Study plan

Name of study plan: Stavební inženýrství - materiály a diagnostika staveb

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Civil Engineering - Materials and Diagnostics of Structures
Type of study: Follow-up master full-time
Required credits: 90
Elective courses credits: 0
Sum of credits in the plan: 90
Note on the plan: platí pro nástup od akad. roku 2024/25

Name of the block: Compulsory courses
Minimal number of credits of the block: 40
The role of the block: Z

Code of the group: NM20230100
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, 1. semestr
Requirement credits in the group: In this group you have to gain at least 22 credits
Requirement courses in the group: In this group you have to complete at least 6 courses
Credits in the group: 22
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
123POMI	**Advanced Materials Engineering** *Zbyšek Pavlík, Milena Pavlíková* ***Zbyšek Pavlík*** *Zbyšek Pavlík (Gar.)*	Z,ZK	5	2P+2C	Z	z
102ZMMP	**Basics of Measuring Material Parameters** *Petr Semerák* ***Petr Semerák*** *Petr Semerák (Gar.)*	Z	2	1P+1C	Z	z
132MKOM	**Modelling of Composite Materials** *Michal Šejnoha* ***Michal Šejnoha*** *Michal Šejnoha (Gar.)*	KZ	4	2P+1C	Z	z
101MVD	**Methods for Data Processing** *Daniela Jarušková, Jana Nosková, Jozef Bobok* ***Jana Nosková***	Z,ZK	5	2P+2C	Z	z
210ZKKJ	**Testing and Quality Control** *Jiří Litoš, Radoslav Sovják* ***Radoslav Sovják*** *Jiří Litoš (Gar.)*	ZK	3	2P	Z	z
123DSM	**Degradation of Building Materials** *Alena Vimmrová, Martin Keppert* ***Martin Keppert*** *Alena Vimmrová (Gar.)*	ZK	3	2P	Z	z

Characteristics of the courses of this group of Study Plan: Code=NM20230100 Name=Stavební inženýrství - materiály a diagnostika staveb, 1. semestr

123POMI	Advanced Materials Engineering	Z,ZK	5
102ZMMP	Basics of Measuring Material Parameters	Z	2

Physical basics of measuring electrical and non-electric quantities. Basics of Uncertainty Theory. Processing of measured data. General basics of metrology, quantities and units. Direct measurement of weight, lengths, time and other quantities. Basic principles of electricity. Basic design of analog and digital electrical measuring devices - ammeters, voltmeters. Measurement of non-electric quantities by electrical methods, converters of non-electric quantities (mass, temperature, humidity of air and building materials, deformation, change of position, etc.).

132MKOM	Modelling of Composite Materials	KZ	4

The course introduces the theory of homogenization which allows prediction of effective properties of heterogeneous materials by exploiting both classical micromechanics and numerical modeling of periodic structures. Grounding on the theory of elasticity the students will become familiar with the behavior of general anisotropic materials. Application of theoretical formulations is illustrated on several examples of heterogeneous structures encountered in civil as well as mechanical engineering. Such structures include wood, masonry, asphalt mixtures, fibrous composites, metal foams, etc. Determination of effective elastic (Hooke's law) will be accompanied by homogenization of parameters governing various mass transport processes assuming steady state heat flow (Fourier's law, coefficient of thermal conduction) and moisture (Fick's law, coefficient of diffusion). These basic concepts will be eventually presented in the framework of multi-scale homogenization. The students will also become familiar with the CELP software intended for a quick estimate of properties of mutli-phase material system.

101MVD	Methods for Data Processing	Z,ZK	5

After introductory steps, basic and more advanced methods for hypothesis testing and parameter estimation are presented. Attention is paid to the R language and environment for statistical computing.

210ZKKJ	Testing and Quality Control	ZK	3
Building Testing. Building surveys and survey methodologies. Quality management concept. Quality systems of construction production companies and production of building materials and components. Stages of quality control of projects, construction and finished structures. Principles of internal and external control. Accreditation and certification bodies. Accreditation of testing laboratories. Certification of production quality systems and product certification. The importance of the quality manual and its contents. Interpretation of statistical and non-statistical methods in quality management and control. Quality improvement processes.			
123DSM	Degradation of Building Materials	ZK	3

Code of the group: NM20230200
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, 2. semestr
Requirement credits in the group: In this group you have to gain at least 18 credits
Requirement courses in the group: In this group you have to complete at least 4 courses
Credits in the group: 18
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
210DIIK	**Diagnostics of Engineering Structures** *Jiří Litoš, Radoslav Sovják, Jan Zatloukal, Martin Jonáš, Petr Konvalinka* ***Jiří Litoš*** *Jiří Litoš (Gar.)*	Z,ZK	5	2P+2C	Z,L	z
123DMBD	**Engineered Wood Products** *Martin Böhm* ***Martin Böhm***	Z,ZK	5	2P+2C	L	z
123SIMA	**Silicate Materials** *Milena Pavlíková* ***Milena Pavlíková***	ZK	3	2P	L	z
132VPCK	**Multiscale Description of Cementitious Composites** *Vít Šmilauer, Petr Kabele, Jiří Němeček* ***Vít Šmilauer*** *Vít Šmilauer (Gar.)*	Z,ZK	5	2P+2C	L	z

Characteristics of the courses of this group of Study Plan: Code=NM20230200 Name=Stavební inženýrství - materiály a diagnostika staveb, 2. semestr

210DIIK	Diagnostics of Engineering Structures	Z,ZK	5
The course aims to introduce diagnostics of civil engineering structures, mechanical, thermal, hygric, chemical and others influences of genesis of failure of civil engineering structures, specificaly on engineering structures (bridges, footbridges, halls etc.). During thecourse students will introduce with behavior of engineering structures, structural and material failures, testing devices for diagnostics and data evaluation.			
123DMBD	Engineered Wood Products	Z,ZK	5
The course focuses on the relationship between the structure of wood and its properties. Wood is a renewable raw material that is widely used in the construction industry. However, in addition to its many advantages, wood has disadvantages. In particular, its lower resistance to biological agents, anisotropy and dimensional change with changes in humidity are limiting in terms of its use in construction. Part of the problem discussed is the use of technologies that would reduce the negative properties of wood while maintaining its favorable properties. In addition, the course includes the study and characterization of wood-based materials and the conditions of their use for a wide range of applications in the construction industry.			
123SIMA	Silicate Materials	ZK	3
Silicate materials find applications in many industries. Traditional and modern materials include cement, hydraulic cement, alkaline and active materials, wood, stone, ceramics and stone, hard materials, and unique nanomaterials. They are used for building new, old, and historical objects.			
132VPCK	Multiscale Description of Cementitious Composites	Z,ZK	5
Cement composites (mortars, concretes) form the basis of today's civilization and construction industry. The properties of these composites can be changed in a wide range according to the required properties. The subject presents a multi-scale description of these cement composites, from the atomic scale to the structural scale. It includes an overview of selected experimental methods used to identify elasticity, viscoelasticity, strength, heat of hydration, or chemical composition. Analytical and numerical methods are introduced in the course. The subject is supplemented with a whole range of engineering applications on which these methods have been successfully used: designs and optimization of massive concrete structures, special durable structures, shotcrete, alkali-activated fly ash and fiber-reinforced composites. In the practical section, students will visit the laboratory of electron microscopy, nanoindentation, try out the measurement of temperatures during hydration and the use of finite element software OOFEM to calculate temperatures on massive concrete structures.			

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 16
The role of the block: S

Code of the group: NM20230100_1
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, PV předměty, 1. semestr
Requirement credits in the group: In this group you have to gain at least 8 credits
Requirement courses in the group: In this group you have to complete at least 2 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
101YFAV	**Introduction to Functional Analysis and Variational Methods** *Jozef Bobok, Zdeněk Skalák, Jan Lamač* ***Aleš Nekvinda*** *Aleš Nekvinda (Gar.)*	KZ	2	1P+1C	Z,L	s

123YFCH	**Introduction to Physical Chemistry** *Martin Keppert* ***Martin Keppert*** *Martin Keppert (Gar.)*	KZ	4	2P+1C	Z	S
123YPMP	**Advanced Materials for Construction Practice** *Jan Fořt, Lukáš Fiala* ***Jan Fořt*** *Jan Fořt (Gar.)*	KZ	4	2P+1C	Z	S
123YTPM	**Transport Processes in Materials** *Robert Černý, Jiří Maděra* ***Jiří Maděra*** *Robert Černý (Gar.)*	KZ	4	2P+1C	Z	S
123YTUM	**Sustainable Building Materials** *Martin Böhm, Klára Kobetičová, Jan Fořt* ***Jan Fořt*** *Jan Fořt (Gar.)*	KZ	4	2P+1C	Z	S
132YPRP	**Deformation and Failure of Materials** *Milan Jirásek, Petr Havlásek, Lenka Dohnalová* ***Milan Jirásek*** *Milan Jirásek (Gar.)*	KZ	4	2P+1C	Z	S

Characteristics of the courses of this group of Study Plan: Code=NM20230100_1 Name=Stavební inženýrství - materiály a diagnostika staveb, PV předměty, 1. semestr

101YFAV	Introduction to Functional Analysis and Variational Methods	KZ	2
123YFCH	Introduction to Physical Chemistry	KZ	4
123YPMP	Advanced Materials for Construction Practice	KZ	4
123YTPM	Transport Processes in Materials	KZ	4
123YTUM	Sustainable Building Materials	KZ	4
132YPRP	Deformation and Failure of Materials	KZ	4

Viscoelasticity, models for concrete creep and shrinkage. Theory of plasticity, principles of limit analysis. Fracture mechanics.

Code of the group: NM20230200_1
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, PV předměty, 2. semestr
Requirement credits in the group: In this group you have to gain at least 8 credits
Requirement courses in the group: In this group you have to complete at least 2 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**
102YEMP	**Electrical Measurement Devices** *Petr Semerák* ***Petr Semerák*** *Petr Semerák (Gar.)*	Z	2	1P+1C	L	S
122YTSD	**Technology of Component Production** *Rostislav Šulc* ***Rostislav Šulc*** *Rostislav Šulc (Gar.)*	Z	2	1P+1C	Z,L	S
123YMNM	**Advanced Design Techniques of Building Materials** *Václav Kočí* ***Eva Vejmelková***	Z	4	1P+3C	L	S
132YNAT	**Numerical Analysis of Transport Processes** *Jaroslav Kruis, Tomáš Krejčí* ***Jaroslav Kruis*** *Jaroslav Kruis (Gar.)*	Z	4	2P+2C	L	S
134YPMK	**Design of Membrane Structures** *Svitlana Kalmykova* ***Svitlana Kalmykova*** *Svitlana Kalmykova (Gar.)*	Z	2	1P+1C	L	S
210YMMD	**Measurement Methods in Diagnostics** *Jiří Litoš, Vladimír Šána, Petr Konrád* ***Jiří Litoš*** *Jiří Litoš (Gar.)*	Z	4	2P+2C	L	S
210YSB	**Special Concretes** *Pavel Reiterman, Vendula Kellnerová, Ondřej Holčapek* ***Pavel Reiterman*** *Pavel Reiterman (Gar.)*	Z	2	2P	Z,L	S

Characteristics of the courses of this group of Study Plan: Code=NM20230200_1 Name=Stavební inženýrství - materiály a diagnostika staveb, PV předměty, 2. semestr

102YEMP	Electrical Measurement Devices	Z	2

Principles of experiments, setting up apparatus, monitoring the measured quantity. Standardization and attestation for individual tasks. Indirect measurement of weight, lengths, time and other quantities. Measurement of other non-electric quantities by electrical methods, types of sensors (transducers). Construction of ohmmeters, capacity and inductance meters and other quantities. Measurement using an oscilloscope. Computer-controlled experiment and measurement system, sensor assembly, measuring device, AD converter, computer. Metering stations. Measurement of the coefficient of thermal conductivity and other thermal parameters of building materials.

122YTSD	Technology of Component Production	Z	2
123YMNM	Advanced Design Techniques of Building Materials	Z	4
132YNAT	Numerical Analysis of Transport Processes	Z	4

Studenti se seznámí se základy nejpoužívanějších numerických metod pro řešení stacionárních a nestacionárních úloh vedení tepla a vlhkosti v porézních materiálech jako jsou metoda sítí, metoda konečných prvků, metoda konečných objemů a metoda hraničních prvků. Metodě konečných prvků (MKP) je věnována největší pozornost. Je zde podrobně vysvětlen princip a odvození MKP pro transportní procesy - prostorová a časová diskretizace, konečné prvky - typy, aproximační funkce, numerická integrace. Studenti si procvičí řešení jednoduchých příkladů pomocí MKP a vyzkouší si počítačovou implementaci MKP.

134YPMK	Design of Membrane Structures	Z	2
210YMMD	Measurement Methods in Diagnostics	Z	4

Division of measurement methods. Basics of experimental measurement and instrumentation of tested elements and structures. Theory of experiment, measurement and processing of results. Test methodology of different materials. Strain gauges, design and principles of different types of transducers, application of strain gauges, measuring panels. Static and dynamic load tests of structures, elements and components. Destructive and non-destructive test methods. Diagnostics of building structures. Field trips to the experiment or the building site.

210YSB	Special Concretes	Z	2

This course is aimed at expanding knowledge in the field of special concretes and composites for specific applications. The core of the course is to acquaint students with both the technological aspects of the production, testing and use of special concretes, as well as the applicable legislative framework for individual types of special concretes. Specific practical applications and experiences are also presented within the course.

Name of the block: Povinně volitelné předměty, doporučení S4
Minimal number of credits of the block: 34
The role of the block: S4

Code of the group: NM20230200_2
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, diplomový seminář
Requirement credits in the group: In this group you have to gain at least 4 credits
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 4
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
101DSEM	**Diploma Seminar** *Jozef Bobok*	Z	4	5C	L	S4
102DSEM	**Diploma Seminar**	Z	4	5C	L	S4
122DSEM	**Diploma Seminar**	Z	4	5C	L	S4
123DSEM	**Diploma Seminar** *Eva Vejmelková* ***Eva Vejmelková*** *Eva Vejmelková (Gar.)*	Z	4	5C	L	S4
132DSEM	**Diploma Seminar** *Vít Šmilauer, Jaroslav Kruis, Tomáš Krejčí, Aleš Jíra, Pavel Tesárek* ***Aleš Jíra***	Z	4	5C	L	S4
210DSEM	**Diploma Seminar** *Jiří Litoš, Pavel Reiterman Pavel Reiterman (Gar.)*	Z	4	5C	L	S4

Characteristics of the courses of this group of Study Plan: Code=NM20230200_2 Name=Stavební inženýrství - materiály a diagnostika staveb, diplomový seminář

101DSEM	Diploma Seminar	Z	4
102DSEM	Diploma Seminar	Z	4
122DSEM	Diploma Seminar	Z	4
123DSEM	Diploma Seminar	Z	4
132DSEM	Diploma Seminar	Z	4
210DSEM	Diploma Seminar	Z	4

Code of the group: NM20230300
Name of the group: Stavební inženýrství - materiály a diagnostika staveb, diplomová práce
Requirement credits in the group: In this group you have to gain at least 30 credits
Requirement courses in the group: In this group you have to complete at least 1 course
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
101DPM	**Diploma Thesis** *Daniela Jarušková, Jana Nosková, Michal Beneš, Milan Bořík, Jakub Šolc* ***Jana Nosková*** *Daniela Jarušková (Gar.)*	Z	30	24C	Z	S4
102DPM	**Diploma Thesis** *Petr Pokorný, Václav Nežerka, Pavel Novák* ***Jiří Novák***	Z	30	24C	Z	S4
122DPM	**Diploma Thesis** *Rostislav Šulc, Čeněk Jarský, Pavel Svoboda, Tomáš Váchal, Miloslava Popenková, Pavel Neumann, Vjačeslav Usmanov* ***Tomáš Váchal***	Z	30	24C	Z	S4
123DPM	**Diploma Thesis** *Zbyšek Pavlík, Milena Pavlíková, Alena Vimmrová, Martin Keppert, Klára Kobetičová, Jiří Maděra, Eva Vejmelková, Jitka Krejsová, Zdenka Bažantová, ...* ***Eva Vejmelková*** *Eva Vejmelková (Gar.)*	Z	30	24C	Z	S4
132DPM	**Diploma Thesis** *Michal Šejnoha, Petr Kabele, Milan Jirásek, Petr Havlásek, Aleš Jíra, Pavel Tesárek, Václav Nežerka, Jan Sýkora, Martin Doškář, ...* ***Aleš Jíra***	Z	30	24C	Z	S4

210DPM	**Diploma Thesis** *Jiří Litoš, Radoslav Sovják, Jan Zatloukal, Petr Konvalinka, Pavel Reiterman, Michal Mára, Jindřich Fornůsek, Karel Kolář, Petr Máca* ***Jiří Litoš*** *Jiří Litoš (Gar.)*	Z	30	24C	Z	S4

Characteristics of the courses of this group of Study Plan: Code=NM20230300 Name=Stavební inženýrství - materiály a diagnostika staveb, diplomová práce

101DPM	Diploma Thesis	Z	30
Please contact your teacher or guarantor of this subject.			
102DPM	Diploma Thesis	Z	30
In accordance with the thesis proposal.			
122DPM	Diploma Thesis	Z	30
123DPM	Diploma Thesis	Z	30
In accordance with the thesis proposal.			
132DPM	Diploma Thesis	Z	30
In accordance with the thesis proposal.			
210DPM	Diploma Thesis	Z	30
Students will get the opportunity to organize complex process of experimental work from the beginning of production, experimental investigation to of the data. Thesis are designed to fit scientific and research activity of the Experimental Centre			

List of courses of this pass:

Code	Name of the course	Completion	Credits
101DPM	Diploma Thesis	Z	30
Please contact your teacher or guarantor of this subject.			
101DSEM	Diploma Seminar	Z	4
101MVD	Methods for Data Processing	Z,ZK	5
After introductory steps, basic and more advanced methods for hypothesis testing and parameter estimation are presented. Attention is paid to the R language and environment for statistical computing.			
101YFAV	Introduction to Functional Analysis and Variational Methods	KZ	2
102DPM	Diploma Thesis	Z	30
In accordance with the thesis proposal.			
102DSEM	Diploma Seminar	Z	4
102YEMP	Electrical Measurement Devices	Z	2
Principles of experiments, setting up apparatus, monitoring the measured quantity. Standardization and attestation for individual tasks. Indirect measurement of weight, lengths, time and other quantities. Measurement of other non-electric quantities by electrical methods, types of sensors (transducers). Construction of ohmmeters, capacity and inductance meters and other quantities. Measurement using an oscilloscope. Computer-controlled experiment and measurement system, sensor assembly, measuring device, AD converter, computer. Metering stations. Measurement of the coefficient of thermal conductivity and other thermal parameters of building materials.			
102ZMMP	Basics of Measuring Material Parameters	Z	2
Physical basics of measuring electrical and non-electric quantities. Basics of Uncertainty Theory. Processing of measured data. General basics of metrology, quantities and units. Direct measurement of weight, lengths, time and other quantities. Basic principles of electricity. Basic design of analog and digital electrical measuring devices - ammeters, voltmeters. Measurement of non-electric quantities by electrical methods, converters of non-electric quantities (mass, temperature, humidity of air and building materials, deformation, change of position, etc.).			
122DPM	Diploma Thesis	Z	30
122DSEM	Diploma Seminar	Z	4
122YTSD	Technology of Component Production	Z	2
123DMBD	Engineered Wood Products	Z,ZK	5
The course focuses on the relationship between the structure of wood and its properties. Wood is a renewable raw material that is widely used in the construction industry. However, in addition to its many advantages, wood has disadvantages. In particular, its lower resistance to biological agents, anisotropy and dimensional change with changes in humidity are limiting in terms of its use in construction. Part of the problem discussed is the use of technologies that would reduce the negative properties of wood while maintaining its favorable properties. In addition, the course includes the study and characterization of wood-based materials and the conditions of their use for a wide range of applications in the construction industry.			
123DPM	Diploma Thesis	Z	30
In accordance with the thesis proposal.			
123DSEM	Diploma Seminar	Z	4
123DSM	Degradation of Building Materials	ZK	3
123POMI	Advanced Materials Engineering	Z,ZK	5
123SIMA	Silicate Materials	ZK	3
Silicate materials find applications in many industries. Traditional and modern materials include cement, hydraulic cement, alkaline and active materials, wood, stone, ceramics and stone, hard materials, and unique nanomaterials. They are used for building new, old, and historical objects.			
123YFCH	Introduction to Physical Chemistry	KZ	4
123YMNM	Advanced Design Techniques of Building Materials	Z	4
123YPMP	Advanced Materials for Construction Practice	KZ	4
123YTPM	Transport Processes in Materials	KZ	4
123YTUM	Sustainable Building Materials	KZ	4

132DPM	Diploma Thesis	Z	30
	In accordance with the thesis proposal.		
132DSEM	Diploma Seminar	Z	4
132MKOM	Modelling of Composite Materials	KZ	4
	The course introduces the theory of homogenization which allows prediction of effective properties of heterogeneous materials by exploiting both classical micromechanics and numerical modeling of periodic structures. Grounding on the theory of elasticity the students will become familiar with the behavior of general anisotropic materials. Application of theoretical formulations is illustrated on several examples of heterogeneous structures encountered in civil as well as mechanical engineering. Such structures include wood, masonry, asphalt mixtures, fibrous composites, metal foams, etc. Determination of effective elastic (Hooke's law) will be accompanied by homogenization of parameters governing various mass transport processes assuming steady state heat flow (Fourier's law, coefficient of thermal conduction) and moisture (Fick's law, coefficient of diffusion). These basic concepts will be eventually presented in the framework of multi-scale homogenization. The students will also become familiar with the CELP software intended for a quick estimate of properties of mutli-phase material system.		
132VPCK	Multiscale Description of Cementitious Composites	Z,ZK	5
	Cement composites (mortars, concretes) form the basis of today's civilization and construction industry. The properties of these composites can be changed in a wide range according to the required properties. The subject presents a multi-scale description of these cement composites, from the atomic scale to the structural scale. It includes an overview of selected experimental methods used to identify elasticity, viscoelasticity, strength, heat of hydration, or chemical composition. Analytical and numerical methods are introduced in the course. The subject is supplemented with a whole range of engineering applications on which these methods have been successfully used: designs and optimization of massive concrete structures, special durable structures, shotcrete, alkali-activated fly ash and fiber-reinforced composites. In the practical section, students will visit the laboratory of electron microscopy, nanoindentation, try out the measurement of temperatures during hydration and the use of finite element software OOFEM to calculate temperatures on massive concrete structures.		
132YNAT	Numerical Analysis of Transport Processes	Z	4
	Studenti se seznámí se základy nejpoužívanějších numerických metod pro řešení stacionárních a nestacionárních úloh vedení tepla a vlhkosti v porézních materiálech jako jsou metoda sítí, metoda konečných prvků, metoda konečných objemů a metoda hraničních prvků. Metodě konečných prvků (MKP) je věnována největší pozornost. Je zde podrobně vysvětlen princip a odvození MKP pro transportní procesy - prostorová a časová diskretizace, konečné prvky - typy, aproximační funkce, numerická integrace. Studenti si procvičí řešení jednoduchých příkladů pomocí MKP a vyzkouší si počítačovou implementaci MKP.		
132YPRP	Deformation and Failure of Materials	KZ	4
	Viscoelasticity, models for concrete creep and shrinkage. Theory of plasticity, principles of limit analysis. Fracture mechanics.		
134YPMK	Design of Membrane Structures	Z	2
210DIIK	Diagnostics of Engineering Structures	Z,ZK	5
	The course aims to introduce diagnostics of civil engineering structures, mechanical, thermal, hygric, chemical and others influences of genesis of failure of civil engineering structures, specificaly on engineering structures (bridges, footbridges, halls etc.). During thecourse students will introduce with behavior of engineering structures, structural and material failures, testing devices for diagnostics and data evaluation.		
210DPM	Diploma Thesis	Z	30
	Students will get the opportunity to organize complex process of experimental work from the beginning of production, experimental investigation to of the data. Thesis are designed to fit scientific and research activity of the Experimental Centre		
210DSEM	Diploma Seminar	Z	4
210YMMD	Measurement Methods in Diagnostics	Z	4
	Division of measurement methods. Basics of experimental measurement and instrumentation of tested elements and structures. Theory of experiment, measurement and processing of results. Test methodology of different materials. Strain gauges, design and principles of different types of transducers, application of strain gauges, measuring panels. Static and dynamic load tests of structures, elements and components. Destructive and non-destructive test methods. Diagnostics of building structures. Field trips to the experiment or the building site.		
210YSB	Special Concretes	Z	2
	This course is aimed at expanding knowledge in the field of special concretes and composites for specific applications. The core of the course is to acquaint students with both the technological aspects of the production, testing and use of special concretes, as well as the applicable legislative framework for individual types of special concretes. Specific practical applications and experiences are also presented within the course.		
210ZKKJ	Testing and Quality Control	ZK	3
	Building Testing. Building surveys and survey methodologies. Quality management concept. Quality systems of construction production companies and production of building materials and components. Stages of quality control of projects, construction and finished structures. Principles of internal and external control. Accreditation and certification bodies. Accreditation of testing laboratories. Certification of production quality systems and product certification. The importance of the quality manual and its contents. Interpretation of statistical and non-statistical methods in quality management and control. Quality improvement processes.		

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