University
of Ljubljana
Faculty
of Civil and Geodetic Engineering

Presentation of the study programme

1st CYCLE PROFESSIONAL BACHELOR DEGREE PROGRAMME
CONSTRUCTION MANAGEMENT (BA)

1. Information about the study programme

Professional bachelor degree programme *Construction Management* consists of 3 years (6 semesters) and amounts to 180 ECTS points. In the 6th semester the study programme offers elective modules, Organisation, Structures and Traffic.

2. Basic goals of the programme and general competences

2.1 Basic goals of the programme

- Educating graduates to acquire extensive general basic knowledge from the area of civil engineering, important for independent work in practice, and at the same time some basic knowledge from the areas that facilitate their search for job.
- To allow students to get practical experiences from civil engineering in the beginning as well as during the study.
- To offer students a programme with elective contents that offer more detailed insight into some practical skills from the area of civil engineering and the related knowledge areas within the faculty and the university.
- To allow students to change to related first cycle study programmes and to continue with second cycle study, by taking into account the conditions foreseen by this programme.
- To allow international comparability and possibilities of changing study programmes by harmonising the study programme with the guidelines from the renewed study programmes according the Bologna Declaration, based on which graduates can continue their second cycle studies in Europe and find job within the European Union.
- To increase progression of students and provide better quality by introducing regular study, with the development of general tutorship by students and teachers as well as tutorship for specific courses.
- To assure harmonisation of the programme with minimum requirements set out by the Association FEANI and thus programme accreditation for the title Euro-eng..

Students acquire the necessary basic knowledge from fundamental natural and IT courses, basic knowledge from the fundamental courses of civil engineering and basic knowledge from professional civil engineering courses. Within elective courses in the second and third year, students may specialise and also start preparing for further study according to the programmes of second cycle.

Within the study students acquire traditional knowledge upgraded with the latest achievements, delivered in a contemporary manner with modern technology. They learn about all specifics of Slovenia and Europe as a consequence of special historic, social-economic or geographic characteristics. By working in groups, within a project work and theme tasks they get accustomed to team work, public presentation and working with customers. With practical work in the field and in laboratories the graduates acquire the necessary skills to work in civil engineering.

To strengthen the acquired professional skills, the programme foresees continuous practical work and four-week practical training in construction and similar companies, representing also the target employment areas. Students finish the study with a thematically oriented and applicative diploma work.

The result of the programme with such structure is graduates with extensive theoretic and detailed professional knowledge, with competences to perform independent tasks from the area of civil engineering in Slovenia and in Europe.

2.2 General competences acquired through the programme

With the study of Construction Management students acquire general competences such as:

- basic knowledge from the area of civil engineering,
- ability to use knowledge in practice,
- ability to be autonomous in professional work,
- development of communication skills and abilities, especially communication in international environment,
- taking into account safety, functional, economic, environmental and ecologic aspects of work,
- ability to learn,
- ability to take decisions,
- oral and written communication skills in the Slovenian language,
- basics of computer science,
- ethic reflection and commitment to professional ethics,
- knowledge of a foreign language,
- cooperative skills, abilities to work in a group and in international environment.

2.3 Course-related competences acquired through the programme

With the study of Construction Management students acquire mainly course-related competences such as:

- professional knowledge from the area of civil engineering: mainly from the field of design, organisation, management and regulation of construction works and construction manufacturing, computer-aided design, ecology, spatial planning and environmental issues,
- independent design of individual structural elements,
- understanding interdependencies between technical and environmental problems and the ability to conceive and design environment-friendly building structures,
- performing specific less demanding tasks from the area of civil engineering for independent and team work as well as cooperation in managing existing technological procedures of the activities described in the first paragraph,
- recognizing, formulating and solving realistic, generally typical work problems by using different procedures,
- managing basic knowledge from the area of civil engineering (natural sciences, mathematics, information science, mechanics, building materials) and ability to connect knowledge with different areas and applications,
- application of knowledge in specialised areas of civil engineering (structures, traffic, hydraulics, construction management),
- development of skills and abilities in using knowledge from the area of civil engineering,
- knowledge and understanding of the basics and historic development of civil engineering,
- understanding general structure of the basic discipline and its link with sub-disciplines,
- application of information-communication technology and systems, most frequently used in civil engineering practice.

3. Conditions for enrolment and selection criteria when enrolment is restricted

To enrol to the professional bachelor degree program Construction Management the candidates are required to:

a) pass school-leaving exam in a four-year secondary school programme;
b) professional matura exam;
c) or matura exam.

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.

In the event of restricted enrolment the candidates will be selected according to:

- general success in school-leaving exam or (professional) matura exam 60 %
- general success in the 3rd and 4th year 40 %.

Candidates also meet the criteria for enrolment, if they finish education of the same level abroad.

4. 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 Construction Management 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 that prove 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.

5. Conditions for progression through the programme

5.1 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 course of 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. We are planning to introduce similar system of help to students also within the new professional bachelor degree programme »Construction Management«, which is in accordance with item 9 of Article 7 of the Criteria on Accreditation. The supervisor system will cover individual years, and the tutorship system will be designed according to the common principles of the University in Ljubljana, i.e. in the form of integral support to study and for individual courses in the form of course tutorship. The tutorship system will include all teachers and student of higher years.

Class of each year will have their own supervisor. The students will be allocated with a supervisor from the first year onwards, and smaller groups of student will also have their tutors consisting of teachers or students from higher years.

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 on opinion of the Study Board of FGG. The decree also defines the principles of faster advancement.

5.2 Conditions for repeated enrolment in the same year

Failing to meet all the obligations defined by the study programme for the advancement in the next year, students may enrol in the same year for the second time. They are entitled to the repeated enrolment only once for the duration of the study, provided that they achieve at least 30 credit points according to ECTS.

6. Conditions for completion of the study

Students finish the study by accomplishing the foreseen obligations totalling 180 credit points according to ECTS, including practical training and diploma thesis.
According to the Professional and Academic Titles Act the graduate is awarded with the professional title diplomirani inženir gradbeništva (VS*), abbreviated as dipl. inž. gradb. (VS*), level 6/2.

*Visokošolski Strokovni študij
In compliance with the Professional and Academic Titles Act (Official Gazette No. 61/2006) professional and scientific titles as well as titles acquired by education shall not be translated to foreign languages. However, as reference only, the title acquired according corresponds to the English title Bachelor of Civil Engineering (PS*).
* Professional Study

7. Transfers between study programmes

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 professional study programme of Construction Management (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 in the first cycle professional study programme Construction Management 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 professional study programme Construction Management, the candidate may enrol to the higher year of the first cycle professional study programme Construction Management.

8. Methods of assessment

Knowledge is examined and evaluated in individual courses. Accordingly, the teaching process in each course finishes with the examination of knowledge and acquired skills. The forms of knowledge testing (oral or written examinations, preliminary examinations, seminar works, work logs, practical assignments, projects, portfolios, peer evaluation) are evaluated in the study plans of individual courses. General rules of knowledge testing are regulated by the Rules on testing and evaluation of knowledge at UL, FGG, adopted by the Senate of FGG. The details are defined by the Study Regulations.

The student receives a single grade of the exam, consisting of grades for the performed required works in an individual course. Each work shall be evaluated with a positive grade. According to the Statute of the University of Ljubljana the following grading scale is used:

10 – (91–100 %: excellent: exceptional results with negligible mistakes),
9 – (81–90 %: very good: above average knowledge with few mistakes),
8 – (71–80 %: very good: sound outcomes),
7 – (61–70 %: good: good knowledge, but with significant shortcomings)
6 – (51–60 %: sufficient: performance meets the minimum criteria),
5 to 1 – (50 % and less: unsatisfactory: performance does not meet minimum criteria).

The candidate's performance is considered successful for grades from satisfactory (6) to excellent (10).

9. Study programme courses, Syllabus

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

1st YEAR	**Contact hours**								
	L	**S**	**ST**	**LT**	**FW**	**OW**	**ID**	**Σ SO***	**ECTS***
1st semester									
Introduction to Civil Engineering	45						45	90	3
Physics	45	15	30				90	180	6
Engineering Mathematics I	45		45				90	180	6
Municipal Economics and Construction Legislation	30		30				60	120	4
Engineering Communication	30			15			45	90	3
Buildings	60	15		45			120	240	8
Total 1st semester	**255**	**30**	**105**	**60**			**450**	**900**	**30**
2nd semester									
Statics	60		60				120	240	8
Hydromechanics and Hydraulics	45	15		30			90	180	6
Construction and Building Materials	45			45			90	180	6
Computer Science	30	15		15			60	120	4
Geodetic Engineering	30			15			45	90	3
GIS and Spatial Records	15	15	15				45	90	3
Total 2nd semester	**225**	**45**	**75**	**105**			**450**	**900**	**30**
Total 1st and 2nd semester	**480**	**75**	**180**	**165**			**900**	**1800**	**60**

2nd YEAR	Contact hours								
	L	S	ST	LT	FW	OW	ID	Σ SO*	ECTS*
3rd semester									
Fundamentals of Soil Mechanics	45			25	5		75	150	5
Strength of Materials	60		45				105	210	7
Engineering Mathematics II	45		30				75	150	5
Design and Construction of Roads	45			45			90	180	6
Surface Drainage	30	15	15				60	120	4
External elective course 1							45	90	3
Total 3rd semester	**255**	**15**	**105**	**70**	**5**		**450**	**900**	**30**
4th semester									
Geotechnical Constructions	60	10		45	5		120	240	8
Timber Structures	30			30			60	120	4
Structural Analysis	30		30				60	120	4
Fundamentals of Concrete and Masonry Structures	60		60				120	240	8
External elective course 2							90	180	6
Total 4th semester	**225**	**10**	**165**	**45**	**5**		**450**	**900**	**30**
Total 3rd and 4th semester	**480**	**25**	**270**	**115**	**10**		**900**	**1800**	**60**

3rd YEAR	Contact hours								
	L	S	ST	LT	FW	OW	ID	Σ SO*	ECTS*
5th semester									
Technological Processes	30		45				75	150	5
Concrete Objects	30			30			60	120	4
Organisation and Management of Construction Works	45		45				90	180	6
Fundamentals of Steel Structures	45	15	45				105	210	7
Module course 1	30			30			60	120	4
Professional elective course	30			30			60	120	4
Total 5th semester	**210**	**15**	**165**	**60**			**450**	**900**	**30**
6th semester									
Module course 2	30		30				60	120	4
Module course 3	30		30				60	120	4
Module course 4	30		30				60	120	4
Practical Training (4 weeks)	6					160	74	240	8
Diploma Work						150	150	300	10
Total 6th semester	**96**		**90**			**310**	**404**	**900**	**30**
Total 5rd and 6th semester	**306**	**15**	**255**	**60**	**0**	**310**	**854**	**1800**	**60**

ELECTIVE MODULES:

MODULE STRUCTURES									
Fundamentals of Earthquake Engineering	30			30			60	120	4
Bioclimatic Buildings**	30			30			60	120	4
Steel Buildings**	30			30			60	120	4
Computer-Aided Design of Structures**	30			30			60	120	4
Concrete Bridges**	30			30			60	120	4
MODULE ORGANISATION									
Quality Assurance and Quality Control	30		30				60	120	4
Building Land Development and Valuation	30		30				60	120	4
Project Planning and Management	30		30				60	120	4
Fundamentals of Economics in Civil Engineering	30		30				60	120	4
MODULE TRAFFIC									
Traffic	30			30			60	120	4
Geotechnics of Traffic Structures	30			30			60	120	4

Intelligent Transportation Systems	30	30	60	120	4
Design and Construction of Railways	30	30	60	120	4

* Student workload amounts to 60 ECTS/year, which comes to 1800 hours/year; the hours include contact hours (CH) and independent work (IW).

** In the 5th and 6th semester students can select one of the modules: Structures, Organisation and Traffic Module. The course Basics of Earthquake Engineering in the module Structures is mandatory professional course of the module Structures. From the remaining 4 courses students choose 3 courses. In the modules Organisation and Traffic students are required to select all four courses of the module.

Study programme courses - elective courses

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

Programme elective course	Contact hours						ID	Σ SO*	ECTS*
	L	S	ST	LT	FW	OW			
Fire resistance of Structures	45		30				75	150	5

10. Possibilities of elective courses and mobility

Elective courses are foreseen: one in the 3rd, 4th and 5th semester (3 ECTS, 6 ECTS and 4 ECTS, respectively) and elective modules in the 5th and 6th semester (16 ECTS). Among elective courses from FGG students are recommended to select courses also from other modules of this programme and from other study programs of FGG. External elective courses may be selected anywhere.

Student may transfer 30 ECTS points of the programme (one study semester, regardless of mandatory and elective units) from any other area of civil engineering, provided there exists an adequate agreement signed with UL FGG.

11. Presentation of individual courses

INTRODUCTION TO CIVIL ENGINEERING (3 ETCS)
History of civil engineering. Role of civil engineering in modern society. Encyclopaedia of modern civil engineering. Presentation of the importance of interdisciplinary nature of civil engineering. Role and responsibility of engineer in the process of planning and construction.

PHYSICS (6 ECTS)
Physical quantities and measuring units. Description of movement, straight movement, curved movement in the plane. Force, description of force by vector, 1st and 3rd Newton's law, force of foundation, weight, force of resistance, force of spring, moment of force, centre of gravity. 2nd Newton's law. Theorem on centre of gravity movements. Forces in circulation, moment of inertia, Steiner's theorem. Work of force, power of force. Kinetic, potential and elastic energy. Preservation of mechanical energy. Newton's gravity law. Structure of matter. Basic properties of solid matter, liquids and gases. Hook's law. Compressibility. Boyle's law. Weight pressure, manometers. Compression measurements with closed and open mercury manometer. Buoyancy. Temperature. Temperature elasticity. Gas equation, gas mixtures. Internal energy, heat, law of energy preservation. Sources of energy. Thermal sources. Specific heat, thermal capacity, combustion heat. Thermal transfer. Thermal conduction; thermal resistance, transition through several layers. Transfer coefficients, K-factor.
Changes of aggregate condition. Evaporation and humidity. Hygrometers.

ENGINEERING MATHEMATICS I (6 ECTS)
Sets, numbers, mapping. Linear algebra: geometric vectors, systems of linear equations, matrices, determinants, eigenvalues and eigenvectors of matrices. Sequences and series. Limits and continuity of function of single variable, properties of continuous functions. Derivation of function of single variable, properties of derivable functions, local and global extremes.

MUNICIPAL ECONOMICS AND CONSTRUCTION LEGISLATION (4 ECTS)
Concept, meaning and role of municipal economics. Municipal infrastructure: definition of concept, as part of local community property. Cost aspects of municipal economics activities: depreciation, prices for communal products and services. Organisation of municipal economics activities. Construction of complexes as administration matter; principles and elements of administrative procedure. Building and operating permit: contents; procedure for their acquisition. Spatial documents: types, contents and their importance for defining location conditions. Material rights on real estates and their role for the acquisition of building permits. Accommodation of land for construction.

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.

BUILDINGS (8 ECTS)
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. Construction-physical requirements based on functional analysis of active spaces. Definition of the concept of functional zones: construction complexes within the system of material - structure - space. Identification and specification of functional zones: construction 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 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, non-transparent – 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.

STATICS (8 ECTS)
Basic concepts in the theory of structures: Example of building structures. Basic geometric models of building structures. Basic types of loads of building structures. Model of rigid and deformable body. Basic properties of building structures. Basic concepts of regulation for the design of building structures. Stability of rigid body. Equilibrium conditions for the system of forces with graphic interpretation. Calculus of reactions and forces in ties and stability-defined plane structures. Equilibrium equations for plane girder, calculation of axial and transverse forces as well as torsional and bending moments in stability-defined plane structures, the concept of envelope, the concept of influences, defining most favourable load position. Description and application of software for the stability analysis of plane building structures.

HYDROMECHANICS AND HYDRAULICS (6 ECTS)
Physical properties of fluids. Continuity, dynamics and equation of matter for fluids as well as the principle of solving basic equations. Hydraulic stability: forces and capturing points at flat and bent surfaces, buoyancy and floating. Kinematics of ideal non-compressible fluid: flow lines, trajectories, traces, whirled and non-whirled (potential) flow. Dynamics of ideal noncompressible fluid: Bernoulli's and energy equation, impulsive statement, groundwater flow in porous areas. Flow of real fluid: laminary and turbulent flow, limit layer, resistance of bodies.

CONSTRUCTION AND BUILDING MATERIALS (6 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 and their definition and quantifying 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.

COMPUTER SCIENCE (4 ECTS)
Basics of computer science – development of computer science, functioning of computers, legal and sociological aspects of computers and IT. Operating systems – overview and functioning of operating systems, virtualisation. User programs. Elaboration of documents – document standards, basic concepts, preparing longer/sophisticated documents. Calculations with tables. Introduction to programming. Distributed computer science. Safety of information – basic concepts, safety of operating systems, safety of data, protection against viruses, digital signature. Data standards. Data collections. Multimedia.

GEODETIC ENGINEERING (3 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. Geodetic terrestrial measurements. Contemporary measuring systems and methods. Basic principles in defining coordinate points. Detailed measurements. Plans and maps. Geodetic records. General on geodesy for the construction of buildings and other spatial interventions. Basic methods of laying out. Geodetic works for building construction. Geodetic works for highway and railway engineering. Hydrographical measurements.

GIS AND SPATIAL RECORDS (3 ECTS)
Technology. Basic concepts. Georeferencing. Models of real world. Databases. Organisation. Developmental life cycles. Copyrights and similar rights. Standardisation. Applications. Infrastructure Databank.

FUNDAMENTALS OF SOIL MECHANICS (5 ECTS)
Basics of geology. Basics of hydrogeology, water in the ground. Rocks: magmatic, metamorphic, sedimentary – stratigraphy. Basics of mineralogy and petrology. Basics of tectonics. Geological maps. Erosion phenomena in geo-environment. Physical properties of rocks and soils. Basic mechanical properties of ground, basic behaviour of soils, laboratory tests. Primary and additional stresses in the ground, soil deformations. Water in the ground, concept of pore pressure, effective and total stresses, water seepage. Soil consolidation.

STRENGTH OF MATERIALS (7 ECTS)
Basics of mechanics of deformable body. Equilibrium equations of deformable body. Generalised Hook's law. Basic equations of linear theory of elasticity and solving at the conceptual level by using computer programs. Typical constitutive equations of building materials. Analysis of plane structures: Basic assumptions and equations of bending by axial force, calculus of inner forces, deformations and displacements in simple elastic beams using the method of direct integration, calculation of normal and shear stresses in beam cross-section, main stresses, geometrical characteristics of cross-section. Basic assumptions and equations of uniform torsion, calculus of stresses for the beam with thin-walled cross-

section, torsional moment of inertia. Analysis of elastic plane structures using displacement method and with the help of software, rigidity matrix and load vector, influences and envelopes of stability-non-defined plane structures. Basic assumptions and equations of elastic composite beams, importance of slip between beams, calculus of inner forces, deformations, slip and displacements of simple two-layer composite beams with and without the help of software. Basic equations of geometrically nonlinear theory of plane beams, bending of elastic and plastic column, bending load-carrying capacity of column and impact of different imperfections to its load-carrying capacity, stability of structures. Plastic and visco-elastic analysis of plane beams, method of plastic hinges, softening of cross-sections and redistribution of inner forces, limit load-carrying capacity of cross-section and limit load-carrying capacity of structures.

ENGINEERING MATHEMATICS II (5 ECTS)
Riemann's integral of function of single variable: primitive function, integration methods (integration by parts, introduction of a new variable in defined or undefined integral), application. Function of several real variables: continuity, partial derivation, gradient, chain rule, total differential, extremes – local, global. Double Riemann's integral: definition, properties, calculation, introduction of new variables, application. Ordinary differential equations: solution, initial problem, linear differential equation.

DESIGN AND CONSTRUCTION OF 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, basics of the theory of traffic flow, basics of traffic planning. Basic principles for defining dimensions of road elements. Road cross-section: functional elements and permeability. Geometrical and technical elements of road axis and intersections. Functional surfaces (cross-roads, crossings, service and maintenance surfaces). Elements for road drainage – basics. Carriageway structure – composition and basics of design. Traffic signalling and equipment. Basics of road and crossroad design. Basics for the construction and maintenance of roads (building site, construction, maintenance). Urban traffic surfaces (types, dimensions, compositions). Traffic management and intelligent transportation systems (basics).

SURFACE DRAINAGE (4 ECTS)
Precipitation and drainage; drainage of surface waters; water balance. Analysis of heavy rain for drainage; outflow conditions. Coincidence of high water phenomena in recipients and drainage systems. Retention and unloading of waters. Design of systems for the drainage of polluted waters; structures at drainage systems; design and maintenance of systems, structures and devices. High waters; flood-control measures; flood-control construction of complexes; evaluation of appropriate (necessary) flood safety in urban surfaces against run-offs and backwaters. Water retention: design and execution of drainages; surface water regulation: design and execution (roadside gutters; conduits; outlets); anti-erosion protection of surfaces (along roads, by smaller water bodies; at building sites).

GEOTECHNICAL CONSTRUCTIONS (8 ECTS)
Stability of ground and slopes. Earth pressures, simple weight supporting structures. Load-carrying capacity of ground under shallow point and belt foundation. Basics of shallow and deep foundation (necessary tests, planning, technologies). Construction of buildings in open pits, supporting structures. Deep foundation of structures (technologies, load-carrying capacity and settlements of axially loaded piles). When to choose shallow foundation, when deep foundation. Module of ground reaction. Planning and construction of embankments. Planning and construction of cuts. Mass balance of earth works. Preparation of foundation ground. Water drainage. Basics of using geotextiles.

TIMBER STRUCTURES (4 ECTS)
Advantages and disadvantages of timber structures. Physical, mechanical and rheological properties of wood and built timber products in dependence of the environmental conditions. Presentation of the technology for the elaboration of some basic structural timber products. Criteria for the classification of timber into strength classes. Starting points for the design of timber structural elements. Limit state method of timber structures. Limit load-carrying capacity and design of timber structural elements from solid wood with axial, axial-bending and shear loads including the influences of bending and lateral

failure. Resistance and elasticity of connecting elements and connections. Calculation and limits of timber structure displacements. Computational evidence of composite bending and compressive load-carrying elements of timber structures. Protective structures. Load-carrying systems of timber roof structures. Measures for the protection of timber structures against environmental impacts and fire. Basic rules for the execution of connections, nodes and details of timber structures.

STRUCTURAL ANALYSIS (4 ECTS)
Basic engineering modelling of the impacts on structures according to the valid standards. Basics of engineering structural modelling. Calculating effects of influences in typical simple plane structures, loaded by forces influencing stability, with a special emphasis on the physical understanding and fast definition of the effects of influences. Simplified practical calculations of the forces in slabs. Basic practical application of software for the calculation of plane structures.

FUNDAMENTALS OF CONCRETE AND MASONRY STRUCTURES (8 ECTS)
Properties and historic development of concrete and masonry structures. Limit state method and safety factors for concrete and masonry structures. Mechanical properties of materials (concrete, steel and walls). Design of reinforced concrete elements: Limit state of cross-section and design at bending with axial force, shear and torsion, and selection of initial dimensions. Limit state of applicability. Design of reinforced concrete elements. Basics of design (with tables) and design of RC slabs. Elaboration of reinforcement plans and list of reinforcement. Basic structural measures for providing seismic resistance of RC elements. Basic concepts of prestressed concrete. Design of walls: types of brick and masonry. Limit shear and bending load-carrying capacity of a wall and design. Basics of construction and strengthening of masonry buildings in seismic areas. Basic rules and regulations for the execution of concrete structures.

TECHNOLOGICAL PROCESSES (5 ECTS)
Introduction to building technology: history of the technological development; overview of contemporary technological processes in civil engineering; technological specifics in individual structures. Basic technological processes in civil engineering: technological processes of earth works: technological processes of masonry works: types of basic masonry structures, technological processes of reinforcing works: technological processes of basic prefabrication works: areas of application for prefabricates in civil engineering, dry-wet assembly procedures. Manufacturing plants in civil engineering: manufacturing plants for assembly elements. Quality assurance and monitoring for construction in all design stages. Basic technological processes in the construction of engineering structures: construction of dams and bridges.

CONCRETE OBJECTS (4 ECTS)
Conditions and requirements for conception, design and execution of concrete objects. Computational load and safety of structures. Advantages and disadvantages of possible structural systems of load-carrying structures. Construction technologies for monolith and prefabricated concrete and masonry structures.
Modelling the behaviour of reinforced concrete structures and details using the method of spacers and tensile connections. Functions, design and structural characteristics of the elements of reinforced concrete load-carrying structures. Specifics of modelling, analysis, design and execution of prefabricated concrete structures. Structural systems of masonry structures. Interaction of masonry and concrete elements of structures. Design of simple masonry objects. Efficient design of reinforcement and details. Basic rules for making building plans. Computer-aided design of position, shuttering and reinforcement plans of concrete structures.

ORGANISATION AND MANAGEMENT OF CONSTRUCTION WORKS (6 ECTS)
Basic concepts from the area of organisation. History and development of organisation. Manufacturing factors, productivity and cost-effectiveness of construction. Design of technological process, basics of standardisation and payment for work. 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. Principles of design and

management.

FUNDAMENTALS OF STEEL STRUCTURES (7 ECTS)
Place and role of steel as building material in Slovenia and in the world. Mechanical properties of steel. Standard qualities, marking and selection of steel quality. Technological procedures of steel processing. Types, technology of manufacturing and standard assortment of steel semi-products. Production and assembly of steel structures. Concepts of the design of steel structures. Valid standards and regulations for the analysis and design of steel structures. Modelling and global analysis of steel structures. Software support to the analysis and design of steel structures. Fire safety and anti-corrosion protection of steel structures. Durability and repair of steel structures. Binding elements and connections. Simple connections of structural elements loaded in strain, compression and bending. Basic principles of the stability of structures. Concept of compactness and distribution of cross-sections according to their compactness. Load-carrying capacity of cross-sections to compression, strain, shear and bending. Load-carrying capacity of basic elements of steel structures.

PRACTICAL TRAINING (8 ECTS)
Students learn about and do the work intended for graduates of this study in practice. They mainly get familiar with the organisation structure of construction companies and with current activities in construction companies, field works – active building site, or in an office. They perform less demanding works in an active project.

FUNDAMENTALS 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.

BIOCLIMATIC BUILDINGS (4 ECTS)
Concept of bioclimatic orientation: considering physiological needs of human being and geographical and climatic conditions of 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. Analysis of daylighting 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.

STEEL BUILDINGS (4 ECTS)
Typical steel structures: single storey steel buildings, multi-storey steel buildings, steel reservoirs, silos, towers and pillars, high-voltage power lines. Possible design conceptions. Criteria for the selection of structural design. Defining typical load. Specifics in the analysis and design. Characteristic details. Fire safety and anti-corrosion protection. Construction and assembly procedure. Project for a selected single or multi-storey steel building.

COMPUTER-AIDED DESIGN OF STRUCTURES (4 ECTS)
By using computer tools students make projects of typical building structures. Based on valid legislation they determine the influences on the structure, define its initial dimensions, conceives adequate structural model as a basis for the analysis of influences in the structure, analyse influences in the structure using computer program, check structural dimensions, define the necessary reinforcement and draw reinforcement plans, using computer; they prepare the remaining documentation, including among others technical report, they prepare supply plan and publish the elaborated project in adequate form on the

Internet. Using computer program they prepare presentation of their projects. They cooperate and communicate with fellow students and with the teacher, also with the help of contemporary computer communication equipment.

CONCRETE BRIDGES (4 ECTS)
Conditions and requirements of conception, design and execution of concrete bridges. Computational load of bridges. Advantages and disadvantages of possible structural systems of bridge structures. Construction technologies of monolith and prefabricated concrete bridges. Functions, design and structural specifics of concrete bridge elements: bridge drainage. Specifics of modelling, analysis, design and execution of prefabricated concrete bridges. Design of simple concrete bridges. Measures for the assurance of concrete bridge durability. Maintenance and repair of concrete bridges. Execution of structural details and bridge reinforcement. Elaboration of shutterings and reinforcement plans for bridges.

QUALITY ASSURANCE AND QUALITY CONTROL (4 ECTS)
External and internal quality control. Standardisation of quality; Slovenian and European standards. Characteristics of the quality management systems with the emphasis of their specifics in construction companies. Quality assurance in all stages of construction process (design, construction, maintenance of structures). Quality control techniques of input and output materials in the manufacturing process. Confirmation of compatibility of building products. Total quality management.

BUILDING LAND DEVELOPMENT AND VALUATION (4 ECTS)
Basic concepts in the area of land development and valuation. Development of building land as intervention into private property – international overview. Instruments of land policy: preemption right, consolidation of building land and expropriation. Needs and purposes of real estate valuation. Standards of real estate valuation. Concept of real estate, value evaluation and principles in evaluating these values of real estates. Elaboration of a valuation report.

PROJECT PLANNING AND MANAGEMENT (4 ECTS)
Project definition; project goals; relation between project and its environment. Principles of project organisation in construction companies. Organisation of work in projects, project teams. Project management. Project processes. Project information system. Methods of network planning. WBS structure. Resource planning and cost estimates. Monitoring of realisation and project management.

FUNDAMENTALS OF ECONOMICS IN CIVIL ENGINEERING (4 ECTS)
Specifics of economics in civil engineering, market of civil engineering products and services. Marketing activities, investments in building capacities. Planning of civil engineering manufacturing and understanding of production function as input for achieving output – civil engineering services and product. Pricing policy for civil engineering manufacturing (own price, sales price). Calculation methods for defining own costs for civil engineering structures and services. Evaluation of cost-efficiency of civil engineering manufacturing and impact of economy on the costs of civil engineering manufacturing. Specifics of evaluations and const monitoring of civil engineering manufacturing in different stages of construction and managing costs in time. Empirical methods for the valuation and monitoring of costs, price indices for civil engineering products and services and other data sources for the calculation of construction works and account settlement. Specifics of maintenance costs and functioning costs of structures.

TRAFFIC (4 ECTS)
Basic parameters of traffic flow. Basic characteristics of traffic flow. Models for calculating individual design solutions. Traffic surface capacities. Basics of traffic design. Basics of the service theory in traffic.

GEOTECHNICS OF TRAFFIC SUCTURES (4 ECTS)
Supporting structures on roads. Methods for ground improvement. Geotextiles in road construction. Geotechnical aspects in the construction of the lower and upper structure of roads. Basics of rock mechanics and cuts in rocks. Drainage of roads. Basics of tunnel engineering.

INTELLIGENT TRANSPORTATION SYSTEMS (4 ECTS)
Upgrade of general knowledge on the theory of traffic flow and traffic planning. Monitoring of traffic, measuring devices in road traffic. Traffic management systems in international traffic network, systems of communicating traffic information or active dynamic systems for increasing road permeability. Traffic-weather information system and winter service, meteorological conditions of the road surface. Systems of electronic toll collection. Traffic management systems in towns, urban road problems, traffic regimes, urban traffic signalling and equipment. Devices for calming urban traffic. Parking arrangements and garage houses, system of parking management and payment, requirements for parking surfaces. System of managing goods traffic, vehicle weighing. System of services in public transport, bus stops. Traffic signalling and traffic equipment. Systems for managing exceptional events, road works. Traffic and environment.

DESIGN AND CONSTRUCTION OF RAILWAYS (4 ECTS)
General concept of railway infrastructure – upper and lower structure of railway tracks (definition, contents, basic characteristics, subsystems, components and elements of railway infrastructure, essential demands, geometric elements of railway infrastructure (axes, circular arc, transition zone, transition ramp, superstructure, lateral acceleration, inclinations, vertical round-ups). Design and construction of railway junctions and railway stations.

FIRE RESISTANCE OF STRUCTURES (5 ECTS)
General about fire engineering. Overview of basic concepts. European construction standards and regulations. Fire load. Models of standard and real fires. Measures of active fire protection. Escape routes. Measures of passive fire protection. Influence of elevated temperature on the properties of structural materials. Definition of temperature distribution in a structure in time and place. Specifics of different materials and structural types. Computational definition of fire resistance of load-carrying structures.

DIPLOMA WORK (10 ECTS)
Composite parts: Introduction. Working hypothesis. Sources and methods. Results. Discussion. Abstract.