Faculty of Civil Engineering

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFAS42	Field Course of Structural Geodesy	Mid-semester mark	1

Course type	Course code	Course language	Timetable information
Practice	EN1	English	FRI:08:15-12:00(EOAF_TSZ);

The main purpose of the subject is introduce the most modern techniques and methods for students in the field of state surveying and movement detection of civil engineering structures. The students apply the skills and knowledges learned in Surveying I, II and Field Course of Surveying to solve more complex structural engineering projects. Project are solved by students team. During the practices students survey some inner parts of a more levelled building, determine the geometry of axis of an about 30 m high brick chimney. Furthermore they determine the deflections of a slab and the distortions of floor. They determine the deflection of a cable bridge caused by traffic. They are introduced into the applications of photogrammetry, remote sensing and laserscanning in the area of construction engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFAT41	Surveying I.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(KF27);
Practice	EN1	English	TUE:10:15-12:00(KGLABA);
Practice	EN2	English	TUE:10:15-12:00(KGLABB);

Surveying and Geodesy. Height systems. Optical levelling, the surveyors' level. Line levelling (procedure, field observations and processing). Systematic error sources of levelling, the two-peg-test. Line levelling, detail point levelling. Height observations for horizontal layouts.Horizontal positioning observations. Angular observations and the theodolite. Calibration procedure of the theodolite. Measuring with the theodolites: set up, sighting, horizontal and vertical angular observations, systematic error sources. The computation of the mean direction and the zenith angle. Centring excentric observations. Trigonometric heighting.Distance observations: corrections, reductions. Physical methods of distance measurements. Electrooptical Distance Meters. Processing distance observations. Plane surveying. Computation of horizontal coordinates on the projection grid. Orientation of the horizontal circle. Intersections.

Subject code	Subject name	Requirement	ECTS credit
BMEEODHAS41	Design of Structures Projectwork	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:10:15-12:00(KF12);

Students need to accomplish a complex design projectwork that is based on the knowledge gained through the branch courses. The project work is supervised by three lecturers from three areas of structural engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEODHASDM	Diploma work (Branch of Structural Engineering)	Mid-semester mark	24

Course type	Course code	Course language	Timetable information
Practice	ENA	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMSDM	Diploma work (MSc in Structural Engineering)	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENB	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMA-A1	Building Construction Methodology	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-09:00(K184);
Practice	EN1	English	THU:09:15-10:00(K184);

During the semester methodology of planning, methods of design of building constructions are presented. Listing of requirements depend on function of building (building physical, acoustical point of views and fire protection). Designation of structural hierarchy based on the determined requirements. Building constructional relationship and design rules: i) skirtings - connections of load-bearing structures ii) structures of floors (floors on ground, floors of general slabs) - connections of load-bearing structures iii) facade - connections of load-bearing structures iv) thermal insulation and rainwater seepage, soil moisture and waterproofing - connections of load-bearing structures v) special building constructions (windows, doors, gates), structures of fire protection (skylights, suspended walls against fume spreading).

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAS41	Construction Materials II.	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	THU:12:15-14:00(MMFL3);
Laboratory	EN1	English	THU:12:15-14:00(MMFL2);
Lecture	EN0	English	WED:08:15-10:00(MMFP);

Importance of selection construction materals. Ranges of applicability of construction materials. Influencing factors to the strength of concrete. Steam curing. Influencing factors to the water tightness and the freeze-thaw resistance of concrete. Fibre reinforced concrete. Light weight concrete. Metals. Aluminium. Production of iron and steel. Steel-carbon interaction diagram. Martenzite. Heat curing of steel. Steel corrosion. Normal potential. Roads. Road making materials. Aggreagates and possible binders to pavements. Properties of bitumen and asphalt. Concrete pavements. Properties of road marking. Concrete corrosion. Protection against concrete corrosion. Properties of polymers. Polymeric protection layers. Thermal and sound insulations.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAS43	Building Construction II.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(K375);
Practice	EN1	English	WED:10:15-12:00(K184);

Floor structures, finishes, orders of layers: floors on ground, floors of intermediate slabs, floors of attics, terraces, prefabricated concrete and stone pavings. Tile and plate roof claddings, metal sheet seamed strip claddings: orders of layers, materials, rules of technique, details, rainwater gutter systems. Structures of built-in-roofs: structures and roofing of pitched roofs, orders of layers, foils of vapour-/air-/waterproofing. Facade claddings: plastered, thermal insulated, assembled light and heavy claddings. Posterior thermal insulation of facades. Curtain walls, glass roofs. Structures and materials of dry technologies: assembled walls, ceilings, floors. Building physics: thermal and vapour protection. Acoustics, protection against noise. Building construction solutions of building reconstruction, tasks of refurbishment.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT41	Chemistry of Construction Materials	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(K184);

The importance and necessity of chemistry in civil engineering. The structure of atoms, the electron shell structure, the structure of molecules and chemical bonding models. States of materials - explanation by intermolecular forces. Ideal and real laws of gases. Fluid systems properties. The structure of crystalline solids (ionic, atomic, molecular and metallic lattice crystal structure and properties). Difference between ideal and realistic structure, macroscopic properties of crystalline materials, lattice defects. Structure and properties of non-crystalline (amorphous or glassy) solids. Macromolecular substances and its chemical properties. Homogeneous and heterogeneous systems. Gibbs law. interfacial phenomena. The types of chemical reactions, speed of chemical reactions. Activation energy and reaction heat. Hess's law. Chemical equilibrium. Acids, bases and salts. The pH concept. Hydrolysis of salts. Electrochemistry. Redox processes, redox potentials. Production of metals, corrosion of metals. Binding materials and binding mechanism. Cement chemistry. Chemical and mineralogical composition of cements. Hydration products, CSH, CAH, CH, primary and secondary ettringite. Application of theoretical knowledge in engineering practice.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT42	Civil Engineering Representation and Drawing	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:16:15-18:00(K184);
Practice	EN1	English	MON:10:15-12:00(K371);

3 main parts of the subject: 1. Descriptive geometry 2. Engineering drawing 3. Freehand drawing. 1. Basics of descriptive geometry course modules: Students gain knowledge and skills in regularities and techniques of descriptive geometry, developing spacial reasoning. Topics: basic constructions in planes of projections, transformations, tasks of intersections, intersections and interpenetrations of plane and curved solids, cast shadows, construction in scale, special revolution solids and skew surfaces. Additional representation systems: dimensioned representations, orthogonal axonometry, perspective projection. 2. Engineering drawing course modules: Students gain knowledge and skills in engineering drawing, specific notations, proportions and scale, magnification, minification, construction of ground plans and sections. 3. Engineering free-hand representation course modules: develop free-hand drawing in scale.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT44	Building Construction Study	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-13:00(K375);
Practice	EN1	English	WED:13:15-15:00(K375);

Subject of architectural engineering, fundamental terms and base definitions. elations of buildings and building constructions. Effects on buildings, requirements of building constructions. Building blocks and specific brick connections. Load-bearing wall systems and lintel beams in wall structures. Groups of foundation modes and characteristics. Water insulation of under grade parts of buildings. Slabs and ring beams. Balconies. Basics of mechanical installations of residential buildings. Frame system buildings, construction systems and materials. Structures of stairs, systematization. Railings, main coverings. Types of traditional roof trusses, specialties, rainwater gutters and roof claddings. Order of layers of flat roofs, rainwater drainage, gullies, waterproofing materials. Types and materials of typical external and internal doors and windows. Classic contact facade finishes. Basics of building physics.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMPRE2	Technical Drawing	Mid-semester mark	0

Course type	Course code	Course language	Timetable information
Practice	EN0	English	TUE:12:15-14:00(K184); WED:08:15-10:00(K184);

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTAT41	CAD for Civil Engineers	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	THU:12:15-14:00(K142a);
Laboratory	EN3	English	THU:14:15-16:00(KF30a);
Laboratory	EN1	English	THU:08:15-10:00(K142a);

Besides an overview on CAD systems and application fields, students will learn the 2D drawing commands that enable carrying out basic design tasks. Layer management, block definition and applying annotations and dimensions are discussed in detail. Learning printing options and parameters supports further design works in the BSc civil engineering program. The aim of the course is to let students understand the potential and capabilities of CAD systems and their applications. The course introduces the basic spatial drawing solutions providing bases for high level courses involving 3D constructions, BIM applications.

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTAT43	Geoinformatics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	TUE:10:15-12:00(K142a);
Laboratory	EN1	English	TUE:10:15-12:00(K142a);
Lecture	EN0	English	MON:14:15-16:00(KM30);

The aim of Geoinformatics is to introduce the principles and potential application fields of geographic information systems (GIS) in the civil engineering practice. The course discusses the basic concepts and applications of GIS, the modelling process needed to create GIS, the reference systems of geometric data, the spatial data sources and data acquisition methods, the aspects of data quality, the resources, tools, databases of GIS, the basics of data analysis, visualization and implementation of GIS. Through the lectures and labs students learn the GIS workflow based on desktop and web-based solutions, and tools of spatial process modelling, data management and web integration.

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMK51	Numerical Methods	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Practice	EN2	English	WED:16:15-18:00(KF30a); FRI:13:15-15:00(KF30a);
Practice	EN1	English	MON:12:15-14:00(KF30a); THU:08:15-10:00(KF30a);

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTPRE1	Basic Informatics	Mid-semester mark	0

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	MON:15:15-17:00(KF30a); THU:12:15-14:00(KF30a);

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT41	Geology	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	TUE:12:15-14:00(K136);
Lecture	EN0	English	MON:12:15-14:00(K136);

The geology provides the characterisation of geological formations and materials from a civil engineering point of view. It describes the processes and the interactions between the engineering works and the geological environment. The dynamics of the Earth, the description of raw materials and geo-materials used in engineering practice (minerals and rocks), the geological risks such as earthquakes, volcanism, landslides and their effect, characterisation of surface and subsurface waters and related geological problems.

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT42	Soil Mechanics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KM21);
Practice	EN1	English	THU:14:15-16:00(KM21);

Origin of soils, soil exploration, soil samples. Components of soils (phase relationships, grain size distribution, consistency limits), soil classification, compaction. Stresses in the soil (under static conditions, conditions of steady vertical flow). Flow of water through soil due gravity (Darcy's law, coefficient of permeability, flow nets). Compressibility of soil (reasons and types of compression). Shear strength of soil (Mohr-Coulomb failure criterion, determination of shearing strength).

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT45	Foundation Engineering	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-17:00(KM21);

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG-2	Environmental Geology	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:10:15-12:00(KM21);
Practice	EN1	English	FRI:12:15-13:00(KM21);

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG63	Numerical Methods in Geotechnics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	FRI:09:15-10:00(KM21);
Lecture	EN0	English	FRI:08:15-09:00(KM21);

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMS52	Soil-structure interaction	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:08:15-10:00(KM78); WED:14:15-16:00(KM78);

Practice	EN1	English	WED:14:15-16:00(KM78);

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-A1	Steel Buildings	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(EL111); THU:10:15-12:00(EL111);
Practice	EN1	English	THU:10:15-12:00(EL111);

Low rise industrial halls. Lattice girders. Crane girders. Design of secondary members (purlins, sheeting). Analysis and design: Principles, analysis and modelling methods, global analysis of frames.Stability analysis and design of steel structures. Floor systems, design of composite floor systems. Joints and connections in steel and composite building structures. Bracing of steel and composite structures. Seismic design of structures. Fire design. Highrise and tall buildings.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-A2	Reinforced Concrete Buildings	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(KF12); TUE:10:15-12:00(EL111);
Practice	EN1	English	TUE:10:15-12:00(EL111);

Formation of reinforced concrete buildings, loads and effects, basics of earthquake design. Plastic behaviour of flat slabs, prestressing. Structural systems of highrise buildings. structural elements of the stiffening systems: shear walls, flat-slabs, cores, frames with masonry infill. Formation of timber halls, sizing of prefabricated prestressed and glued laminated timber structural elements. Masonry structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-B3	Engineering Works	Exam	3

Course type	Course code	Course language	Timetable information
Practice	EN0	English	WED:08:15-10:00(KF12);

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-PP	Structural Design Projectwork	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:10:15-12:00(KF12);

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS41	Steel and Composite Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(EL111);
Practice	EN1	English	MON:12:15-13:00(EL111);

Design specialities of plated steel girders: plate and web buckling phenomena and design according Eurocodes. Design of steel structural members subjected to bending and axial compression – interaction formulae according EC3. Simple joints in steel structures – structural behaviour and design. Structural behaviour of steel and concrete composite members; design of composite beams and columns according EC4.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS42	RC and Masonry Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(K375);
Practice	EN1	English	TUE:10:15-12:00(K375);

Design principles of reinforced concrete slab and frame structures, exact and approximate design methods, structural details. Bracing systems of reinforced concrete buildings, determination of the forces acting to the individual shear walls, checking of stability. Detailing of reinforced concrete structures (beam end, corbel, frame corner, curved bars, stairs, force transfer between members, expansion joints, etc.). Types and strength characteristics of masonry. Design principles of unreinforced masonry walls according to EC6. Reinforced masonry walls.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS43	Bridges and Infrastructures	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-10:00(EL111);

Historical development of bridges. Basic terms of bridges. Classification of bridges. Superstructure systems. Typical superstructures of steel, steel and concrete composite as well as concrete bridges. Composite action between main girders. Basis of bridge design. Traffic load models and their application rules for highway and railway bridges. Testing of bridges. Substructures of bridges: abutments and piers. Bridge equipment. Conceptual design of bridges. Fitting of bridges into environment, bridge aesthetics. Supervision of bridges. Reconstruction and strengthening of bridges. Civil engineering work in traffic infrastructure, systems and hydraulic engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS46	Laboratory Practice of Testing of Structures and Materials	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	TUE:14:15-18:00(EL111); TUE:14:15-18:00(MMFP);

Experimental demonstration the behaviour of the loaded structural members and joints made from different materials (steel, reinforced or prestressed concrete, composite, glass…). Introduction into different experimental and measurement techniques and equipments. Up-to-date building materials and material testing methods. General and specific analytical and diagnostic methods for building materials and structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT41	Basis of Design	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:10:15-12:00(KF12);

Modelling of structures, design process. Selection of structural form and material. Structural model. Thrust line. Probabilistic basics of structural design, partial (safety) factor method. Selection of critical load case, design load. Actions on structures. Material laws. Geometrically linear and nonlinear analysis, Elastic and plastic resistance. Superposition. Limit states. Load-carrying capacity and serviceability. Beams and columns. Design of structures for horizontal actions. Spatial structures. Classification of structures according to their form and static behaviour.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT42	Steel Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:14:15-17:00(KF12);

Lectures of Steel Structures have the general aim to study the basics of the design of steel stuctures, which consists of the design of simple structural members, simple joints and the investigation of the basic failure phenomenon, which can occure in steel structures. The program consists of the following topics: Steel grades, mechanical properties of the steel material. Calculation of cross sectional properties. Design of centrically loaded tension members. Design of Centrically loaded compression members. Buckling problem – behaviour – design method. Design of beams: construction, behaviour under bending and shear interaction. Beam structural behaviour - design approaches for lateral torsional buckling.Design of bolted connections. Design of welded connections. Fatigue design and brittle fracture. Plate buckling phenomena, basics of the cross section classification.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT43	Reinforced Concrete Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:08:15-11:00(EL111);

Structural safety of reinforced concrete (RC) structures; loads and effects on RC strucrures, material properties of concrete and reinforcing steel; moment- curvature relation of RC cross sections; Uncracked and cracked cross section; flexural strength theory, strength and ductility; design of RC cross section; eccentric compression; shear failure in beams without and with shear reinforcement; strength in bending and torsion; anchorage and stress development, bar curtailment; deflection and crack width.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMK51	Methods of Engineering Analysis	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(KM78);
Practice	EN1	English	TUE:10:15-12:00(KM78);

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMS51	Structures 1	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(KM78); THU:10:15-12:00(KM78);
Practice	EN1	English	THU:10:15-12:00(KM78);

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAS42	Structural Analysis II.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(KF12); THU:10:15-12:00(KM30);
Practice	EN1	English	THU:10:15-12:00(KM30);

Problem statements for mechanical problems. Solution with approximative displacement functions, Ritz method. Fundamentals of the finite element method. Fundamentals of matrix analysis and application for computation of structures. Equations of the Euler-Bernoulli beam model. Equations of the Timoshenko beam model. Models of bar structures: equations of truss, grid, planar and spatial frame models. Differential equations of the classical plate theory. Differential equations of the Mindlin plate theory. Analytical solution methods for the equations of plate problems, application of the finite element method. Differential equations of discs in the states of plane stress and plane strain. Analytical solutions of discs problems, application of the finite element method. Derivation of shell models, shell elements of the finite element method.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAS43	Dynamics of Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K376);

Computation of the equivalent mechanical model of structures with a single degree of freedom: stiffness, mass, damping, consideration of friction. Differential equation of motion. Vibration of mechanical systems with a single degree of freedom: free vibration, forced vibrations with harmonic excitation, general excitation, and excitation with support motion for undamped and damped systems. Modeling of systems with multiple degrees of freedom, meaning of the matrices of the system. Differential equation system of motion. Vibrations of mechanical systems with multiple degrees of freedom: free vibration, forced vibrations with harmonic excitation, general excitation, and excitation with support motion. Free vibrations of continua: differential equation of vibrating strings, axial and flexural vibration of beams. Fundamentals of earthquake analysis, response function of structures, meaning and usage of response spectrum.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT41	Basis of Statics and Dynamics	Exam	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	MON:14:15-16:00(KM78); WED:10:15-13:00(KM30);

Classification of mechanics, basic vector operations. Kinematics of particles, description of motion in Cartesian coordinate system. Newton's laws of motion. Concurrent and general force systems in the plane, distributed forces: reduction, resultant, centroid, equilibration. Mechanical work. Planar motion of rigid bodies. Centroid and moment of inertia of rigid bodies. Kinetics of rigid bodies moving in the plane. Linear momentum, angular momentum, theorems of change of kinetic energy for particles and rigid bodies. Constraints. External and internal forces of planar structures and trusses. Statical determinacy. Spatial force systems: reduction, resultant, equilibration. Spatial structures. Internal force diagrams of statically determinate planar bar structures, relationships between internal force diagrams. Sliding friction and rolling resistance.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT42	Introduction to Strength of Materials	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	THU:12:15-14:00(K375);

Internal forces and internal force diagrams of planar and spatial structures (revision, generalization). Moments of inertia and principal directions of planar figures. Strength properties of materials. Concept of stresses and deformations. Material models: linearly elastic material and linerly elastic and perfectly plastic material. Beam element, beam model composed of elastically connected cross-sections. Computation of normal stresses in beams for centric tension/compression, simple bending, skew bending, and tension/compression combined with bending. Computation of shear stresses in beams for pure shearing, torsion, and shearing combined with bending. Eccentric compression of cross-sections of no tension matrials. Shear centre of thin-walled cross-sections. Displacements of bent beams with straight axis. Principal stresses and principal directions.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT43	Structural Analysis I.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(KM30); THU:12:15-14:00(K371);

Principle of small displacements: displacements of rigid body chains using small displacements. Computation of displacements of statically determinate simple and compound structures using displacement equivalency statements. Virtual force systems, concept of virtual complementary work, theorem of virtual forces. Computation of displacements of statically determinate simple and compound structures using the theorem of virtual forces. Influence lines of internal forces and displacements of statically determinate structures. Maximal internal forces. Concept of envelope curves. Computation of statically indeterminate planar structures under fix loads using the force method. Computation of statically indeterminate planar structures under moving load using the force method: influence lines. Computation of statically indeterminate planar structures under fix loads using the displacement method.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN-2	Nonlinear Mechanics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:11:15-13:00(KM78);
Practice	EN1	English	FRI:13:15-15:00(KM78);

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMS51	FEM for Civil Engineers	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:14:15-16:00(KM78);
Practice	EN1	English	WED:10:15-12:00(KM78);

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMST9	Advanced Mechanics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:11:15-13:00(KM78);
Practice	EN1	English	FRI:13:15-15:00(KM78);

Basic variables of nonlinear continuum mechanics, equations of kinematics. Definition of strain, small and large strains, strain tensors. Definition of stress, stress tensors. Thermodynamic conditions of material models, stress and strain pairs, the most important material models for elasto-plastic and time-dependent materials. Basic equations of continuum mechanics, strong and weak forms. Different work and energy theorems, applications. Basic solution methods of equations of continuum mechanics, displacement and force methods, stress functions. Basic mechanical equations of beams, plates and shells.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT41	Railway Tracks	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-15:00(KF99);

Basic concepts of the railway tracks and vehicles, most important technical parameters. Features of normal railways, suburban railways, urban railways, classification of different types of railways. Speed, acceleration, changing of acceleration. Horizontal and vertical alignment of the railway tracks, straights, circular curves and transition curves, superelevation, vertical curves. Elements of the substructure and superstructure. Rails, sleepers, rail fastenings, ballast, subgrade, strengthening of the subgrade. Setting out major and detail points of curves and transition curves. Structures and solutions of dewatering and drainage of railway tracks. Basic concepts of conventional and continuously welded rail tracks. Types of turnouts and simple track connections. Basic concepts of railway stations, platforms, passenger access.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT42	Roads	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-16:00(KF99);

History of transportation. Sustainable transportation and transportation policy. The system of tracks, vehicles and drivers/passengers. Design and behavioural patterns and self-explaining roads. Transport facilities. Elements of the alignment in cross sections, horizontal and vertical alignment. Basic rules and disciplines of planning and design. Transition of superelevation. Planning process: planning, design project, construction, operation. Traffic operation

basics: measures of traffic, traffic operation and management. Intersections and junctions. Urban transportation planning, the concept of accessibility. Characteristics, production and installation of asphalt pavements. Types of tracks, layers, materials. Design of new pavement structures. Construction, management and operation of road networks. Project 1: Authorization plan of a curved section of a secondary main road with transition curves: site plan on a contour line map with long section and cross sections. Drainage, earthwork, road marking. Project 2: Feasibility study of a main road between two point on a contour line map.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT43	Urban and Regional Development	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(KF99);

Infrastructure and Regional Development. Historical construction processes of canals, railways, motorways. Aviation and the internet age. Livable, sustainable cities, regions. Computer aided teamwork. Construction projects, mobility measures; parking regulations. Improving traffic safety, Traffic management and intelligent investments. Basics of Land-Use Planning. Cities with road pricing, congestion pricing. Lessons learned in Oslo, London, Stockholm, Singapore. Calculations with demand curves.The city as a system. [Area, core network]. The morphology of the city. Basics on the the Hungarian settlement system. Development of large cities. Concentration, suburbanization. Fundamentals of urban planning. Case studies: Paris, Budapest – Vienna – Prague.The regional development strategy of the European Union. Steps and documents of the implementation in Hungary. Strategic Environmental Assessments. Monitoring of Environmental Effects.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT44	Theory of Administration, Real Estate Registration	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(K144);

Preparation of major civil engineering projects. Governance of Civil Engineering activities. World-wide examples. Case studies for Public Transport and/or Water Management. Private and public projects. Investments by modern Public Private Partnerships. Lessons on Civil Engineering “Mega-Projects”. [Major Canals, Bridges. Motorways. Channel Tunnel, Oresund Bridge.] Student studies and presentations on actual projects. Public participation. The Role of Civil Organisations. Chamber of Engineers, Institute of Civil Engineers. International Organisations. [PIARC, IRF, UIC, UITP, IABSE, IAHR]. The process of public procurements. Competition and transparency requirements.Authorisitation processes. Participants and stake-holders. Legal and administrative requirements. Environmental Acts, Decrees and Guidelines. Land registry processes and tasks. Real estate valuation. Elementary Cost – Benefit – Analysis. Financing and banking requirements.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKAT41	Basics of Environmental Engineering	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(K389);

The aim of the course is to provide basic scientific and engineering background for further studies in environmental engineering by giving introduction to the following subjects: basics of ecology, the natural cycle of ecologically important elements and substances, the environmental effects of human activities, the ecological footprint, energy consumption patterns and energy production technologies, renewable energy sources. Selected environmental problems associated with civil engineering activities (water, air and soil pollution), with focus on the urban environment. Tools and methods for conducting environmental impact assessment.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKAT42	Public Works I.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(KM31);
Practice	EN1	English	TUE:08:15-10:00(KM31);

The main goal of the subject is to provide information about the most important features of the public works. The subject is also including the connections between the different public works and other establishments. Further aim is to provide knowledge for the future general designers and technical managers to make the right decisions on the underground infrastructure of settlements. Main scopes are: system knowledge and design of different publc work types like water acquisiton, drinking water supply, waste water networks, storm water networks and public works asset management.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAT41	Hydrology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:08:15-10:00(KF10);
Practice	EN1	English	TUE:08:15-10:00(KF10);

The global water cycle. The water balance. Basic elements of hydrometeorology. Evaporation and its main features. The origin of the precipitation, quantitative characteristics, principles of precipitation. Weather, weather conditions, climate. The concept and principles of runoff. Infiltration. runoff estimation on small and large catchments. Elements of hydrography. Exploration of natural streams. Characterisation of subsurface waters and their principles. Characterisation of groundwater regime.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAT42	Hydraulics I.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(KF10);
Practice	EN1	English	TUE:08:15-10:00(KF10);

Physical properties of water. Hydrostatics: pressure distribution, absolute and relative equilibrium. Equilibrium of submerged and floating bodies. The flow of fluids: velocity, discharge, continuity, specific energy head, other properties. Laminar and turbulent motion. Behaviour of ideal and real fluids. Outflow, through-flow. Channel flow. Hydraulic jump, energy breaker. Weirs, sluice-gates. Steady-state flow in pipes. Seepage in porous media. Wells. Turbo-machines.