechanical and natural air conditioning for buildings by considering the requirements for comfort, indoor air quality and energy consumption. It is necessary that students have taken courses in heat engines or installation technology.

The course will discuss requirement for indoor air quality and cooling, energy saving for air-conditioning systems and design of ventilation systems. Emphases are on the use of I-x graphs for air, cooling of air using cooling equipment and cold water, heat recycling and different efficiency and economy evaluations. Intake devices (distributors and control systems) are studied as well as the construction of air duct systems. Ventilation machinery and different control of air-conditioning systems are discussed including blowers and electricity use. Sound design for ventilation systems is presented. Software is introduced, to assist with selection and dimensioning of equipment as well as the calculation of the cooling needs of buildings. Building regulations and relevant standards will be examined. A tour will be organized to inspect a complete air conditioning system in operation.

Reading material:
Teaching and learning activities:
Assessment methods:

Language of instruction: Icelandic.

BT NOR1001 NORDPLUS INTENSIVE COURSE ON SUSTAINABLE ENERGY AND WATER 3 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, introductory
Type of course: Elective
Prerequisites: No prerequisites.
Schedule: The core of the course takes place during a one intensive study week. Firstly, the exchange week will be preceded by pre-tasks to prepare the visit. Secondly, lectures on power generation technologies will be held and teaching materials for mutual use will be produced. Thirdly, visits to both large and smaller energy production units will be made in order to put theory into practice. Fourthly, after the study week the students shall deliver a technical report and a diary to document their participation and experience.
Supervising teacher: Jónas Þór Snæbjörnsson
Lecturer: Aldís Ingimarsdóttir and Jónas Þór Snæbjörnsson.

Learning outcome: On completion of the course students should:
Knowledge:
Students and teachers from Iceland, Estonia, Sweden and Finland will widen their knowledge and skills in sustainable management of waste, water and energy within the Nordic countries through different working activities and site visits to companies working within the realm of the course topic.
Skills:
The intensive study week will encurage and provide practice in sharing and presenting mutual knowledge on sustainable technologies for water and waste management, including the energy issues.
Competence:
Students from different countries and cultures will be working together in mixed groups throughout the intensive week and thus have the opportunity to learn from and get to know each other. The co-operation will create understanding and appreciation of other Nordic countries and cultures, and provide students with confidence in interacting with their colleuges in other countries.

Content:

The Nordplus-network Advanced Nordic Technology for Energy and Environment" (=ANTEE) will develop, create and design new ways to approach climate change issues. The energy issues related to alternative technologies will be promoted during the project.

Partner Universities: Reykjavik University, School of Science and Engineering (Iceland), TTK University of Applied Sciences (Estonia), Halmstad University (Sweden), School of Business and Engineering,Tampere University on Applied Sciences (Finnland). A guest participant is the programme in Environmental Engineering and KEA, Copenhagen School of Design and Technology (Denmark).

Each university will send 5-7 students, along with a teacher, to an intensive study week. In the spring of 2017 the intensive study week will be hosted by the Reykjavik University in Iceland.

Reading material: Material published on-line, such as by governmental agencies and relevant material from companies distributed during site visits.
Teaching and learning activities: Lectures, presentations and site visits to project related companies and/or governmental agencies. Students write a diary and a scientific report, documenting their experience and activities. Students make two group presentations on topics related to the project description defined each year.
Assessment methods: The course is a fail/pass course. Assessment of presentations, reports and attendance count 100% in the evaluation.
All the students will get 3 ECTS units as a part of their engineering examination by completing the following tasks: (i) handing in of pre-tasks for the study week (1 ECTS unit) (ii) taking part in the study week (1 ECTS unit) (iii) handing in of 2 reports: Daily travel diary and a Scientific report on the issues discussed during the study week (1 ECTS unit).
Language of instruction: English.

T-806-SST2 CONCRETE STRUCTURES II 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced / Second cycle, introductory.
Type of course: Elective.
Prerequisites: Concrete Structures I (BT SST1013). The Finite Element Method and Structural Analysis (BT BUR3003)
Schedule: Runs for 12 weeks – 6 hours in class each week.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Eyþór Rafn Þórhallsson.

Learning outcome: On completion of the course students should:

Knowledge:
- Be familiar with use of strip method for calculating design moments in two-way slabs.
- Be familiar with use of yield line theory for calculating design moments in ordinary slabs.
- Be familiar with constructing the finite-element models for concrete slabs and deep beams and calculating according to a linear theory.
- Be familiar with the design process in service limit state and in the ultimate limit state according to Eurocode 2.
- Be familiar with calculating process for punching shear around columns. Recognize the design process for pre- and post-stress structures.
- Recognize calculating methods for analysis of loss of stress in cables, such as for creep, shrinkage and relaxation.
- Recognize the design process for Earthquake Engineering design.

Skills:
- Be able to design one way and two way slabs with strip method and yield line theory.
- Be able to build the finite-element model of slabs and deep beams.
- Be able to design staircase, pad and strip foundations and retaining walls.
- Be able to design vertical concrete members with first and second order moments.

Competence:
- Be able to complete the design of structures in reinforced concrete with all necessary documents.

Content: Slabs analysed and designed using yield line methods and strip methods for slabs founded on walls and columns. Special focus is on design documents and drawings. Different reinforced concrete

members are covered such as foundations, columns, walls, deep beams and staircases. Pre- and post-tensioned structural members are introduced. Furthermore, Earthquake engineering design for concrete structures will be introduced.

Reading material: Bill Mosley, John Bungey & Ray Hulse, *Reinforced Concrete Design*.
Teaching and learning activities: Students complete 4 design projects and one lab exercise.
Assessment methods: Evaluation of project work, including an oral defense, counts for 100% of the final grade.
Language of instruction: English.

T-806-UMFE TRAFFIC AND ROAD CONSTRUCTION MANAGEMENT 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced / Second cycle, introductory.
Type of course: Elective.
Prerequisites: Road Design – urban and rural (BT VEG 1013).
Schedule: Runs for 12 weeks – 6 hours in class each week.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Björn Ólafsson, Haraldur Sigþórsson.

Learning outcome: On completion of the course students should:

Knowledge:

- Know different methods to organise traffic counts and how to use the outcome for traffic forecasts and further evaluation.
- Know different kinds of road surfaces and their design principles.
- Know how to estimate the necessary design of drainage pipes under roads.
- Know how to prepare, plan and organise road construction, splitting the work into units and planning the time schedules.

Skills:

- Able to calculate traffic capacity for various roads and crossings.
- Able to understand basic assumptions to count, plan and forecast traffic.
- Able to choose the appropriate crossing type.
- Able to organise road constructions and make cost analysis.
- Able to plan the operation and maintenance for road construction.
- Able to plan road construction work.

Competence:

- Be able to manage traffic considerations for road projects.
- Be able to work on the supervision and surveillance of road construction projects.

Content: Traffic counts, analysis and prognosis, capacity of roads. Road surfaces, incl. asphalt, tarmac, macadam, concrete. Drainage. Planning and estimating road works incl. supervision, cost estimates and project scheduling. Operation and maintenance of road projects. Work on organising a road project.

Reading material:
Teaching and learning activities:
Assessment methods: Evaluation of project work in road construction management. Oral exam in traffic management.
Language of instruction: English.

BT LAG3003 WATER SUPPLY AND WASTEWATER DISPOSAL 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced / Second cycle, introductory.
Type of course: Elective.
Prerequisites: Hydraulics (BT REN1003).
Schedule: Runs for 12 weeks – 6 hours in class each week.
Supervising teacher: Aldís Ingimarsdóttir.
Lecturer: Aldís Ingimarsdóttir, Brynjólfur Björnsson. Guest lecturers from industry.

Learning outcome: Upon completion of the course, it is expected that students will:

Knowledge:

- Be familiar with the role and structure of freshwater and sewer systems.
- Know the difference between groundwater and surface water and to make a distinction with regard to quantity and composition.
- Ability to assess water requirements for both domestic and commercial use.
- Familiar to leaks in piping systems and the main reasons for leaky systems and how to limit the risk of leakage.
- Be able to use the Hardy - Cross method for distribution of water in ring systems.
- Have knowledge of water tanks and the purpose of different types.
- Be familiar with the basic procedures to clean drinking water.
- Be familiar with the equipment used in water and drainage systems; piping materials, valves, pumps, pumping stations and equipment.
- Have knowledge of snow melting and leakage into sewer pipes.
- Have knowledge of contamination of wastewater, the treatment system are used and how to choose the treatment structures.

Skills:

- Be able to use hydraulics to calculate the flow in pipes and design simple utility systems for drinking water distribution.
- Know the difference between ring lines and branch lines and be able to design simple versions of those.
- Know the composition of rainwater and wastewater; both residential- and industrial, with respect to composition and quantity.

Competence:

- Be able to design simple water supply and seweage systems.

Content: The course is focused on projects in designing distribution systems, both fresh water and sewage systems, for small towns and city districts. The objective is that students will understand the fundamental principles of water and sewage systems and be able to apply them in solving technical installation problems.

Reading material: To be decided.
Teaching and learning activities: Lectures, problem-solving sessions and project work.
Assessment methods: A written examination counts 60%; project work 40%.
Language of instruction: English/Icelandic.

Courses in the 4th year – Fall or Spring semester

BT LOK1012 FINAL PROJECT 24 ECTS

Year of study: Fourth year.
Semester: Spring / Fall.
Level of course: First cycle, advanced.
Type of course: Core.
Prerequisites: A total of 174 ECTS credits in the Applied Civil Engineering program.
Schedule: Runs for 15 weeks.
Supervising teacher: Guðbrandur Steinþórsson.
Lecturer: External supervisors from the industry.

Learning outcome: On completion of the course students should:

- Have used engineering methods to solve extensive projects in the field of civil and/or construction engineering.
- Have learned to use independent and goal oriented methods in practical project work and/or research work in the field of civil and/or construction engineering.
- Have obtained a broad overview through the interaction of courses where he/she applies knowledge from many subjects previously studied in the Applied Civil Engineering program.
- Be able to present design and/or research results in a clear way, both in writing and orally.

Content: A design and/or research project selected by the student and approved by the supervising teacher. The student is required to show his capability to work independently. Projects are drawn from the field of civil or construction engineering, in cooperation with firms and companies in the industry. The main emphasis is on an organized technical approach to the problem and it´s definition, gathering of information, synthesis, analysis and optimization, 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: As recommended by supervisors.
Teaching and learning activities: The student works independently for 15 weeks, with the guidance of a supervising teacher and an external expert from the relevant industry. Regular meetings with supervisor and other instructors, see RU´s *Rules for Final Projects in Applied Engineering*.
Assessment methods: Evaluation of project thesis, presentation and oral examination counts 100%.
Language of instruction: Icelandic.

AT RSN1003 MANAGEMENT AND INNOVATION 6 ECTS

Year of study: Third year / Fourth year.
Semester: Fall.
Level of course: First cycle, introductory.
Type of course: Core.
Prerequisites: None.
Schedule: Taught for 12 weeks – 6 hours a week.
Supervising teacher: Páll Kr Pálsson.
Lecturer: Páll Kr Pálsson.

Learning outcome:

Knowledge: On the completion af the course students should be able invent business ideas that are then fostered scrutinised and matured through brainstorming, canvas methods and the creation of a business plan. On the completion of this course the students also should:
• Possess a clear understanding of the methodology and theoretical understanding of the managerial aspect used in defining and writing complete business plans.
• Understand innovation through the search for promising, inspiring and rich ideas, idea evaluation and selection.
• Understand the basics of innovation through technical developmental processes and life-cycle of both products and businesses.
• Understand marketing through market analysis and create a marketing and sales plans that define customers and market demands.
• Understand the technical challenges in innovation and define developmental processes for solutions and plan actions accordingly.
• Understand the financial and funding aspect of innovation: Plan for capital and financing, revenue and cost estimates, cash flow plan and balance sheets. Also cost estimations, revenue, value assessment and sensitivity analysis.
• Understand innovation through the human aspect of management such as the need for direction, strategy, organisation chart, and human resource management.
• Define business opportunities and write a business plan and interpret business plans.
Also students should at the completion of the course know how to define business opportunities and make a text- and calculation models in order to evaluate the business opportunity according to demand, solution, profit and financing interest. To know how to avoid making mistakes when searching and evaluating business opportunities.
Skills: Students should be able to adapt the most important methods in optimizing business opportunities by analysing current situation and suggest methods that are likely to lead to optimal results in business planning and business plans. Also students shall be able to describe how to realize their proposals.
Competence: To possess the knowledge to present and interpret the outcome of a business plan and be able to establish and/or operate minor companies.

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 continuous 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: As recommended by teacher.
Teaching and learning activities: Lectures, company visits and project work.
Assessment methods: Four interim reports count 62%, the final report 18%, and an oral examination 20%.
Language: Icelandic.

BT BYG2013 DESIGN OF TIMBER AND STEEL STRUCTURES II 6 ECTS

Year of study: Third year.
Semester: Spring.
Level of course: First cycle, advanced.
Type of course: Elective.
Prerequisites: Timber and Steel Structures I (BT BYG1003), The Finite Eement Method and Structural Analysis (BT BUR3003).
Schedule: Runs for 12 weeks – 6 hours in class each week. Timber structures are taught for 6 weeks and steel structures for 6 weeks.
Supervising teacher: Eyþór Rafn Þórhallsson.
Lecturer: Eyþór Rafn Þórhallsson, Jóhann Albert Harðarson.

Learning outcome: After the course the student shall:

Knowledge:

- Have knowledge of the design of timber and steel in ultimate limit state
- Have knowledge of deflections calculations in timber and steel structures.
- Know and be able to design the connections for wood and steel structures.

Skills:

- Be able to design timber beams with variable section (single tapered, double tapered, pitched cambered beams)
- Be able to design curved timber beams.
- Be able to design two and three-pin portal frames and arches made of timber or steel.
- Be able to check fire resistance of timber structures.
- Know how to design holes in gluelam beams.
- Be able to design composite timber elements.
- Be able to design moment resisting connections in steel and timber.

Competence:

- Be able to complete the design report for structures in steel and timber with all necessary documents.
- Be able to explain and justify the design selected and submitted.

Content: Two timber projects will be solved. The first one is a roof made of glulam beams with variable section and purlins of sawn timber. The second project is to design a three hinged frame and bracings. Serviceability limit state and ultimate limit state will be considered as well as fire resistance. Durability and environmental aspects of timber will be discussed. The third project is to design steel structure, portal frame in industrial building.

Reading material:
Design of timber structures, Swedish wood, 2011. ISBN númer: 978-91-637-0055-2.
Structural Design of Steelwork, Lawrence Martin and John Purkiss. ISBN: 13:978-0-7506-5060-1.
Teaching and learning activities: Lectures and problem solving sessions.
Assessment methods: Evaluation of project work counts for 100% of the final grade.
Language of instruction: Icelandic.