Study plan

Name of study plan: Budovy a prostředí, specializace Stavební fyzika

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Buildings and Environment
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 2023/24

Name of the block: Compulsory courses
Minimal number of credits of the block: 53
The role of the block: Z

Code of the group: NB20230100
Name of the group: Budovy a prostředí, společná část, 1. semestr
Requirement credits in the group: In this group you have to gain at least 17 credits
Requirement courses in the group: In this group you have to complete at least 5 courses
Credits in the group: 17
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
101APM	**Applied Mathematics** *Petr Kučera, Petr Mayer, Jozef Bobok, Iva Malechová, Zdeněk Skalák* ***Zdeněk Skalák*** *Petr Kučera (Gar.)*	Z,ZK	3	1P+1C	Z	z
102FYZB	**Thermomechanics** *Vítězslav Vydra* ***Vítězslav Vydra*** *Vítězslav Vydra (Gar.)*	Z	2	2P	Z	z
124SF2B	**Building Physics 2** *Zbyněk Svoboda, Jaroslav Vychytil* ***Jaroslav Vychytil*** *Zbyněk Svoboda (Gar.)*	Z,ZK	4	2P+2C	Z	z
125SYB	**Building Systems** *Karel Kabele, Jan Tywoniak* ***Karel Kabele*** *Karel Kabele (Gar.)*	ZK	4	4P	Z	z
125VVKB	**Heating, Ventilation and Air Conditioning of Buildings** *Karel Kabele, Daniel Adamovský, Michal Kabrhel, Miroslav Urban* ***Karel Kabele*** *Karel Kabele (Gar.)*	ZK	4	4P	Z	z

Characteristics of the courses of this group of Study Plan: Code=NB20230100 Name=Budovy a prostředí, společná část, 1. semestr

101APM	Applied Mathematics	Z,ZK	3

basic concepts of differential and integral calculus of functions of one and more real variables, basic concepts from linear algebra, solutions of systems of liner algebraic equations, boundary problems for ordinary and partial differential equations (ODE,PDE), concept of classical solution, weak formulations of boundary problems, weak solutions, Lax-Milgram lemma, existence of weak solution, boundary problems for linear ODE of second order with mixed boundary conditions, relation between classial and weak solution, regularity of weak solutions, finite difference method, finite element method for solutions of boundary problems, solution of Laplace's and Poisson's equations by finite difference method, solution of heat equation by finite difference method, one-dimensional case, solution of heat equation by finite difference method, two-dimensional case, solution of heat equation by finite element method, one-dimensional case.

102FYZB	Thermomechanics	Z	2

This course will concentrate on basic principles of transport of heat and mass (conduction, convection, radiation, heat pumps; transport of moist in building materials) with practical examples such as heat loss of a pipe, solar heating/cooling systems and heat loss thru a window (two plates of glass with a gas between). An excursion to a large solar-cooling installation with a solar-powered heat pump is a part of the course.

124SF2B	Building Physics 2	Z,ZK	4

Extension and supplementation of knowledge from the basic course in building physics. Detailed analysis of boundary conditions for calculations, governing equations, thermal transmittance of windows and curtain walls, linear and point thermal transmittance, ventilated constructions, energy performance of buildings, thermal protection of historic buildings, complex thermal engineering problems. Sunlight and solar radiation, effect of size and position of lighting aperture, effect of pre-set structures on lighting, choice of surface colours, risk of glare, sound insulation, calculation of sound insulation, sound propagation in building interiors, importance of absorptive and reflective properties of building structures, noise reduction by structural design, sound propagation from building to exterior, necessary properties of designed screens.

125SYB	Building Systems	ZK	4

Multi-criteria analysis of the requirements for the indoor environment and the function of the systems in different types of buildings and plants and optimization criteria for the design of energy and ecological building systems. Relationships between building technical equipment and the building. Integrated view of conceptual solutions in different building types in terms of indoor systems and building design. E.g. office buildings, residential buildings, halls, shopping centres, cultural centres, industrial buildings, sports buildings, family houses, passive etc. The audience will be introduced to the requirements for the indoor environment, the characteristic elements of energy and environmental building systems in relation to the structural design for the building type.

125VVKB	Heating, Ventilation and Air Conditioning of Buildings	ZK	4

An advanced course in heating, ventilation and air conditioning of buildings focused on the integrated design and operation of technical systems for the production, transformation and distribution of energy in buildings to ensure thermal comfort, air quality and optimum indoor environment with minimal environmental impact. Knowledge at the level of undergraduate basic courses in heating and ventilation is assumed for graduation).

Code of the group: NB20230200
Name of the group: Budovy a prostředí, společná část, 2. semestr
Requirement credits in the group: In this group you have to gain at least 6 credits
Requirement courses in the group: In this group you have to complete at least 2 courses
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
124INB1	**Integrated Design of Buildings** *Jan Růžička, Jan Pešta, Martin Volf, Tereza Pavlů, Petr Hájek, Antonín Lupíšek **Tereza Pavlů** Petr Hájek (Gar.)*	Z,ZK	3	2P+1C	L	z
125EABB	**Energy Audit of Buildings** *Karel Kabele, Michal Kabrhel, Miroslav Urban **Karel Kabele** Karel Kabele (Gar.)*	Z,ZK	3	2P+1C	L	z

Characteristics of the courses of this group of Study Plan: Code=NB20230200 Name=Budovy a prostředí, společná část, 2. semestr

124INB1	Integrated Design of Buildings	Z,ZK	3

The main objective of the subject Integrated Building Design is to get an complex overview of the principles of integrated buildings design, life cycle assessment of buildings, evaluation of building performance, green/sustainable certification systems and understand environmental, social and economic aspects of the built environment.

125EABB	Energy Audit of Buildings	Z,ZK	3

Advanced course for introduction into energy auditing. Lectures topics: Energy audit and energy performance of buildings, legislation. EPDB - energy performance directive for buildings. Methodology of calculating energy performance of buildings. Energy audit - procedure and parts. Sankey energy flow diagram. Analysis of initial condition, description of initial condition object survey and survey of project documentation. Determining source efficiency, distribution and emission of heat. Steps towards reduction of energy consumption - building, heating, lighting, ventilating systems, technologies. Application of measures on a specific object. Synergic impact of energy saving measures. Economical evaluation, evaluation from the aspect of environment protection. Evaluation - emission Individual object survey. Energy audit of industrial objects.Methods of buildings evaluation. Seminar is focused on the realistic buildings resulting to presenting case study report about energy audit of existing building.

Code of the group: NB20230302
Name of the group: Stavební fyzika, 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
124DPM	**Diploma Thesis** *Kateřina Mertenová, Jiří Pazderka, Tomáš Vlach, Tomáš Čejka, Martin Jiránek, Marek Pokorný **Jiří Pazderka** Jiří Pazderka (Gar.)*	Z	30	24C	Z	z

Characteristics of the courses of this group of Study Plan: Code=NB20230302 Name=Stavební fyzika, diplomová práce

124DPM	Diploma Thesis	Z	30

The topics of diploma theses are based on the needs of practice or the scientific research activity of the department, the scope and difficulty corresponds to the student's knowledge acquired during the master's studies. The supervisor of the thesis can designate additional consultants to the student.

Name of the block: Compulsory courses in the specialization
Minimal number of credits of the block: 33
The role of the block: PS

Code of the group: NB20230102_1
Name of the group: Stavební fyzika, předměty specializace, 1. semestr
Requirement credits in the group: In this group you have to gain at least 13 credits

Requirement courses in the group: In this group you have to complete at least 4 courses
Credits in the group: 13
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
124MAKO	**Materials and Building Envelopes** *Pavel Kopecký **Pavel Kopecký** Pavel Kopecký (Gar.)*	KZ	3	1P+2C	Z	PS
124MTTV	**Measurement of Thermal Quantities** *Jiří Novák **Jiří Novák** Jiří Novák (Gar.)*	Z	3	1P+1C	Z	PS
124SDET	**Construction Detail** *Kateřina Mertenová **Kateřina Mertenová** Kateřina Mertenová (Gar.)*	KZ	3	2C	Z	PS
124SPB1	**Specialized Project Design 1** *Jan Tywoniak, Jan Růžička, Kateřina Mertenová, Ctislav Fiala **Kateřina Mertenová** Kateřina Mertenová (Gar.)*	KZ	4	3C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=NB20230102_1 Name=Stavební fyzika, předměty specializace, 1. semestr

124MAKO	Materials and Building Envelopes	KZ	3

Most defects of the building enclosures are the result of internal stresses from volumetric changes of materials caused by the action of non-force loads, for example periodic changes of temperature or moisture content. As a result, such defects decrease the durability and reliability of building components. This subject attempts to combine construction mechanics with hygro-thermal performance of buildings and material engineering. It deals with the effect of climatic loads on the building envelope and physical processes taking place in the building envelope (transfer of heat, moisture and air) related to those climatic loads.

124MTTV	Measurement of Thermal Quantities	Z	3

This course provides an introduction into measurement methods used in building physics. The course consists of three blocks. The first block introduces elementary knowledge in statistics and theory o measurement as a background necessary for processing of measured data, estimation of measurement uncertainty and interpretation of the measurement result. The second block is focused on methods used for measurement of thermal quantities. The physical principles, typical application and limits of selected methods are presented. The third block introduces typical tasks of building design and construction process which solution involves measurement of thermal quantities. Practical classes consist of theoretical exercises of data processing and analysis, laboratory experiments including measurement and evaluation of measured results, educational tours and demonstrations of selected measurement methods.

124SDET	Construction Detail	KZ	3

The aim of the subject is to acquire complex skills in the creating of construction details of energy-efficient buildings and their thermal technical assessment. The specific selection of processed details will correspond to the type of building, however, it will always take into account the main problem areas on the system boundary of the building and the connection of various structures where thermal bridges could occur. Emphasis will be placed on: - the complexity of the solution - the structural logic of the connection of particuler parts of the building envelope - the practical feasibility and durability of the detail - elimination of thermal bridges - thermal and humidity assessment of the detail (2D or 3D heat conduction) following the energy assessment of the entire building - ensuring the airtightness of the building envelope with regard to practical feasibility (variants of materials and connections of airtightness layer) - compliance with architectural expression / aesthetic principles It is possible to link the subject to the Specialized Project 1, in which the design of the building will be optimized in particular from the point of view of: - structural, technological and material (including environmental analysis) - thermal technical (system boundary, design of the thermal envelope) - creating a high-quality indoor microclimate (air exchange, acoustics, lighting, sunlight, overheating)

124SPB1	Specialized Project Design 1	KZ	4

The purpose of the course is to gain practical experience in particular tasks with the application of the basic principles of integrated design, the conceptual solution of the building and its optimization from the point of view of: - structural, technological and material (including environmental analysis) - thermal technical (system boundary, design of the building envelope, assessment of structural components) - creating a high-quality indoor microclimate (air exchange, acoustics, lighting, sunlight, overheating, elimination of thermal bridges) - technical systems (energy and resource management). Increased emphasis is placed on the assessment of the structural and physical properties of structures and internal environment. Students are motivated to acquire basic engineering skills when solving topics dealing with the issue of environmentally and energy-optimized buildings and ecological architecture, such as: - formulation of the problem - proposal of its solution in variants - evaluation of particular variants and selection of the optimal solution. This is an independent work in the studio: "Conceptual solution of a building or a set of buildings". The assignment is based on a completed architectural study.

Code of the group: NB20230202_1
Name of the group: Stavební fyzika, předměty specializace, 2. semestr
Requirement credits in the group: In this group you have to gain at least 20 credits
Requirement courses in the group: In this group you have to complete at least 6 courses
Credits in the group: 20
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
124AKUB	**Acoustics of Buildings** *Jaroslav Vychytil, Jiří Nováček **Jiří Nováček** Jiří Nováček (Gar.)*	Z,ZK	4	1P+2C	L	PS
124DOSB	**Daylight in Buildings** *Jaroslav Vychytil, Lenka Maierová **Lenka Maierová** Jaroslav Vychytil (Gar.)*	Z,ZK	4	1P+2C	L	PS
124MAKV	**Measurement of Acoustic Quantities** *Jiří Nováček **Jiří Nováček** Jiří Nováček (Gar.)*	Z	2	1P+1C	L	PS
124MDO	**Measurement of Daylighting** *Jaroslav Vychytil **Jaroslav Vychytil** Jaroslav Vychytil (Gar.)*	Z	2	1P+1C	L	PS
124TEOB	**Thermal Protection of Buildings** *Zbyněk Svoboda **Zbyněk Svoboda** Zbyněk Svoboda (Gar.)*	Z,ZK	4	1P+2C	L	PS

124SP2B	**Specialized design project 2** *Jan Tywoniak, Miroslav Urban* ***Jan Růžička***	KZ	4	3C	L	PS

Characteristics of the courses of this group of Study Plan: Code=NB20230202_1 Name=Stavební fyzika, předměty specializace, 2. semestr

124AKUB	Acoustics of Buildings	Z,ZK	4
Students will significantly expand the basic knowledge of building acoustics that they have acquired during their undergraduate studies. The follow-up course is aimed not only at a more detailed explanation and practice of the basic topics, but also at expanding them to new topics that the building physics specialist or acoustician commonly encounters in building practice.			
124DOSB	Daylight in Buildings	Z,ZK	4
Determining the position of the Sun in the sky using numerical methods. Plotting the position of the sun in various solar diagrams. Sunlight in residential and other specific spaces. Specifics of assessment and marginal conditions according to the Czech vs. European standards. Definition of cosine radiator and daylight factor, use in determining the amount of daylight in simple situations. Daylighting requirements depending on the purpose of the space. Necessary properties of sky, lighting aperture and shading obstruction. Possibilities of determining the individual components of the daylight factor. Daylight access to the facade of the building. Evaluation and calculation of overhead lighting.			
124MAKV	Measurement of Acoustic Quantities	Z	2
Within the course, students will be introduced to selected measurement methods used in the field of building acoustics in both theoretical and practical terms. The experience gained will help them to better understand the topics discussed in the basic acoustics courses and at the same time better adaptation in building physics practice.			
124MDO	Measurement of Daylighting	Z	2
The course expands the knowledge of daylighting obtained mainly in the compulsory subjects 124SF1, 124SF01 and 124SFA1 and in the optional subject 124XSFO. Students will become familiar with the principles and necessary conditions for measuring daylight and light-technical properties of selected building elements. Specifically, this is the measurement of illuminance in a network of control points, on a horizontal, inclined and vertical plane, measurement of the light reflection factor, pollution of the lighting hole and the like. Students can later use this knowledge in the design of the structure in terms of its reflective properties, the size of the lighting holes, the direction of the light flow, color and the like.			
124TEOB	Thermal Protection of Buildings	Z,ZK	4
Detailed information for future building physics specialists in the field of thermal and moisture behaviour of structures and buildings. Methods of preparing input data for calculations, transient models of thermal and moisture behaviour of structures, use of simulation models of structures in practice, multidimensional heat transfer and its use for more accurate determination of properties of structures (thermal transmittance of curtain walls and windows, linear thermal transmittance of point facade anchors, etc.). Fundamentals of CFD modelling (heat transfer by conduction, radiation and convection in building structures and buildings).			
124SP2B	Specialized design project 2	KZ	4
The subject of the Special Design Studio SPB2 is a complex material,s tructural and technology design of a building with respect to the principals of sustainable building.			

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 4
The role of the block: PV

Code of the group: NB20230202_2
Name of the group: Stavební fyzika, PV předměty, 2. semestr
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 2 courses
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
124YMMF	**Mathematical Modelling in Building Physics** ***Pavel Kopecký***	Z	2	1P+1C	L	PV
125YUOB	**Artifical illumination** *Bohumír Garlík, Pavla Dvořáková* ***Pavla Dvořáková*** *Pavla Dvořáková (Gar.)*	Z	2	1P+1C	L	PV
143APE	**Applied Ecology** *Tomáš Dostál* ***Tomáš Dostál*** *Tomáš Dostál (Gar.)*	Z	2	2P	L	PV
124YPRM	**Natural and Recycled Building Materials** *Jan Růžička, Martin Volf, Tereza Pavlů* ***Tereza Pavlů*** *Tereza Pavlů (Gar.)*	Z	2	1P+1C	L	PV
125YOZE	**Renewable Energy Sources** *Michal Kabrhel* ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	Z	2	2P	L	PV

Characteristics of the courses of this group of Study Plan: Code=NB20230202_2 Name=Stavební fyzika, PV předměty, 2. semestr

124YMMF	Mathematical Modelling in Building Physics	Z	2
Students learn how to establish computational models of dynamic systems in building physics (heat and moisture transfer in buildings and building components). The emphasis is on introducing the principles of numerical solutions, their application and critical evaluation of the calculated results.			
125YUOB	Artifical illumination	Z	2
The course provides a basic introduction to artificial lighting. Lighting technical quantities and related calculations are included. The theoretical principles of indoor lighting and lighting systems are discussed with application to various types of buildings and plants. Students are introduced to an overview of light sources and luminaires and their characteristics. Power, control and management and maintenance of lighting systems are also discussed along with energy consumption. There is also basic information on emergency lighting and outdoor lighting. Excursions are also part of the teaching. During the tutorials, a lighting project (plus electrical) is designed for a given space using the DIALux evo software.			
143APE	Applied Ecology	Z	2
Learning basic of ecological terminology, landscape ecology and ecological stability. Energy flow in the different ecosystems.			
124YPRM	Natural and Recycled Building Materials	Z	2

125YOZE	Renewable Energy Sources	Z	2

The course deals with renewable energy sources and building energy systems. The different types of energy-solar, wind, biomass, geothermal and hydro-are discussed in detail. The characteristics of the energies and the most appropriate methods of use are described. Attention is paid to understanding the correct way to design facilities and systems that use renewable energy sources.

List of courses of this pass:

Code	Name of the course	Completion	Credits
101APM	Applied Mathematics	Z,ZK	3

basic concepts of differential and integral calculus of functions of one and more real variables, basic concepts from linear algebra, solutions of systems of liner algebraic equations, boundary problems for ordinary and partial differential equations (ODE,PDE), concept of classical solution, weak formulations of boundary problems, weak solutions, Lax-Milgram lemma, existence of weak solution, boundary problems for linear ODE of second order with mixed boundary conditions, relation between classial and weak solution, regularity of weak solutions, finite difference method, finite element method for solutions of boundary problems, solution of Laplace's and Poisson's equations by finite difference method, solution of heat equation by finite difference method, one-dimensional case, solution of heat equation by finite difference method, two-dimensional case, solution of heat equation by finite element method, one-dimensional case.

102FYZB	Thermomechanics	Z	2

This course will concentrate on basic principles of transport of heat and mass (conduction, convection, radiation, heat pumps; transport of moist in building materials) with practical examples such as heat loss of a pipe, solar heating/cooling systems and heat loss thru a window (two plates of glass with a gas between). An excursion to a large solar-cooling installation with a solar-powered heat pump is a part of the course.

124AKUB	Acoustics of Buildings	Z,ZK	4

Students will significantly expand the basic knowledge of building acoustics that they have acquired during their undergraduate studies. The follow-up course is aimed not only at a more detailed explanation and practice of the basic topics, but also at expanding them to new topics that the building physics specialist or acoustician commonly encounters in building practice.

124DOSB	Daylight in Buildings	Z,ZK	4

Determining the position of the Sun in the sky using numerical methods. Plotting the position of the sun in various solar diagrams. Sunlight in residential and other specific spaces. Specifics of assessment and marginal conditions according to the Czech vs. European standards. Definition of cosine radiator and daylight factor, use in determining the amount of daylight in simple situations. Daylighting requirements depending on the purpose of the space. Necessary properties of sky, lighting aperture and shading obstruction. Possibilities of determining the individual components of the daylight factor. Daylight access to the facade of the building. Evaluation and calculation of overhead lighting.

124DPM	Diploma Thesis	Z	30

The topics of diploma theses are based on the needs of practice or the scientific research activity of the department, the scope and difficulty corresponds to the student's knowledge acquired during the master's studies. The supervisor of the thesis can designate additional consultants to the student.

124INB1	Integrated Design of Buildings	Z,ZK	3

The main objective of the subject Integrated Building Design is to get an complex overview of the principles of integrated buildings design, life cycle assessment of buildings, evaluation of building performance, green/sustainable certification systems and understand environmental, social and economic aspects of the built environment.

124MAKO	Materials and Building Envelopes	KZ	3

Most defects of the building enclosures are the result of internal stresses from volumetric changes of materials caused by the action of non-force loads, for example periodic changes of temperature or moisture content. As a result, such defects decrease the durability and reliability of building components. This subject attempts to combine construction mechanics with hygro-thermal performance of buildings and material engineering. It deals with the effect of climatic loads on the building envelope and physical processes taking place in the building envelope (transfer of heat, moisture and air) related to those climatic loads.

124MAKV	Measurement of Acoustic Quantities	Z	2

Within the course, students will be introduced to selected measurement methods used in the field of building acoustics in both theoretical and practical terms. The experience gained will help them to better understand the topics discussed in the basic acoustics courses and at the same time better adaptation in building physics practice.

124MDO	Measurement of Daylighting	Z	2

The course expands the knowledge of daylighting obtained mainly in the compulsory subjects 124SF1, 124SF01 and 124SFA1 and in the optional subject 124XSFO. Students will become familiar with the principles and necessary conditions for measuring daylight and light-technical properties of selected building elements. Specifically, this is the measurement of illuminance in a network of control points, on a horizontal, inclined and vertical plane, measurement of the light reflection factor, pollution of the lighting hole and the like. Students can later use this knowledge in the design of the structure in terms of its reflective properties, the size of the lighting holes, the direction of the light flow, color and the like.

124MTTV	Measurement of Thermal Quantities	Z	3

This course provides an introduction into measurement methods used in building physics. The course consists of three blocks. The first block introduces elementary knowledge in statistics and theory o measurement as a background necessary for processing of measured data, estimation of measurement uncertainty and interpretation of the measurement result. The second block is focused on methods used for measurement of thermal quantities. The physical principles, typical application and limits of selected methods are presented. The third block introduces typical tasks of building design and construction process which solution involves measurement of thermal quantities. Practical classes consist of theoretical exercises of data processing and analysis, laboratory experiments including measurement and evaluation of measured results, educational tours and demonstrations of selected measurement methods.

124SDET	Construction Detail	KZ	3

The aim of the subject is to acquire complex skills in the creating of construction details of energy-efficient buildings and their thermal technical assessment. The specific selection of processed details will correspond to the type of building, however, it will always take into account the main problem areas on the system boundary of the building and the connection of various structures where thermal bridges could occur. Emphasis will be placed on: - the complexity of the solution - the structural logic of the connection of particuler parts of the building envelope - the practical feasibility and durability of the detail - elimination of thermal bridges - thermal and humidity assessment of the detail (2D or 3D heat conduction) following the energy assessment of the entire building - ensuring the airtightness of the building envelope with regard to practical feasibility (variants of materials and connections of airtightness layer) - compliance with architectural expression / aesthetic principles It is possible to link the subject to the Specialized Project 1, in which the design of the building will be optimized in particular from the point of view of: - structural, technological and material (including environmental analysis) - thermal technical (system boundary, design of the thermal envelope) - creating a high-quality indoor microclimate (air exchange, acoustics, lighting, sunlight, overheating)

124SF2B	Building Physics 2	Z,ZK	4

Extension and supplementation of knowledge from the basic course in building physics. Detailed analysis of boundary conditions for calculations, governing equations, thermal transmittance of windows and curtain walls, linear and point thermal transmittance, ventilated constructions, energy performance of buildings, thermal protection of historic buildings, complex thermal engineering problems. Sunlight and solar radiation, effect of size and position of lighting aperture, effect of pre-set structures on lighting, choice of surface colours,

	risk of glare, sound insulation, calculation of sound insulation, sound propagation in building interiors, importance of absorptive and reflective properties of building structures, noise reduction by structural design, sound propagation from building to exterior, necessary properties of designed screens.		
124SP2B	Specialized design project 2	KZ	4
	The subject of the Special Design Studio SPB2 is a complex material,s tructural and technology design of a building with respect to the principals of sustainable building.		
124SPB1	Specialized Project Design 1	KZ	4
	The purpose of the course is to gain practical experience in particular tasks with the application of the basic principles of integrated design, the conceptual solution of the building and its optimization from the point of view of: - structural, technological and material (including environmental analysis) - thermal technical (system boundary, design of the building envelope, assessment of structural components) - creating a high-quality indoor microclimate (air exchange, acoustics, lighting, sunlight, overheating, elimination of thermal bridges) - technical systems (energy and resource management). Increased emphasis is placed on the assessment of the structural and physical properties of structures and internal environment. Students are motivated to acquire basic engineering skills when solving topics dealing with the issue of environmentally and energy-optimized buildings and ecological architecture, such as: - formulation of the problem - proposal of its solution in variants - evaluation of particular variants and selection of the optimal solution. This is an independent work in the studio: "Conceptual solution of a building or a set of buildings". The assignment is based on a completed architectural study.		
124TEOB	Thermal Protection of Buildings	Z,ZK	4
	Detailed information for future building physics specialists in the field of thermal and moisture behaviour of structures and buildings. Methods of preparing input data for calculations, transient models of thermal and moisture behaviour of structures, use of simulation models of structures in practice, multidimensional heat transfer and its use for more accurate determination of properties of structures (thermal transmittance of curtain walls and windows, linear thermal transmittance of point facade anchors, etc.). Fundamentals of CFD modelling (heat transfer by conduction, radiation and convection in building structures and buildings).		
124YMMF	Mathematical Modelling in Building Physics	Z	2
	Students learn how to establish computational models of dynamic systems in building physics (heat and moisture transfer in buildings and building components). The emphasis is on introducing the principles of numerical solutions, their application and critical evaluation of the calculated results.		
124YPRM	Natural and Recycled Building Materials	Z	2
125EABB	Energy Audit of Buildings	Z,ZK	3
	Advanced course for introduction into energy auditing. Lectures topics: Energy audit and energy performance of buildings, legislation. EPDB - energy performance directive for buildings. Methodology of calculating energy performance of buildings. Energy audit - procedure and parts. Sankey energy flow diagram. Analysis of initial condition, description of initial condition object survey and survey of project documentation. Determining source efficiency, distribution and emission of heat. Steps towards reduction of energy consumption - building, heating, lighting, ventilating systems, technologies. Application of measures on a specific object. Synergic impact of energy saving measures. Economical evaluation, evaluation from the aspect of environment protection. Evaluation - emission Individual object survey. Energy audit of industrial objects.Methods of buildings evaluation. Seminar is focused on the realistic buildings resulting to presenting case study report about energy audit of existing building.		
125SYB	Building Systems	ZK	4
	Multi-criteria analysis of the requirements for the indoor environment and the function of the systems in different types of buildings and plants and optimization criteria for the design of energy and ecological building systems. Relationships between building technical equipment and the building. Integrated view of conceptual solutions in different building types in terms of indoor systems and building design. E.g. office buildings, residential buildings, halls, shopping centres, cultural centres, industrial buildings, sports buildings, family houses, passive etc. The audience will be introduced to the requirements for the indoor environment, the characteristic elements of energy and environmental building systems in relation to the structural design for the building type.		
125VVKB	Heating, Ventilation and Air Conditioning of Buildings	ZK	4
	An advanced course in heating, ventilation and air conditioning of buildings focused on the integrated design and operation of technical systems for the production, transformation and distribution of energy in buildings to ensure thermal comfort, air quality and optimum indoor environment with minimal environmental impact. Knowledge at the level of undergraduate basic courses in heating and ventilation is assumed for graduation).		
125YOZE	Renewable Energy Sources	Z	2
	The course deals with renewable energy sources and building energy systems. The different types of energy-solar, wind, biomass, geothermal and hydro-are discussed in detail. The characteristics of the energies and the most appropriate methods of use are described. Attention is paid to understanding the correct way to design facilities and systems that use renewable energy sources.		
125YUOB	Artifical illumination	Z	2
	The course provides a basic introduction to artificial lighting. Lighting technical quantities and related calculations are included. The theoretical principles of indoor lighting and lighting systems are discussed with application to various types of buildings and plants. Students are introduced to an overview of light sources and luminaires and their characteristics. Power, control and management and maintenance of lighting systems are also discussed along with energy consumption. There is also basic information on emergency lighting and outdoor lighting. Excursions are also part of the teaching. During the tutorials, a lighting project (plus electrical) is designed for a given space using the DIALux evo software.		
143APE	Applied Ecology	Z	2
	Learning basic of ecological terminology, landscape ecology and ecological stability. Energy flow in the different ecosystems.		

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