

# Study plan

## Name of study plan: Inteligentní budovy - platný od roku 2020

Faculty/Institute/Others: Faculty of Electrical Engineering

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:

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 88

The role of the block: P

Code of the group: 2020\_MIBBME

Name of the group: Safety of the master's studies

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 1 course

Credits in the group: 0

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
BEZM	<b>Safety in Electrical Engineering for a master's degree</b> Vladimír K la, Radek Havlí ek, Ivana Nová, Josef ernohous, Petr Novák, Zden k Burian, Adam Bou a, Pavel Mlejnek <b>Radek Havlí ek</b> Vladimír K la (Gar.)	Z	0	2BP+2BC	Z	P

### Characteristics of the courses of this group of Study Plan: Code=2020\_MIBBME Name=Safety of the master's studies

BEZM	Safety in Electrical Engineering for a master's degree	Z	0			
The course provides for students of all programs periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the current Directive of the Dean.						

Code of the group: 2020\_MIBDIP

Name of the group: Diploma Thesis

Requirement credits in the group: In this group you have to gain 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
ADIP26	<b>Diploma Thesis</b>	Z	26	36s	L	P

### Characteristics of the courses of this group of Study Plan: Code=2020\_MIBDIP Name=Diploma Thesis

ADIP26	Diploma Thesis	Z	26			
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.						

Code of the group: 2020\_MIBP

Name of the group: Compulsory subjects of the programm

Requirement credits in the group: In this group you have to gain 50 credits

Requirement courses in the group: In this group you have to complete 12 courses

Credits in the group: 50

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) <i>Tutors, authors and guarantors (Gar.)</i>	Completion	Credits	Scope	Semester	Role
125ESB	<b>Buildings Ecology Systems</b> <i>Ilona Koubková, Stanislav Frolík, Hana Kabrhelová Hana Kabrhelová Stanislav Frolík (Gar.)</i>	KZ	4	2P	L	P
125EABU	<b>Energy Audit of Building</b> <i>Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Miroslav Urban, Michal Kabrhel Hana Kabrhelová Karel Kabele (Gar.)</i>	KZ	4	2P+1C	L	P
124KPKP	<b>Building Structures - Final Review</b> <i>Čtislav Fiala Čtislav Fiala (Gar.)</i>	ZK	4	3P	Z	P
124OSIB	<b>Lighting and Acoustics</b> <i>Jaroslav Vychytil, Lenka Maierová Jaroslav Vychytil Jaroslav Vychytil (Gar.)</i>	KZ	4	2P	Z	P
2161108	<b>Transport Phenomena</b> <i>Martin Barták Martin Barták Martin Barták (Gar.)</i>	Z,ZK	4	2P+1C	*	P
2161109	<b>Automatic control in environmental engineering of building</b> <i>Jiří Bašta, Jindřich Boháč Jiří Bašta Jiří Bašta (Gar.)</i>	Z,ZK	4	2P+1C	*	P
A5M14RPI	<b>Distribution of Electric Energy and Drives</b> <i>Jiří Lettl, Pavel Mindl, Jan Bauer Jiří Lettl Jiří Lettl (Gar.)</i>	Z,ZK	5	2P+1L	Z	P
2161102	<b>Radiant and Industrial Heating</b> <i>Jiří Bašta, Jindřich Boháč Jiří Bašta Jiří Bašta (Gar.)</i>	Z,ZK	4	2P+1C	*	P
A5M38SZS	<b>Sensors and Networks</b> <i>Antonín Platil, Pavel Ripka Antonín Platil Pavel Ripka (Gar.)</i>	Z,ZK	4	2P+1L	Z	P
124ST1	<b>Thermal Engineering in Construction 1</b> <i>Jan Tywoniak Jan Tywoniak (Gar.)</i>	ZK	5	2P	Z	P
B5M99SCT	<b>Technology for Smart Cities</b> <i>Lukáš Ferkl, Jan Velák Lukáš Ferkl Lukáš Ferkl (Gar.)</i>	Z,ZK	4	2P+1C	L	P
2161567	<b>Ventilation and Air Conditioning</b> <i>František Drkal, Vladimír Zmrhal, Miloš Lain Vladimír Zmrhal Vladimír Zmrhal (Gar.)</i>	Z,ZK	4	2P+1C	2	P

**Characteristics of the courses of this group of Study Plan: Code=2020\_MIBP Name=Compulsory subjects of the programm**

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.			
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.			
124KPKP	Building Structures - Final Review	ZK	4
124OSIB	Lighting and Acoustics	KZ	4
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.			
A5M14RPI	Distribution of Electric Energy and Drives	Z,ZK	5
2161102	Radiant and Industrial Heating	Z,ZK	4
Student will be informed about the basics of radiant and other industrial heating systems			
A5M38SZS	Sensors and Networks	Z,ZK	4
Applications of sensors in buildings			
124ST1	Thermal Engineering in Construction 1	ZK	5
B5M99SCT	Technology for Smart Cities	Z,ZK	4
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.			

Code of the group: 2020\_MIBPRO1

Name of the group: Project 1

Requirement credits in the group: In this group you have to gain 6 credits

Requirement courses in the group: In this group you have to complete 1 course

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
2163033	<b>Design IB I.</b> Martin Barták, Jiří Bašta, Jindřich Boháč, Vladimír Zmrhal, Miloš Lain, Jiří Hemerka, Miroslav Kůrka, Tomáš Matuška, Roman Vavřík, ..... <b>Jiří Bašta</b> Jiří Bašta (Gar.)	Z	6	0P+4C	*	P
125PIB1	<b>Project 1</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Miroslav Urban, Michal Kabrhel, Zuzana Veverková, Karel Papež, Bohumír Garlík, ..... <b>Hana Kabrhelová</b> Michal Kabrhel (Gar.)	Z	6	4C	L	P
A5M99PR1	<b>Project 1</b> <b>Pavel Mlejnek</b> Petr Kašpar (Gar.)	Z	6	0P+4C	L	P

**Characteristics of the courses of this group of Study Plan: Code=2020\_MIBPRO1 Name=Project 1**

2163033	Design IB I.	Z	6	Design of heating systems, heat distributors and systems for using recoverable source of energy. Design of ventilation and air conditioning systems, including gas cleaning and reduction of noise.		
125PIB1	Project 1	Z	6	The Project 1 is the subject of an inter-faculty field of Intelligent Buildings. Its content is focused on intelligent buildings to connect knowledge from undergraduate studies to other disciplines. Students in the project demonstrates the ability to independently handle project in intelligent buildings using a thorough analysis of current problems from the literature.		
A5M99PR1	Project 1	Z	6	The topic of the thesis is chosen by the student and selected from the list of topics. "Project 1" is followed by "Project 2" with a higher difficulty. The assignment of the project is subject to the approval of the faculty guarantor or tutor. The work will be publicly presented.		

Code of the group: 2020\_MIBPRO2

Name of the group: Project 2

Requirement credits in the group: In this group you have to gain 6 credits

Requirement courses in the group: In this group you have to complete 1 course

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
2163034	<b>Project IB II.</b> <b>Jiří Bašta</b> Jiří Bašta (Gar.)	Z	6	0P+4C	*	P
125PIB2	<b>Project 2</b> <b>Hana Kabrhelová</b> Michal Kabrhel (Gar.)	Z	6	4C	Z	P
A5M99PR2	<b>Project 2</b> <b>Pavel Mlejnek</b> Petr Kašpar (Gar.)	Z	6	0P+4C	Z	P

**Characteristics of the courses of this group of Study Plan: Code=2020\_MIBPRO2 Name=Project 2**

2163034	Project IB II.	Z	6	Project and experimental solution of environmental devices. Optimization investment and operating costs, economic appraisal of ecologic investment.		
125PIB2	Project 2	Z	6	The Project 2 is the subject of an inter-faculty field of Intelligent Buildings. Students in the project demonstrates the ability to independently handle project in intelligent buildings.		
A5M99PR2	Project 2	Z	6	The topic of the thesis is chosen by the student and selected from the list of topics. Project 2 mostly follows the topic of "Project 1" with a higher difficulty. The assignment of the project is subject to the approval of the faculty guarantor or tutor. The work will be publicly presented.		

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: 2020\_MIBPV

Name of the group: Compulsory optionally subjects

Requirement credits in the group: In this group you have to gain at least 32 credits (at most 92)

Requirement courses in the group: In this group you have to complete at least 8 courses (at most 23)

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
2162035	<b>Alternative Energy Sources</b> Tomáš Matuška <b>Tomáš Matuška</b> Tomáš Matuška (Gar.)	KZ	4	2P+1C	*	PV
2151154	<b>Refrigeration and heat pumps</b> Miroslav Petrák, Jiří Petrák <b>Miroslav Petrák</b>	KZ	4	3P+1C		PV
A5M16EUE	<b>Economics of Energy Use</b> Jiří Beranovský <b>Jiří Beranovský</b> Jiří Beranovský (Gar.)	KZ	4	3P+1C	Z	PV
A5M15ES1	<b>Electrical Light 1</b> Petr Žák <b>Petr Žák</b>	KZ	4	2P+1S	Z	PV
A5M34EZS	<b>Electronic security systems</b> Miroslav Husák, Jan Novák <b>Miroslav Husák</b> (Gar.)	KZ	4	3P+1L	Z	PV
A5M34ELE	<b>Electronics</b> Adam Boua, Vít Záhlava <b>Adam Boua</b> Adam Boua (Gar.)	KZ	4	3P+1L	L	PV
125EIBB	<b>Electroengineering and intelligent buildings</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Bohumír Garlík <b>Bohumír Garlík</b> Bohumír Garlík (Gar.)	KZ	4	2P	Z	PV
2162700	<b>Experimental Methods 1</b> Miroslav Kuera <b>Miroslav Kuera</b> Miroslav Kuera (Gar.)	KZ	4	0P+4L	*	PV
A5M16FIP	<b>Corporate finance</b> Oldřich Starý, Jiří Vašíček, Blanka Kůrková <b>Oldřich Starý</b> (Gar.)	KZ	4	3P+1C	L	PV
A5M13FVS	<b>Photovoltaic Systems</b> Jakub Holovský, Ladislava Černá, Vít Zslav Benda <b>Jakub Holovský</b> Jakub Holovský (Gar.)	KZ	4	3P+1L	Z	PV
124INBB	<b>Integrated Design of Buildings</b> Petr Hájek, Antonín Lupíšek <b>Antonín Lupíšek</b> Petr Hájek (Gar.)	Z,ZK	4	2P+1C		PV
A5M38MEB	<b>Measurements in the Buildings</b> Petr Kašpar <b>Petr Kašpar</b> Petr Kašpar (Gar.)	KZ	4	2P+1L	Z	PV
125MEC	<b>Simulation of Building Energy Performance</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele <b>Hana Kabrhelová</b> Karel Kabele (Gar.)	KZ	4	1P+1C	Z	PV
A5M13NZZ	<b>Independent sources</b> Karel Dušek, Václav Papež <b>Karel Dušek</b> Karel Dušek (Gar.)	KZ	4	3P+1L	Z	PV
125OZEB	<b>Renewable Energy Sources</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Michal Kabrhel <b>Hana Kabrhelová</b> Michal Kabrhel (Gar.)	ZK	4	2P	L	PV
125PBZB	<b>Fire Services</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Karel Papež, Bohumír Garlík <b>Hana Kabrhelová</b> Ilona Koubková (Gar.)	KZ	4	2P	L	PV
2162019	<b>Industrial Heating, Ventilation, Airconditioning</b> František Drkal, Vladimír Zmrhal, Miloš Lain <b>Vladimír Zmrhal</b> Vladimír Zmrhal (Gar.)	KZ	4	2P+1C	2	PV
A5M38SBD	<b>Collection and Data Transfer</b> Pavel Mlejnek <b>Pavel Mlejnek</b> Jiří Novák (Gar.)	KZ	4	2P+1C	L	PV
2162064	<b>Noise and Vibration Control</b> Miroslav Kuera, Richard Nový <b>Miroslav Kuera</b> Miroslav Kuera (Gar.)	KZ	4	2P+1C	*	PV
125SYB	<b>Building Systems</b> Stanislav Frolík, Hana Kabrhelová, Karel Kabele, Jan Tywoniak, Roman Musil <b>Hana Kabrhelová</b> Karel Kabele (Gar.)	ZK	4	4P	Z	PV
125TECE	<b>Technological Units</b> Ilona Koubková, Stanislav Frolík, Hana Kabrhelová, Karel Kabele <b>Hana Kabrhelová</b> Ilona Koubková (Gar.)	KZ	4	2P	Z	PV
2162113	<b>Heating</b> Jiří Bašta, Jindřich Boháček, Roman Vavřík <b>Jiří Bašta</b> Jiří Bašta (Gar.)	KZ	4	2P+2C	1	PV
2162066	<b>Heat Supply</b> Tomáš Matuška <b>Tomáš Matuška</b> Tomáš Matuška (Gar.)	KZ	4	2P+1C	3	PV

#### Characteristics of the courses of this group of Study Plan: Code=2020\_MIBPV Name=Compulsory optionally subjects

2162035	Alternative Energy Sources Principles and basics of alternative energy sources use in buildings. Solar energy. Heat pumps. Biomass utilization.	KZ	4
2151154	Refrigeration and heat pumps 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 unit's parameters to other working conditions. • Improvement of the Rankin cycle's parameters. • Classification of multistage cycles, cascade cycles. • Refrigerants: classification, nomenclature, legislation. • Sorption cycles: classification, thermodynamic fundamentals of multicomponent systems, absorption cycles LiBr-H <sub>2</sub> O - basic form, basic processes. • Heat pumps: heating and hot tap water. • Heat sources for HP	KZ	4
A5M16EUE	Economics of Energy Use 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.	KZ	4
A5M15ES1	Electrical Light 1	KZ	4
A5M34EZS	Electronic security systems	KZ	4
A5M34ELE	Electronics	KZ	4

125EIBB	Electroengineering and intelligent buildings	KZ	4
Construction of intelligent buildings (IB) is founded on mathematical-physical principles and draws from various definitions of IB. The information society, intelligent systems, new technologies, and nanotechnologies have significant impact on various system applications of technical equipment of buildings. The underlying idea is mainly energy and material saving and provision of the optimum parameters of indoor and outdoor environment. A new field rises, focused on user oriented building industry. Influence of electromagnetic environment, electromagnetic compatibility, implementation of intelligently operating equipment in buildings requires a systemic approach to solution of the whole complex of technical equipment of buildings. To let the students have a good grasp on new solutions within technical equipment of buildings and construction of IB, this subject aims to present a general view of such solutions. In a transparent form via examples, description of existing and future IB solutions, explanation of logical systems, including logical PLC control and IRC control of building on the room level, communications and implementation of fuzzy control shall be provided. New installation of LonWorks networks inside the building shall be described, same as intelligent ABB i-bus and KNX/EIB wiring, aimed at energy saving. The final part of the lectures shall concentrate on electronic access control and fire alarm security systems within the integrated control system.			
2162700	Experimental Methods 1	KZ	4
Introduction study of experimental technique in environmental engineering			
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.			
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.			
124INBB	Integrated Design of Buildings	Z,ZK	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.			
125MEC	Simulation of Building Energy Performance	KZ	4
Introductory course for modelling and simulation of building energy performance.			
A5M13NZZ	Independent sources	KZ	4
Electrochemical sources of the electric power - overview. Electrochemical sources (accumulators), applications. Uninterruptible power sources in IB. Other sources of the electrical energy. Perspective sources of electrical energy, storage of energy.			
125OZEB	Renewable Energy Sources	ZK	4
The course deals with renewable energy sources and energy systems in buildings. The various types of energy are discussed in detail - solar, wind, biomass, geothermal and hydro. Described are the characteristics of energy utilization and appropriate ways.			
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.			
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.			
A5M38SBD	Collection and Data Transfer	KZ	4
2162064	Noise and Vibration Control	KZ	4
Student will be informed about the basic acoustic dimensions, which are important for evaluation of noise.			
125SYB	Building Systems	ZK	4
125TECE	Technological Units	KZ	4
Saunas, fireplaces, kitchen technology, elevators, heat pumps, technology, swimming pools, heat source and technological systems.			
2162113	Heating	KZ	4
Knowledge improvement from the field of heating of residential and industrial buildings. Designing of convective and radiant heating systems.			
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.			

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: 2020\_MIBVOLPRE

Name of the group: Elective subjects

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group:

~Nabídku volitelných předmětů uspořádaných podle kateder najdete na webových stránkách  
<http://www.fel.cvut.cz/cz/education/volitelne-predmety.html>

## List of courses of this pass:

Code	Name of the course	Completion	Credits
124INBB	Integrated Design of Buildings	Z,ZK	4
124KPKP	Building Structures - Final Review	ZK	4
124OSIB	Lighting and Acoustics	KZ	4
124ST1	Thermal Engineering in Construction 1	ZK	5
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
Construction of intelligent buildings (IB) is founded on mathematical-physical principles and draws from various definitions of IB. The information society, intelligent systems, new technologies, and nanotechnologies have significant impact on various system applications of technical equipment of buildings. The underlying idea is mainly energy and material saving and provision of the optimum parameters of indoor and outdoor environment. A new field rises, focused on user oriented building industry. Influence of electromagnetic environment, electromagnetic compatibility, implementation of intelligently operating equipment in buildings requires a systemic approach to solution of the whole complex of technical equipment of buildings. To let the students have a good grasp on new solutions within technical equipment of buildings and construction of IB, this subject aims to present a general view of such solutions. In a transparent form via examples, description of existing and future IB solutions, explanation of logical systems, including logical PLC control and IRC control of building on the room level, communications and implementation of fuzzy control shall be provided. New installation of LonWorks networks inside the building shall be described, same as intelligent ABB i-bus and KNX/EIB wiring, aimed at energy saving. The final part of the lectures shall concentrate on electronic access control and fire alarm security systems within the integrated control system.			
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
Introductory course for modelling and simulation of building energy performance.			
125OZEB	Renewable Energy Sources	ZK	4
The course deals with renewable energy sources and energy systems in buildings. The various types of energy are discussed in detail - solar, wind, biomass, geothermal and hydro. Described are the characteristics of energy utilization and appropriate ways.			
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
The Project 1 is the subject of an inter-faculty field of Intelligent Buildings. Its content is focused on intelligent buildings to connect knowledge from undergraduate studies to other disciplines. Students in the project demonstrates the ability to independently handle project in intelligent buildings using a thorough analysis of current problems from the literature.			
125PIB2	Project 2	Z	6
The Project 2 is the subject of an inter-faculty field of Intelligent Buildings. Students in the project demonstrates the ability to independently handle project in intelligent buildings.			
125SYB	Building Systems	ZK	4
125TECE	Technological Units	KZ	4
Saunas, fireplaces, kitchen technology, elevators, heat pumps, technology, swimming pools, heat source and technological systems.			
2151154	Refrigeration 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 unit's parameters to other working conditions. • Improvement of the Rankin cycle's parameters. • Classification of multistage cycles, cascade cycles. • Refrigerants: classification, nomenclature, legislation. • Sorption cycles: classification, thermodynamic fundamentals of multicomponent systems, absorption cycles LiBr-H <sub>2</sub> O - 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 Knowledge improvement from the field of heating of residential and industrial buildings. Designing of convective and radiant heating systems.	KZ	4
2162700	Experimental Methods 1 Introduction study of experimental technique in environmental engineering	KZ	4
2163033	Design IB I. Design of heating systems, heat distributors and systems for using recoverable source of energy. Design of ventilation and air conditioning systems, including gas cleaning and reduction of noise.	Z	6
2163034	Project IB II. Project and experimental solution of environmental devices. Optimization investment and operating costs, economic appraisal of ecologic investment.	Z	6
A5M13FVS	Photovoltaic Systems 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.	KZ	4
A5M13NZZ	Independent sources Electrochemical sources of the electric power - overview. Electrochemical sources (accumulators), applications. Uninterruptible power sources in IB. Other sources of the electrical energy. Perspective sources of electrical energy, storage of energy.	KZ	4
A5M14RPI	Distribution of Electric Energy and Drives	Z,ZK	5
A5M15ES1	Electrical Light 1	KZ	4
A5M16EUE	Economics of Energy Use 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.	KZ	4
A5M16FIP	Corporate finance 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.	KZ	4
A5M34ELE	Electronics	KZ	4
A5M34Ezs	Electronic security systems	KZ	4
A5M38MEB	Measurements in the Buildings 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.	KZ	4
A5M38SBD	Collection and Data Transfer	KZ	4
A5M38SZS	Sensors and Networks Applications of sensors in buildings	Z,ZK	4
A5M99PR1	Project 1 The topic of the thesis is chosen by the student and selected from the list of topics. "Project 1" is followed by "Project 2" with a higher difficulty. The assignment of the project is subject to the approval of the faculty guarantor or tutor. The work will be publicly presented.	Z	6
A5M99PR2	Project 2 The topic of the thesis is chosen by the student and selected from the list of topics. Project 2 mostly follows the topic of "Project 1" with a higher difficulty. The assignment of the project is subject to the approval of the faculty guarantor or tutor. The work will be publicly presented.	Z	6
ADIP26	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	26
B5M99SCT	Technology for Smart Cities	Z,ZK	4
BEZM	Safety in Electrical Engineering for a master's degree The course provides for students of all programs periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the current Directive of the Dean.	Z	0

For updated information see <http://bilakniha.cvut.cz/en/f3.html>

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