Study plan

Name of study plan: Inteligentní budovy

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Intelligent Buildings
Type of study: Follow-up master full-time
Required credits: 120
Elective courses credits: 0
Sum of credits in the plan: 120
Note on the plan: tento studijní plán platí od nástupu 2020

Name of the block: Compulsory courses
Minimal number of credits of the block: 88
The role of the block: Z

Code of the group: NX202001
Name of the group: Inteligentní budovy, 1. semestr
Requirement credits in the group: In this group you have to gain at least 14 credits
Requirement courses in the group: In this group you have to complete at least 3 courses
Credits in the group: 14
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
124ST1	**Thermal Engineering in Construction** *Jan Tywoniak **Jan Tywoniak** Jan Tywoniak (Gar.)*	ZK	5	2P	Z	z
124OSIB	**Acoustics and Lighting** *Jaroslav Vychytil, Lenka Maierová **Jaroslav Vychytil** Jaroslav Vychytil (Gar.)*	KZ	4	2P	Z	z
A5M14RPI	**Distribution of Electric Energy and Drives** *Jiří Lettl, Pavel Mindl, Jan Bauer **Jiří Lettl** Jiří Lettl (Gar.)*	Z,ZK	5	2P+1L	Z	z

Characteristics of the courses of this group of Study Plan: Code=NX202001 Name=Inteligentní budovy, 1. semestr

124ST1	Thermal Engineering in Construction	ZK	5
The subject discusses the basic chapters of building physics - part hygrothermal performance of buildings in an overview manner with the aim of providing basic information to students coming from non-construction bachelor's fields and at the same time supplementing knowledge and linking it with contexts for students coming from civil engineering.			
124OSIB	Acoustics and Lighting	KZ	4
The course introduces students to the basics of building lighting technology and building acoustics and deepens further knowledge.			
A5M14RPI	Distribution of Electric Energy and Drives	Z,ZK	5

Code of the group: NX202002
Name of the group: Inteligentní budovy, 2. semestr
Requirement credits in the group: In this group you have to gain at least 26 credits
Requirement courses in the group: In this group you have to complete at least 4 courses
Credits in the group: 26
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
125PIB1	**Project 1** *Zuzana Veverková, Ilona Koubková, Michal Kabrhel, Karel Kabele, Stanislav Frolík, Bohumír Garlík, Daniel Adamovský, Miroslav Urban, Pavla Hofbauer Pechová, ... **Stanislav Frolík** Michal Kabrhel (Gar.)*	Z	6	4C	L	z
125EABU	**Energy Audit of Building** *Michal Kabrhel, Karel Kabele, Miroslav Urban **Karel Kabele** Karel Kabele (Gar.)*	KZ	4	2P+1C	L	z

125ESB	**Buildings Ecology Systems** *Stanislav Frolík* ***Stanislav Frolík*** *Stanislav Frolík (Gar.)*	KZ	4	2P	L	z
2161109	**Automatic control in environmental engineering of building** *Jiří Bašta, Jindřich Boháč* ***Jiří Bašta*** *Jiří Bašta (Gar.)*	Z,ZK	4	2P+1C	*	z
2161567	**Ventilation and Air Conditioning** *Vladimír Zmrhal, Petr Zelenský* ***Vladimír Zmrhal*** *Vladimír Zmrhal (Gar.)*	Z,ZK	4	2P+1C	2	z
A5M38SZS	**Sensors and Networks** *Pavel Ripka, Antonín Platil* ***Antonín Platil*** *Pavel Ripka (Gar.)*	Z,ZK	4	2P+1L	L	z

Characteristics of the courses of this group of Study Plan: Code=NX202002 Name=Inteligentní budovy, 2. semestr

125PIB1	Project 1	Z	6
Project 1 is the subject of the interfaculty course Intelligent Buildings. Its content is focused on the issue of intelligent buildings in order to link the knowledge from the Bachelor's degree to other disciplines. In the project, the student demonstrates the ability to independently develop a project in the field of intelligent buildings using a thorough analysis of the current state of the art from the literature.			
125EABU	Energy Audit of Building	KZ	4
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.			
125ESB	Buildings Ecology Systems	KZ	4
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.			
2161109	Automatic control in environmental engineering of building	Z,ZK	4
Application of basic approaches to automatic control of HVAC systems and equipments. Automatic control sequences of air conditioning and sources of heat.			
2161567	Ventilation and Air Conditioning	Z,ZK	4
Main knowledge for design, control and evaluation of ventilation and air conditioning systems. Design according to demands for treatment of thermal and humidity state and quality of air in residential and technological rooms.			
A5M38SZS	Sensors and Networks	Z,ZK	4
Applications of sensors in buildings			

Code of the group: NX202003
Name of the group: Inteligentní budovy, 3. 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 5 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**
125PIB2	**Project 2** ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	Z	6	4C	Z	z
2161102	**Radiant and Industrial Heating** *Jiří Bašta, Roman Vavřička* ***Jiří Bašta*** *Jiří Bašta (Gar.)*	Z,ZK	4	2P+1C	*	z
B5M99SCT	**Technology for Smart Cities** *Lukáš Ferkl* ***Lukáš Ferkl*** *Lukáš Ferkl (Gar.)*	Z,ZK	4	2P+1C	Z	z
125TECE	**Technological Units** *Ilona Koubková, Hana Kabrhelová* ***Ilona Koubková*** *Ilona Koubková (Gar.)*	KZ	4	2P	Z	z
125SYB	**Building Systems** *Jan Tywoniak, Karel Kabele* ***Karel Kabele*** *Karel Kabele (Gar.)*	ZK	4	4P	Z	z

Characteristics of the courses of this group of Study Plan: Code=NX202003 Name=Inteligentní budovy, 3. semestr

125PIB2	Project 2	Z	6
Project 2 is the subject of the interfaculty discipline Intelligent Buildings. In the project, the student demonstrates the ability to independently develop a more advanced project in the field of intelligent buildings.			
2161102	Radiant and Industrial Heating	Z,ZK	4
Student will be informed about the basics of radiant and other industrial heating systems			
B5M99SCT	Technology for Smart Cities	Z,ZK	4
125TECE	Technological Units	KZ	4
Saunas, fireplaces, kitchen technology, elevators, heat pumps, technology, swimming pools, heat source and technological systems.			
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.			

Code of the group: NX202004

Name of the group: Inteligentní budovy, 4. semestr
Requirement credits in the group: In this group you have to gain at least 26 credits
Requirement courses in the group: In this group you have to complete at least 1 course
Credits in the group: 26
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
125DPIB	**Diploma Thesis** ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	Z	26	20C	L	Z

Characteristics of the courses of this group of Study Plan: Code=NX202004 Name=Inteligentní budovy, 4. semestr

125DPIB	Diploma Thesis	Z	26

Thesis of students studying the Master's degree programme Intelligent Buildings. Independent final thesis usually in the form of a complex project, theoretical work or a combination of the previous forms.

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 32
The role of the block: PV

Code of the group: NX2020_1
Name of the group: Inteligentní budovy, povinně volitelné předměty
Requirement credits in the group: In this group you have to gain at least 32 credits
Requirement courses in the group: In this group you have to complete at least 8 courses
Credits in the group: 32
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
124KPKP	**Building Structures** *Ctislav Fiala* ***Ctislav Fiala*** *Ctislav Fiala (Gar.)*	ZK	4	3P	Z	PV
125OZEB	**Renewable Energy Sources** *Michal Kabrhel* ***Michal Kabrhel*** *Michal Kabrhel (Gar.)*	ZK	4	2P	Z	PV
124INBB	**Integrated Design of Buildings** *Jan Růžička, Tereza Pavlů, Martin Volf, Petr Hájek, Antonín Lupíšek* ***Petr Hájek*** *Petr Hájek (Gar.)*	Z,ZK	4	2P+1C	Z	PV
125EIBB	**Electroengineering and intelligent buildings** *Bohumír Garlík, Hana Kabrhelová* ***Bohumír Garlík*** *Bohumír Garlík (Gar.)*	KZ	4	2P	Z	PV
2161108	**Transport Phenomena** *Martin Barták* ***Martin Barták*** *Martin Barták (Gar.)*	Z,ZK	4	2P+1C	*	PV
2162113	**Heating** *Jiří Bašta, Jindřich Boháč, Roman Vavřička* ***Jiří Bašta*** *Jiří Bašta (Gar.)*	KZ	4	2P+2C	1	PV
A5M15ES1	**Electrical Light 1** *Petr Žák, Petr Žák* ***Petr Žák*** *Petr Žák (Gar.)*	KZ	4	2P+1S	Z	PV
A5M38MEB	**Measurements in the Buildings** *Petr Kašpar* ***Petr Kašpar*** *Petr Kašpar (Gar.)*	KZ	4	2P+1L	Z	PV
2162035	**Alternative Energy Sources** *Tomáš Matuška* ***Tomáš Matuška*** *Tomáš Matuška (Gar.)*	KZ	4	2P+1C	*	PV
2151154	**Refrigertion and heat pumps**	KZ	4	3P+1C		PV
2162019	**Industrial Heating, Ventilation, Airconditioning** *Vladimír Zmrhal, Miloš Lain* ***Vladimír Zmrhal*** *Vladimír Zmrhal (Gar.)*	KZ	4	2P+1C	2	PV
A5M34ELE	**Electronics** *Alexandr Laposa, Adam Bouřa* ***Alexandr Laposa*** *Alexandr Laposa (Gar.)*	KZ	4	3P+1L	L	PV
A5M38SBD	**Collection and Data Transfer** *Pavel Mlejnek* ***Pavel Mlejnek*** *Pavel Mlejnek (Gar.)*	KZ	4	2P+1L	L	PV
125PBZB	**Fire Services** *Ilona Koubková, Bohumír Garlík, Daniel Adamovský, Pavla Hofbauer Pechová* ***Ilona Koubková*** *Ilona Koubková (Gar.)*	KZ	4	2P	L	PV
125MEC	**Simulation of Building Energy Performance** *Karel Kabele, Miroslav Urban* ***Karel Kabele*** *Karel Kabele (Gar.)*	KZ	4	1P+1C	Z	PV
2162700	**Experimental Methods 1** *Miroslav Kučera* ***Miroslav Kučera*** *Miroslav Kučera (Gar.)*	KZ	4	0P+4L	*	PV
2162064	**Noise and Vibration Control** *Miroslav Kučera, Richard Nový* ***Miroslav Kučera*** *Miroslav Kučera (Gar.)*	KZ	4	2P+1C	*	PV
2162066	**Heat Supply** *Tomáš Matuška* ***Tomáš Matuška*** *Tomáš Matuška (Gar.)*	KZ	4	2P+1C	3	PV

A5M34EZS	**Electronic security systems** *Miroslav Husák, Jan Novák, Tomáš Teplý, Václav Prajzler* ***Václav Prajzler*** *Václav Prajzler (Gar.)*	KZ	4	3P+1L	Z	PV
A5M13NZZ	**Independent sources** *Pavel Hrzina, Václav Papež* ***Pavel Hrzina*** *Pavel Hrzina (Gar.)*	KZ	4	3P+1L	Z	PV
A5M13FVS	**Photovoltaic Systems** *Pavel Hrzina, Ladislava Černá, Vítězslav Benda* ***Ladislava Černá*** *Pavel Hrzina (Gar.)*	KZ	4	2P+2L	L	PV
A5M16EUE	**Economics of Energy Use** *Jiří Beranovský, Július Bemš* ***Jiří Beranovský*** *Július Bemš (Gar.)*	KZ	4	3P+1C	Z	PV
A5M16FIP	**Corporate finance** *Oldřich Starý, Jiří Vašíček, Blanka Kučerková* ***Jiří Vašíček*** *Oldřich Starý (Gar.)*	KZ	4	3P+1C	L	PV

Characteristics of the courses of this group of Study Plan: Code=NX2020_1 Name=Inteligentní budovy, povinně volitelné předměty

124KPKP	Building Structures	ZK	4
Basics of building structures. Functional requirements, structural systems, spatial effect of the structural system. Vertical load-bearing structures, floor structures, overhanging structures. Envelopes of buildings, windows, partitions, floors, suspended ceilings. Stairs, roof construction timber roof trusses, roof envelopes. Foundation structures, structural solution of the substructure, waterproofing of the substructure. Structural systems of single and multi-storey buildings, structural systems of long-span structures.			
125OZEB	Renewable Energy Sources	ZK	4
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.			
124INBB	Integrated Design of Buildings	Z,ZK	4
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.			
125EIBB	Electroengineering and intelligent buildings	KZ	4
The information society, intelligent systems, new technologies significantly influence various HVAC system applications. The fundamental idea is to save energy, materials and ensure optimal indoor and outdoor environmental parameters. The influence of electromagnetic environment, electromagnetic compatibility, application of intelligent devices in buildings requires a system approach to solve the whole complex of HVAC and intelligent wiring.			
2161108	Transport Phenomena	Z,ZK	4
Basics of transport phenomena for the study programme Intelligent Buildings. Momentum, heat and mass transport in built environment.			
2162113	Heating	KZ	4
Knowledge improvement from the field of heating of residential and industrial buildings. Designing of convective and radiant heating systems.			
A5M15ES1	Electrical Light 1	KZ	4
A5M38MEB	Measurements in the Buildings	KZ	4
The students will learn about principles of measurement of basic physical quantities in the building. As the majority of the physical quantities are converted to the electrical signals, an overview of measurement of the electrical quantities is also presented. The subject is not intended for students who have already studied the subjects Electrical measurement and Sensors and transducers on CTU FEE.			
2162035	Alternative Energy Sources	KZ	4
Principles and basics of alternative energy sources use in buildings. Solar energy. Heat pumps. Biomass utilization.			
2151154	Refrigertion and heat pumps	KZ	4
The subject is an introduction to the refrigeration technology and the heat pumps with the following thematic areas: Fundamentals of thermodynamics. Classification of cycles. Single-stage vapour cycle: basic form, basic processes. Converting of units parameters to other working conditions. Improvement of the Rankin cycles parameters. Classification of multistage cycles, cascade cycles. Refrigerants: classification, nomenclature, legislation. Sorption cycles: classification, thermodynamic fundaments of multicomponent systems, absorption cycles LiBr-H20 - basic form, basic processes. Heat pumps: heating and hot tap water. Heat sources for HP			
2162019	Industrial Heating, Ventilation, Airconditioning	KZ	4
Design and functional properties of ventilation systems for technological premises. Heat and mass transfer, aerodynamics calculation. Energy demands of systems.			
A5M34ELE	Electronics	KZ	4
A5M38SBD	Collection and Data Transfer	KZ	4
125PBZB	Fire Services	KZ	4
Fire water,hydrant systems,fire pipe,fire station.Fixed fire-fighting water with water mist, foam, and halon. Special fire-fighting equipment.Protecting buildings against fire spread from technological equipment.Electric fire alarm. Fire control equipment. Backup power source.			
125MEC	Simulation of Building Energy Performance	KZ	4
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.			
2162700	Experimental Methods 1	KZ	4
Introduction study of experimental technique in environmental engineering			
2162064	Noise and Vibration Control	KZ	4
Student will be informed about the basic acoustic dimensions, which are important for evaluation of noise.			
2162066	Heat Supply	KZ	4
District heating with heat generators in heat-only and combined heat&power mode. Heat generators. Heating networks. Renewable energy sources in district heating.			
A5M34EZS	Electronic security systems	KZ	4
A5M13NZZ	Independent sources	KZ	4
Electrochemical sources of the electric power - overview. Electrochemical sources (accumulators), applications. Uninteruptible power sources in IB. Other sources of the electrical energy. Perspective sources of electrical enegy, storage of energy.			
A5M13FVS	Photovoltaic Systems	KZ	4
Solar energy and its exploitation using photovoltaic systems. Photovoltaic phenomena, solar cells and their characteristics, solar modules (construction, technology, parameters). Photovoltaic systems (including energy conservation). Photovoltaic system applications, optimisation of operating conditions. Basic economical and ecological aspects, present trends.			
A5M16EUE	Economics of Energy Use	KZ	4
Organization and energy management of company, buildings or energy systems. Energy need and consumption, energy balance. Energy characterization of aggregate, secondary energy sources. Energy audit and feasibility study, optimization of energy management of energy systems. Prices and tariffs, economy and financial analysis.			

A5M16FIP	Corporate finance	KZ	4

Principles of finance, present value and alternative cost of capital, financial calculus, long-term finance, valuation of bonds and stocks, investment decision and net present value, IRR, comparison time period, annual equivalent value, inflation and return, capital asset pricing model, portfolio, sensitivity analysis and risk, short term finance, cash flow management.Dividend policy.

List of courses of this pass:

Code	Name of the course	Completion	Credits
124INBB	Integrated Design of Buildings	Z,ZK	4

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.

124KPKP	Building Structures	ZK	4

Basics of building structures. Functional requirements, structural systems, spatial effect of the structural system. Vertical load-bearing structures, floor structures, overhanging structures. Envelopes of buildings, windows, partitions, floors, suspended ceilings. Stairs, roof construction timber roof trusses, roof envelopes. Foundation structures, structural solution of the substructure, waterproofing of the substructure. Structural systems of single and multi-storey buildings, structural systems of long-span structures.

124OSIB	Acoustics and Lighting	KZ	4

The course introduces students to the basics of building lighting technology and building acoustics and deepens further knowledge.

124ST1	Thermal Engineering in Construction	ZK	5

The subject discusses the basic chapters of building physics - part hygrothermal performance of buildings in an overview manner with the aim of providing basic information to students coming from non-construction bachelor's fields and at the same time supplementing knowledge and linking it with contexts for students coming from civil engineering.

125DPIB	Diploma Thesis	Z	26

Thesis of students studying the Master's degree programme Intelligent Buildings. Independent final thesis usually in the form of a complex project, theoretical work or a combination of the previous forms.

125EABU	Energy Audit of Building	KZ	4

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.

125EIBB	Electroengineering and intelligent buildings	KZ	4

The information society, intelligent systems, new technologies significantly influence various HVAC system applications. The fundamental idea is to save energy, materials and ensure optimal indoor and outdoor environmental parameters. The influence of electromagnetic environment, electromagnetic compatibility, application of intelligent devices in buildings requires a system approach to solve the whole complex of HVAC and intelligent wiring.

125ESB	Buildings Ecology Systems	KZ	4

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.

125MEC	Simulation of Building Energy Performance	KZ	4

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.

125OZEB	Renewable Energy Sources	ZK	4

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.

125PBZB	Fire Services	KZ	4

Fire water,hydrant systems,fire pipe,fire station.Fixed fire-fighting water with water mist, foam, and halon. Special fire-fighting equipment.Protecting buildings against fire spread from technological equipment.Electric fire alarm. Fire control equipment. Backup power source.

125PIB1	Project 1	Z	6

Project 1 is the subject of the interfaculty course Intelligent Buildings. Its content is focused on the issue of intelligent buildings in order to link the knowledge from the Bachelor's degree to other disciplines. In the project, the student demonstrates the ability to independently develop a project in the field of intelligent buildings using a thorough analysis of the current state of the art from the literature.

125PIB2	Project 2	Z	6

Project 2 is the subject of the interfaculty discipline Intelligent Buildings. In the project, the student demonstrates the ability to independently develop a more advanced project in the field of intelligent buildings.

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.

125TECE	Technological Units	KZ	4

Saunas, fireplaces, kitchen technology, elevators, heat pumps, technology, swimming pools, heat source and technological systems.

2151154	Refrigertion and heat pumps	KZ	4

The subject is an introduction to the refrigeration technology and the heat pumps with the following thematic areas: Fundamentals of thermodynamics. Classification of cycles. Single-stage vapour cycle: basic form, basic processes. Converting of units parameters to other working conditions. Improvement of the Rankin cycles parameters. Classification of multistage cycles,

cascade cycles. Refrigerants: classification, nomenclature, legislation. Sorption cycles: classification, thermodynamic fundaments of multicomponent systems, absorption cycles LiBr-H20 - basic form, basic processes. Heat pumps: heating and hot tap water. Heat sources for HP			
2161102	Radiant and Industrial Heating	Z,ZK	4
Student will be informed about the basics of radiant and other industrial heating systems			
2161108	Transport Phenomena	Z,ZK	4
Basics of transport phenomena for the study programme Intelligent Buildings. Momentum, heat and mass transport in built environment.			
2161109	Automatic control in environmental engineering of building	Z,ZK	4
Application of basic approaches to automatic control of HVAC systems and equipments. Automatic control sequences of air conditioning and sources of heat.			
2161567	Ventilation and Air Conditioning	Z,ZK	4
Main knowledge for design, control and evaluation of ventilation and air conditioning systems. Design according to demands for treatment of thermal and humidity state and quality of air in residential and technological rooms.			
2162019	Industrial Heating, Ventilation, Airconditioning	KZ	4
Design and functional properties of ventilation systems for technological premises. Heat and mass transfer, aerodynamics calculation. Energy demands of systems.			
2162035	Alternative Energy Sources	KZ	4
Principles and basics of alternative energy sources use in buildings. Solar energy. Heat pumps. Biomass utilization.			
2162064	Noise and Vibration Control	KZ	4
Student will be informed about the basic acoustic dimensions, which are important for evaluation of noise.			
2162066	Heat Supply	KZ	4
District heating with heat generators in heat-only and combined heat&power mode. Heat generators. Heating networks. Renewable energy sources in district heating.			
2162113	Heating	KZ	4
Knowledge improvement from the field of heating of residential and industrial buildings. Designing of convective and radiant heating systems.			
2162700	Experimental Methods 1	KZ	4
Introduction study of experimental technique in environmental engineering			
A5M13FVS	Photovoltaic Systems	KZ	4
Solar energy and its exploitation using photovoltaic systems. Photovoltaic phenomena, solar cells and their characteristics, solar modules (construction, technology, parameters). Photovoltaic systems (including energy conservation). Photovoltaic system applications, optimisation of operating conditions. Basic economical and ecological aspects, present trends.			
A5M13NZZ	Independent sources	KZ	4
Electrochemical sources of the electric power - overview. Electrochemical sources (accumulators), applications. Uninteruptible power sources in IB. Other sources of the electrical energy. Perspective sources of electrical enegy, storage of energy.			
A5M14RPI	Distribution of Electric Energy and Drives	Z,ZK	5
A5M15ES1	Electrical Light 1	KZ	4
A5M16EUE	Economics of Energy Use	KZ	4
Organization and energy management of company, buildings or energy systems. Energy need and consumption, energy balance. Energy characterization of aggregate, secondary energy sources. Energy audit and feasibility study, optimization of energy management of energy systems. Prices and tariffs, economy and financial analysis.			
A5M16FIP	Corporate finance	KZ	4
Principles of finance, present value and alternative cost of capital, financial calculus, long-term finance, valuation of bonds and stocks, investment decision and net present value, IRR, comparison time period, annual equivalent value, inflation and return, capital asset pricing model, portfolio, sensitivity analysis and risk, short term finance, cash flow management.Dividend policy.			
A5M34ELE	Electronics	KZ	4
A5M34EZS	Electronic security systems	KZ	4
A5M38MEB	Measurements in the Buildings	KZ	4
The students will learn about principles of measurement of basic physical quantities in the building. As the majority of the physical quantities are converted to the electrical signals, an overview of measurement of the electrical quantities is also presented. The subject is not intended for students who have already studied the subjects Electrical measurement and Sensors and transducers on CTU FEE.			
A5M38SBD	Collection and Data Transfer	KZ	4
A5M38SZS	Sensors and Networks	Z,ZK	4
Applications of sensors in buildings			
B5M99SCT	Technology for Smart Cities	Z,ZK	4

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