

# Study plan

## Name of study plan: Mezifakultní studijní program 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: p edm ty s kódem 2xxx na Fakult strojní, p edm ty s kódem Axxx na Fakult elektrotechnické, voliteln 2161110 nebo 2161567

Name of the block: Compulsory courses

Minimal number of credits of the block: 88

The role of the block: Z

Code of the group: MIBPF1\_2019

Name of the group: Inteligentní budovy, povinné p edm ty programu

Requirement credits in the group: In this group you have to gain at least 62 credits

Requirement courses in the group: In this group you have to complete at least 14 courses

Credits in the group: 62

Note on the group:

bez 2161110

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
124OSIB	<b>Lighting and Acoustics</b> Jaroslav Vychytil, Lenka Maierová <b>Jaroslav Vychytil</b> Jaroslav Vychytil (Gar.)	KZ	4	2P	Z	z
124ST1	<b>Thermal Engineering in Construction 1</b> Jan Tywoniak <b>Jan Tywoniak</b> Jan Tywoniak (Gar.)	ZK	5	2P	Z	z
A5M14RPI	<b>Distribution of Electric Energy and Drives</b> Ji í Lettl, Pavel Mindl, Jan Bauer <b>Ji í Lettl</b> Ji í Lettl (Gar.)	Z,ZK	5	2P+1L	Z	z
125EABU	<b>Energy Audit of Building</b> Hana Kabrhelová	KZ	4	2P+1C	L	z
125ESB	<b>Buildings Ecology Systems</b> Hana Kabrhelová	KZ	4	2P	L	z
125PIB1	<b>Project 1</b> Hana Kabrhelová	Z	6	4C	L	z
2161109	<b>Automatic control in environmental engineering of building</b> Ji í Bašta	Z,ZK	4	2P+1C	*	z
A5M33IZS	<b>Information and Knowledge-Based Systems</b>	Z,ZK	4	2P+1C	L	z
125PIB2	<b>Project 2</b> Hana Kabrhelová Michal Kabrhel (Gar.)	Z	6	4C	Z	z
125SYB	<b>Building Systems</b> Jan Tywoniak, Karel Kabele, Hana Kabrhelová, Stanislav Frolík <b>Hana Kabrhelová</b> Karel Kabele (Gar.)	ZK	4	4P	Z	z
125TECE	<b>Technological Units</b> Karel Kabele, Hana Kabrhelová, Stanislav Frolík, Ilona Koubková <b>Hana Kabrhelová</b> Ilona Koubková (Gar.)	KZ	4	2P	Z	z
2161102	<b>Radiant and Industrial Heating</b> Ji í Bašta, Jind ich Bohá <b>Ji í Bašta</b> Ji í Bašta (Gar.)	Z,ZK	4	2P+1C	*	z
A5M38SZS	<b>Sensors and Networks</b> Antonín Platil, Pavel Ripka <b>Antonín Platil</b> Pavel Ripka (Gar.)	Z,ZK	4	2P+1L	L	z
A5M16FIP	<b>Corporate finance</b>	KZ	4	3P+1C	L	z

Characteristics of the courses of this group of Study Plan: Code=MIBPF1\_2019 Name=Inteligentní budovy, povinné p edm ty programu

124OSIB	Lighting and Acoustics	KZ	4
124ST1	Thermal Engineering in Construction 1	ZK	5
A5M14RPI	Distribution of Electric Energy and Drives	Z,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.			
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.			
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.			
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.			
A5M33ZS	Information and Knowledge-Based Systems	Z,ZK	4
The course provides the student with a necessary overview of information technologies with attention paid to requirements of intelligent building information systems. Further on, the student learns the basic methods and techniques applicable to knowledge based systems aimed at automated solving of decision-making problems. The attention is paid namely to data and knowledge representation and its modeling so that the students are able to communicate effectively with IT and knowledge engineering experts. The students will also learn the basics of networking protocols used in intelligent buildings.			
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.			
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			
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.			

Code of the group: MIBDIPF1\_2016

Name of the group: Inteligentní budovy, diplomová práce

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
125DPIB	Diploma Thesis Hana Kabrhelová	Z	26	20C	L	z

Characteristics of the courses of this group of Study Plan: Code=MIBDIPF1\_2016 Name=Inteligentní budovy, diplomová práce

125DPIB	Diploma Thesis	Z	26
The thesis is the final article in which the student demonstrates the ability to independently handle the topic for the building services systems. The student consults his work with the supervisor of the thesis. Themes of work and type of treatment may be different.			

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 28

The role of the block: PV

Code of the group: MIBPV1F1\_2016

Name of the group: Inteligentní budovy, povinn volitelné p edm ty

Requirement credits in the group: In this group you have to gain 28 credits

Requirement courses in the group: In this group you have to complete at least 7 courses

Credits in the group: 28

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
124INBB	<b>Integrated Design of Buildings</b> <i>Petr Hájek, Antonín Lupíšek Antonín Lupíšek Petr Hájek (Gar.)</i>	Z,ZK	4	2P+1C		PV
124KPKP	<b>Building Structures - Final Review</b> <i>Čtislav Fiala Čtislav Fiala Čtislav Fiala (Gar.)</i>	ZK	4	3P	Z	PV
125EIBB	<b>Electroengineering and intelligent buildings</b> <i>Karel Kabele, Hana Kabrhelová, Stanislav Frolík, Ilona Koubková, Bohumír Garlík Hana Kabrhelová Bohumír Garlík (Gar.)</i>	KZ	4	2P	Z	PV
125OZEB	<b>Renewable Energy Sources</b> <i>Karel Kabele, Hana Kabrhelová, Stanislav Frolík, Ilona Koubková, Michal Kabrhel Hana Kabrhelová Michal Kabrhel (Gar.)</i>	ZK	4	2P	L	PV
2152038	<b>Energy Sources and Conversions</b>	KZ	4	3P+1C	*	PV
2161108	<b>Transport Phenomena</b> <i>Martin Barták Martin Barták Martin Barták (Gar.)</i>	Z,ZK	4	2P+1C	*	PV
A5M15ES1	<b>Electrical Light 1</b> <i>Petr Žák, Petr Žák</i>	KZ	4	2P+1S	Z	PV
A5M35MAS	<b>Modeling and simulation</b>	KZ	4	2P+2C	Z	PV
A5M38MEB	<b>Measurements in the Buildings</b> <i>Petr Kašpar Petr Kašpar Petr Kašpar (Gar.)</i>	KZ	4	2P+1L	Z	PV
124ST2	<b>Thermal Engineering 2</b> <i>Jan Tywniak</i>	KZ	4	2P		PV
125MEC	<b>Simulation of Building Energy Performance</b> <i>Hana Kabrhelová</i>	KZ	4	1P+1C	Z	PV
125PBZB	<b>Fire Services</b> <i>Hana Kabrhelová</i>	KZ	4	2P	L	PV
2162035	<b>Alternative Energy Sources</b>	KZ	4	2P+1C	*	PV
2162114	<b>Heating</b> <i>Jiří Bašta</i>	KZ	4	2P+1C	*	PV
2162115	<b>Ventilation and Air Conditioning</b>	KZ	4	2P+1C	*	PV
A5M02AKA	<b>Acoustic Applications</b>	KZ	4	2P+2L	L	PV
A5M17BUP	<b>Biological Effects of Electromagnetic Field</b>	KZ	4	2P+2L	L	PV
A5M34ELE	<b>Electronics</b>	KZ	4	3P+1L	L	PV
A5M38SPD	<b>Collection and data transfer</b> <i>Pavel Mlejnek</i>	KZ	4	3P+1L	L	PV
2152060	<b>Refrigeration Technique and Heat Pumps for Intelligent Buildings</b>	KZ	4	3P+1C	*	PV
2162064	<b>Noise and Vibration Control</b> <i>Miroslav Ku era, Richard Nový Miroslav Ku era Miroslav Ku era (Gar.)</i>	KZ	4	2P+1C	*	PV
2162700	<b>Experimental Methods 1</b> <i>Miroslav Ku era Miroslav Ku era Miroslav Ku era (Gar.)</i>	KZ	4	0P+4L	*	PV
A5M13FVS	<b>Photovoltaic Systems</b> <i>Jakub Holovský, Ladislava erná, Vít zslav Benda Jakub Holovský Jakub Holovský (Gar.)</i>	KZ	4	3P+1L	Z	PV
A5M13NZZ	<b>Independent sources</b> <i>Václav Papež Václav Papež Václav Papež (Gar.)</i>	KZ	4	3P+1L	Z	PV
A5M16EUE	<b>Economics of Energy Use</b> <i>Jiří Beranovský Jiří Beranovský Jiří Beranovský (Gar.)</i>	KZ	4	3P+1C	Z	PV
A5M34EZS	<b>Electronic security systems</b> <i>Miroslav Husák, Jan Novák Jan Novák Miroslav Husák (Gar.)</i>	KZ	4	3P+1L	Z	PV
A5M38BEM	<b>Electromagnetic compatibility</b>	KZ	4	1P+1L	Z	PV

**Characteristics of the courses of this group of Study Plan: Code=MIBPV1F1\_2016 Name=Inteligentní budovy, povinn volitelné p edm ty**

124INBB	Integrated Design of Buildings	Z,ZK	4
124KPKP	Building Structures - Final Review	ZK	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.			
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 proper way to design facilities and systems that use renewable energy sources.			
2152038	Energy Sources and Conversions	KZ	4

2161108	Transport Phenomena Basics of transport phenomena for the study programme Intelligent Buildings. Momentum, heat and mass transport in built environment.	Z,ZK	4
A5M15ES1	Electrical Light 1	KZ	4
A5M35MAS	Modeling and simulation	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
124ST2	Thermal Engineering 2	KZ	4
125MEC	Simulation of Building Energy Performance Introductory course for modelling and simulation of building energy performance.	KZ	4
125PBZB	Fire Services 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.	KZ	4
2162035	Alternative Energy Sources Principles and basics of alternative energy sources use in buildings. Solar energy. Heat pumps. Biomass utilization.	KZ	4
2162114	Heating Supplemented knowledge from heating of residential and industrial buildings. Designing of convective and radiant heating systems.	KZ	4
2162115	Ventilation and Air Conditioning Main principles of ventilation and air conditioning. Source materials for design of systems. Natural ventilation, forced ventilation, air conditioning systems - output (capacity)and operation.	KZ	4
A5M02AKA	Acoustic Applications Lecture summarize applications in physical acoustics, room and building acoustics, environmental acoustics, noise and vibration control, physiological acoustics, diagnostics, and ultrasound.	KZ	4
A5M17BUP	Biological Effects of Electromagnetic Field Biophysical Aspects of Electromagnetic Fields (EF) coupling of Various Biological Systems (BS). Interaction of EF with BS - overview. Mechanism of Interaction and Biological Effects. Experimental Results and Hypotheses of Biological Effects of Static and Stationary Electrical, Magnetic and Nonstationary Fields. Mathematical Solution of Interaction. EF generated by living Organism. Applications of EF in Medicine. Hygienic Standards.	KZ	4
A5M34ELE	Electronics	KZ	4
A5M38SPD	Collection and data transfer	KZ	4
2152060	Refrigeration Technique and Heat Pumps for Intelligent Buildings	KZ	4
2162064	Noise and Vibration Control Student will be informed about the basic acoustic dimensions, which are important for evaluation of noise.	KZ	4
2162700	Experimental Methods 1 Introduction study of experimental technique in environmental engineering	KZ	4
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 enegy, storage of energy.	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
A5M34EZS	Electronic security systems	KZ	4
A5M38BEM	Electromagnetic compatibility	KZ	4

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 4

The role of the block: S

Code of the group: MIBPV2F1\_2019

Name of the group: Compulsory optionally subjects

Requirement credits in the group: In this group you have to gain at least 4 credits

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

Credits in the group: 4

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
2161110	Air Conditioning and Industrial Ventilation	Z,ZK	4	2P+1C	*	s
2161567	Ventilation and Air Conditioning	Z,ZK	4	2P+1C	2	s

Characteristics of the courses of this group of Study Plan: Code=MIBPV2F1\_2019 Name=Compulsory optionally subjects

2161110	Air Conditioning and Industrial Ventilation Main functional elements of ventilation and air conditioning systems. Air conditioning systems. Ventilation systems for residential and technological rooms.	Z,ZK	4
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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.			

### 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
124ST2	Thermal Engineering 2	KZ	4
125DPIB	Diploma Thesis	Z	26
The thesis is the final article in which the student demonstrates the ability to independently handle the topic for the building services systems. The student consults his work with the supervisor of the thesis. Themes of work and type of treatment may be different.			
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 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 proper 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
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.			
2152038	Energy Sources and Conversions	KZ	4
2152060	Refrigeration Technique and Heat Pumps for Intelligent Buildings	KZ	4
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.			
2161110	Air Conditioning and Industrial Ventilation	Z,ZK	4
Main functional elements of ventilation and air conditioning systems. Air conditioning systems. Ventilation systems for residential and technological rooms.			
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.			

2162035	<b>Alternative Energy Sources</b> Principles and basics of alternative energy sources use in buildings. Solar energy. Heat pumps. Biomass utilization.	KZ	4
2162064	<b>Noise and Vibration Control</b> Student will be informed about the basic acoustic dimensions, which are important for evaluation of noise.	KZ	4
2162114	<b>Heating</b> Supplemented knowledge from heating of residential and industrial buildings. Designing of convective and radiant heating systems.	KZ	4
2162115	<b>Ventilation and Air Conditioning</b> Main principles of ventilation and air conditioning. Source materials for design of systems. Natural ventilation, forced ventilation, air conditioning systems - output (capacity) and operation.	KZ	4
2162700	<b>Experimental Methods 1</b> Introduction study of experimental technique in environmental engineering	KZ	4
A5M02AKA	<b>Acoustic Applications</b> Lecture summarize applications in physical acoustics, room and building acoustics, environmental acoustics, noise and vibration control, physiological acoustics, diagnostics, and ultrasound.	KZ	4
A5M13FVS	<b>Photovoltaic Systems</b> 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	<b>Independent sources</b> 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	<b>Distribution of Electric Energy and Drives</b>	Z,ZK	5
A5M15ES1	<b>Electrical Light 1</b>	KZ	4
A5M16EUE	<b>Economics of Energy Use</b> 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	<b>Corporate finance</b> 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
A5M17BUP	<b>Biological Effects of Electromagnetic Field</b> Biophysical Aspects of Electromagnetic Fields (EF) coupling of Various Biological Systems (BS). Interaction of EF with BS - overview. Mechanism of Interaction and Biological Effects. Experimental Results and Hypotheses of Biological Effects of Static and Stationary Electrical, Magnetic and Nonstationary Fields. Mathematical Solution of Interaction. EF generated by living Organism. Applications of EF in Medicine. Hygienic Standards.	KZ	4
A5M33IZS	<b>Information and Knowledge-Based Systems</b> The course provides the student with a necessary overview of information technologies with attention paid to requirements of intelligent building information systems. Further on, the student learns the basic methods and techniques applicable to knowledge based systems aimed at automated solving of decision-making problems. The attention is paid namely to data and knowledge representation and its modeling so that the students are able to communicate effectively with IT and knowledge engineering experts. The students will also learn the basics of networking protocols used in intelligent buildings.	Z,ZK	4
A5M34ELE	<b>Electronics</b>	KZ	4
A5M34Ezs	<b>Electronic security systems</b>	KZ	4
A5M35MAS	<b>Modeling and simulation</b>	KZ	4
A5M38BEM	<b>Electromagnetic compatibility</b>	KZ	4
A5M38MEB	<b>Measurements in the Buildings</b> 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
A5M38SPD	<b>Collection and data transfer</b>	KZ	4
A5M38Szs	<b>Sensors and Networks</b> Applications of sensors in buildings	Z,ZK	4

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

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