

Study plan

Name of study plan: Building Structures

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Civil Engineering

Type of study: Bachelor full-time

Required credits: 258

Elective courses credits: -18

Sum of credits in the plan: 240

Note on the plan: platí od nástupu 2020

Name of the block: Compulsory courses

Minimal number of credits of the block: 232

The role of the block: Z

Code of the group: BD20200100

Name of the group: Building Structures, Compulsory Subjects, 1st semester

Requirement credits in the group: In this group you have to gain at least 30 credits (at most 28)

Requirement courses in the group: In this group you have to complete at least 7 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
101CG01	Constructive Geometry Hana Lakomá Hana Lakomá Hana Lakomá (Gar.)	Z,ZK	5	2P+2C	Z	z
101MT01	Mathematics 1 František Bubeník, Kateřina Janžurová, Yuliya Namlyeyeva Yuliya Namlyeyeva Yuliya Namlyeyeva (Gar.)	Z,ZK	6	2P+3C	1	z
123BM01	Building Materials Alena Vimmrová, Jan Kočí, Václav Kočí Alena Vimmrová Alena Vimmrová (Gar.)	Z,ZK	5	2P+2C	Z	z
126BIME	BIM	Z	1	1P+1C	Z	z
132ST01	Structural Mechanics 1 Michal Šejnoha Michal Šejnoha Michal Šejnoha (Gar.)	Z,ZK	6	2P+2C	Z	z
154FS01	Fieldwork Surveying Tomáš Křemen Tomáš Křemen Tomáš Křemen (Gar.)	Z,ZK	6	2P+3C	Z	z
104CFL1	Czech/Foreign Language 1 Sandra Giormani	Z	1	2C	Z	z
TV1	Physical Education	Z	0	0+2	Z	z

Characteristics of the courses of this group of Study Plan: Code=BD20200100 Name=Building Structures, Compulsory Subjects, 1st semester

101CG01	Constructive Geometry	Z,ZK	5
Description of space and main methods of the projection - multiview (Monge) projection as a basis for orientation in 3D CAD systems, axonometry, linear perspective. Surfaces in building practice - graphic laws of surfaces, geometric characteristics of surfaces, images of surfaces in appropriate projections, realization and application; visualization of surfaces in a graphic software. Namely: Cylinders and Cones, Hyperboloid of Revolution, Helical Surfaces, Quadrics. Curves in building practice - types of mathematical description, Frenet Frame, osculating circle.			

101MT01	Mathematics 1	Z,ZK	6
1. Sequences of real numbers, fundamental concepts and definitions, limits of sequences and methods for their calculating, the number e. 2. Functions of a real variable, fundamental concepts and definitions, limits (proper and improper) and methods for their calculating, continuity. 3. Basic theorems for continuous functions and their applications: Bolzano's and Weierstrass's theorems, derivatives and their geometric and physical meaning, derivative rules, derivative of composite and inverse functions. 4. Derivatives of higher orders, differentials of the 1st and higher orders, Lagrange's theorem and its consequences, l'Hospital's rules. 5. An analysis of functions sequent on the properties of the 1st and 2nd derivatives (intervals of monotony, local extremes, convexity and concavity, points of inflection, asymptotes). 6. Global (absolute) extremes on compact intervals, word problems. Taylor's theorem, Taylor's polynomial and its applications. 7. Vector (linear) spaces, the vector space of ordered n-tuples, R ² , R ³ , linear combinations, linear independence and dependence, bases, the dimension, subspaces. 8. Linear hull, matrices, the rank of a matrix, Gauss's algorithm. 9. Systems of linear algebraic equations, basic methods for solving, Gaussian elimination, Frobenius theorem. 10. Matrix multiplication, inverse matrices and their applications, matrix equations. 11. Determinants of the 2nd and 3rd orders, Sarrus's rule, inverse matrices by means of determinants, Cramer's rule. 12. Fundamental properties of geometric vectors. General form and parametric representation of a plane. Parametric equations of straight lines. A straight line as the intersection of two planes. 13. Relationship problems on straight lines and planes, deviations and distances of planes and straight lines. Application of analytic methods for solving geometric problems in the space.			
123BM01	Building Materials	Z,ZK	5
Main aim of course is giving basic information about the structure and properties of the building materials and about their testing methods on the base of the contemporary knowledge and materials engineering approach. The laboratory work (exercise) consists in the testing of building materials from the point of view of physically - chemical properties and their quality control.			
126BIME	BIM	Z	1
The course is focused on basic knowledge in the field of building information modeling (BIM) in theoretical and practical areas, usable across various construction industry specializations and fields. Students will be acquainted not only with the basic knowledge of BIM (on the theoretical and practical level), data formats, IT systems typical for the building industry, but also with the context of BIM in the current construction industry in relation to the whole project life cycle and its specifics (delivery, expert focus, construction projects phases, etc.) Theoretical knowledge is complemented by practical exercises aimed at mastering and understanding the basic principles of object-oriented parametric modeling.			
132ST01	Structural Mechanics 1	Z,ZK	6
The principal objective of the course is to familiarize students with basic principles of mechanics such as equilibrium and equivalency applied to statically determined structures 1. Concurrent forces - definition of force, basic theorems and axioms, equilibrium, equivalency 2. Concurrent forces - resultants by rectangular components 3. Statics of particles - free-body diagrams, equilibrium of rigid particles 4. General system of forces - resultant forces and resultant moments, cross product, scalar product 5. General system of forces - resolution of forces to a force and a couple 6. Parallel system of forces in two and three dimensions 7. Statics of rigid bodies - idealization of two and three-dimensional supports and connections 8. Statics of rigid bodies - equilibrium in two and three dimensions 9. Statics of rigid bodies - reaction forces of simple and compound statically determined structures 10. Statics of rigid bodies - reaction forces applying principle of virtual displacements and rotations 11. Analysis of trusses - definition, classification, zero force members 12. Analysis of trusses - application of the method of joints 13. Analysis of trusses - application of the method of sections			
154FS01	Fieldwork Surveying	Z,ZK	6
Introduction to surveying, basic geodetic calculations, evaluation of precision and accuracy of a measurement, theory of errors, instrumentation, topographic survey, angular and distance measurements, determination of heights, photogrammetry, laser scanning, mapping, setting-out in construction, surveying for monitoring of displacements, cadastre of real estates.			
104CFL1	Czech/Foreign Language 1	Z	1
This course accents the communicative approach to language teaching. Therefore, individual lessons are primarily centred around an underlying topic that is complemented by the communicative language function. Further appropriate language aspects (i.e. grammar, lexis, pronunciation, skills) arise from the given communicative need. Students thus learn basic communication in common situations. The Czech course is intended for students of the English Programme. The course is aimed to provide training in basic language means necessary for communication in everyday situations. After successful completion the student gains a credit. End of course level according to CEFR: A1 (Beginners)			
TV1	Physical Education	Z	0

Code of the group: BD20200200

Name of the group: Building Structures, Compulsory Subjects, 2nd semester

Requirement credits in the group: In this group you have to gain at least 30 credits (at most 28)

Requirement courses in the group: In this group you have to complete at least 7 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
101MT02	Mathematics 2 František Bubeník, Yuliya Namlyeyeva Yuliya Namlyeyeva Yuliya Namlyeyeva (Gar.)	Z,ZK	6	2P+3C	L	z
102PHD	Physics	Z,ZK	4	3P+1C	L	z
105SOSC	Social Sciences	Z,ZK	5	4P+1C	L	z
123BUC	Chemistry	Z,ZK	4	3P+1C	L	z
132ST02	Structural Mechanics 2 Jan Vorel Jan Vorel Jan Vorel (Gar.)	Z,ZK	6	2P+2C	L	z
135SOM1	Soil Mechanics 1	Z	3	2P+1C	L	z
104CL2	Czech/Foreign Language 2 Svatava Boboková-Bartíková, Sandra Giormani Svatava Boboková-Bartíková (Gar.)	Z,ZK	2	2C	L	z
TV2	Physical Education	Z	0	0+2	L	z

Characteristics of the courses of this group of Study Plan: Code=BD20200200 Name=Building Structures, Compulsory Subjects, 2nd semester

101MT02	Mathematics 2	Z,ZK	6
1. Indefinite integral, primitive functions, tabular integrals. Fundamental methods for calculating indefinite integrals: per partes, substitutions. 2. Integration of rational functions (with simple imaginary roots in denominators at most one). 3. Selected special substitutions. 4. Definite integral, fundamental methods for calculating definite integrals: Newton- Leibniz's formula, per partes, substitutions. 5. Improper integrals, convergence and divergence of improper integrals, methods of computation. 6. Geometrical and physical applications of integral calculus : area of a plane figure, volume of a solid of revolution, length of the graph of a function, static moments and the centre of gravity of a plane figure. 7. Functions of several variables. Definition domains, in case of two variables also level curves and graphs. Partial derivatives, partial derivatives of higher orders. 8. Directional derivatives. Gradient. Total differential. Derivatives and partial derivatives of functions defined implicitly. 9. Equations of tangent and normal lines of a plane curve and tangent planes and normal lines of a surface. 10. Local extrema and local extrema with respect to a set (constrained extrema). 11. Global extrema on a set. 12. Differential equations of the 1st order, separation of variables, homogeneous equations. Cauchy problems. 13. Linear differential equations of the 1st order, variation of a constant. Exact equations. Cauchy problems.			
102PHD	Physics	Z,ZK	4
Principal goal of the lectures is to present those fundamentals of physics necessary for further special courses. 1. Atoms. Molecules. Ions. Phases. Structures of substances. 2. Kinematics. Coordinate system. Radiusvector.Velocity. Acceleration. 3. Dynamics. Force. Newton's laws of motion. 4. Force field. Newton's law of universal gravitation. Work. Energy. Conservation law. 5. Deformation. Stress and strain. 6. Tensile, compressive and shear stress. Hooke's law. 7. Flow. Viscosity. Laminar and turbulent flow. Bernoulli's equation. 8. Oscillations. Basic definitions and characteristics. 9. Elastic waves in fluids and solids. 10. Interference. Acoustic waves. 11. Equilibrium thermodynamics. Heat and temperature. Thermodynamic work. 12. Thermal expansion of substances. 13. Heat transfer: convection, conduction, radiation.			
105SOSC	Social Sciences	Z,ZK	5
Basic economic terms, demand, supply, market equilibrium. Rational consumer choice, indifferent curve, elasticity of demand. Firm and production function in short and long run. Long run and short run cost. Perfect competition and monopolistic competition, oligopoly, monopoly. Markets for productive inputs. Public goods. Basics of macroeconomics. Macroeconomic aggregates. The law part of the subject concentrates on selected current developing law areas. In the subject will be given summary of Law of intellectual property, especially Copyright, Personality Rights of individual and data protection. The interpretation will be demonstrate on basic of Czech law. Previous law knowledge is not needed.			
123BUC	Chemistry	Z,ZK	4
Lectures deal with the basic chemical principles in the branches as general, inorganic, organic and physical chemistry. Instances of topics are composition, properties and behaviour of water, soil, air, wood, macromolecular compounds, inorganic binders, metals and other materials used in civil engineering.			
132ST02	Structural Mechanics 2	Z,ZK	6
The principal objective of the course is to familiarize students with the application of basic principles of mechanics to the determination of distribution of internal forces in statically determined structures. 1. Definition of internal forces - normal force, shear force and bending moment in two and three dimensions, sign convention 2. Evaluation of internal forces at a given point from equilibrium 3. Differential equations of equilibrium, Normal force, shear force and bending moment diagrams by integration 4. Distribution of internal forces on simple straight and inclined beams 5. Distribution of internal forces on curved beams 6. Distribution of internal forces on compound beam-column structures 7. Cables subjected to concentrated and uniformly distributed loads 8. Application of principal of virtual displacements to the evaluation of internal forces 9. Geometry of mass and areas, center of gravity 10. First and second moments of area (moments of inertia), radii of gyration 11. Principle moments of inertia, ellipse of inertia 12. Elementary definition of stress 13. Review lecture			
135SOM1	Soil Mechanics 1	Z	3
Basic course of Geology for Civil Engineers. Introduction to geological processes, structural geology, hydrogeology and engineering geology. The practical part of the course includes recognizing of stones and minerals.			
104CL2	Czech/Foreign Language 2	Z,ZK	2
This course accents the communicative approach to language teaching. Therefore, individual lessons are primarily centred around an underlying topic that is complemented by the communicative language function. Further appropriate language aspects (i.e. grammar, lexis, pronunciation, skills) arise from the given communicative need. Basic communication in common situations is further enriched by communicative skills in a more specific university environment. The Czech course is intended for students in the English Programme, who have already gained some basic knowledge in the Czech language, i.e. they are at A1/A2 level. The course is aimed to provide training in language means necessary for communication in everyday situations and at university. After successful completion the student gains a credit and exam. End of course level according to CEFR: A2			
TV2	Physical Education	Z	0

Code of the group: BD20200300

Name of the group: Building structures, Compulsory Subjects, 3rd semester

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
101MT03	Mathematics 3 František Bubeník, Yuliya Namlyeyeva, Martin Hála, Ondřej Zindulka Ondřej Zindulka Ondřej Zindulka (Gar.)	Z,ZK	6	3P+2C		z
124BSD1	Building Structures 1	Z	4	2P+1C	Z	z
132TELA	Theory of Elasticity Jan Vorel Jan Vorel Jan Vorel (Gar.)	Z,ZK	6	3P+2C	Z	z
135SOM2	Soil Mechanics 2	Z,ZK	5	2P+1C	Z	z
141HYAE	Hydraulics Ivana Marešová	Z,ZK	5	2P+2C	L	z
142WEE	Water and Environmental Engineering Milan Zukal, Ladislav Satrapa, Jaroslav Pollert, Kateřina Slavičková, Bohumil Šťastný, Filip Horký, Miroslav Brouček Milan Zukal Milan Zukal (Gar.)	Z,ZK	4	3P+1C		z

Characteristics of the courses of this group of Study Plan: Code=BD20200300 Name=Building structures, Compulsory Subjects, 3rd semester

101MT03	Mathematics 3	Z,ZK	6
1.Linear differential equations of the n-th order, initial value problems. Homogeneous equations: fundamental system, general solution. Fundamental system for equation with constant coefficients. Descriptive statistics. 2. Reduction of order. Nonhomogeneous equations: variation of parameters, method of undetermined coefficients. Descriptive statistics: box-plot, outliers. Bivariate data. 3. Dot product of functions in $C([a,b])$, orthogonality of functions. Setup of a boundary value problem, examples. Bivariate descriptive statistics. Linear regression. 4. Problem $u''+au=f$, $u(0)=u(\pi)=0$, eigenvalues and eigenfunctions. Orthogonality of eigenfunctions. Solvability (as it depends on "a"). Some other problems. Introduction to probability theory. Classical probability. 5. Double integral, Fubini Theorem, substitution, polar coordinates. Conditional probability; independent events. 6. Applications of double integral. Discrete random variables. 7. Triple Riemann integral, Fubini Theorem, substitution, cylindrical and spherical coordinates. applications of double and triple integral. Binomial distribution. 8. Applications of triple integral. Continuous random variables. 9.Line integral of a scalar field, applications. Continuous random variable: expected value and variance. 10. Line integral of a vector field, Green Theorem. Normal distribution. 11. Conservative fields. Applications of normal distribution. 12. Applications of line integrals. Inferential statistics.			
124BSD1	Building Structures 1	Z	4
132TELA	Theory of Elasticity	Z,ZK	6
Basic assumptions and basic equations of theory of elasticity. Assumptions on deformation and stress distribution in beams. Tension and compression, pure bending, bending moments in two planes, combination of axial and bending stresses. Core of a cross section. Differential equation of elasticity curve. Shear stresses in flexural beams. Free torsion. Elastic-plastic and plastic state of cross-section. Stability of beams. 2D problems, walls and plates.			
135SOM2	Soil Mechanics 2	Z,ZK	5
Basic course of Soil Mechanics for Civil Engineers. Introduction to origin of soils, soil description, multi-phase media behaviour, soil classification, compressibility and shear resistance, soil testing, earth pressures, assessment of stability and deformation of soil mass, applications in civil engineering.			
141HYAE	Hydraulics	Z,ZK	5
Physical properties of water. Hydrostatics - pressure in a gravitational field, applications of the Pascal's law (hydraulic jack), hydrostatic forces, loading of construction by liquids, buoyancy force. Basics of hydrodynamics - characteristics, regimes and types of water flow, hydraulic resistance, application of basic equations. Pressure flow in pipes - energy losses due to friction, minor losses, simple cases of pipe computations, pipe systems with pump, formation of a water hammer. Steady flow in open channels - uniform flow, hydraulic design of a channel, critical flow, longitudinal profiles of water level. Hydraulics of structures - outflow from an orifice and from a pipe system, flow through culverts and bridge openings. Forces due to water in motion. Water flow measurement. Groundwater flow - types, effects, filtration law, solving of a seepage.			
142WEE	Water and Environmental Engineering	Z,ZK	4
In the course students will obtain basic knowledge about water and environmental management. The focuses on practical knowledge with close relation to other disciplines of civil engineering. The subject is taught in form of lectures and tutorials. The stress is laid on presentations with case studies (positive and negative) using all audio visual forms. Lectures of this course are divided into two parts Water Engineering and Environmental Engineering.			

Code of the group: BD20200400

Name of the group: Building structures, Compulsory Subjects, 4th semester

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
124BSD2	Building Structures 2 Eva Burgetová	Z,ZK	5	2P+1C	L	Z
126ECM	Economics and Management Aleš Tomek, Martin Čáseňský, Radan Tomek Aleš Tomek (Gar.)	Z,ZK	7	4P+2C		Z
132SM3E	Structural Mechanics 3 Petr Řeřicha Petr Řeřicha (Gar.)	Z,ZK	5	2P+2C	L	Z
133FSTC	Fundamentals of Structural Design - Concrete Petr Štemberk, Yulia Khmurovská Petr Štemberk	Z,ZK	4	2P+1C	L	Z
134FSTT	Fundamentals of Structural Design - Steel Zdeněk Sokol Michal Jandera Zdeněk Sokol (Gar.)	Z,ZK	3	2P+1C	L	Z
136TSUP	Transp. Structures and Urban Planning Kateřina Janžurová, Václav Jetel, Ivan Horký, Leoš Horníček, Jan Valentin Jan Valentin (Gar.)	Z,ZK	6	5P+1C		Z

Characteristics of the courses of this group of Study Plan: Code=BD20200400 Name=Building structures, Compulsory Subjects, 4th semester

124BSD2	Building Structures 2	Z,ZK	5
126ECM	Economics and Management	Z,ZK	7
A-Z of construction engineering and management both at the corporate and project level, concentrates on methods applicable in the context of construction project management - e.g. planning and controlling of all vital processes, contact with external environment of firm and projects etc. Online Building Industry Game (BIG) - a computer simulation of a realistic business environment where participants play the role of contractors, competing in a market with variable demand for construction work - will be played by all course participants through the whole semester.			
132SM3E	Structural Mechanics 3	Z,ZK	5
Deflections by the principle of virtual work. Statically indeterminate planar frames and trusses, force method. Slope deflection method and Cross (moment distribution) method for frames. Secondary moments in trusses. Prerequisites:Statically determinate planar frames, trusses and gridworks (balconies), reactions, internal forces diagrams. Active knowledge and expedience is required in solving examples. Reasonable minimum is 8 credits in structural mechanics			
133FSTC	Fundamentals of Structural Design - Concrete	Z,ZK	4
The course is focused on design of concrete structures based on ultimate state design method. The focal topics are design of reinforced concrete members for basic types of straining (bending, shear, combination of normal forces and bending moments) including determination of load effects; introduction to serviceability limit states. Other topics are technology of production and material properties of concrete and their testing, properties of steel reinforcement and interaction of reinforcement and concrete. The prerequisite courses are Structural mechanics, Theory of Elasticity, Building materials, Building structures.			
134FSTT	Fundamentals of Structural Design - Steel	Z,ZK	3

136TSUP	Transp. Structures and Urban Planning	Z,ZK	6
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Introduction to the transportation engineering with the focus on road and railroad infrastructure. Rail transport and its advantages and disadvantages. Railway track and tram track construction. Noise and anti-noise measures. Road design and principles. Environmental aspects of road infrastructure. Pavement design (thickness design) and principles of the pavement structure functions. Crossings and junctions. Construction materials for highway and rail road engineering. Introduction to urban zoning and planning including urbanism. Relationships of urban planning and environmental, economic, culture-social, space and operational aspects of landscape and urban areas. Information to planning tools, procedures and used applications.

Code of the group: BD20200500

Name of the group: Building structures, Compulsory Subjects, 5th semester

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete at least 5 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
124BPH	Building Physics Zbyněk Svoboda, Jiří Nováček Jiří Nováček Zbyněk Svoboda (Gar.)	Z,ZK	6	3P+2C	Z	z
132STA	Structural Analysis Petr Řeřicha Petr Řeřicha (Gar.)	Z,ZK	5	2P+2C	Z	z
133CM01	Concrete and Masonry Structures 1 Petr Bílý, Iva Broukalová Iva Broukalová	Z,ZK	6	3P+2C	Z	z
134ST01	Steel Structures Zdeněk Sokol Michal Jandera Zdeněk Sokol (Gar.)	Z,ZK	6	3P+2C	Z	z
135FS01	Foundation of Structures Jan Záleský, Jan Valenta Jan Záleský (Gar.)	Z,ZK	7	3P+3C	Z	z

Characteristics of the courses of this group of Study Plan: Code=BD20200500 Name=Building structures, Compulsory Subjects, 5th semester

124BPH	Building Physics	Z,ZK	6
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Basic review of the thermal protection of buildings, building acoustics and daylighting (heat transfer, thermal conductivity, thermal resistance and thermal transmittance, multidimensional heat transfer, thermal bridges and thermal joints, diffusion of water vapour and vapour condensation, mould growth, transient heat transfer, risk of overheating, low-energy, passive and zero-energy buildings, sound in the living and working environment, perception and description of sound: intensity, frequency, time factor, information value, interindividual sensitivity, point, line and plane sound sources, sound power level, directivity factor, sound propagation in the free field conditions, sound propagation in the diffuse field conditions, definable and indefinable sounds, airborne and structureborne sound, definition, measurement, evaluation and the limits, sound reduction index of double structures, mass-air-mass resonance, standing waves in a cavity, definition, measurement, evaluation, the sun and the environment, basics of spherical astronomy, horizons and equatorial coordinates, calculating of the sun azimuth and altitude, daylight and lighting, visual perception, basics of photometry, daylight factor and calculation models of the sky, methods for determining daylight factor, influence of environment on a daylighting: photometric characteristics of shielding barriers, technical characteristics of lighting openings).

132STA	Structural Analysis	Z,ZK	5
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Displacement method for planar frames and gridworks. Extreme effects of live load, influence lines. Stress and strain tensors, traction vector, principal stresses in directions, material strength. Finite element principles and techniques, error of the finite element solutions. Prerequisites: The force and slope deflection methods for statically indeterminate planar frames and trusses, elementary elasticity, stresses and strains in beams, Hooke's law. 13 credits in structural mechanics and elasticity is a reasonable minimum to enter the course.

133CM01	Concrete and Masonry Structures 1	Z,ZK	6
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Structural design of concrete structures; prerequisite course 133FSTC Fundamentals of Structural Design - Concrete. Calculation models, methods of analysis (focus on simplified and empirical methods), reinforcing and detailing for particular structures and structural elements: slabs, frames, shear walls, staircase, basement and retaining walls, foundations.

134ST01	Steel Structures	Z,ZK	6
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The purpose of this course is to learn basic principles and general arrangement and structural detailing of multi-storey buildings and single storey buildings. Brief information about structural analysis, load, design codes and structural stability is also given. The course gives some examples of large span, tall and industrial buildings. Historical preface, usage of steel structures in civil engineering, important buildings and structures. Steel properties, material testing, steel structure production, Safety of steel structures. Limit state design. Codes and rules for design. Global analysis. Cross section classification. Design of profiles subjected to tension, compression, bending, torsion, warping. The combination of different actions. Buckling strength at compression, lateral buckling at bending, buckling of webs. Welded and bolted connections. Composite structures. Thinwalled structures. Structural fire design. Corrosion protection. Aluminium and alloys.

135FS01	Foundation of Structures	Z,ZK	7
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Basic design methods for shallow footings, piles, retaining structures, foundation pits, sheet pile walls, anchors and soil improvement. Principles of monitoring in foundation engineering. Use of Eurocode 7. Selected case histories.

Code of the group: BD20200600

Name of the group: Building structures, Compulsory Subjects, 6th semester

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete at least 5 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
124BC01	Non-loadbearing Construction Vladimír Žďára Vladimír Žďára Vladimír Žďára (Gar.)	Z,ZK	7	2P+3C	L	Z
124SDP1	Structural Design, Project 1	KZ	6	4C	L	Z
125BSE	Buildings Services Systems Hana Kabrhelová, Ilona Koubková, Stanislav Frolík, Karel Kabele, Michal Kabrhel Hana Kabrhelová Karel Kabele (Gar.)	Z,ZK	5	2P+2C	L	Z
133CM02	Concrete and Masonry Structures 2 Iva Broukalová, Jan Vitek, Marek Foglar, Roman Šafář, Lukáš Vráblík Marek Foglar Jan Vitek (Gar.)	Z,ZK	7	4P+2C	L	Z
134TS01	Timber Structures Petr Kuklík Petr Kuklík (Gar.)	Z,ZK	5	3P+1C	L	Z

Characteristics of the courses of this group of Study Plan: Code=BD20200600 Name=Building structures, Compulsory Subjects, 6th semester

124BC01	Non-loadbearing Construction	Z,ZK	7	Course is focused on complex approach to practice design of the building envelope, flat and sloped roofing, doors and windows, partition walls, floor structures and ceilings. This course introduces theoretical foundations and computational approaches about two fields of building design: building physics and structure interaction. Integrated design of the nonbearing structures together with other building systems.		
124SDP1	Structural Design, Project 1	KZ	6	Focus on complex approach to practice design, analysis and optimization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed statical design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.		
125BSE	Buildings Services Systems	Z,ZK	5	Introductory Course of Building Services is focused on sanitary installations, gas supply system and heating systems. Sanitary installations - introduction, hydraulic pipes, water supply facilities, balance water needs. Internal water supply systems - installation, materials, calculation, waste water and disposal, sewage systems, internal drainage, types of fixtures. Gas - external pipelines, connections, balance of gas, internal pipeline systems, flue gas. Central heating and design of heating surfaces. Calculation of heat balance. Heating system. Preparation of hot water. Heat sources - boiler, electric heating, district heating, renewable sources.		
133CM02	Concrete and Masonry Structures 2	Z,ZK	7	Design of concrete structures on serviceability. Limit states approach. Stress control, cracking and crack width analysis, allowable crack width in concrete structures. Deformation of reinforced concrete structures, numerical and simplified analysis, criteria of acceptance. Prestressed concrete. Introduction, basic principles, design philosophy, prestress losses, technology of prestressing, pre-tensioning and post-tensioning, verification of serviceability and ultimate limit states. Masonry structures, introduction, terminology, design of structural elements, reinforced masonry. Strengthening of masonry structures. Precast concrete structures, design situations, specific problems. Strut and tie models. Joints. Industrial halls. Composite concrete-concrete structures. Introduction to concrete bridges and introduction to engineering structures.		
134TS01	Timber Structures	Z,ZK	5	The course is focused on basic rules for mechanical resistance, serviceability, durability of timber structures in normal temperature and in fire.		

Code of the group: BD20200700

Name of the group: Building structures, Compulsory Subjects, 7th semester

Requirement credits in the group: In this group you have to gain at least 28 credits

Requirement courses in the group: In this group you have to complete at least 7 courses

Credits in the group: 28

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
122TCD	Technology of Construction Čeněk Jarský, Michal Procházka, Alexander Kravcov, Mária Párová Čeněk Jarský (Gar.)	Z,ZK	6	4P+2C	Z	Z
123MED	Material Engineering Alena Vimmrová, Jan Fořt, Igor Medved' Alena Vimmrová Igor Medved' (Gar.)	Z,ZK	5	2P+2C	Z	Z
124BSD3	Building Structures 3 Vladimír Žďára	Z,ZK	3	2P+1C	Z	Z
124PDRD	Failures, Deterioration, Renovations Eva Burgetová Eva Burgetová (Gar.)	Z,ZK	3	2P+1C	L	Z
125BSE2	Buildings Services Systems 2 Hana Kabrhelová, Ilona Koubková, Stanislav Frolík, Karel Kabele, Michal Kabrhel, Daniel Adamovský, Zuzana Veverková Hana Kabrhelová Daniel Adamovský (Gar.)	Z,ZK	5	2P+2C	Z	Z

Characteristics of the courses of this group of Study Plan: Code=BD20200700 Name=Building structures, Compulsory Subjects, 7th semester

122TCD	Technology of Construction	Z,ZK	6
Goal: To learn students to know construction processes and their design and to create a model of the building process of a project for planning and management of its implementation Contents: 1. Introduction to construction technology, construction processes, basic terminology. 2. Earthworks, excavation of rock classes, types of excavation, shoring, compaction, drainage. 3. Production and transport of concrete mixture. Formwork and traditional system, placement of reinforcement, storage and compaction of fresh concrete, curing of fresh concrete. 4. Construction Equipment (equipment for mining, transportation and compaction of rocks, concrete transport equipment, lifting equipment, tower and mobile cranes, trucks, elevators, hoists, trays, tools for finishing work). 6. Excursion to construction site. 7. Finishing works in building industry. Plasters, facings, paintings, soffits, wallpapers floors. 8. Facades, fronts. Internal installations, sewerage, water, gas, electricity mains. 9. Health and safety at work. Environmental protection during construction. Quality requirements for construction processes. 10. Implementation of buildings and projects. Main concepts and terms. Technological, spatial and time analysis of the building process, 11. Technological stages and their characteristics for homogenous and non homogenous buildings. Long term and short term construction planning and scheduling. Construction technology design. 12. Flow method in building industry, use of construction technology network analysis for project management. Use of computers in project planning and management. 13. Principles of design of site facilities and equipment			
123MED	Material Engineering	Z,ZK	5
Subject gives information on principles of designing and development of new types of materials having directed properties for specific building applications and structures.			
124BSD3	Building Structures 3	Z,ZK	3
124PDRD	Failures, Deterioration, Renovations	Z,ZK	3
Characteristic failures of buildings and their lifetime, analyses of loading impacts and influences from point of failure view, non-force impacts, building-technical survey of buildings, degradation and corrosion processes, historical structures (foundations, vaults, ceilings, roof trusses), failures and reconstruction of masonry, concrete, reinforced concrete, wooden, steel and prefabricated structures, protection of buildings against increased moisture effects.			
125BSE2	Buildings Services Systems 2	Z,ZK	5
Introduction to the indoor environmental quality, building ventilation and basic artificial lighting and electrical installation. Lectures topics: Microenvironment and its constituents. Microenvironment-health requirements. Design of air-handling systems - basics, criteria. Ventilation systems - Principles of natural and mechanical ventilation. Heat recovery. Parts of air handling systems. Fundamentals of air-conditioning systems. Natural and Combined lighting. Electricity distribution. Electrical installations. Tutorials focused on practical design of ventilation and basic light and electrical systems.			

Code of the group: BD20200800

Name of the group: Building structures, Compulsory Subjects, 8th semester

Requirement credits in the group: In this group you have to gain at least 24 credits

Requirement courses in the group: In this group you have to complete at least 3 courses

Credits in the group: 24

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
124FSHB	Fire Safety and Healthy Buildings Martin Jiránek, Zuzana Rácová, Veronika Kačmaříková, Václav Kupilík, Petr Hejtmánek Václav Kupilík Martin Jiránek (Gar.)	Z,ZK	6	3P+2C	L	Z
126CMAN	Construction Management Aleš Tomek, Radan Tomek Aleš Tomek Aleš Tomek (Gar.)	Z,ZK	6	3P+2C	L	Z

Characteristics of the courses of this group of Study Plan: Code=BD20200800 Name=Building structures, Compulsory Subjects, 8th semester

124FSHB	Fire Safety and Healthy Buildings	Z,ZK	6
Constituents of indoor microclimate, hazardous substances (VOCs, HFRs, heavy metals, moulds, microbes, aerosols, radionuclides, etc.), their sources and health effects. Influence of building structures and materials on quality of indoor microclimate. Design of buildings with respect to optimisation of indoor microclimate. Analysis of fire - course of fire, burning process, fire loading; legislation and European Standards; fire safety solutions - fire project, requirement for fire resistance of buildings, escape ways, distance separation, fire-fighting equipment; fire behaviour of the most used materials (wood, steel, concrete, plastics); protection of building materials against fire (brickwork, concreting, plasters and sprays, coatings, impregnates of wood, encasements, glued facings of mineral fibres); sandwiches from fire point of view; influence of claddings on the course fire; passive protection of building structures - fire walls, fire glazed structures, fire ceiling, draft stops and seals; repressive measures - electric fire signalling, stationary extinguishing devices, smoke extract, hydrant systems.			
126CMAN	Construction Management	Z,ZK	6
Course is oriented mainly on practical applications of corporate construction management systems. It includes corporate strategy, corporate finance and budgeting, marketing and methods of business development, etc. Sustainable profitability of the construction business and the best practice at both - field and corporate level is explained.			

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 8

The role of the block: PV

Code of the group: BD20200700_2

Name of the group: Building Structures, Optional Subjects, 7-8th semester

Requirement credits in the group: In this group you have to gain at least 8 credits (at most 0)

Requirement courses in the group: In this group you have to complete at least 4 courses

Credits in the group: 8

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
134GSTR	Glass Structures Martina Eliášová Martina Eliášová Martina Eliášová (Gar.)	Z	2	1P+1C		PV
124YKSE	Complex Construction Detailing	Z	2	1P+1C	Z	PV
124YEOT	Energy Optimised Timber Buildings	Z	2	1P+1C	Z	PV
133YBBD	Basis of Bridges Design Roman Šafář Roman Šafář Roman Šafář (Gar.)	Z	2	1P+1C	Z	PV
134TBS	Timber Based Structures Petr Kuklík Michal Jandera Petr Kuklík (Gar.)	Z	2	1P+1C	Z	PV
126YMCC	Management in Construction Company	Z	2	1P+1C	L	PV
133CASD	Computer Aided Structural Design Josef Novák Josef Novák Josef Novák (Gar.)	Z	2	1P+1C	Z,L	PV
132MMO	Modern Methods of Optimization Matěj Lepš Matěj Lepš Matěj Lepš (Gar.)	Z	2	1P+1C	Z	PV

Characteristics of the courses of this group of Study Plan: Code=BD20200700_2 Name=Building Structures, Optional Subjects, 7-8th semester

134GSTR	Glass Structures				Z	2
The course is intending to introduce the students the field of structural applications of glass and to give them some specific skills for calculation and detailing of for basic glass structures: panes beams and fins, columns and walls, point-supported glass, as well as for glazing systems such as glass facades, canopies and roofs, stairs and floors. On this purpose the properties of glass as structural material will be presented in comparison with other basic building materials, together with selected examples of glass/glazing applications. Design details and connecting technology, relevant technical regulations, specification and current methods applied in design will be described. Worked examples will accompany the lectures for better understanding, and design project will help to fix specific knowledge.						
124YKSE	Complex Construction Detailing				Z	2
124YEOT	Energy Optimised Timber Buildings				Z	2
Main goal of the subject Energy optimized timber buildings is to give complex overview of structural variants of timber buildings and to describe technical consequences connected with energy optimized, low energy and passive building. This subject covers complex design of timbers structures including structural and technological solutions, building physics, acoustics and fire resistance. Special attention is focused on design principles and basic calculations of low energy and passive buildings						
133YBBD	Basis of Bridges Design				Z	2
The course of Bases of Bridge Design is focused on principal problems related to design of bridges - spatial arrangement and equipment of road and railway bridges, types of bridge structures and technologies of construction of concrete bridges. During seminars, design of a road, single-span, cast-in situ, prestressed concrete slab bridge is carried out.						
134TBS	Timber Based Structures				Z	2
Examples of timber structures and bridges. Structural systems and details. Recommended design.						
126YMCC	Management in Construction Company				Z	2
Construction business and the best practice at the corporate level. Course is oriented on corporate business management in construction, i.e. unlike standard management courses relating mostly to field management topics. All crucial areas from strategy and organization to human resources are explained, with the special concern for sustainable profitability of the business.						
133CASD	Computer Aided Structural Design				Z	2
Computer Aided Structural Design has been implemented as an optional compulsory course which provides students to gain knowledge in a computer aided design and analysis of reinforced concrete structures. The objective of the course is to demonstrate the practical use of selected FEM software for the limit state design of various concrete structures. Namely, the focus is on computational models, reinforcement design, numerical modelling, crack control, deformation control and internal forces distribution. Students willing to sign up for the course are expected to have fundamental experience with the design of concrete structures.						
132MMO	Modern Methods of Optimization				Z	2
The course is aimed at an overview of numerical optimization methods applicable not only in the Civil Engineering area. The emphasis is put more on the introduction of driving principles, however, practical applications in MATLAB environment are also conducted during exercises.						

Name of the block: Povinně volitelné předměty, doporučení S1

Minimal number of credits of the block: 18

The role of the block: S1

Code of the group: BD20200700_1

Name of the group: Building Structures, Project, 7. semester

Requirement credits in the group: In this group you have to gain 6 credits

Requirement courses in the group: In this group you have to complete at least 1 course

Credits in the group: 6

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
124SDP2	Structural Design, Project 2	KZ	6	4C	L	S1
133SDP2	Structural Design, Project 2 Iva Broukalová	KZ	6	4C	Z	S1
134SDP2	Structural Design, Project 2 Zdeněk Sokol, Petr Kuklík Petr Kuklík (Gar.)	KZ	6	4C	Z	S1

135SDP2	Structural Design, Project 2 <i>Michal Jandera Michal Jandera Michal Jandera (Gar.)</i>	KZ	6	4C	Z	S1
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Characteristics of the courses of this group of Study Plan: Code=BD20200700_1 Name=Building Structures, Project, 7. semester

124SDP2	Structural Design, Project 2	KZ	6			
Focus on complex approach to practice design, analysis and optimization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed statical design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.						
133SDP2	Structural Design, Project 2	KZ	6			
Structural design of given structure (building). Preliminary design of the structure. Technical documentation, drawings. Detailed design of chosen structural elements includes analysis, reinforcement design, reinforcement drawings.						
134SDP2	Structural Design, Project 2	KZ	6			
Design of steel / timber load bearing building structure according to external requirements in relation to interaction of load bearing and final completion structural elements. The project is assigned by the seminar leader.						
135SDP2	Structural Design, Project 2	KZ	6			
Focus on complex approach to practice design, analysis and optimization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed statical design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.						

Code of the group: BD20200800_1

Name of the group: Building Structures, Bachelor Project

Requirement credits in the group: In this group you have to gain 12 credits

Requirement courses in the group: In this group you have to complete at least 1 course

Credits in the group: 12

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
102BPRO	Bachelor Project	Z	12	10C	L,Z	S1
122BPRO	Bachelor Project	Z	12	10C	L,Z	S1
123BPRO	Bachelor Project	Z	12	10C	L,Z	S1
124BPRO	Bachelor Project	Z	12	10C	L,Z	S1
125BPRO	Bachelor Project <i>Hana Kabrhelová Karel Kabele (Gar.)</i>	Z	12	10C	L,Z	S1
132BPRO	Bachelor Project	Z	12	10C	L,Z	S1
133BPRO	Bachelor Thesis	Z	12	10C	L,Z	S1
134BPRO	Bachelor Project <i>Michal Jandera</i>	Z	12	10C	L,Z	S1
135BPRO	Bachelor Project	Z	12	10C	L,Z	S1

Characteristics of the courses of this group of Study Plan: Code=BD20200800_1 Name=Building Structures, Bachelor Project

102BPRO	Bachelor Project in accordance with the thesis proposal	Z	12			
122BPRO	Bachelor Project The bachelor's thesis ends the bachelor study. The student demonstrates that he / she can apply the knowledge gained during the study on a specific project. The work may take the form of theoretical or project. Students consult the issue with the thesis supervisors and experts from the predetermined departments.	Z	12			
123BPRO	Bachelor Project In accordance with the thesis proposal	Z	12			
124BPRO	Bachelor Project	Z	12			
125BPRO	Bachelor Project Final project concluded by bachelor theses defense and state exam.	Z	12			
132BPRO	Bachelor Project in accordance with a thesis proposal	Z	12			
133BPRO	Bachelor Thesis in accordance with the thesis proposal	Z	12			
134BPRO	Bachelor Project In this course, student formulates a bachelor's thesis that is necessary to reach the bachelor's degree.	Z	12			
135BPRO	Bachelor Project Individual assignment in accordance with the thesis proposal	Z	12			

List of courses of this pass:

Code	Name of the course	Completion	Credits
101CG01	Constructive Geometry Description of space and main methods of the projection - multiview (Monge) projection as a basis for orientation in 3D CAD systems, axonometry, linear perspective. Surfaces in building practice - graphic laws of surfaces, geometric characteristics of surfaces, images of surfaces in appropriate projections, realization and application; visualization of surfaces in a graphic software. Namely: Cylinders and Cones, Hyperboloid of Revolution, Helical Surfaces, Quadrics. Curves in building practice - types of mathematical description, Frenet Frame, osculating circle.	Z,ZK	5
101MT01	Mathematics 1 1. Sequences of real numbers, fundamental concepts and definitions, limits of sequences and methods for their calculating, the number e. 2. Functions of a real variable, fundamental concepts and definitions, limits (proper and improper) and methods for their calculating, continuity. 3. Basic theorems for continuous functions and their applications: Bolzano's and Weierstrass's theorems, derivatives and their geometric and physical meaning, derivative rules, derivative of composite and inverse functions. 4. Derivatives of higher orders, differentials of the 1st and higher orders, Lagrange's theorem and its consequences, l'Hospital's rules. 5. An analysis of functions sequent on the properties of the 1st and 2nd derivatives (intervals of monotony, local extremes, convexity and concavity, points of inflection, asymptotes). 6. Global (absolute) extremes on compact intervals, word problems. Taylor's theorem, Taylor's polynomial and its applications. 7. Vector (linear) spaces, the vector space of ordered n-tuples, R ² , R ³ , linear combinations, linear independence and dependence, bases, the dimension, subspaces. 8. Linear hull, matrices, the rank of a matrix, Gauss's algorithm. 9. Systems of linear algebraic equations, basic methods for solving, Gaussian elimination, Frobenius theorem. 10. Matrix multiplication, inverse matrices and their applications, matrix equations. 11. Determinants of the 2nd and 3rd orders, Sarrus's rule, inverse matrices by means of determinants, Cramer's rule. 12. Fundamental properties of geometric vectors. General form and parametric representation of a plane. Parametric equations of straight lines. A straight line as the intersection of two planes. 13. Relationship problems on straight lines and planes, deviations and distances of planes and straight lines. Application of analytic methods for solving geometric problems in the space.	Z,ZK	6
101MT02	Mathematics 2 1. Indefinite integral, primitive functions, tabular integrals. Fundamental methods for calculating indefinite integrals: per partes, substitutions. 2. Integration of rational functions (with simple imaginary roots in denominators at most one). 3. Selected special substitutions. 4. Definite integral, fundamental methods for calculating definite integrals: Newton-Leibniz's formula, per partes, substitutions. 5. Improper integrals, convergence and divergence of improper integrals, methods of computation. 6. Geometrical and physical applications of integral calculus: area of a plane figure, volume of a solid of revolution, length of the graph of a function, static moments and the centre of gravity of a plane figure. 7. Functions of several variables. Definition domains, in case of two variables also level curves and graphs. Partial derivatives, partial derivatives of higher orders. 8. Directional derivatives. Gradient. Total differential. Derivatives and partial derivatives of functions defined implicitly. 9. Equations of tangent and normal lines of a plane curve and tangent planes and normal lines of a surface. 10. Local extrema and local extrema with respect to a set (constrained extrema). 11. Global extrema on a set. 12. Differential equations of the 1st order, separation of variables, homogeneous equations. Cauchy problems. 13. Linear differential equations of the 1st order, variation of a constant. Exact equations. Cauchy problems.	Z,ZK	6
101MT03	Mathematics 3 1. Linear differential equations of the n-th order, initial value problems. Homogeneous equations: fundamental system, general solution. Fundamental system for equation with constant coefficients. Descriptive statistics. 2. Reduction of order. Nonhomogeneous equations: variation of parameters, method of undetermined coefficients. Descriptive statistics: box-plot, outliers. Bivariate data. 3. Dot product of functions in C([a,b]), orthogonality of functions. Setup of a boundary value problem, examples. Bivariate descriptive statistics. Linear regression. 4. Problem $u''+au=f$, $u(0)=u(\pi)=0$, eigenvalues and eigenfunctions. Orthogonality of eigenfunctions. Solvability (as it depends on "a"). Some other problems. Introduction to probability theory. Classical probability. 5. Double integral, Fubini Theorem, substitution, polar coordinates. Conditional probability; independent events. 6. Applications of double integral. Discrete random variables. 7. Triple Riemann integral, Fubini Theorem, substitution, cylindrical and spherical coordinates. applications of double and triple integral. Binomial distribution. 8. Applications of triple integral. Continuous random variables. 9. Line integral of a scalar field, applications. Continuous random variable: expected value and variance. 10. Line integral of a vector field, Green Theorem. Normal distribution. 11. Conservative fields. Applications of normal distribution. 12. Applications of line integrals. Inferential statistics.	Z,ZK	6
102BPRO	Bachelor Project in accordance with the thesis proposal	Z	12
102PHD	Physics Principal goal of the lectures is to present those fundamentals of physics necessary for further special courses. 1. Atoms. Molecules. Ions. Phases. Structures of substances. 2. Kinematics. Coordinate system. Radiusvector. Velocity. Acceleration. 3. Dynamics. Force. Newton's laws of motion. 4. Force field. Newton's law of universal gravitation. Work. Energy. Conservation law. 5. Deformation. Stress and strain. 6. Tensile, compressive and shear stress. Hooke's law. 7. Flow. Viscosity. Laminar and turbulent flow. Bernoulli's equation. 8. Oscillations. Basic definitions and characteristics. 9. Elastic waves in fluids and solids. 10. Interference. Acoustic waves. 11. Equilibrium thermodynamics. Heat and temperature. Thermodynamic work. 12. Thermal expansion of substances. 13. Heat transfer: convection, conduction, radiation.	Z,ZK	4
104CFL1	Czech/Foreign Language 1 This course accents the communicative approach to language teaching. Therefore, individual lessons are primarily centred around an underlying topic that is complemented by the communicative language function. Further appropriate language aspects (i.e. grammar, lexis, pronunciation, skills) arise from the given communicative need. Students thus learn basic communication in common situations. The Czech course is intended for students of the English Programme. The course is aimed to provide training in basic language means necessary for communication in everyday situations. After successful completion the student gains a credit. End of course level according to CEFR: A1 (Beginners)	Z	1
104CL2	Czech/Foreign Language 2 This course accents the communicative approach to language teaching. Therefore, individual lessons are primarily centred around an underlying topic that is complemented by the communicative language function. Further appropriate language aspects (i.e. grammar, lexis, pronunciation, skills) arise from the given communicative need. Basic communication in common situations is further enriched by communicative skills in a more specific university environment. The Czech course is intended for students in the English Programme, who have already gained some basic knowledge in the Czech language, i.e. they are at A1/A2 level. The course is aimed to provide training in language means necessary for communication in everyday situations and at university. After successful completion the student gains a credit and exam. End of course level according to CEFR: A2	Z,ZK	2
105SOSC	Social Sciences Basic economic terms, demand, supply, market equilibrium. Rational consumer choice, indifferent curve, elasticity of demand. Firm and production function in short and long run. Long run and short run cost. Perfect competition and monopolistic competition, oligopoly, monopoly. Markets for productive inputs. Public goods. Basics of macroeconomics. Macroeconomic aggregates. The law part of the subject concentrates on selected current developing law areas. In the subject will be given summary of Law of intellectual property, especially Copyright, Personality Rights of individual and data protection. The interpretation will be demonstrate on basis of Czech law. Previous law knowledge is not needed.	Z,ZK	5
122BPRO	Bachelor Project The bachelor's thesis ends the bachelor study. The student demonstrates that he / she can apply the knowledge gained during the study on a specific project. The work may take the form of theoretical or project. Students consult the issue with the thesis supervisors and experts from the predetermined departments.	Z	12
122TCD	Technology of Construction Goal: To learn students to know construction processes and their design and to create a model of the building process of a project for planning and management of its implementation Contents: 1. Introduction to construction technology, construction processes, basic terminology. 2. Earthworks, excavation of rock classes, types of excavation, shoring, compaction,	Z,ZK	6

drainage. 3. Production and transport of concrete mixture. Formwork and traditional system, placement of reinforcement, storage and compaction of fresh concrete, curing of fresh concrete. 4. Construction Equipment (equipment for mining, transportation and compaction of rocks, concrete transport equipment, lifting equipment, tower and mobile cranes, trucks, elevators, hoists, trays, tools for finishing work). 6. Excursion to construction site. 7. Finishing works in building industry. Plasters, facings, paintings, soffits, wallpapers floors. 8. Facades, fronts. Internal installations, sewerage, water, gas, electricity mains. 9. Health and safety at work. Environmental protection during construction. Quality requirements for construction processes. 10. Implementation of buildings and projects. Main concepts and terms. Technological, spatial and time analysis of the building process, 11. Technological stages and their characteristics for homogenous and non homogenous buildings. Long term and short term construction planning and scheduling. Construction technology design. 12. Flow method in building industry, use of construction technology network analysis for project management. Use of computers in project planning and management. 13. Principles of design of site facilities and equipment			
123BM01	Building Materials	Z,ZK	5
Main aim of course is giving basic information about the structure and properties of the building materials and about their testing methods on the base of the contemporary knowledge and materials engineering approach. The laboratory work (exercise) consists in the testing of building materials from the point of view of physically - chemical properties and their quality control.			
123BPRO	Bachelor Project In accordance with the thesis proposal	Z	12
123BUC	Chemistry	Z,ZK	4
Lectures deal with the basic chemical principles in the branches as general, inorganic, organic and physical chemistry. Instances of topics are composition, properties and behaviour of water, soil, air, wood, macromolecular compounds, inorganic binders, metals and other materials used in civil engineering.			
123MED	Material Engineering	Z,ZK	5
Subject gives information on principles of designing and development of new types of materials having directed properties for specific building applications and structures.			
124BC01	Non-loadbearing Construction	Z,ZK	7
Course is focused on complex approach to practice design of the building envelope, flat and sloped roofing, doors and windows, partition walls, floor structures and ceilings. This course introduces theoretical foundations and computational approaches about two fields of building design: building physics and structure interaction. Integrated design of the nonbearing structures together with other building systems.			
124BPH	Building Physics	Z,ZK	6
Basic review of the thermal protection of buildings, building acoustics and daylighting (heat transfer, thermal conductivity, thermal resistance and thermal transmittance, multidimensional heat transfer, thermal bridges and thermal joints, diffusion of water vapour and vapour condensation, mould growth, transient heat transfer, risk of overheating, low-energy, passive and zero-energy buildings, sound in the living and working environment, perception and description of sound: intensity, frequency, time factor, information value, interindividual sensitivity, point, line and plane sound sources, sound power level, directivity factor, sound propagation in the free field conditions, sound propagation in the diffuse field conditions, definable and indefinable sounds, airborne and structureborne sound, definition, measurement, evaluation and the limits, sound reduction index of double structures, mass-air-mass resonance, standing waves in a cavity, definition, measurement, evaluation, the sun and the environment, basics of spherical astronomy, horizons and equatorial coordinates, calculating of the sun azimuth and altitude, daylight and lighting, visual perception, basics of photometry, daylight factor and calculation models of the sky, methods for determining daylight factor, influence of environment on a daylighting: photometric characteristics of shielding barriers, technical characteristics of lighting openings).			
124BPRO	Bachelor Project	Z	12
124BSD1	Building Structures 1	Z	4
124BSD2	Building Structures 2	Z,ZK	5
124BSD3	Building Structures 3	Z,ZK	3
124FSHB	Fire Safety and Healthy Buildings	Z,ZK	6
Constituents of indoor microclimate, hazardous substances (VOCs, HFRs, heavy metals, moulds, microbes, aerosols, radionuclides, etc.), their sources and health effects. Influence of building structures and materials on quality of indoor microclimate. Design of buildings with respect to optimisation of indoor microclimate. Analysis of fire - course of fire, burning process, fire loading; legislation and European Standards; fire safety solutions - fire project, requirement for fire resistance of buildings, escape ways, distance separation, fire-fighting equipment; fire behaviour of the most used materials (wood, steel, concrete, plastics); protection of building materials against fire (brickwork, concreting, plasters and sprays, coatings, impregnates of wood, encasements, glued facings of mineral fibres); sandwiches from fire point of view; influence of claddings on the course fire; passive protection of building structures - fire walls, fire glazed structures, fire ceiling, draft stops and seals; repressive measures - electric fire signalling, stationary extinguishing devices, smoke extract, hydrant systems.			
124PDRD	Failures, Deterioration, Renovations	Z,ZK	3
Characteristic failures of buildings and their lifetime, analyses of loading impacts and influences from point of failure view, non-force impacts, building-technical survey of buildings, degradation and corrosion processes, historical structures (foundations, vaults, ceilings, roof trusses), failures and reconstruction of masonry, concrete, reinforced concrete, wooden, steel and prefabricated structures, protection of buildings against increased moisture effects.			
124SDP1	Structural Design, Project 1	KZ	6
Focus on complex approach to practic design, analysis and optimalization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed statical design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.			
124SDP2	Structural Design, Project 2	KZ	6
Focus on complex approach to practic design, analysis and optimalization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed statical design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.			
124YEOT	Energy Optimised Timber Buildings	Z	2
Main goal of the subject Energy optimized timber buildings is to give complex overview of structural variants of timber buildings and to describe technical consequences connected with energy optimized, low energy and passive building. This subject covers complex design of timbers structures including structural and technological solutions, building physics, acoustics and fire resistance. Special attention is focused on design principles and basic calculations of low energy and passive buildings			
124YKSE	Complex Construction Detailing	Z	2
125BPRO	Bachelor Project Final project concluded by bachelor theses defense and state exam.	Z	12
125BSE	Buildings Services Systems	Z,ZK	5
Introductory Course of Building Services is focused on sanitary installations, gas supply system and heating systems. Sanitary installations - introduction, hydraulic pipes, water supply facilities, balance water needs. Internal water supply systems - installation, materials, calculation, waste water and disposal, sewage systems, internal drainage, types of fixtures. Gas - external pipelines, connections, balance of gas, internal pipeline systems, flue gas. Central heating and design of heating surfaces. Calculation of heat balance. Heating system. Preparation of hot water. Heat sources - boiler, electric heating, district heating, renewable sources.			
125BSE2	Buildings Services Systems 2	Z,ZK	5
Introduction to the indoor environmental quality, building ventilation and basic artificial lighting and electrical installation. Lectures topics: Microenvironment and its constituents. Microenvironment-health requirements. Design of air-handling systems - basics, criteria. Ventilation systems - Principles of natural and mechanical ventilation. Heat recovery. Parts of			

air handling systems. Fundamentals of air-conditioning systems. Natural and Combined lighting. Electricity distribution. Electrical installations. Tutorials focused on practical design of ventilation and basic light and electrical systems.			
126BIME	BIM	Z	1
The course is focused on basic knowledge in the field of building information modeling (BIM) in theoretical and practical areas, usable across various construction industry specializations and fields. Students will be acquainted not only with the basic knowledge of BIM (on the theoretical and practical level), data formats, IT systems typical for the building industry, but also with the context of BIM in the current construction industry in relation to the whole project life cycle and its specifics (delivery, expert focus, construction projects phases, etc.) Theoretical knowledge is complemented by practical exercises aimed at mastering and understanding the basic principles of object-oriented parametric modeling.			
126CMAN	Construction Management	Z,ZK	6
Course is oriented mainly on practical applications of corporate construction management systems. It includes corporate strategy, corporate finance and budgeting, marketing and methods of business development, etc. Sustainable profitability of the construction business and the best practice at both - field and corporate level is explained.			
126ECM	Economics and Management	Z,ZK	7
A-Z of construction engineering and management both at the corporate and project level, concentrates on methods applicable in the context of construction project management - e.g. planning and controlling of all vital processes, contact with external environment of firm and projects etc. Online Building Industry Game (BIG) - a computer simulation of a realistic business environment where participants play the role of contractors, competing in a market with variable demand for construction work - will be played by all course participants through the whole semester.			
126YMCC	Management in Construction Company	Z	2
Construction business and the best practice at the corporate level. Course is oriented on corporate business management in construction, i.e. unlike standard management courses relating mostly to field management topics. All crucial areas from strategy and organization to human resources are explained, with the special concern for sustainable profitability of the business.			
132BPRO	Bachelor Project in accordance with a thesis proposal	Z	12
132MMO	Modern Methods of Optimization	Z	2
The course is aimed at an overview of numerical optimization methods applicable not only in the Civil Engineering area. The emphasis is put more on the introduction of driving principles, however, practical applications in MATLAB environment are also conducted during exercises.			
132SM3E	Structural Mechanics 3	Z,ZK	5
Deflections by the principle of virtual work. Statically indeterminate planar frames and trusses, force method. Slope deflection method and Cross (moment distribution) method for frames. Secondary moments in trusses. Prerequisites: Statically determinate planar frames, trusses and gridworks (balconies), reactions, internal forces diagrams. Active knowledge and expedience is required in solving examples. Reasonable minimum is 8 credits in structural mechanics			
132ST01	Structural Mechanics 1	Z,ZK	6
The principal objective of the course is to familiarize students with basic principles of mechanics such as equilibrium and equivalency applied to statically determined structures 1. Concurrent forces - definition of force, basic theorems and axioms, equilibrium, equivalency 2. Concurrent forces - resultants by rectangular components 3. Statics of particles - free-body diagrams, equilibrium of rigid particles 4. General system of forces - resultant forces and resultant moments, cross product, scalar product 5. General system of forces - resolution of forces to a force and a couple 6. Parallel system of forces in two and three dimensions 7. Statics of rigid bodies - idealization of two and three-dimensional supports and connections 8. Statics of rigid bodies - equilibrium in two and three dimensions 9. Statics of rigid bodies - reaction forces of simple and compound statically determined structures 10. Statics of rigid bodies - reaction forces applying principle of virtual displacements and rotations 11. Analysis of trusses - definition, classification, zero force members 12. Analysis of trusses - application of the method of joints 13. Analysis of trusses - application of the method of sections			
132ST02	Structural Mechanics 2	Z,ZK	6
The principal objective of the course is to familiarize students with the application of basic principles of mechanics to the determination of distribution of internal forces in statically determined structures. 1. Definition of internal forces - normal force, shear force and bending moment in two and three dimensions, sign convention 2. Evaluation of internal forces at a given point from equilibrium 3. Differential equations of equilibrium, Normal force, shear force and bending moment diagrams by integration 4. Distribution of internal forces on simple straight and inclined beams 5. Distribution of internal forces on curved beams 6. Distribution of internal forces on compound beam-column structures 7. Cables subjected to concentrated and uniformly distributed loads 8. Application of principal of virtual displacements to the evaluation of internal forces 9. Geometry of mass and areas, center of gravity 10. First and second moments of area (moments of inertia), radii of gyration 11. Principle moments of inertia, ellipse of inertia 12. Elementary definition of stress 13. Review lecture			
132STA	Structural Analysis	Z,ZK	5
Displacement method for planar frames and gridworks. Extreme effects of live load, influence lines. Stress and strain tensors, traction vector, principal stresses in directions, material strength. Finite element principles and techniques, error of the finite element solutions. Prerequisites: The force and slope deflection methods for statically indeterminate planar frames and trusses, elementary elasticity, stresses and strains in beams, Hooke's law. 13 credits in structural mechanics and elasticity is a reasonable minimum to enter the course.			
132TELA	Theory of Elasticity	Z,ZK	6
Basic assumptions and basic equations of theory of elasticity. Assumptions on deformation and stress distribution in beams. Tension and compression, pure bending, bending moments in two planes, combination of axial and bending stresses. Core of a cross section. Differential equation of elasticity curve. Shear stresses in flexural beams. Free torsion. Elastic-plastic and plastic state of cross-section. Stability of beams. 2D problems, walls and plates.			
133BPRO	Bachelor Thesis in accordance with the thesis proposal	Z	12
133CASD	Computer Aided Structural Design	Z	2
Computer Aided Structural Design has been implemented as an optional compulsory course which provides students to gain knowledge in a computer aided design and analysis of reinforced concrete structures. The objective of the course is to demonstrate the practical use of selected FEM software for the limit state design of various concrete structures. Namely, the focus is on computational models, reinforcement design, numerical modelling, crack control, deformation control and internal forces distribution. Students willing to sign up for the course are expected to have fundamental experience with the design of concrete structures.			
133CM01	Concrete and Masonry Structures 1	Z,ZK	6
Structural design of concrete structures; prerequisite course 133FSTC Fundamentals of Structural Design - Concrete. Calculation models, methods of analysis (focus on simplified and empirical methods), reinforcing and detailing for particular structures and structural elements: slabs, frames, shear walls, staircase, basement and retaining walls, foundations.			
133CM02	Concrete and Masonry Structures 2	Z,ZK	7
Design of concrete structures on serviceability. Limit states approach. Stress control, cracking and crack width analysis, allowable crack width in concrete structures. Deformation of reinforced concrete structures, numerical and simplified analysis, criteria of acceptance. Prestressed concrete. Introduction, basic principles, design philosophy, prestress losses, technology of prestressing, pre-tensioning and post-tensioning, verification of serviceability and ultimate limit states. Masonry structures, introduction, terminology, design of structural elements, reinforced masonry. Strengthening of masonry structures. Precast concrete structures, design situations, specific problems. Strut and tie models. Joints. Industrial halls. Composite concrete-concrete structures. Introduction to concrete bridges and introduction to engineering structures.			
133FSTC	Fundamentals of Structural Design - Concrete	Z,ZK	4
The course is focused on design of concrete structures based on ultimate state design method. The focal topics are design of reinforced concrete members for basic types of straining (bending, shear, combination of normal forces and bending moments) including determination of load effects; introduction to serviceability limit states. Other topics are technology of production and material properties of concrete and their testing, properties of steel reinforcement and interaction of reinforcement and concrete. The prerequisite courses are Structural mechanics, Theory of Elasticity, Building materials, Building structures.			

133SDP2	Structural Design, Project 2	KZ	6
Structural design of given structure (building). Preliminary design of the structure. Technical documentation, drawings. Detailed design of chosen structural elements includes analysis, reinforcement design, reinforcement drawings.			
133YBBD	Basis of Bridges Design	Z	2
The course of Bases of Bridge Design is focused on principal problems related to design of bridges - spatial arrangement and equipment of road and railway bridges, types of bridge structures and technologies of construction of concrete bridges. During seminars, design of a road, single-span, cast-in situ, prestressed concrete slab bridge is carried out.			
134BPRO	Bachelor Project	Z	12
In this course, student formulates a bachelor's thesis that is necessary to reach the bachelor's degree.			
134FSTT	Fundamentals of Structural Design - Steel	Z,ZK	3
134GSTR	Glass Structures	Z	2
The course is intended to introduce the students the field of structural applications of glass and to give them some specific skills for calculation and detailing of for basic glass structures: panes beams and fins, columns and walls, point-supported glass, as well as for glazing systems such as glass facades, canopies and roofs, stairs and floors. On this purpose the properties of glass as structural material will be presented in comparison with other basic building materials, together with selected examples of glass/glazing applications. Design details and connecting technology, relevant technical regulations, specification and current methods applied in design will be described. Worked examples will accompany the lectures for better understanding, and design project will help to fix specific knowledge.			
134SDP2	Structural Design, Project 2	KZ	6
Design of steel / timber load bearing building structure according to external requirements in relation to interaction of load bearing and final completion structural elements. The project is assigned by the seminar leader.			
134ST01	Steel Structures	Z,ZK	6
The purpose of this course is to learn basic principles and general arrangement and structural detailing of multi-storey buildings and single storey buildings. Brief information about structural analysis, load, design codes and structural stability is also given. The course gives some examples of large span, tall and industrial buildings. Historical preface, usage of steel structures in civil engineering, important buildings and structures. Steel properties, material testing, steel structure production, Safety of steel structures. Limit state design, Codes and rules for design. Global analysis. Cross section classification. Design of profiles subjected to tension, compression, bending, torsion, warping. The combination of different actions. Buckling strength at compression, lateral buckling at bending, buckling of webs. Welded and bolted connections. Composite structures. Thinwalled structures. Structural fire design. Corrosion protection. Aluminium and alloys.			
134TBS	Timber Based Structures	Z	2
Examples of timber structures and bridges. Structural systems and details. Recommended design.			
134TS01	Timber Structures	Z,ZK	5
The course is focused on basic rules for mechanical resistance, serviceability, durability of timber structures in normal temperature and in fire.			
135BPRO	Bachelor Project	Z	12
Individual assignment in accordance with the thesis proposal			
135FS01	Foundation of Structures	Z,ZK	7
Basic design methods for shallow footings, piles, retaining structures, foundation pits, sheet pile walls, anchors and soil improvement. Principles of monitoring in foundation engineering. Use of Eurocode 7. Selected case histories.			
135SDP2	Structural Design, Project 2	KZ	6
Focus on complex approach to practical design, analysis and optimization of multi-storey or long-span building structures, or their reconstruction. Analysis of load, functional and technologic requirements, design of load-bearing system alternatives including foundations, preliminary bearing elements dimensions calculation, choice of most suitable version. Detailed static design of chosen version, calculation, technical report and drawings. Check of bearing and non-bearing structures interaction and assembly techniques. Public presentation.			
135SOM1	Soil Mechanics 1	Z	3
Basic course of Geology for Civil Engineers. Introduction to geological processes, structural geology, hydrogeology and engineering geology. The practical part of the course includes recognizing of stones and minerals.			
135SOM2	Soil Mechanics 2	Z,ZK	5
Basic course of Soil Mechanics for Civil Engineers. Introduction to origin of soils, soil description, multi-phase media behaviour, soil classification, compressibility and shear resistance, soil testing, earth pressures, assessment of stability and deformation of soil mass, applications in civil engineering.			
136TSUP	Transp. Structures and Urban Planning	Z,ZK	6
Introduction to the transportation engineering with the focus on road and railroad infrastructure. Rail transport and its advantages and disadvantages. Railway track and tram track construction. Noise and anti-noise measures. Road design and principles, Environmental aspects of road infrastructure. Pavement design (thickness design) and principles of the pavement structure functions. Crossings and junctions. Construction materials for highway and rail road engineering. Introduction to urban zoning and planning including urbanism. Relationships of urban planning and environmental, economic, culture-social, space and operational aspects of landscape and urban areas. Information to planning tools, procedures and used applications.			
141HYAE	Hydraulics	Z,ZK	5
Physical properties of water. Hydrostatics - pressure in a gravitational field, applications of the Pascal's law (hydraulic jack), hydrostatic forces, loading of construction by liquids, buoyancy force. Basics of hydrodynamics - characteristics, regimes and types of water flow, hydraulic resistance, application of basic equations. Pressure flow in pipes - energy losses due to friction, minor losses, simple cases of pipe computations, pipe systems with pump, formation of a water hammer. Steady flow in open channels - uniform flow, hydraulic design of a channel, critical flow, longitudinal profiles of water level. Hydraulics of structures - outflow from an orifice and from a pipe system, flow through culverts and bridge openings. Forces due to water in motion. Water flow measurement. Groundwater flow - types, effects, filtration law, solving of a seepage.			
142WEE	Water and Environmental Engineering	Z,ZK	4
In the course students will obtain basic knowledge about water and environmental management. The focuses on practical knowledge with close relation to other disciplines of civil engineering. The subject is taught in form of lectures and tutorials. The stress is laid on presentations with case studies (positive and negative) using all audio visual forms. Lectures of this course are divided into two parts Water Engineering and Environmental Engineering.			
154FS01	Fieldwork Surveying	Z,ZK	6
Introduction to surveying, basic geodetic calculations, evaluation of precision and accuracy of a measurement, theory of errors, instrumentation, topographic survey, angular and distance measurements, determination of heights, photogrammetry, laser scanning, mapping, setting-out in construction, surveying for monitoring of displacements, cadastre of real estates.			
TV1	Physical Education	Z	0
TV2	Physical Education	Z	0

For updated information see <http://bilakniha.cvut.cz/en/FF.html>

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