The English version of the curriculum for the „Master's Programme in Civil and Environmental Engineering" is not legally binding and is for informational purposes only. The legal basis is regulated in the curriculum published in the University of Innsbruck Bulletin on 4 May 2007, issue 50, No. 224. Decision of the Curriculum Committee of the Faculty of Civil Engineering on 18.04.2007, approved by Senate Decree on 19.04.2007:

On the basis of § 25 para. 1 No. 10 Universities Act 2002, BGBl. I (Federal Law Gazette) No. 120, most recently amended by Federal Law BGBl. I (Federal Law Gazette) No. 134/2008 and § 32 Section "Regulations of Study Law", republished in the University of Innsbruck Bulletin of 3 February 2006, Issue 16, No. 90, most recently amended by the University of Innsbruck Bulletin of 7 May 2008, Issue 42, No. 272, the following is decreed:

Curriculum for the **Master's Degree Programme in Civil and Environmental Engineering** at the Faculty of Civil Engineering of the University of Innsbruck

§ 1 Qualification profile

(1) The Master's Programme in Civil and Environmental Engineering belongs to the group of studies of engineering sciences. Internationally, the degree "Diplomingenieurin" or "Diplomingenieur" earned in this course corresponds to a Master of Science (MSc) degree in this particular field.

(2) The field of civil engineering covers a wide range of subjects from feasibility studies, planning, construction design and analysis to the realization, operation, maintenance and renovation of constructions like buildings, bridges, transport infrastructure, water supply facilities and power stations. Due to the important role attributed to the protection of the environment and the protection against natural hazards, the course of studies also focuses on the civil engineering-related disciplines of environmental engineering like traffic planning, flood and avalanche protection, protection against noise, and the treatment of waste water and solid waste.

(3) The construction industry comprises a wide range of activities and is therefore a major contributor to the economic performance and well-being of any country. This variety of activities and the close interaction of civil and environmental engineering with natural sciences, economics and law, and the rapid advances in construction and environmental technologies make the training of students all the more demanding.

(4) The Master's Programme in Civil and Environmental Engineering of the University of Innsbruck aims at developing essential skills and competencies, i.e.:

1. Scientific skills
   a) through in-depth training in the basic principles and methods of natural sciences,

b) by promoting analytical, interdisciplinary and networked thinking and the ability of students to think critically,
c) by promoting abstraction and modeling skills;

2. Engineering skills
   a) by promoting students' understanding of complex interrelations and engineering problems through research-based instruction,
   b) by developing expertise in solving core tasks of engineering practice,
   c) by realising the creative potential of students to solve complex practical problems independently,
   d) by teaching students strategies to address new problems and challenges in civil and environmental engineering,
   e) by training them in modern IT, management and presentation methods,
   f) by raising their awareness about a holistic approach which con-siders projects in a technical, economic and environmental context;

3. Soft skills
   a) by developing soft skills useful for their roles both as team members and team leaders,
   b) by acquiring further knowledge in foreign languages,
   c) by developing an interest in life-long learning and further personal education.

(5) Graduates of the Master's Programme in Civil and Environmental Engineering will be able to work in the fields mentioned above. In addition to these fields, they are particularly qualified for leading and managing positions in engineering and for further study in a doctoral programme aiming at the advancement of technical sciences through independent research.

§ 2 Scope and Length

(1) The Master's Programme in Civil and Environmental Engineering comprises 120 ECTS credits (ECTS-C), which equals four semesters, taking a workload of 30 ECTS credits per semester as a basis. One ECTS credit equals a workload of 25 hours. One hour per semester (SSt.) equals the number of teaching units of 45 minutes multiplied by the number of teaching weeks during the term. Students have to earn a total of 52.5 ECTS credits in six compulsory modules and 40 ECTS credits in four optional modules. The master thesis amounts to 27.5 ECTS credits. The compulsory modules comprise 60 SSt and the optional modules comprise 115 SSt.

(2) The Master's Programme in Civil and Environmental Engineering is divided in a general part and a specialized part. Specializations according to sub. 1 and 2 comprise two compulsory modules each as listed in § 5 para. 2 sub. 1 and 2 and para. 3 sub. 1 and 2. Students have to choose one of the following specializations:

1. Infrastructure and Environment (IU) or
2. Construction and Management (KM)

At the latest, they have to make their choice after they have completed the compulsory modules listed in § 5 para. 1 *AIE1, CE1* and *IBBK1*, informing the Dean of Studies of the

Faculty for Civil and Environmental Engineering in writing about their chosen specialization. Once students have sat for an exam in one of the courses contained in the compulsory modules of their specialization listed in § 5 sub. 2 and 3, they are no longer allowed to switch specialization.

(3) The general part of the course of studies is identical for all students and comprises three compulsory modules with a total of 30 ECTS credits. The chosen specialization comprises two compulsory modules with a total of 20 ECTS credits and four optional modules. Students have to earn a total of 40 ECTS credits in courses contained in these optional modules. The master thesis equals 27.5 ECTS credits and the defense of the master thesis (compulsory module *Defensio)* equals 2.5 ECTS credits.

§ 3 Admission

(1) Admission to the Master's Programme in Civil and Environmental Engineering requires the completion of a relevant subject-specific bachelor's programme or a relevant subject-specific bachelor's programme of a university of applied sciences or another equivalent course of studies at an accredited Austrian or non-Austrian post-secondary educational institution.

(2) Completion of the Bachelor's Programme in Civil and Environmental Engineering at the University of Innsbruck is valid in any event as completion in the sense of para 1.

§ 4 Courses and maximum number of students

(1) Lecture (VO)
Lectures serve to convey content through lecture presentations and explanations supported by examples and demonstrations. Interaction between students and the lecturer is to be encouraged.

(2) Tutorial (UE)
1. Tutorials are courses that enable the student to put into practice the material learned in the corresponding lecture; they also offer the opportunity to work independently on study exercises. Depending on the educational objective, these exercises can take the form of calculations, constructions, planning, programming, presentations and management tasks, laboratory work or any combination of these.
2. Tutorials are courses with continuous performance assessment.
3. As a rule, the maximum number of students is 30; for laboratory and equipment tutorials the maximum is 15.

(3) Lecture with Tutorial (VU)
1. VU courses are a combination of lecture and tutorial, providing flexibility so that the choice of delivery, by lecture or tutorial, depends on the requirements of the content to be taught. If the group has to be divided up for the tutorial because of the number of participants, then typically in VU courses 50% of the hours are used for the lecture, and 50% for the tutorial.
2. VU courses are courses with continuous performance assessment.

3. As a rule, the maximum number of students for lecture and tutorial courses (VU) is 30 for the tutorial part; for laboratory and equipment tutorials the maximum is 15.

(4) Seminar (SE)
1. Seminars serve to introduce scientific methods and provide an introduction to discourse in the field. Students have to work on a given topic/project by means of scientific methods. Participants are to make independent oral and/or written contributions.
2. Seminars are courses with continuous performance assessment.
3. As a rule, the maximum number of students is 30.

(5) Excursions (EX)
1. Excursions are an opportunity for students to gain further knowledge about the content of their courses through practical real-life examples.
2. Excursions are courses with continuous performance assessment.
3. As a rule, the maximum number of students is 30.

§ 5 Name of the modules and names, type and credits of the courses contained in the modules

(1) The general subjects, which are identical for all students, consist of the following three compulsory modules of ten ECTS points each

1. ***Module Alpine Infrastructure Engineering 1 (AIE1)*** ***8 SSt, 10 ECTS-C***
Basic principles of the design and construction of infrastructure and assessment of their environmental impact. Detailed study of hydraulic, geotechnical, environmental, transport related and process engineering aspects.

a) **Selected Aspects of Foundation Engineering** **VO2, 2.5 ECTS-C**
Complementary aspects of foundation engineering. Site investigation with drilling and sounding, construction and testing of piles, earth dams, environmental geotechnical engineering, geosynthetics, safety aspects.

b) **Hydraulics 2** **VU2, 2.5 ECTS-C**
Introduction to unsteady hydraulics and hydraulic modelling combined with assignments for students (hydrodynamic equations and simplifications).

c) **System Analysis and Process Engineering 1** **VU2, 2.5 ECTS-C**
Basic principles of system analysis and process engineering (physical, chemical and biological principles, hazardous substances in soil, water and air, thermodynamics, transportation and transformation; reaction kinetics, material flow analysis).

d) **Traffic and Environment** **VU2, 2.5 ECTS-C**
Environmental impact, traffic noise (road, rail, air transport), sound level survey, sound level calculation, mapping and assessment of traffic noise, noise control, vibration, air pollution, space requirement, compensatory measures, protection of plants and animals;

2. ***Module Computational Engineering 1 (CE1)*** ***8 SSt 10 ECTS-C***
Foundations of numerical mathematics and the finite element method (FEM); applying FEM for the linear analysis of the load carrying behaviour of 2D and 3D structures;

a) **FEM 1 − Linear Strength Analyses** **VO2, 2.5 ECTS-C**
Introduction to the displacement formulation of the finite element method for problems in linear elasticity (2D and 3D continuum finite elements, finite elements for beams, slabs and shells);

b) **FEM 1 − Linear Strength Analyses** **UE2, 2.5 ECTS-C**
Demonstration of the application of a FE-program for solving problems of linear elasticity (linear FE-analyses of panels, slabs and shells); students are instructed to conduct linear FE-analyses independently.

c) **Numerical Mathematics** **VO2, 2.5 ECTS-C**

Foundations of numerical mathematics: representation of numbers on the computer, numerical differentiation and integration, interpolation and approximation, matrix decomposition and systems of linear equations, solution of non-linear equations, differential equations;

d) **Numerical Mathematics** **UE2, 2.5 ECTS-C**
Tutorials accompanying the lecture impart further knowledge about the contents of the lecture: computational exercises, practical engineering tasks using mathematical software, independent programming.

3. ***Module Innovative Building materials, Construction Techniques and Structures 1 (IBBK1)*** ***8 SSt, 10 ECTS-C***
Solving realistic problems in project development, design, construction and realization of load-bearing structures up to their delivery and use, with special emphasis on the material concrete and the legal aspects of each stage of the project.

a) **Concrete Technology 1** **VU2, 2.5 ECTS-C**
Fundamental principles of concrete production and processing (cement and hydrate products, aggregates and their properties, concrete additives and admixtures, fresh and hardened concrete, chemical hardening process of cement and resulting material properties, durability, requirements for concrete in testing standards and guidelines).

b) **Design and Constructions** **VU2, 2.5 ECTS-C**
Fundamental principles of the design and construction of loadbearing structures and their realization in real-life design projects.

c) **Building Construction 2** **VU2, 2.5 ECTS-C**
In-depth study of selected methods for the construction of buildings; construction systems, construction methods and building materials considering operation, mechanical strain and cost effectiveness; development of detailed solutions for the construction of buildings and for complex heating, cooling and ventilation systems of buildings;

d) **Legal Aspects in the Execution of Projects** **VU2, 2.5 ECTS-C**
An introduction to the field; discussion of legal aspects using real-life projects from their development to their delivery and use; land register, town and country planning, discussion of the relevant legals aspects of every stage of the project; discussion of various legal aspects like work contracts, liability of planners and contractors, guarantee/damages, and construction defects.

(2) The compulsory modules and courses for the specialization *Infrastructure and the Environment* are:

1. ***Module Alpine Infrastructure Engineering 2 (AIE2)*** ***12 SSt, 12.5 ECTS-C***
Solving the main problems of infrastructure construction, considering the particularities of the alpine region such as dealing with water resources and their use for power generation, the develoopement of traffic concepts as well as railway construction and maintenance.

a) **Alpine Water Supply** **VU2, 2.5 ECTS-C**
Water supply management with special emphasis on alpine conditions (water resource management) and software-based pipe network computation.

b) **Railway Engineering** **VU3, 2.5 ECTS-C**
Rail stress considering thermal and residual rail stress, track system stress, maintenance and renovation of track superstructure, construction during traffic operation, performance of tracks and route junctions.

c) **System Analysis and Process Engineering 2** **VU2, 2.5 ECTS-C**
Detailed methods of system analysis and process engineering (model description, chemical-physical and biological models of water and wastewater treatment, biological and thermal models of waste treatment).

d) Traffic Planning and Traffic Engineering **VU3, 2.5 ECTS-C**
Traffic development and mobility, capacity of intersections, traffic forecasts, traffic modelling,

coordination of traffic light, traffic telematics, forecast and organsiation of stationary traffic, traffic concepts, transport policy, cost-benefit-analysis.

e) **Water Engineering and Hydropower in the Alps** **VU2, 2.5 ECTS-C**
Design, construction and monitoring of hydraulic structures; hydraulic machines; case studies of international hydropower projects.

2. ***Modul Computational Engineering 2 (CE2-IU)*** ***6 SSt, 7.5 ECTS-C***
Acquiring the theoretical basis of numerical methods and applying them to solve problems of water and foundation engineering; getting to know their potential and limits in order to apply these procedures responsibly.

a) **Computational Fluid Dynamics** **VU2, 2.5 ECTS-C**
Lecture on numerical hydraulic modelling combined with assignments for students (basics of CFD, numerical methods, shallow water equations, turbulence models).

b) **Numerics in Geotechnical Engineering** **SE2, 2.5 ECTS-C**
Introduction to standard geotechnical software by means of realistic problems. Special attention is paid to the sensitivity of the results to input parameters. Special aspects of finite element calculations in geotechnical engineering.

c) **Programming Language 2** **VU2, 2.5 ECTS-C**
To acquire a thorough knowledge of and practical skills in programming languages, eg. Fortran and C++

(3) The compulsory modules and courses for the specialization *Construction and Management* are:

1. ***Innovative Building Materials, Construction Techniques and Structures 2 (IBBK2)*** ***12 SSt, 12.5 ECTS-C***
In-depth knowledge in constructional subjects considering pre-stressed constructions, composite structures and materials; fundamentals of time and resource management;

a) **Resources Management and Operations Planning** **SE2, 2.5 ECTS-C**
Theoretical bases and their practical application; insight into selected topics of time and operations planning methods, events and the configuration of relationships, calculation of buffer times and performance factors, progress controll, operations planning in underground and surface construction;

b) **Concrete Structures 2** **VU3, 2.5 ECTS-C**
Basic design and construction rules for prestressed concrete structures (external prestressing and internal prestressing with and without band) and their application in practical assignements;

c) **Timber Design 2** **VU2, 2.5 ECTS-C**
Advanced timber design (fasteners, composed cross sections, design procedures and calculation of connections and truss systems; design training and exercises);

d) **Composite Construction** **VU3, 2.5 ECTS-C**
Advanced composite construction, design procedures for composite components and their dimensioning according to the current bodies of rules and regulations, presentation of various possible constructions and details using drawings, presentation of realized projects;

e) **Construction Materials 3** **VU2, 2.5 ECTS-C**
Detailed discussion of construction materials, e.g. hardening and alloys, wood, corrosion, coatings, remediation processes.

2. ***Module Computational Engineering 2 (CE2-KM)*** ***6 SSt, 7.5 ECTS-C***
Acquiring the theoretical bases of the finite-elements-method (FEM); applying FEM for the numerical simulation of nonlinear load-carrying behaviour of two- and three-dimensional structures until their failure; acquiring the mathematical bases and methods of risk analysis in building projects.

a) **FEM 2 − Nonlinear Finite Element Analyses** **VO2, 2.5 ECTS-C**
Ultimate load analysis of steel structures, concrete and reinforced concrete structures using the finite element method (nonlinear material models for steel and concrete within the framework of plasticity theory and damage theory; incremental-iterative solution strategy for nonlinear problems);

b) **FEM 2 − Nonlinear Finite Element Analyses** **UE2, 2.5 ECTS-C**
Demonstration of the nonlinear FE-analysis (ultimate load analysis) of structures on the basis of problems encountered in engineering practice; students are guided to conduct nonlinear FE-analyses independently and to interpret the results;

c) **OR and Risk Analysis** **VU2, 2.5 ECTS-C**
Risk analysis of engineering projects, qualitative and quantitative mathematical risk models (e.g. decision trees, Monte Carlo simulation, fuzzy logic). Interpretation of results; project-oriented risk management; risk assessment, decision making.

(4) Students have to earn a total of 40 ECTS-POINTS from four optional modules. Regardless of their chosen specialisation they have to complete courses from modules *AIE3* (art. 5 para. 4 sub. 1) and *IBBK 3* (art. 5 para. 4 sub. 3) amounting to 12.5 ECTS-C each, courses from module *CE3* (art. 5 para. 4 sub. 2) amounting to 10.0 ECTS-C and courses from module *SK2* (art. 5 para. 4 sub. 4) amounting to 5.0 ECTS-C. In addition to the courses listed in art. 5 para. 4 sub. 1 to 4 students can choose courses from modules *AIE3*, *CE3* and *IBBK3* that they have not yet taken in the compulsory modules *AIE2* (art. 5 para.. 2 sub. 1), *CE2-IU* (art. 5 para.. 2 sub. 2), *IBBK2* (art. 5 para. 3 sub. 1) and *CE2-KM* (art. 5 para. 3 sub. 2).

1. ***Modul Alpine Infrastructure Engineering 3 (AIE3)*** ***12.5 ECTS-C***
Specialization in planning, constructing, monitoring and maintaining traffic lines, tunnels, river engineering, sewage and waste plants and measures to reduce alpine risks e.g. torrents and avalanches.

a) **Waste Resources Management** **VU3, 2.5 ECTS-C**
Advanced knowledge of material balance, waste treatment plants and waste management systems (state of the art of waste treatment technology, procedural methods to control soil, water and air pollution)

b) **Selected Topics of Soil Mechanics** **SE2, 2.5 ECTS-C**
'Critical state soil mechanics', constitutive relations for geotechnical engineering (elastoplasticity and hypoplasticity), limit theorems, soil structure interaction, safety in geotechnical engineering.

c) **Operational Tunneling** **VU3, 2.5 ECTS-C**
Introduction to the "New Austrian Tunnelling Method", conventional advance, shallow tunnels, shafts and caverns, the Austrian standard ÖN B2203, building site equipment and logistics, safety management; integrated tutorial: choice of equipment, speed of advance, conventional and mechanised advance, support quantity value and LAST-model (comparison of wage hours for excavation and support), building site equipment.

d) **Facilities and Technology of Freight Transportation** **VU2, 2.5 ECTS-C**
Freight transportation facilities, marshalling facilities, freight transportation logistic management, logistic centres, combined traffic such as container transport systems, piggy-back transport, combi-trailer, optimisation of signalling and control by codification, system engineering as an aspect of cost-effectiveness;

e) **Bioenergy** **VU2, 2.5 ECTS-C**
Technology of energy generation from biomass by combustion, gasification and fermentation compared to other alternative energy systems;

f) **Soil-mechanical Testing** **SE2, 2.5 ECTS-C**
Laboratory and field investigations of physical and mechanical soil properties, in particular index properties and tests to determine the action of groundwater upon soil.

g) **Rock and Tunnelmechanics** **VU3, 2.5 ECTS-C**

Fundamentals of tunnel design, excavation and heading methods, support, mechanical properties of rock, interaction of rock and support, face stability, ground line method, approximations for shallow tunnels, surface settlements, mechanics of blasting.

h) **River Construction and Water Ecology** **VU2, 2.5 ECTS-C**
Design and planning of river engineering projects (near-to-nature projects, renaturation, sediment transport, ecological aspects);

i) **Geoinformation Systems** **VU2, 2.5 ECTS-C**
Introduction to geographical information systems: hardware, software, data (acquisition, use, rights and duties), use, practical assignments;

j) **High-Capacity Traffic** **VO2, 2.5 ECTS-C**
Fundamentals of planning high-speed traffic and public passenger transport facilities (city railways, undergrounds, trams, busses) considering vehicles, routes, layout of lines, design of stops, management and design of station forecourts;

k) **Engineering Hydrology and River Area Management** **VU2, 2.5 ECTS-C**
Hydrological processes, estimation of flood flows, assessment and management of flood risk in alpine and urban catchments

l) **Determining Coordinates and Location using GPS** **VU2, 2.5 ECTS-C**
Basics of GPS-systems (NAVSTAR GPS, Glonass, Galileo), methods of measurement (high-precision static, dynamic, real-time kinematic) and their application.

m) **Resource Management** **VU2, 2.5 ECTS-C**
Presentation of technical options for recycling resources such as soil, air and energy, based on the principles of autarky and sustainability

n) **Snow, Ice and Avalanche Mechanics** **VO2, 2.5 ECTS-C**
Physical and mechanical properties of ice and snow. Constitutive relations, transformations of snow, stress and strain states in ice bodies and snow covers, snow pressure, theory of avalanches and avalanche dynamics.

o) **Cableway Installations** **VU2, 2.5 ECTS-C**
Technical developments in cableway installations, legal requirements in Austria, terminology, fundamental knowledge about ropes and rope joints, calculation of the ropes and their lines, strength of ropes, ropes dimensioning, cableway systems

p) **Urban Drainage and Water Quality** **VU3, 2.5 ECTS-C**
Integrated urban water management (drainage and waste water treatment) by means of numerical models (rainfall characteristics, rainfall runoff models, biological processes in waste water treatment plants)

q) **Urban Traffic Planning** **VU2, 2.5 ECTS-C**
Travel behaviour, planning policies, public infrastructure measures, push-and-pull measures, measures to promote environmentally-friendly transport modes (pedestrian traffic, cyclists, public transport), traffic calming, design of road space; practice: discussion of traffic problems and solutions, environmental impact;

r) **Road Construction and Road Maintenance** **VO2, 2.5 ECTS-C**
Road structure, subsoil and road foundation, base and wearing courses, road drainage, roadside furniture, procedure of road construction, road traffic laws, road maintenance, pavement management systems;

s) **Monitoring and P-Measurements in the Alpine Region** **VU2, 2.5 ECTS-C**
Geodetic precision measurements to monitor the terrain and constructions in Alpine areas: methods of measurement, measurement set-ups, statistic analyses;

t) **Water and Environmental Law** **VO2, 2.5 ECTS-C**
Selected aspects of water and environmental law (constitutional and legal basics and background).

u) **Torrent and Avalanche Control** **VU2, 2.5 ECTS-C**
Basic torrent, avalanche and erosion theory (technical and biological protection measures, risk maps for torrents, avalanches, rock fall and erosion)

2. ***Module Computational Engineering 3 (CE3)*** ***10.0 ECTS-C***
Advanced theory of numerical simulation methods and visualization methods; mastering the

analytic process, from data acquisition, modeling, numerical and/or experimental analysis to the interpretation and assessment of the results for static and dynamic problems in structural engineering;

a) **Structural Dynamics** **VU3, 5.0 ECTS-C**
Discretization of load-bearing structures for problems in structural dynamics; vibrations of single-degree- and multi-degree-of-freedom systems in the time and frequency domain; fundamental principles of earthquake engineering (response spectra, dynamic response); stochastic dynamics of structures; in-situ testing on small scale model structures (computer-oriented experimental structural dynamics);

b) **Advanced CAD** **VU2, 2.5 ECTS-C**
3-D modeling and visualization of supporting structures, buildings and building details using a CAD software package; advanced understanding of the application of CAD in building design and construction projects; scripting and macro programming);

c) **FEM 3 – Multifield Problems** **VU3, 5.0 ECTS-C**
Basic principles of the analysis of multi-field problems (MFP) by means of FEM; porous multi-phase materials; elasto-plastic material models; demonstration of an FE-analysis of MFP; instructions for conducting the analysis and for the interpretation of results;

d) **FEM 4 – Area-Supporting Framework** **VU3, 5.0 ECTS-C**
Basic principles of the analysis of surface structures, in particular of shell structures, by the Finite Element Method (FEM); demonstration of the application of an FE-program for the analysis of shells; independent FE-analysis of shells;

e) **Higher Analysis** **VU2, 2.5 ECTS-C**
Advanced analysis in several variables; partial differential equations, Fourier series, Fourier transformation, stochastic analysis;

f) **Numerical Methods of Finite Elements** **VU3, 2.5 ECTS-C**
Mathematical foundation of the finite element method and relevant numerical methods; principles of linear elasticity theory: variational problem and FE-approximation, error estimates; order of convergence. Types of elements, linear and nonlinear systems of equations;

g) **Photogrammetry and Digital Terrain Models** **VU2, 2.5 ECTS-C**
Basics of photogrammetric surveying methods and their application in map and plan production, documentation of construction progress and defects, digital elevation models, satellite and aerial photographs and orthophotos as a basis for planning in the construction industry;

3. ***Module: Innovative Building Materials, Construction Techniques and Structures 3 (IBBK3)*** ***12.5 ECTS-C***
Advanced knowledge of special constructions (bridges, particular structures), topics concerning building physics and material technology.

a) **Construction Engineering and Management 2** **VU2, 2.5 ECTS-C**
Shuttering (operational and economic aspects), use of cranes (planning, types); deep building pits (technical and economic aspects), excursions subject to availability;

b) **Building Physics 2** **VU3, 2.5 ECTS-C**
Theoretical and practical aspects of heat engineering (U-value of layered and compound parts with the problem of thermal bridges, certification procedures, thermal insulation of glazing, overheating in summer), vapour diffusion (temperature factor and humidity factor, verification procedures) and building acoustics (assessment principles and requirements, planning of protections against airborne noise and impact sound according to different standards) from both a theoretical and a practical point of view (e.g. calculation of components);

c) **Construction Industry** **VU2, 2.5 ECTS-C**
Cost accounting, operative controlling (building site), procurement, logistics, management of consortiums/teams;

d) **Concrete Technology 2** **VU2, 2.5 ECTS-C**

Requirements for and production of special concretes for special applications in construction and new developments in concrete technology

e) **The Construction of Bridges** **VU3, 5.0 ECTS-C**
Calculation, design and construction of bridges as well as practical exercises and design assignments.

f) **Energy Concepts for Structures** **VU2, 2.5 ECTS-C**
Energy management/sector, energy consumption data, energy flow charts, Carnot cycle, quantity of heat required, fossil and renewable energy;

g) **Structural Design 3** **VU3, 2.5 ECTS-C**
Innovative construction processes and constructions in the field of structural engineering considering operation, mechanical strain and cost effectiveness;

h) **Timber Detailing** **VO2, 2.5 ECTS-C**
Engineering and detailing of timber constructions (houses and wide span roof structures), resistance, durability, building physics and connections details (walls, ceilings, roof elements etc.);

i) **Planning and Building in Foreign Countries** **SE2, 2.5 ECTS-C**
Introduction to planning and construction in foreign countries; experts from Austria and abroad will be invited to the seminars to talk about their experience with projects abroad;

j) **Project Management and Interdisciplinary Planning 2** **SE2, 2.5 ECTS-C**
Aspects of project management: skills needed to lead projects, negotiation techniques, crisis management, creative problem solving, project coordination by the general planner, tasks and coordination of experts, web-based project communication, models for the handling of projects, specific tasks of the project supervisor with practical examples;

k) **Special Constructions** **VU2, 2.5 ECTS-C**
Additional information about the structural design, construction and execution of special buildings e.g. water-tight, reservoirs, concrete structures, skyscrapers etc.

l) **Metal Constructions and Glass Constructions** **VU3, 2.5 ECTS-C**
Using FEM for the design of metal constructions, assessment of the service life of cracked components, fracture mechanics and calculation of crack propagation, tank constructions („design by analysis“), aluminum structures (materials technology, special features as compared to steel structures), glass constructions, engineering design, (product data management, parts list);

m) **Construction of Steel Bridges** **VU3, 5.0 ECTS-C**
Basic principles of project planning and realization of steel bridges, structural analysis and design of the primary and secondary load carrying systems, construction and implementation of special structural systems, bridge equipment (bearings, expansion joints) and bridge maintenance;

n) **Development of Structural Systems** **VU2, 2.5 ECTS-C**
Basic principles of developing structural systems for timber constructions (selected structural systems, stability and reinforcement of structural systems for engineered structures and bridges), design and detailing of structural systems, instructions to solve design tasks independently;

o) **Corporate Governance** **SE2, 2.5 ECTS-C**
Legal principles (company law), organisation theory, management of planning and/or construction companies, management skills, benchmarking, basics of business controlling, management of planning offices/building sites, human-resources management, marketing in the construction industry, company foundation etc.;

p) **Strengthening, Renovation And Building in Existing Structures.** **VU2, 2.5 ECTS-C**
Introduction to methods and concepts for the renovation and strengthening of existing (maybe damaged) structures; practical examples.

q) **Materials for Civil Engineering 4** **VO2, 2.5 ECTS-C**
Selected special procedures to process materials and influence material properties;

r) **Materials for Civil Engineering 5** **VU2, 2.5 ECTS-C**
Damage to and failure modes of building materials and components under normal and abnormal environmental conditions, thermal and fire behaviour of building materials and compo-

nents, thermodynamics of fires (fire loads and burning rates, furnace temperature), fire protection (flammability requirements, flammability and explosiveness of materials in general and building materials)

4. ***Soft Skills 2*** ***5.0 ECTS-C***
To acquire general verbal and social skills, practical application of technical knowledge;

a) **Excursion for Civil-Engineers** **EX2, 1.0 ECTS-C**
One long and several short excursions to visit and discuss real construction work;

b) **Foreign Languages 2** **UE2, 2.5 ECTS-C**
Students can choose a foreign language course from the programme of the university's International Language Centre to develop their personality and acquire additional skills useful in their professional lives;

c) **Gender in Engineering 2** **VO2, 2.0 ECTS-C**
Opportunities and advantages of applied gender diversity (variety and diversity) in various fields like education and work with a focus on engineering;

d) **Practice in Civil and Environmental Engineering** **SE2, 1.5 ECTS-C**
In this seminar students report on and discuss their experiences during a technical internship comprising at least 240 working hours;

e) **Social Competences 2** **UE2, 2.5 ECTS-C**
Students can choose one of the following courses from the programme of the university's Department of Psychosocial Intervention and Communication to develop their personality and acquire additional skills useful in their professional lives: team work, optimisation of cooperation, team development, presentation, chairing meetings, conflict management, discussion techniques 2 (group discussions);

(5) All students have to complete the compulsory module to defend their master thesis at the end of their studies; it comprises 2.5 ECTS-C.

Defense of Master Thesis ***2.5 ECTS-C***
Students have to be able to give a lecture about their master thesis before the examination board, defend the results and answer questions during the following discussion.

(6) The recommended study programme is listed in the appendix.

§ 6 Internship

Students are recommended to do a technical internship to test and apply the knowledge and skills gained during their studies practically. An internship comprising at least 240 working hours is a prerequisite for admission to the seminar Practice in Civil and Environmental Engineering (§ 5 para. 4 sub. 4d).

§ 7 Master Thesis

During the Master's Programme in Civil and Environmental Engineering a master thesis has to be written, which equals 27.5 ECTS-C. The master thesis is a piece of scientific work which serves to prove the student's ability to work on a scientific topic independently using the correct methodology and to produce correct results.

§ 8 Procedure for the allotment of places in courses with a limited number of participants

In courses with a limited number of participants, places will be allocated as follows:

1. Students whose study time will be prolonged if they are not admitted will be given priority.
2. If the criterion according to para. 1 is inadequate for the regulation of admission to a course, then first preference will be given to students for whom this course forms a part of a compulsory module, and second preference to students for whom this course forms part of an optional module.
3. If the criteria according to para. 1 and 2 for the regulation of admission are inadequate, then the available places will be allocated by lot.

§ 9 Examination Regulations

(1) Lecturers are required to inform students about evaluation criteria and methods at the beginning of the course and to choose one of the examination methods listed in para. 2 to 5.

(2) All lectures of a compulsory or optional module are evaluated by means of a single exam at the end of the course.
Examination methods: oral and/or written exams.

(3) All tutorials of a compulsory or optional module are evaluated by means of continuous performance assessment during the course.

(4) All lectures with tutorials of a compulsory or optional module are evaluated by means of continuous performance assessment in the tutorial part and one final exam in the lecture part.
Examination method: tutorial: continuous performance assessment, lecture: written and/or oral exam;

(5) All seminars of a compulsory or elective module are evaluated by means of continuous performance assessment during the course and one final course exam.
Examination method: continuous performance assessment and written and/or oral exam.

(6) All excursions are evaluated on the basis of students' participation and their report on the excursion.
Exam method: continuous performance assessment.

(7) A compulsory module is completed when all of its courses have been evaluated positively.

(8) An optional module is completed when all the courses necessary to gain the required ECTS credits have been evaluated positively.

(9) The master thesis can be registered as soon as students have successfully completed the modules *AIE1, CE1* and *IBBK1* listed in § 5 para. 1. The Dean of Studies has to assess whether students fulfill the above mentioned prerequisites.

(10) The Master's Programme is concluded with the defense of the master thesis in an oral exam valid 2.5 ECTS credits. This exam has to be given before an examination board and lasts about 50 minutes, of which 20 are reserved for the presentation of the master thesis.

(11) The exams given for the module *Soft Skills 2* in the courses listed in § 5 para.4 sub.4b are regulated by the examination regulations of the International Language Centre of the University of Innsbruck, and in the courses listed in § 5 para. 4 sub 4e by the examination regulations of the Department of Psychosocial Intervention and Communication of the University of Innsbruck.

§ 10 Academic Degree

Graduates of the Master's Programme in Civil and Environmental Engineering are awarded the academic degree *Diplomingenieurin* or *Diplomingenieur* (graduate in civil engineering), abbreviated *Dipl.-Ing.* or *DI.*

§ 11 Implementation

This curriculum comes into force on October 1, 2008.

For the Curriculum Committee:
Ao. Univ.-Prof. Dipl.-Ing. Dr. Rudolf Stark

For the Senate:
Univ.-Prof. Dr. Ivo Hajnal

Appendix: Recommended Study Programme

Appendix: Recommended Study Programme

(1)	1st Term	Type/ hours	ECTS credits	compulsory/ optional	Module
1.	Selected Aspects of Foundation Engineering	VO2	2.5	C	AIE1
2.	Hydraulics 2	VU2	2.5	C	AIE1
3.	System Analysis und Process Engineering 1	VU2	2.5	C	AIE1
4.	Traffic and Environment	VU2	2.5	C	AIE1
5.	FEM 1 – Linear Strength Analyses	VO2	2.5	C	CE1
6.	FEM 1 – Linear Strength Analyses	UE2	2.5	C	CE1
7.	Numerical Mathematics	VO2	2.5	C	CE1
8.	Numerical Mathematics	UE2	2.5	C	CE1
9.	Concrete Technology 1	VU2	2.5	C	IBBK1
10.	Design and Constructions	VU2	2.5	C	IBBK1
11.	Building Construction 2	VU2	2.5	C	IBBK1
12.	Legal Aspects in the Execution of Projects	VU2	2.5	C	IBBK1

(2)	2nd Term − Infrastructure and Environment	Type/ hours	ECTS credits	compulsory/ optional	Module
1.	System Analysis und Process Engineering 2	VU2	2.5	C	AIE2
2.	Traffic Planning and Traffic Engineering	VU3	2.5	C	AIE2
3.	Numerics in Geotechnical Engineering	SE2	2.5	C	CE2-IU
4.	Programming Language 2	VU2	2.5	C	CE2-IU
5.	Waste Resources Management	VU3	2.5	O	AIE3
6.	Operational Tunneling	VU3	2.5	O	AIE3
7.	Facilities and Technology of Freight Transportation	VU2	2.5	O	AIE3
8.	Soil-mechanical testing	SE2	2.5	O	AIE3
9.	High-Capacity Traffic	VO2	2.5	O	AIE3
10.	Engineering Hydrology and River Area Management	VU2	2.5	O	AIE3
11.	Determining Coordinates and Location using GPS	VU2	2.5	O	AIE3
12.	Urban Drainage and Water Qualitiy	VU3	2.5	O	AIE3
13.	Urban Traffic Planning	VU2	2.5	O	AIE3
14.	Monitoring and P-Measurements in the Alpine Region	VU2	2.5	O	AIE3
15.	Water and Environmental Law	VO2	2.5	O	AIE3
16.	FEM 2 - Nonlinear Finite Element Analyses	VO2	2.5	O	CE2-KM
17.	FEM 2 - Nonlinear Finite Element Analyses	UE2	2.5	O	CE2-KM
18.	Structural Dynamics	VU3	5.0	O	CE3
19.	Advanced CAD	VU2	2.5	O	CE3
20.	Numeric Methods of Finite Elements	VU3	2.5	O	CE3
21.	Resources Management and Operations Planning	SE2	2.5	O	IBBK2
22.	Concrete Structures 2	VU3	2.5	O	IBBK2
23.	Construction Materials 3	VU2	2.5	O	IBBK2
24.	Building Construction 2	VU2	2.5	O	IBBK3
25.	Concrete Technology 2	VU2	2.5	O	IBBK3
26.	Energy Concepts for Structures	VU2	2.5	O	IBBK3
27.	Structural Design 3	VU3	2.5	O	IBBK3
28.	Timber Detailing	VO2	2.5	O	IBBK3
29.	Metal Construction and Glass Construction	VU3	2.5	O	IBBK3
30.	Construction Industry	VU2	2.5	O	IBBK3
31.	Corporate Governance	SE2	2.5	O	IBBK3
32.	Strengthening, Renovation and Building in Existing Structures	VU2	2.5	O	IBBK3

(3)	2nd Term − Construction and Management	Type/ hours	ECTS credits	compulsory/ optional	Module
1.	Resources Management and Operations Planning	SE2	2.5	C	IBBK2

2.	Concrete Structures 2	VU3	2.5	C	IBBK2
3.	Construction Materials 3	VU2	2.5	C	IBBK2
4.	FEM 2 - Nonlinear Finite Element Analyses	VO2	2.5	C	CE2-KM
5.	FEM 2 - Nonlinear Finite Element Analyses	UE2	2.5	C	CE2-KM
6.	System Analysis und Process Engineering 2	VU2	2.5	O	AIE2
7.	Traffic Planning and Traffic Engineering	VU3	2.5	O	AIE2
8.	Waste Resources Management	VU3	2.5	O	AIE3
9.	Operational Tunneling	VU3	2.5	O	AIE3
10.	Facilities and Technology of Freight Transportation	VU2	2.5	O	AIE3
11.	Soil-mechanical testing	SE2	2.5	O	AIE3
12.	High-Capacity Traffic	VO2	2.5	O	AIE3
13.	Engineering Hydrology and River Area Management	VU2	2.5	O	AIE3
14.	Determining Coordinates and Location using GPS	VU2	2.5	O	AIE3
15.	Urban Drainage and Water Qualitiy	VU3	2.5	O	AIE3
16.	Urban Traffic Planning	VU2	2.5	O	AIE3
17.	Monitoring and P-Measurements in the Alpine Region	VU2	2.5	O	AIE3
18.	Water and Environmental Law	VO2	2.5	O	AIE3
19.	Numerics in Geotechnical Engineering	SE2	2.5	O	CE2-IU
20.	Programming Language 2	VU2	2.5	O	CE2-IU
21.	Structural Dynamics	VU3	5.0	O	CE3
22.	Advanced CAD	VU2	2.5	O	CE3
23.	Numeric Methods of Finite Elements	VU3	2.5	O	CE3
24.	Building Construction 2	VU2	2.5	O	IBBK3
25.	Concrete Technology 2	VU2	2.5	O	IBBK3
26.	Energy Concepts for Structure	VU2	2.5	O	IBBK3
27.	Structural Design 3	VU3	2.5	O	IBBK3
28.	Timber Detailing	VO2	2.5	O	IBBK3
29.	Metal Construction and Glass Construction	VU3	2.5	O	IBBK3
30.	Construction Industry	VU2	2.5	O	IBBK3
31.	Corporate Governance	SE2	2.5	O	IBBK3
32.	Strengthening, Renovation and Building in Existing Structures	VU2	2.5	O	IBBK3

(4)	**3rd Term − Infrastructure and Environment**	**Type/ hours**	**ECTS credits**	**compulsory/optional**	**Module**
1.	Alpine Water Supply	VU2	2.5	C	AIE2
2.	Railway Engineering	VU3	2.5	C	AIE2
3.	Water Engineering and Hydropower in the Alps	VU2	2.5	C	AIE2
4.	Computational Fluid Dynamics	VU2	2.5	C	CE2-IU
5.	Selected Topics of Soil Mechanics	SE2	2.5	O	AIE3
6.	Bioenergy	VU2	2.5	O	AIE3
7.	Rock and Tunnelmechanics	VU3	2.5	O	AIE3
8.	River Construction and Water Ecology	VU2	2.5	O	AIE3
9.	Geoinformation Systems	VU2	2.5	O	AIE3
10.	Resource Management	VU2	2.5	O	AIE3
11.	Snow, Ice and Avalanche Mechanics	VO2	2.5	O	AIE3
12.	Cableway Installations	VU2	2.5	O	AIE3
13.	Road Construction and Road Maintenance	VO2	2.5	O	AIE3
14.	Torrent and Avalanche Control	VU2	2.5	O	AIE3
15.	OR and Risk Analysis	VU2	2.5	O	CE2-KM
16.	FEM 3 – Multifield Problems	VU3	5.0	O	CE3
17.	FEM 4 – Area-Supporting Framework	VU3	5.0	O	CE3
18.	Higher Analysis	VU2	2.5	O	CE3
19.	Photogrammetry and Digital Terrain Models	VU2	2.5	O	CE3
20.	Timber Design 2	VU2	2.5	O	IBBK2
21.	Composite Construction	VU3	2.5	O	IBBK2
22.	Building Physics 2	VU3	2.5	O	IBBK3

23.	Building Construction 2	VU2	2.5	O	IBBK3
24.	The Construction of Bridges	VU3	5.0	O	IBBK3
25.	Planning and Building in Foreign Countries	SE2	2.5	O	IBBK3
26.	Project Management and Interdisciplinary Planning 2	SE2	2.5	O	IBBK3
27.	Special Constructions	VU2	2.5	O	IBBK3
28.	Construction of Steel Bridges	VU3	5.0	O	IBBK3
29.	Materials for Civil Engineering 4	VO2	2.5	O	IBBK3
30.	Materials for Civil Engineering 5	VU2	2.5	O	IBBK3

(5)	**3rd Term − Construction and Management**	**Type/ hours**	**ECTS credits**	**compulsory/ optional**	**Module**
1.	Timber Design 2	VU2	2.5	C	IBBK2
2.	Composite Construction	VU3	2.5	C	IBBK2
3.	OR and Risk Analysis	VU2	2.5	C	CE2-KM
4.	Alpine Water Supply	VU2	2.5	O	AIE2
5.	Railway Engineering	VU3	2.5	O	AIE2
6.	Water Engineering and Hydropower in the Alps	VU2	2.5	O	AIE2
7.	Selected Topics of Soil Mechanics	SE2	2.5	O	AIE3
8.	Bioenergy	VU2	2.5	O	AIE3
9.	Rock and Tunnelmechanics	VU3	2.5	O	AIE3
10.	River Construction and Water Ecology	VU2	2.5	O	AIE3
11.	Geoinformation Systems	VU2	2.5	O	AIE3
12.	Ressource Management	VU2	2.5	O	AIE3
13.	Snow, Ice and Avalanche Mechanics	VO2	2.5	O	AIE3
14.	Cableway Installations	VU2	2.5	O	AIE3
15.	Road Construction and Road Maintenance	VO2	2.5	O	AIE3
16.	Torrent and Avalanche Control	VU2	2.5	O	AIE3
17.	Computational Fluid Dynamics	VU2	2.5	O	CE2-IU
18.	FEM 3 – Multifield Problems	VU3	5.0	O	CE3
19.	FEM 4 – Area-Supporting Framework	VU3	5.0	O	CE3
20.	Higher Analysis	VU2	2.5	O	CE3
21.	Photogrammetry and Digital Terrain Models	VU2	2.5	O	CE3
22.	Building Physics 2	VU3	2.5	O	IBBK3
23.	Building Construction 2	VU2	2.5	O	IBBK3
24.	The Construction of Bridges	VU3	5.0	O	IBBK3
25.	Planning and Building in Foreign Countries	SE2	2.5	O	IBBK3
26.	Project Management and Interdisciplinary Planning 2	SE2	2.5	O	IBBK3
27.	Special Constructions	VU2	2.5	O	IBBK3
28.	Construction of Steel Bridges	VU3	5.0	O	IBBK3
29.	Materials for Civil Engineering 4	VO2	2.5	O	IBBK3
30.	Materials for Civil Engineering 5	VU2	2.5	O	IBBK3

(6)	**4th Term**	**Type/ hours**	**ECTS credits**	**compulsory/ optional**	**Module**
	Master Thesis		27.5	C	
	Defensio		2.5	C	D

The classes of the optional module *Soft Skills 2* (§ 5, para. 4, sub. 4) can be taken in any of the four semesters.