University
of Ljubljana
Faculty
of Civil and Geodetic Engineering

Presentation of the study programme

1st CYCLE ACADEMIC STUDY PROGRAMME
CIVIL ENGINERING (BA)

Valid from study year 2018/2019

1. Information about the study programme

Academic bachelor degree programme Civil Engineering consists of 3 years (6 semesters) and amounts to 180 ECTS points. The study programme does not include any orientations. In the 6th semester the study programme is organised in 5 modules: Buildings, Hydraulics, Municipal Engineering, Structures and Traffic. The study program is carried out as a regular and a part-time study.

2. Basic goals of the programme and general competences

- The graduate acquires general basic knowledge and understanding in the wider area of civil engineering.
- The graduate is motivated for further study at the postgraduate level.
- The graduate understands the creative relation necessary for designing built environment in natural or existing urban environment.
- The graduate has wider knowledge of civil engineering allowing interdisciplinary connection with several other areas.
- The graduate acquires education comparable to related study programmes in Slovenia and in wider European area.
- The student is allowed to change to related undergraduate studies.
- The programme is harmonised with the principles of the Bologna Declaration and follows the recommendations by EUCEET and the FEANI Engineering Association.
- Progression conditions and educational practices that encourage regular study as well as the tutorship system assure good progression rate of the students.

3. General competences

General competences of the graduate after the finished university bachelor degree programme of Civil Engineering are mainly the following:

- Ability to define, understand and creatively solve professional challenges.
- Development of the ability of critical, analytical and synthetic thinking.
- Development of professional responsibility and ethics.
- Skills related to professional understanding and written expression, including the use of foreign technical language.
- Ability to use information-communication technology.
- Ability to use the acquired knowledge for independent solving of technical problems in civil engineering.
- Ability to find sources, critically evaluate information, independently upgrade the acquired knowledge and deepen the knowledge in individual specialised areas of civil engineering.
- Ability to establish interdisciplinary connections.
- Taking into account the aspects of safety, functional, economic and ecological principles at work.

4. Course-related competences acquired through the programme

The graduate of the first cycle study of Civil Engineering acquires mainly the following course-related competences:

- Mastering the basic theoretic knowledge, essential for the technical area of civil engineering.
- Managing the basic professional knowledge from the area of civil engineering and essential complementary sciences (geology, geodesy, organisation of works, information science).
- Basic qualifications in the area of civil engineering that allow continuation at the second cycle study.
- Ability to individually acquire new skills.
- The graduate is capable of individual performance of less demanding works and solving individual well defined tasks in civil engineering in the areas of design and realisation of works (for buildings as well as engineering structures), spatial planning, laboratory testing of building materials, etc., and is

as such a good co-worker in a wider expert team, although generally not capable of independent project management.

- Specific competences are given within the description of individual subjects (see study plans).

5. Conditions for enrolment

To enrol to the first cycle of the university bachelor degree programme Civil Engineering the candidates are required to:

a) pass the general matura exam;
b) pass the professional matura exam from any secondary school programme and one of the subjects from the matura exam; the selected subject should not be the same as already passed by the candidate for the professional matura exam;
c) finish any of the four-year secondary school programs before 1. 6. 1995.

The number of places is determined in the Call for enrolment into second cycle study programmes of the University of Ljubljana individually for each academic year.

6. Selection criteria when enrolment is restricted

In the event of limited enrolment

the candidates from items 5. a) and 5. c) shall be selected according to:

- general success in general matura exam or school-leaving exam 60 %
- general success in the 3rd and 4th years of the secondary school 40 %

the candidates from item 5. b) shall be selected according to:

- general success in professional matura exam 40 %
- general success in the 3rd and 4th years of the secondary school 40 %
- success in extra matura examination 20 %

7. Criteria for recognising knowledge and skills acquired before enrolment in the programme

Knowledge conforming in contents and scope to the contents of the courses in the programme Civil Engineering may be acknowledged. The recognition of knowledge and skills acquired before the enrolment is subject to the decision by the Study Board of the Department of Civil Engineering of UL FGG based on student's written application, certificates and other documents proving successful acquisition of knowledge and the contents of the knowledge, and in accordance with the Rules on procedure and criteria for the recognition of informally acquired knowledge and skills, adopted at the 15th meeting of the Senate of UL, 29. 5. 2007.
Based on the approval of the acquired knowledge by the departmental Study Board, the knowledge will be evaluated with the same number of ECTS credit points as defined for the related course.

8. Methods of assessment

The assessment methods are in accordance with the Statute of University of Ljubljana and listed in the Course Syllabi.

9. Conditions for progression through the programme

Conditions for progression from one year to another

Students are allowed to enrol to the second study year after completing by the end of the academic year all the obligations foreseen by the study plan thus achieving 60 credit points according to ECTS. Students may enrol to the third study year after completing by the end of the academic year the obligations foreseen by the study plan and achieving at least 54 credit points according to ECTS.
Exceptionally, students may enrol to the next year also when failing to complete all obligations defined by the study programme for the enrolment to the next study year, by providing justified reasons as defined by Article 153 of the Statute of UL (maternity, longer illness, extreme family and social circumstances, certified status of a person with special needs, active participation in top professional, cultural and sports events, active participation in the university bodies).
Considering the conditions from the above paragraph, students may also enrol to the next year when they accumulate at least 45 credit points according to ECTS. The enrolment according to the above paragraph is the subject to the decision by the Study Board of the Department of Civil Engineering at FGG.

Faculty of Civil and Geodetic Engineering has been offering tutorship and supervision for its students for several years. From the very first year students have designated supervisors for each class, and smaller groups of students can also have individual tutors consisting of teachers or students from higher classes, who help them select orientation, elective courses, etc.
Students with above-average study results are allowed to advance at a faster rate. An adequate decree thereof shall be adopted by the Senate of FGG based on a candidate's application and opinion of the Study Board of FGG. The decree also defines the principles of faster advancement.

Conditions for repeated enrolment in the same year

Failing to meet all the obligations defined by the study program for the advancement in the next year, students may enrol in the same year for the second time, provided that they have obtained at least 30 credit points according to ECTS.

10. Transfers between study programs

Transfer between programmes shall mean termination of education in the student's original study programme (first programme) and continuation of education in the first cycle academic study programme of Civil Engineering (second programme), in which a part of the completed study requirements from the first study programme are recognised as completed. Transfers are possible from the first cycle study programmes, and until their expiration also from the undergraduate study programmes adopted after June 11 2004, where the competences of the finished studies are comparable and according to the acknowledgement criteria at least half of the obligations according to ECTS from the first study programme related to compulsory courses of the second study programme can be acknowledged. Considering the scope of acknowledged obligations from the first study programme in the Republic of Slovenia or abroad student may enrol to the same or higher year in the second study programme. Transferring students shall fulfil the conditions for the enrolment to the second study programme.
Applications of candidates for the transfer to the first cycle academic study programme Civil Engineering and the scope of acknowledged obligations in the study programme will be examined individually by the Study Board of the Department of Civil Engineering. If in the procedure of acknowledging obligations for the purpose of transfer the candidate is approved at least the amount of credit points and those point that are required for the enrolment to a higher year of the first cycle academic study programme Civil Engineering, the candidate may enrol to the higher year of the first cycle academic study programme Civil Engineering.

11. Requirements for completion of the study

Students finish the study by accomplishing the prescribed obligations totalling 180 credit points according to ECTS, including practical training and diploma thesis.

12. Conditions for completion of individual parts of the programme

The Study is uniform.

13. Qualification, professional or academic title

- diplomirani inženir gradbeništva (UN) (first cycle graduate in civil engineering)
- diplomirana inženirka gradbeništva (UN) (first cycle graduate in civil engineering)

14. Qualification, professional or academic title (abbreviation)

- dipl. inž. gradb. (UN)

15. Classifications

- KLASIUS-SRV: Professional higher education (first cycle Bologna)/professional higher education (first cycle Bologna) (16203)
- ISCED: architecture, urbanism and civil engineering (58)
- KLASIUS-P: Civil Engineering (not specified in detail) (5820), Materials and structures (5821), Construction management (5822), Traffic structures (5823)
- Frascati: Technical sciences (2)
- Level SOK: Level SOK 7
- Level EOK: Level EOK 6
- Level EOVK: First cycle

16. Study programme courses, Syllabus

1st YEAR	Contact hours								
	L	S	ST	LT	FW	OW	Σ CH*	Σ SO*	ECTS*
1st semester									
Introduction to Civil Engineering	45						45	90	3
Physics	75	15	45				135	270	9
Construction and Building Materials	60			60			120	240	8
Mathematics I	75		75				150	300	10
Total 1st semester	**255**	**15**	**120**	**60**			**450**	**900**	**30**

2nd semester									
Mathematics II	60		60				120	240	8
Engineering Communication	30		15				45	90	3
Computer Science and Informatics	30			30			60	120	4
Introduction to Statics and Dynamics	75		60				135	270	9
Buildings I	45	15	30				90	180	6
Total 2nd semester	**240**	**15**	**165**	**30**			**450**	**900**	**30**

Total 1st and 2nd semester	**495**	**30**	**285**	**90**			**900**	**1800**	**60**

2nd YEAR	Contact hours								
	L	S	ST	LT	FW	OW	Σ CH*	Σ SO*	ECTS*
3rd semester									
Roads	45			45			90	180	6
Hydromechanics	45			30			75	150	5
Technologies in Civil Engineering	30	15	30				75	150	5
Strength of Materials	75		75				150	300	10
Spatial Development	30		30				60	120	4
Total 3rd semester	**225**	**15**	**135**	**75**			**450**	**900**	**30**

4th semester									
Geodetic Engineering	30			30			60	120	4
Soil Mechanics and Engineering Geology	60			40	5		105	210	7
Organisation and Management of Construction Works	45		45				90	180	6
Structural Analysis	45		45				90	180	6
Buildings II	30			15			45	90	3
External elective course 1	30		30				60	120	4
Total 4th semester	**240**		**120**	**85**	**5**		**450**	**900**	**30**

Total 3rd and 4th semester	**465**	**15**	**255**	**160**	**5**		**900**	**1800**	**60**

3rd YEAR	**Contact hours**								
	L	**S**	**ST**	**LT**	**FW**	**OW**	**Σ CH***	**Σ SO***	**ECTS***
5th semester									
Concrete Structures	60		60				120	240	8
Geotechnical Engineering	45	10		30	5		90	180	6
Engineering Hydraulics	45	15	30				90	180	6
Steel Structures	45		45				90	180	6
Fundamental Concepts of Earthquake Engineering	30		30				60	120	4
Total 5th semester	**225**	**25**	**165**	**30**	**5**		**450**	**900**	**30**

6th semester									
External elective course 2	60			60			120	240	8
Module course 1	45			30			75	150	5
Module course 2	30			30			60	120	4
module course 3	30			30			60	120	4
Practical Training	6					80	34	120	4
Diploma work						75	75	150	5
Total 6th semester	**156**			**120**		**200**	**476**	**900**	**30**

Total 5th and 6th semester	**381**	**25**	**165**	**150**	**5**	**200**	**900**	**1800**	**60**

ELECTIVE COURSES	Contact hours								
	L	S	ST	LT	FW	OW	Σ CH*	Σ SO*	ECTS*
General elective courses									
English for Civil and Geodetic Engineering		60					60	120	4
Digital Design	30		30				60	120	4
Building Right and Building Contract	30		30				60	120	4
Entrepreneurship	45		15				60	120	4
Administrative Procedure and Administrative Dispute	45		15				60	120	4
Physical Education	5			55			60	120	4
From Idea to Building Structure[1]	60		15				75	150	5
Module Structures									
Plates and Shells	45			30			75	150	5
Concrete and Masonry Structures	30			30			60	120	4
Timber Structures	30			30			60	120	4
Module Hydraulics									
Hydraulics	30	15		30			75	150	5
Hydrology	30			30			60	120	4
Introduction to Sanitary Engineering	30			30			60	120	4
Module Traffic									
Railways	45			30			75	150	5
Transportation Engineering	30			30			60	120	4
Geographical Information Systems	30			30			60	120	4
Module Municipal Engineering									
Municipal Economics	45			30			75	150	5
Building Land Management	30			30			60	120	4
Communal Technical Infrastructure	30			30			60	120	4
Module Buildings									
Introduction to Building Design	30			45			75	150	5

Elements of Building Physics	30			30			60	120	4
Building Renovation	30			30			60	120	4
Bioclimatic Design	30			30			60	120	4
Project Management	30			30			60	120	4

L – lectures; S – seminar; SP – seminar practicals; LP – laboratory practicals; FW – field work; OW – other work; CH – contact hours; SO – study obligations

* student obligations total 60 ECTS/year, which agrees with 1800 hours/year; hours include contact hours + individual work
[1]The course is intended exclusively to students of other study programmes, mainly from social sciences

17. Possibilities of elective courses and mobility

Five elective courses are foreseen:

- two external elective courses in the 4th semester (4 ECTS) and in the 6th semester (5 ECTS) and
- elective module (Hydraulics, Municipal Engineering, Structures, Traffic and Buildings) consisting of 3 courses (5+4+4 ECTS) in the 6th semester.

Students can select external elective courses from any study programme at the University. Nevertheless, a list of elective courses is proposed also within the study programme Civil Engineering from the area of law, economy, administration, communicology, foreign languages, as well as specialised courses from the technical and natural sciences. At FGG students may also select courses from other study programmes: Geodesy and Geoinformatics, Technical Real Estate Management, Water Management and Municipal Engineering and Buildings.

Student may transfer 30 ECTS points of the programme (one study semester) from any other area of civil engineering, provided there exists an adequate agreement signed with UL FGG. As students are required to pass the mandatory exams at the institution of enrolment, such exchange is most appropriate in the 6th semester of the study.

18. Presentation of individual courses

INTRODUCTION TO CIVIL ENGINEERING (3 ECTS)
History of civil engineering, role of civil engineering in modern society, encyclopaedia of modern civil engineering (buildings and engineering structures, encyclopaedia of construction technologies, building materials), presentation of the importance of interdisciplinary nature of civil engineering. Role and responsibility of engineer in the process of planning and construction.

PHYSICS (9 ECTS)
Lectures contain the basics of kinematics (straight and curved movement of a particle) and basics of dynamics represented by Newton's laws and Newton's law of gravity, Hook's law and elasticity force, and a short discussion on the forces of friction and resistance. The concept of a body is introduced as a system of particles, subjected to external forces as well as internal forces. Students learn about the concept of momentum and angular momentum of a body, kinematics of rigid body, law of the movement of mass centre and law of the rotation of a rigid body around permanent axis or around gravity axis, force torque and moment of inertia. Then follows the definition of parts of force and strength, introduction of kinetic and potential energy and the definition of conservative and non-conservative forces. Short presentation of the basics of elastomechanics, elasticity energy, impacts of bodies, structure of matter and physical states, and capillary phenomena in liquids. Mechanics is rounded up with the discussion about damped and non-damped oscillation and mechanical waving. Within thermodynamics, the gas laws are discussed, as well as thermal expansion of matter, internal

energy of matter and energy law, thermal transfer, thermal machines and the second law of thermodynamics, phase changes, evaporation and humidity.

CONSTRUCTION AND BUILDING MATERIALS (8 ECTS)
Systematic overview of materials and their characteristics. Basics of standardisation and study of materials in standards, regulations for the design and construction of building structures. Basics of chemical, physical and mechanical properties of materials as well as their definition and quantification with the help of experimental research. Ceramic materials: stone; building ceramics and glass; mineral binders, mortars and casts; concretes. Metal materials: iron metals and non-iron metals and alloys. Polymer materials: synthetic materials; carbohydrate materials. Composite materials: synthetic materials (with particles and fibre reinforced plastic, properties, applicability); natural materials (wood, paper and other natural fibre materials). Overview of methods and characteristics of experimental testing of materials.

MATHEMATICS I (10 ECTS)
Sets and mapping, natural, real and complex numbers, basics of linear algebra (geometric vectors, linear and Euclidian spaces, linear transformations, matrix calculation, systems of linear equations, eigenvalues and eigenvectors of matrices), basics of mathematical analysis (numerical sequences and series, limit and continuity, derivativity, Riemann's integral, Taylor's and Euler-Maclaurin's formula, potential and Fourier's series).

MATHEMATICS II (8 ECTS)
Improper double and triple integral, integral with parameter, curves in space and planes, curve and plane integrals and integral expressions, basics on ordinary and partial differential equations.

ENGINEERING COMMUNICATION (3 ECTS)
Meaning of engineering communication through its historic development and its role in today's construction processes, overview of standards related to engineering drawings with the emphasis on drawings from civil engineering and geodesy, basic drawing skills, golden ratio, projections (general on projections, classification of projections, parallel projections, perspective projections, standard projections, useful projections, special projections), Monge's projection, computer graphics (development, areas of use, hardware), classification of graphic software equipment, computer presentation of drawings and 2D modules, computerised presentation of bodies, advanced computer graphics (visual realism, animation), accompanying software equipment (exchange of drawings, corrections, notes, following changes, subtitles of drawings). Practicals: informative photo and illustration program, precise CAD program.

COMPUTER SCIENCE AND INFORMATICS (4 ECTS)
Basics of computer science, operating systems, user programs, creating documents (document standards, basic concepts, preparation of longer/more demanding documents), calculations with table sheets, introduction to programming (basics of software planning and development, overview of program languages and tools, different ways of programming, basic concepts of programming), divided computer science (local and global computer networks, overview of standards, internet and internet services, divided computation, grid technologies, web services, portals, using internet in civil engineering, creating web pages), safety of information, data standards, data bases and their use in engineering, multimedia.

INTRODUCTION TO STATICS AND DYNAMICS (9 ECTS)
Modelling of building structures: models of supports and ties; models of structures (planar structures, plates and shells, trusses, elastic and cantilevered beams, continuous beam, Gerber's beam, frames, arches, three-member arches, plate, shell); load models (mechanical and non-mechanical load cases, static and dynamic loads, planar, surface and spatial load; volume load; dead load, wind, snow, earthquake, temperature changes, useful load, shrinkage, settlement of supports, explosions, impacts, most unfavourable position of load); mechanical models of structures (stiff and deformable body;

elastic, plastic, viscous, brittle, ductile material). Statics of structures. Concepts: equilibrium of forces; internal forces, equilibrium equations of planar beam; displacements and rotations; static determination and indetermination, the role of supports and ties. Methods of solving: calculation of reactions, inner forces, displacements and rotations; calculation of shells of inner forces and reactions; calculation of influential forces. Dynamics of structures. Concepts: oscillation equations for beams; natural shapes and frequencies of oscillation; free and enforced oscillation, resonance, buffering. Methods of solving: solving equations of free beam oscillation; description of the software method. Computation of mechanical properties of composite cross-sections.

*BUILDINGS I (6 EC*TS)
System: built environment in natural environment. Methodology of engineering design. Structure of basic legal frameworks for the design of living and working environment: history, EC, SI. Modular coordination. Genesis of load-carrying structure. Constructional-physical requirements based on functional analysis of active spaces. Definition of the concept of functional zones: constructional complexes within the system of material - structure - space. Identification and specification of functional zones: constructional complexes on buildings. Basic matrices. Functional analysis up to the description for execution. Calculation of thermal transfer and water steam diffusion (stationary). Dimensioning of TI and steam block. General on facade zone – vertical and horizontal, according to building types, iteration procedure up to the scale of 1:20. Contacts: external wall – roof, external wall – mezzanine structure, external wall – floor in the field, roof – internal division, internal division – mezzanine structure, floor in the field – internal division, nontransparent – transparent structural complex, chimneys, ventilators. Line thermal losses (conduction). Transfer of selected systems from contacts of construction complexes from the scale of 1:20 to the scale of 1:5 up to 1:1. Genesis for functional schemes, systems and contacts to the plan and description for execution.

ROADS (6 ECTS)
History of road construction. Legal and technical regulations. Traffic systems and grids, organisation. Types of traffic surfaces with basic concepts. Terminology in traffic engineering. Road traffic (traffic flows, traffic structure, traffic loads, capacity). Basic principles for defining dimensions of road elements (V-V-O, speed, surveyability, capacity, traffic safety, road and environment). Geometrical and technical elements of road axis (road axis, cross-section, wearing surface, VK). Functional surfaces (cross-roads, intersections, service and maintenance surfaces). Road structures (types, basic demands, typical designs). Road drainage (systems, devices, dimensions). Traffic signalling and equipment and public lighting. Project documentation and legal procedures. Automatic devices in traffic (systems, traffic management and directing, SSN). Traffic management and intelligent transport systems (basics).

HYDROMECHANICS (5 ECTS)
Properties of fluids, comparison of hydromechanics and mechanics of solids (differences). Basic equations: continuity, dynamic, energy equation, equation of state. Principle of solving hydrodynamic problems. Hydrostatics: pressures and forces on flat and curved surfaces, buoyancy, floating stability. Kinematics of ideal non-compressible fluid: flow lines, trajectories, traces. Speed retractor, examples of whirled flow, potential flow and examples from building practice. Dynamics of ideal noncompressible fluid: Bernoulli's and energy equation, Cauchy's equation. Theorem on motive fluid. Groundwater flow, Darcy's law. Flow of real fluid: dynamic similarity, laminary and turbulent flow, limit layer, resistance of bodies. Convection-diffusion equation for the transport of matter in water. Calculation of points of forces at flat and curved surfaces, stabilities and angle of inclinations of floaters and pontoon bridges. Potential flow – flow in angle and knee, source and potential whirl, source and parallel flow. Use for groundwater. Use of Bernoulli's equation for the flow in pipelines. Pumps and turbines in hydraulic systems. Use of impulse expression for the calculation of forces for the pipeline knees and turbine spades. Real liquid: resistance of bodies, parachutist, airplane wing, column. Students participate in 7 longer computational-experimental practical exercises in laboratory

TECHNOLOGIES IN CIVIL ENGINEERING (5 ECTS)
Introduction: historic overview of the development of technologies; overview of modern technological processes in civil engineering; technological specifics in individual structures. Basic technological

processes in civil engineering: technological processes of earth works: preparatory works; principles of structural foundation (shallow, deep foundation ...); technological processes of masonry works: types of basic masonry structures, design of mortars, masonry works; making of plasters (preparation of building site, classical, machine made); technological processes of reinforced concrete works: concrete project (basic of concrete design, scaffolds and shuttering, shuttering plan); concreting process (internal and external concrete transports, standard procedures of concreting process, concreting processes at low and high temperatures, concrete curing); laying of reinforcement (preparation of material, building-in at construction site); technological processes of basic assembly works; areas of use of prefabricates in civil engineering, dry-wet assembly procedures; manufacturing plants in civil engineering: manufacturing and material processing plants (quarries, screening, stone crush works, concrete plants, iron bending plants, joiner's works), auxiliary plants (machinery), plants for craftsman's works (facades, whitewashing, ...), manufacturing plants for assembly elements (structural elements, small items); assurance and supervision of quality construction in all design stages. Special technological processes of concrete structures: technologies of special concretes; defining types of special concretes (massive, abrasion-resistant, micro-reinforced, high-strength, rolled concretes), design of special concretes, possibilities and principles of using special concretes; technologies of demanding shuttering and supporting systems; defining types of shuttering with supporting structure (traditional, metal, transportable, tunnel), basics of design for shuttering structures, construction types of shuttering structures with examples from practice (dams, bridges).

STRENGTH OF MATERIALS (10 ECTS)
General about solid bodies. Concept of continuous matter. Computational models for mechanical analysis Rigid body: geometric description of a body, external load, inner forces and stresses. Deformable body. Co-dependence between stresses and strains. Basic mechanical equations of solid body. Boundary problem. Plane beam: bending of flat beam with axial force, classical bending of beam, uniform torsion of flat beam, variational methods. Within seminar practicals all the stated contents are supported by examples from structural mechanics.

SPATIAL DEVELOPMENT (4 ECTS)
Urbanisation: concept and development phases. Expected demographical and structural changes; development without growth. Development of activity in space; predictions and quantification of needs according to types of land. Spatial acts: type, contents, procedure of adoption, spatial acts as legal base for the regulation of site conditions. Measures for the realisation of spatial acts (land allotment, acquisition of ownership rights, developing land for construction).

GEODETIC ENGINEERING (4 ECTS)
Definition of geodesy, areas of geodesy, tasks of geodesy. Form and dimensions of the Earth. Coordinate systems, coordinates, cartographic projections. Geodetic grids. Theory of geodetic measurements (measures, basic concepts of the theory of errors and levelling). Geodetic terrestrial measurements (geodetic tools, measuring corners, measuring lengths, measuring height differences, relative measuring methods). Contemporary measuring systems and methods (TPS systems, 3D scanners, GPS measurements). Basic principles in defining coordinate points (measuring and coordinate space - calculation). Detailed measurements (acquisition of spatial data). Plans and maps (characteristics, methods of elaboration, types, usefulness). Geodetic records (land cadastre, buildings cadastre, DMR, GIS). General on geodesy for the construction of buildings and other spatial interventions (space use, acquiring permits for interventions, intervention implementation). Basic methods of laying out. Geodetic works for building construction (setting out, monitoring of construction, establishing structural stability – examples from practice). Geodetic works for highway and railway construction (geodetic bases, setting out, construction monitoring, measurements with load tests, establishing stability and deformations of a structure – examples from practice). Hydrographical measurements.

SOIL MECHANICS AND ENGINEERING GEOLOGY (7 ECTS)
Basics of geology (mineralogy, petrology, hydrogeology, tectonics). Rocks: magmatic, metamorphic, sedimentary – stratigraphy. Erosion phenomena in geo-environment. Basic physical and mechanical properties of rocks and soils, basics of soil behaviour, laboratory and field investigations.

Classification of soils. Standards in geotechnics. Original and additional stresses in the ground, soil deformations. Water in the ground, concept of pore pressure, effective and total stresses, water currents, soil consolidation. Ground and slope stability.

ORGANISATION AND MANAGEMENT OF CONSTRUCTION WORKS (*6* ECTS)
Basic concepts from the area of organisation, history and development of organisation. Role, importance and mutual relations of individual participants in the process of construction. Basic sources for construction. Production factors, productivity and cost-effectiveness of construction. Design of technological process. Basics of standardisation and payment for work. Basics of pricing of building structure (construction calculations) and accounting. Studies of work and time. Basics of quality assurance in construction manufacturing, industrialisation of civil engineering. Project of construction management; preliminary studies, preparation works, site arrangement, design of building site elements. Business operations in building site. Organisation of management and renovation of building structures. Process of construction from conception to the end of the life time, accompanying legislation. Principles of design and management, selecting a method of design and management. Methods of network, linear and cyclogram planning. Elaboration of accompanying source and cost estimates. Optimisation of estimates from the aspect of capacities and costs.

STRUCTURAL ANALYSIS (6 ECTS)
Engineering modelling of influences on structures in accordance with valid standards (including permanent and variable influences, basic most elementary modelling of influences of snow and wind). Basics of engineering modelling of structures. Calculations of internal forces in typical simple plane frame structures loaded by static influences. Calculation of displacements for typical simple plane frame structures loaded by static influences using the principle of virtual work. Basic methods of finite elements for plane frame structures. The basic use of computer software for the calculation of plane frame structures. Analysis of plane frame structures using computer software.

*BUILDINGS II (3 EC*TS)
System: built environment in natural environment. Methodology of engineering design. Structure of basic legal frameworks for the design of living and working environment: history, EC, SI. Modular coordination. Genesis of load-carrying structure. Constructional-physical requirements based on functional analysis of active spaces. Definition of the concept of functional zones: constructional complexes within the system of material - structure - space. Identification and specification of functional zones: constructional complexes on buildings. Basic matrices. Functional analysis up to the description for execution. Calculation of thermal transfer and water steam diffusion (stationary). Dimensioning of TI and steam block. General on facade zone – vertical and horizontal, according to building types, iteration procedure up to the scale of 1:20. Contacts: external wall – roof, external wall

– mezzanine structure, external wall – floor in the field, roof – internal division, internal division – mezzanine structure, floor in the field – internal division, nontransparent – transparent structural complex, chimneys, ventilators. Line thermal losses (conduction). Transfer of selected systems from contacts of construction complexes from the scale of 1:20 to the scale of 1:5 up to 1:1. Genesis for functional schemes, systems and contacts to the plan and description for execution.

CONCRETE STRUCTURES (8 ECTS)
Mechanical and rheological properties of concrete, soft and prestressed reinforcement. Types and characteristics of concrete structures. Starting points for the analysis and design of concrete structural elements. Limit state method of concrete structures. Limit load-carrying capacity and design of reinforced concrete cross-sections on bending-axial load (single bending of reinforced concrete cross-section in combination with axial force in areas of large eccentricity, single bending of reinforced concrete cross-section in combination with axial force in areas of small eccentricity). Calculus of auxiliary tables and interaction diagrams for the design. Theoretical bases for the calculation of limit load-carrying capacity of reinforced concrete cross-sections in double bending with axial force. Design of square cross-sections to double eccentric pressure. Limit load-carrying capacity and design of reinforced concrete elements to shear load (calculus of limit load-carrying capacity of reinforced

concrete elements considering transverse force, calculus of limit load-carrying capacity of reinforced concrete elements considering torsional force, calculus of limit load-carrying capacity of plate reinforced concrete elements in breakthrough). Principles of reinforcing reinforced concrete structures. Principles of functioning and behaviour of prestressed structures and prestressing systems. Influence of the level of prestressing on the behaviour of concrete structures. Design of prestressed concrete cross-sections at bending-axial loading. Limit states of applicability of concrete structures. Modelling and calculation of cracks in reinforced and partially prestressed concrete structures in limit state of applicability. Calculus of displacements in reinforced and prestressed concrete structures by taking into account the impact of cracks and rheology of materials. Modelling and calculus of limit load-carrying capacity of elements of concrete structures based on load-carrying capacity of mechanisms with compressive truss frames and tensile ties. Principles of calculating the elements of non-reinforced concrete structures. Calculus of limit load-carrying capacity and design of non-reinforced concrete elements on bending-axial loading. Calculus of limit load-carrying capacity and design of non-reinforced concrete elements on shear loading. Execution of reinforcement and details of reinforced concrete structures. Elaboration of shutterings and reinforcement drawings for concrete structures.

GEOTECHNICAL ENGINEERING (6 ECTS)
Earth pressures. Limit stress of ground condition. Shallow foundation of structures (necessary investigations, planning, technologies). Construction in open building pit, supporting structures. Deep foundation of structures (technologies, load-carrying capacity and pile settlements). Choosing between shallow and deep foundation. Gravity supporting structures. Preparation of foundation ground. Planning and construction of dams. Planning and construction of cuts. Mass balance of earth works. Drainage. Basics of using geo-synthetics.

ENGINEERING HYDRAULICS (6 ECTS)
Precipitation and drainage; drainage of surface waters; water balance. Basics of river hydraulics; erosion forces; flow speeds. Analysis of heavy rains for drainage; drainage conditions; coincidence of floodwater phenomena in recipients and drainage systems; retention and unloading of waters. Drainage design for polluted waters; structures for drainage systems; design and maintenance of systems, structures and devices. High waters; flood-control measures; flood-control construction; evaluation of adequate flood safety in urban surfaces before own and hinterland rainfall waters. Retention of hinterland water: design and execution of different drainages; arrangement of surface waters: design and execution (road-side ditches; kanalets; culverts); arrangement of surface waters at landslides (surface retentions; open ditches; torrent channels); erosion protection of surfaces (road-side, along smaller water streams; at building sites).

STEEL STRUCTURES (6 ECTS)
Introduction: Short historic overview of steel production and development of steel structures. Steel as building material (procedures of steel manufacturing, chemical composition, changing of mechanical properties, mechanical properties of steel, standard qualities, marking and selection of steel quality). Technological procedures in the manufacturing of steel structures (types, manufacturing methods and standard assortment of semi-products, technological procedures for steel treatment, welding, residual stresses). Safety and reliability of steel structures (defining limit states of applicability and limit load-carrying states, partial safety factors). Binding elements and connections (welds, bolts, rivets, caps). Connections (basic principles of design, binding elements in rods loaded with tensile forces and compression, bending and torsion loading of connecting elements, hinged connections). Introduction to structural stability (basic principles of stability, bending of compressed rods, lateral buckling of bending beams, local bending of steel plates). Cross-sections of steel structures (classification of cross-sections according to compactness, specifics of thin cross-sections, load-carrying capacity of cross-sections). Load-carrying elements of steel structures (compressed rods, rods and ropes in compression, bending beams, rods in compression and bending). Introduction to composite concrete and steel structures (basic principles, elastic analysis of composite beams, influence of gradual construction, plastic analysis of composite beams). Steel buildings (design, earthquake, fire and corrosion resistance of buildings, technological processes of steel building construction).

FUNDAMENTAL CONCEPTS OF EARTHQUAKE ENGINEERING (4 ECTS)
Introduction to the dynamics of building structures. Dynamic response of systems with one degree of freedom in seismic load (computational model and equations of movement, structural oscillation, enforced oscillation, response spectra). Simplified calculation of systems with several degrees of freedom in seismic load (method with equivalent static load). Basic concepts of earthquakes and earthquake load (introduction, general about earthquakes, earthquake strength, earthquakes in space and time, characteristics of ground movements at location, project spectra). Basic concepts and principle of earthquake-resistant design (general, load-carrying capacity and ductility, stiffness, buffering, conception of structures). Behaviour of building structures in the past earthquakes (geotechnical complexes, hydraulic complexes, bridges and viaducts, buildings, industrial complexes). Individual seminar work: Analysis of a simple earthquake-resistant structure.

PRACTICAL TRAINING (4 ECTS)
Students perform individual work within agreed job from the wider area of civil engineering supervised by the defined mentor. They record a log of their work, supplemented by enclosures documenting the performed work. The details of the area of work are defined according to the student's preferences and within possibilities.

DIPLOMA WORK (8 ECTS)
Diploma work is made under supervision of a selected teacher as mentor. The work is publicly presented at the end of the study. It shall contain Introduction, Working hypothesis / Starting points, Review of sources, Material and methods, Results, Discussion and Conclusion. As a rule, the thesis deals with practical issues from civil engineering and gives solutions arrived at with the help of study and findings from own professional or research work.

ENGLISH FOR CIVIL AND GEODETIC ENGINEERING (4 ECTS)
Students learn about basic professional terminology in the English language from the area of civil engineering to the extent that they can use English literature and web sources for later study. Revision and upgrading of the English grammar acquired in the secondary school with a special emphasis on language style in professional literature and business correspondence. English terminology from the areas of spatial planning, construction management and construction operations, foundation engineering and geotechnical structures, concrete, steel, timber structures, hydraulics, traffic, geodesy.

DIGITAL DESIGN (4 ECTS)
Role of computer in design. Tools for conceptual and detailed planning. Plane and space, managing space, coordinate systems, transformations. Modelling of bodies, platonic bodies, structural bodies, parametric bodies, operations among bodies. Field modelling, operations in the field. Components in CAAD programs. Libraries, GDL, expansions. Views, projections, bills of material. Surfaces of bodies, textures, shading and managing light. Animation, 4D. CAAD databases, standards. Basic information exchanges among CAAD programs. Formal models of architectural planning. Methods of computer synthesis of plans.

BUILDING RIGHT AND BUILDING CONTRACT (4 ECTS)
Introduction: Civil law as special legal area. General characteristics of civil law. Legal sources. Property lay: subject and rights of property law. Building right according to building regulations. Property right, joint ownership, shared ownership, floor ownership. Easement. Mortgage. Building title. Other rights on real estate. Real estate recording (land cadastre and land register). Law of obligations: Introduction. Contract law.

ENTREPRENEURSHIP (4 ECTS)
Importance of entrepreneurship. Innovation and business opportunities. Role of entrepreneur. Manifestations of entrepreneurship (internal entrepreneurship, family entrepreneurship, technological entrepreneurship). Preparation of a business plan (line of business, company, products and services; market research and analysis; economics of business operations; marketing plan; product and service

plan; development plan, management group and human resources; time plan; critical risks and challenges; financial plan; resource acquisition and resource management).

ADMINISTRATIVE PROCEDURE AND ADMINISTRATIVE DISPUTE (4 ECTS)
General about law and its structure: legal norms, legal acts, legality, validity of law, legal sources. Organisation of the state of the Republic of Slovenia: constitutional system, legislative, judicial and executive branches of power, legal administration. Local self-government: local communities, structure and jurisdictions, relations to the state, financing. Administrative procedure and administrative dispute: basic principles, proceedings of the first instance, administrative decision, general about legal remedies, complaints, extraordinary legal remedies, administrative dispute (judicial control over administration).

PHYSICAL EDUCATION (4 ECTS)
Introduction and definition of the course, role and importance of SE for the quality of life in the time of study and during career. Effects of sports activity on the total physical, mental and social health of students, sports activity as guiding principle to healthy way of life (three selective modules): theoretical and practical contents of sports areas (learning programmes, improvement and sports-recreational training in selected sports areas); theoretical and practical contents of sports areas for the preservation of health (correction of negative effects of study and work, and adaptation to healthy way of life); competition programmes (faculty, university and inter-university competitions in selected sports areas).

FROM IDEA TO BUILDING STRUCTURE (5 ECTS)
History and importance of civil engineering for social and economic development, influence of construction activities on natural and urban environment. Basic concepts in civil engineering, classification of activity, classification of building structures. Civil engineering as interdisciplinary industry (cooperation of other professions in investment projects), role and organisation of the chamber of engineers. Legal frameworks of urban planning and of construction. Procedure and management of investment project (definition of project goals, phases, participants). Specifics of construction industry: design and implementation of unique products – prototypes (Influences of location, principles of profession that provide quality and management of risks in investment project, importance of decisions in initial phases of investment project, influence of these decisions on continuation/implementation of investment project). Building materials: overview, manufacturing, quality control, certification. Energy balance of buildings, taking care of healthy dwelling environment, civil engineering and ecology (life cycle of buildings, carbon footprint, etc.). Basics of design and construction of traffic and municipal infrastructure: spatial planning and construction, interactions structure – environment – human. Overview of technology for the construction of buildings and civil engineering structures. Civil engineering and natural disasters (protection against floods and torrent control, earthquakes, landslides). Information technologies in civil engineering, engineering communication (spatial data bases, GIS, geodetic bases, construction design drawings). Real estate management and valuation.

PLATES AND SHELLS (5 ECTS)
Elasticity theory for plane issues. Two-dimensional (wall) structures. Theory of plates. Applications of Kirchhoff's theory of plates. Applications of the Reissner-Mindlin theory of plates. Understanding plate behaviour: influence of Poisson's coefficient; influence of the ratio between side lengths; influence of stress; torsional moment; dissipation of boundary element; torsional stiffness of plates. Understanding the behaviour of walls and plates made of different building materials: reinforced concrete walls; reinforced concrete plates; definition of moments for the design of orthogonal reinforcement; reinforcement rules; reinforcement in simply supported plate, in clamped plate and in a plate with free edge; plates without torsional stiffness; Eurocode 2 and analyses of reinforced concrete walls and plates; steel plates; creep conditions; Eurocode 3 and analysis of steel walls and plates; composite plates; use in civil engineering; orthotropic and laminated plates. Bending of plates: simply supported plate; analytical solution; numerical analysis of plate bending.

CONCRETE AND MASONRY STRUCTURES (4 ECTS)
Mechanical and rheological properties of steel for prestressing. Principles and systems for prestressing structures. Principles and computer models for the design of elements of prestressed concrete structures. Loss of prestressing force. Selection of prestressing level. Definition of the dimensions of concrete cross-section and cable cross-section. Definition of gravity line of cables. Definition of the necessary longitudinal and transverse soft reinforcement. Calculation of width and mutual distance between cracks of partially prestressed concrete structures. Computational evidence and constructional execution of anchorages. Providing anti-corrosion protection of prestressing reinforcement. Reinforcing and details of reinforced concrete structures. Computer-aided elaboration of panelling and reinforcement plans of prestressed concrete structures. Mechanical properties of bricks, mortar andwalls. Load-carrying mechanisms and design of non-reinforced masonry structures to axial-bending and shear load. Load-carrying mechanisms and design of reinforced masonry structures to axial- bending and shear load. Design and execution of seismically safe masonry structures. Interaction of masonry and concrete structural elements.

TIMBER STRUCTURES (4 ECTS)
Advantages and disadvantages of timber structures. Physical, mechanical and rheological properties of wood and timber building products in dependence of ambient conditions. Technology for manufacturing basic timber building products. Classification of timber in strength classes. Starting points for the analysis of stress-strain state and design of timber structural elements. Limit state method of timber structures. Limit load-carrying capacity and design of timber structural elements from solid wood in axial, axial-bending and shear load. Stability of slender timber structural elements. Specifics of proving safety of laminated glued structures against failure. Resistance and flexibility of binding elements and connections. Calculation and limitations of displacements of timber structures. Theoretical bases and derived computational evidence of composite bent and compressive load- carrying timber structural elements. Assuring local and global stability of timber structures with protective structures. Protection of timber structures against ambient impacts and fire. Basic rules for performing connections, nodes and details of timber structures.

HYDRAULICS (5 ECTS)
Use of equations of real liquid to understand hydraulic systems and boundary conditions for hydraulic design of common structures. Hydraulic design of structures, arrangements and devices that the students have learned about from the technological and construction side within other courses from the water management area. Characteristics and dynamics of real liquid (flow regimes). Flow in pipelines (line and local losses, simple pipelines, pumps, pipeline systems, software). Outlet from openings and equalising levels (permanent and periodic watercourse). Outflow over channels, thresholds and dams. Flow in open rivers (normal flow, composite cross-sections, most favourable cross-section from the aspect of hydrology, local disturbances). Stable sections of rivers (coated and non-coated riverbeds). Permanent non-uniform watercourse (water level curves, calculus of water levels, software). Underground watercourse (rules in porous space, defining permeability coefficient, practical cases). Students will learn about the principles of engineering schematisation, computational procedures, engineering simplifications with the bases of precision estimation, used freely available software for the elaboration of a seminar and laboratory practicals. Elaboration of an individual seminar and laboratory practicals, where the student learns about hydraulic dynamics of fluid flows. The project work combines seminar and laboratory contents and includes a synthesis and comment of results.

HYDROLOGY (4 ECTS)
Overview of the development of hydrology as science in Slovenia and internationally; Physical and chemical properties of water; Circulation of water, energy and matter in nature; Use of probability theory and statistics in hydrology (basics of probability calculus, probability variables, characteristic numbers, theoretical and empirical distributions, frequency factor and probability grids, regression and correlation); Properties of atmosphere and its measurements; Precipitations (measurements, errors in precipitation measurements, processing of precipitation data, modelling of activities in atmosphere, excess precipitation, snow); Remote sensing in hydrology; Evapotranspiration (measurements, calculation methods, Penman-Monteith equation); Outflow of surface waters; Ground properties;

Different forms of water in the ground (humidity in the ground, ground water, infiltration, Darcy); Water balance; Climatic changes and climatic variability; Hydrometrics (measurements of depths, water level and water surface, measuring flow rates); Uncertainty of hydrometric measurements and analyses (error theory); Basics of river hydraulics.

INTRODUCTION TO SANITARY ENGINEERING (4 ECTS)
Historic development of sanitary engineering. Starting points for water supply and treatment of drinking waters: selection of drinking water sources, use and quality of water, water supply systems and complexes, preparation, technological methods and techniques for the preparation of drinking water treatment. Starting point for the drainage and treatment of polluted waters from urban areas:types and quantities of polluted waters, concepts of drainage systems in urban areas and on motorways as well as their design, basic technological methods and techniques for wastewater treatment, structures in sewage systems and communal purifying plants, basics of protection against natural and other disasters.

RAILWAYS (5 ECTS)
General knowledge about railroad infrastructure – substructure and superstructure of railroad tracks (definition, contents, basic characteristics, subsystems, components and elements of railroad infrastructures, essential demands …). Geometric elements of railroad infrastructure (straights, circular arc, transition curve, transition ramp, rail cant, lateral acceleration, inclinations, vertical roundings …). Knowledge from the area of railroad crossing and railway station design and construction.

TRANSPORTATION ENGINEERING (4 ECTS)
Encyclopaedic learning about traffic engineering. Basics of the theory of traffic flow. Basics of measuring traffic parameters. Basic methods of traffic planning. Capacity analysis of individual project solutions (all types of junctions). Basics of design. Basics of construction and maintenance of road infrastructure. Basics of traffic flow management with contemporary intelligent transport systems. Basics of traffic safety. Basics of traffic ecology.

GEOGRAPHIC INFORMATION SYSTEMS (4 ECTS)
Technology: basic terminology (system, information system, datum, information, types of IS, constituents of IS, definition of GIS); georeferencing, models of real world; databases. Organisation: development life cycle, royalties and related rights, standardisation. Applications RDB (Road Data Base).

MUNICIPAL ECONOMICS (5 ECTS)
Public needs and public business entities. Concept, meaning and role of municipal economics. Cost aspects of municipal economic activities. Pricing policies of communal products and services. System of public finances at the local level. Privatisation of municipal activities and private-public partnership. Economical instruments for environmental protection.

BUILDING LAND MANAGEMENT (4 ECTS)
Basic terminology related to building land. Acquisition of the necessary building land for construction: legal transaction, decrees of state administrative body. Equipping land for construction. Economic and financial aspects of organisation and use of building land: compensations, contributions, taxes, indemnities. Private-public partnership in the area of managing building land.

COMMUNAL TECHNICAL INFRASTRUCTURE (4 ECTS)
Basic conceptual definitions. Technical-technological characteristics of municipal networks, objects and devices. Design and site conditions. Technical conditions for land equipment and construction.

INTRODUCTION TO BUILDING DESIGN (5 ECTS)
The planning of space gives the students the knowledge about general issues of standard presentation of an object. Use of adequate measures, design grids, modular coordination and measuring

standardisation enable harmonious presentation of the designed object. Elaboration of spatial simulations and models allows vivid imaging of an object and space surrounding it. The design of residential buildings teaches the students how to develop buildings in space and time. Analysis of development based on examples of positive practice through space and time. Design of spaces based on equipment and communications. Establishing functional connection by connecting technical complexes into closed units. Installation into existing space and design according to the "genius loci" principle. The design of manufacturing buildings deals with non-residential buildings, including office, trade and purely industrial buildings. Learning about the concept of "production". Analysis of development based on examples of positive practice in space and time. Research of manufacturing processes, design of spaces based on equipment and communications. Establishing functional connection by connecting technical complexes into sequential manufacturing units. Arrangement ofdirect vicinity with all the necessary elements of urban equipment with external illumination and horticultural program for the use of surfaces.

ELEMENTS OF BUILDING PHYSICS (4 ECTS)
Nonstationary thermodynamics: distribution of temperature and transfer of temperature in matter, basic methods of solving diffusion equations, thermal losses and thermal protection of buildings. Humidity: relative and absolute humidity, measuring humidity, humidity in building materials and transport of humidity and water steam in porous materials, impact of humidity on mechanical and thermal properties of building materials. Sound: sources of sound and spreading of sound in rooms, reverberation, detection and measuring of sound levels, characterisation and control of noise in buildings. Thermal radiation and light: Appearance and expansion of electromagnetic oscillation, electromagnetic spectrum, light and light flow, thermal radiation of heated bodies, Stefan-Boltzmann's law and emissivity and absorptivity of matter, light expansion through matter, refraction and reflection and scattering of light, colours of bodies and colour phenomena in a space, photometrics, solar light in buildings.

BUILDING RENOVATION (4 ECTS)
Definition of concepts (maintenance, repair, renew and conversion). Structure of maintenance works, life cycle. Repairs (removing mistakes and damages in building envelope). Conversions of spaces (legislation, requirements). Renovation of a selected building – exercise: situation analysis, study of possibilities; concept and design of renovation; implementation and checking the response of existing and renovated building (light, heat, humidity, sound, fire).

BIOCLIMATIC DESIGN (4 ECTS)
Concept of bioclimatic orientation: considering physiological needs of a human being and geographical and climatic conditions of a location in the design of living and working environment and sustainable development. Relation between building biology - building ecology. Basic models of passive systems: direct acquisition, collecting-storing wall, glasshouse and hybrids. Stationary thermal analysis of a building with related microclimatic influences: ventilation, humidity. Daylighting analysis in a room. Analysis of exposure to sun. Sound in a room. Role and starting points for the design of control systems. Overview of autochthon bioclimatically designed buildings in different regions of Slovenia.

PROJECT MANAGEMENT (4 ECTS)
Basic knowledge from design, management and implementation of projects: theoretic bases, calculations, inventory of works, organisation of companies, organisation at building site, simulation analyses (feasibility study ...), safety at work, 'just in time' planning, quality assurance, negotiation plan, contracts, payments, force majeure, predictions, linear programming.