Study plan

Name of study plan: Budovy a prostředí, specializace Technická zařízení budov

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: NB20230301
Name of the group: Technická zařízení budov, 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
125DPM	**Diploma Thesis** ***Stanislav Frolík*** *Stanislav Frolík (Gar.)*	Z	30	24C	Z	z

Characteristics of the courses of this group of Study Plan: Code=NB20230301 Name=Technická zařízení budov, diplomová práce

125DPM	Diploma Thesis	Z	30

Diploma thesis is an independent project of a student at the end of Master degree study programme at the Faculty of Civil Engineering. Diploma thesis consists of two sections, a diploma thesis seminar and the actual thesis. In the diploma seminar section, the student works with the data and backround information relating to the topic of the thesis. The student consults the supervisor.

Name of the block: Compulsory courses in the specialization
Minimal number of credits of the block: 31
The role of the block: PS

Code of the group: NB20230101_1
Name of the group: Technická zařízení budov, předměty specializace, 1. semestr
Requirement credits in the group: In this group you have to gain at least 11 credits

Requirement courses in the group: In this group you have to complete at least 4 courses
Credits in the group: 11
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
125ZTZB	**Building Sanitary Systems** *Stanislav Frolík* ***Stanislav Frolík*** *Stanislav Frolík (Gar.)*	ZK	3	2P	Z	PS
125SZTC	**Seminar on Heating and Cooling of Buildings** ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	Z	2	2C	Z	PS
125SVKB	**Seminar on Ventilation and Air-conditioning of Buildings** ***Daniel Adamovský*** *Daniel Adamovský (Gar.)*	Z	2	2C	Z	PS
125SPB1	**Specialized design project 1** ***Stanislav Frolík*** *Stanislav Frolík (Gar.)*	KZ	4	3C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=NB20230101_1 Name=Technická zařízení budov, předměty specializace, 1. semestr

125ZTZB	Building Sanitary Systems	ZK	3
Principles of environmentally friendly water management. Disposal of sewage water and use of rain water. Measurement of water consumption, system design, pumping devices, water saving and special installations.			
125SZTC	Seminar on Heating and Cooling of Buildings	Z	2
Practical knowledge of the hydraulics of heating and cooling systems enables a deeper understanding of these issues and leads to better design of these systems. It aims at understanding the practical use of design tools and programs for design in the field of heating and cooling of buildings.			
125SVKB	Seminar on Ventilation and Air-conditioning of Buildings	Z	2
The course develops key topics in the field of HVAC in the form of exercises. It focuses on the practical steps of the design of these systems in various operations characterized by specific requirements for ventilation, moisture control, heat load, etc. In the individual exercises, students will learn about the design of HVAC plant, fire ventilation, assessment of measures to limit noise and vibrations in the HVAC system, measurement and control, etc.			
125SPB1	Specialized design project 1	KZ	4
Design project is an independent subject for the students of Master degree study programme of Buildings and Environment. Students should prove deeper knowledge concerning the problem of building services systems.			

Code of the group: NB20230201_1
Name of the group: Technická zařízení budov, 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 7 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
125VPTZ	**Indoor Environment of Buildings** *Karel Kabele, Hana Kabrhelová, Pavla Dvořáková, Zuzana Veverková* ***Zuzana Veverková*** *Zuzana Veverková (Gar.)*	KZ	2	2P	L	PS
125TCHB	**Technological Equipment of Buildings** *Hana Kabrhelová, Ilona Koubková, Pavla Hofbauer Pechová* ***Ilona Koubková*** *Ilona Koubková (Gar.)*	ZK	3	2P	L	PS
125MBTZ	**Building and HVAC Systems Modelling** *Karel Kabele, Miroslav Urban* ***Karel Kabele*** *Karel Kabele (Gar.)*	KZ	3	1P+1C	L	PS
125LTZB	**Laboratory of Building Services Systems** ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	Z	2	2C	L	PS
125CHLA	**Cooling of Buildings** *Daniel Adamovský, Miroslav Urban* ***Miroslav Urban*** *Miroslav Urban (Gar.)*	ZK	3	2P	L	PS
125OZE1	**Renewable Energy Sources** *Michal Kabrhel* ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	ZK	3	2P	Z,L	PS
125SP2B	**Specialized Design Project 2** *Karel Kabele, Daniel Adamovský, Michal Kabrhel, Miroslav Urban, Hana Kabrhelová, Vojtěch Mazanec, Ilona Koubková, Bohumír Garlík, Stanislav Frolík, ...* ***Karel Kabele*** *Karel Kabele (Gar.)*	KZ	4	3C	L	PS

Characteristics of the courses of this group of Study Plan: Code=NB20230201_1 Name=Technická zařízení budov, předměty specializace, 2. semestr

125VPTZ	Indoor Environment of Buildings	KZ	2
The course introduces students to the basic knowledge of the aspects of indoor environmental quality of buildings. Both theoretical and practical fundamentals of indoor environmental issues will be discussed during the lectures.			
125TCHB	Technological Equipment of Buildings	ZK	3
Sauna, fireplaces, kitchen technology, elevators, technology swimming pools, heat pumps, heat source and technological system, technology cooling, fire safety equipment, sprinklers.			

125MBTZ	Building and HVAC Systems Modelling	KZ	3
The course is aimed at explaining the issues of modelling and simulation of energy behaviour of buildings. Students will be introduced to an overview of tools and methodologies for solving these problems and learn how to use the simulation software DesignBuilder. In addition, they will be introduced to climate data, materials, construction and other factors affecting building behaviour. The aim of the course is to provide students with basic knowledge and practical experience in modelling and simulating building energy behaviour.			
125LTZB	Laboratory of Building Services Systems	Z	2
The course focuses on practical work in the field of building services systems. In the course measuring devices parameters will be explained and practical problems will be solved.			
125CHLA	Cooling of Buildings	ZK	3
The course focuses on the basic introduction to cooling technology used for air conditioning of buildings. In the introductory part, students will be introduced to the basic theoretical foundations of thermodynamics, design and sizing requirements for cooling technology. The core part of the course is aimed at familiarizing students with various system solutions of refrigeration technology for building air conditioning.			
125OZE1	Renewable Energy Sources	ZK	3
Renewable sources are becoming increasingly important sources of energy for buildings. Understanding their characteristics is key to the proper design and operation of these systems. The course therefore looks in detail at renewable sources and their applications.			
125SP2B	Specialized Design Project 2	KZ	4
Professional project focused on the design of technical equipment of buildings. The student chooses a topic based on his/her major and uses the knowledge acquired in previous studies.			

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 6
The role of the block: PV

Code of the group: NB20230101_2
Name of the group: Technická zařízení budov, PV předměty, 1. semestr
Requirement credits in the group: In this group you have to gain at least 2 credits
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 2
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
125YATM	**Applied Thermomechanics** *Daniel Adamovský **Daniel Adamovský** Daniel Adamovský (Gar.)*	Z	2	1P+1C	Z	PV
125YPNT	**Spatial Designing of Building Services Systems** ***Stanislav Frolík*** *Stanislav Frolík (Gar.)*	Z	2	2C	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NB20230101_2 Name=Technická zařízení budov, PV předměty, 1. semestr

125YATM	Applied Thermomechanics	Z	2
The course Applied thermocheanics contains three basic groups, in which the student is gradually introduced to selected chapters on moist air, vapour thermodynamics and heat sharing. The aim of each chapter is to introduce students to the principles of equipment common in heating, ventilation and cooling systems that they will encounter in practice. The chapter on humid air will discuss typical and lesser used processes occurring in air handling units. The vapor thermodynamics section focuses on the familiar compressor and absorption chillers and heat pumps. The final chapter will explain the processes and principles related to heat exchangers.			
125YPNT	Spatial Designing of Building Services Systems	Z	2
Designing technical building equipment systems with a focus on 3D modeling and related auxiliary calculation tools. Conversion of models into universal formats for use in other tools according to their focus and technical capabilities. Focus on projection in the BIM environment.			

Code of the group: NB20230201_2
Name of the group: Technická zařízení budov, 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
143APE	**Applied Ecology** *Tomáš Dostál **Tomáš Dostál** Tomáš Dostál (Gar.)*	Z	2	2P	L	PV
125YUOB	**Artifical illumination** *Bohumír Garlík, Pavla Dvořáková **Pavla Dvořáková** Pavla Dvořáková (Gar.)*	Z	2	1P+1C	L	PV
125YEMR	**Electrotechnical Engineering, Measurement and Control of HVAC Systems** *Michal Kabrhel, Bohumír Garlík **Michal Kabrhel** Michal Kabrhel (Gar.)*	Z	2	2P	L	PV
125YOPZ	**Gas services systems** *Ilona Koubková **Ilona Koubková** Ilona Koubková (Gar.)*	Z	2	1P+1C	L	PV

Characteristics of the courses of this group of Study Plan: Code=NB20230201_2 Name=Technická zařízení budov, PV předměty, 2. semestr

143APE	Applied Ecology	Z	2
Learning basic of ecological terminology, landscape ecology and ecological stability. Energy flow in the different ecosystems.			
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.			
125YEMR	Electrotechnical Engineering, Measurement and Control of HVAC Systems	Z	2
The course deals with selected fundamentals of electrical engineering. The concept of smart cities and smart buildings is also addressed. Approaches and systems for designing and evaluating building systems are discussed.			
125YOPZ	Gas services systems	Z	2
Gas connections - draft, addressing gas in the building, including design and assessment of gas appliances, pipe sizing and pressure loss dimensioning pipe examination rooms in terms of the amount of air for combustion, alternative solutions for propane-butane.			

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.			
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.			
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.			
125CHLA	Cooling of Buildings	ZK	3
The course focuses on the basic introduction to cooling technology used for air conditioning of buildings. In the introductory part, students will be introduced to the basic theoretical foundations of thermodynamics, design and sizing requirements for cooling technology. The core part of the course is aimed at familiarizing students with various system solutions of refrigeration technology for building air conditioning.			
125DPM	Diploma Thesis	Z	30
Diploma thesis is an independent project of a student at the end of Master degree study programme at the Faculty of Civil Engineering. Diploma thesis consists of two sections, a diploma thesis seminar and the actual thesis. In the diploma seminar section, the student works with the data and backround information relating to the topic of the thesis. The student consults the supervisor.			
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.			
125LTZB	Laboratory of Building Services Systems	Z	2
The course focuses on practical work in the field of building services systems. In the course measuring devices parameters will be explained and practical problems will be solved.			
125MBTZ	Building and HVAC Systems Modelling	KZ	3
The course is aimed at explaining the issues of modelling and simulation of energy behaviour of buildings. Students will be introduced to an overview of tools and methodologies for solving these problems and learn how to use the simulation software DesignBuilder. In addition, they will be introduced to climate data, materials, construction and other factors affecting building behaviour. The aim of the course is to provide students with basic knowledge and practical experience in modelling and simulating building energy behaviour.			
125OZE1	Renewable Energy Sources	ZK	3
Renewable sources are becoming increasingly important sources of energy for buildings. Understanding their characteristics is key to the proper design and operation of these systems. The course therefore looks in detail at renewable sources and their applications.			
125SP2B	Specialized Design Project 2	KZ	4
Professional project focused on the design of technical equipment of buildings. The student chooses a topic based on his/her major and uses the knowledge acquired in previous studies.			

125SPB1	Specialized design project 1	KZ	4
Design project is an independent subject for the students of Master degree study programme of Buildings and Environment. Students should prove deeper knowledge concerning the problem of building services systems.			
125SVKB	Seminar on Ventilation and Air-conditioning of Buildings	Z	2
The course develops key topics in the field of HVAC in the form of exercises. It focuses on the practical steps of the design of these systems in various operations characterized by specific requirements for ventilation, moisture control, heat load, etc. In the individual exercises, students will learn about the design of HVAC plant, fire ventilation, assessment of measures to limit noise and vibrations in the HVAC system, measurement and control, etc.			
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.			
125SZTC	Seminar on Heating and Cooling of Buildings	Z	2
Practical knowledge of the hydraulics of heating and cooling systems enables a deeper understanding of these issues and leads to better design of these systems. It aims at understanding the practical use of design tools and programs for design in the field of heating and cooling of buildings.			
125TCHB	Technological Equipment of Buildings	ZK	3
Sauna, fireplaces, kitchen technology, elevators, technology swimming pools, heat pumps, heat source and technological system, technology cooling, fire safety equipment, sprinklers.			
125VPTZ	Indoor Environment of Buildings	KZ	2
The course introduces students to the basic knowledge of the aspects of indoor environmental quality of buildings. Both theoretical and practical fundamentals of indoor environmental issues will be discussed during the lectures.			
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).			
125YATM	Applied Thermomechanics	Z	2
The course Applied thermocheanics contains three basic groups, in which the student is gradually introduced to selected chapters on moist air, vapour thermodynamics and heat sharing. The aim of each chapter is to introduce students to the principles of equipment common in heating, ventilation and cooling systems that they will encounter in practice. The chapter on humid air will discuss typical and lesser used processes occurring in air handling units. The vapor thermodynamics section focuses on the familiar compressor and absorption chillers and heat pumps. The final chapter will explain the processes and principles related to heat exchangers.			
125YEMR	Electrotechnical Engineering, Measurement and Control of HVAC Systems	Z	2
The course deals with selected fundamentals of electrical engineering. The concept of smart cities and smart buildings is also addressed. Approaches and systems for designing and evaluating building systems are discussed.			
125YOPZ	Gas services systems	Z	2
Gas connections - draft, addressing gas in the building, including design and assessment of gas appliances, pipe sizing and pressure loss dimensioning pipe examination rooms in terms of the amount of air for combustion, alternative solutions for propane-butane.			
125YPNT	Spatial Designing of Building Services Systems	Z	2
Designing technical building equipment systems with a focus on 3D modeling and related auxiliary calculation tools. Conversion of models into universal formats for use in other tools according to their focus and technical capabilities. Focus on projection in the BIM environment.			
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.			
125ZTZB	Building Sanitary Systems	ZK	3
Principles of environmentally friendly water management. Disposal of sewage water and use of rain water. Measurement of water consumption, system design, pumping devices, water saving and special installations.			
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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