Study plan

Name of study plan: Electrical Engineering, Power Engineering and Management - Technological Systems

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: Electrical Engineering, Power Engineering and Management
Type of study: Follow-up master full-time
Required credits: 116
Elective courses credits: 4
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: 56
The role of the block: P

Code of the group: 2018_MEEMEP
Name of the group: Compulsory subjects of the programme
Requirement credits in the group: In this group you have to gain 31 credits
Requirement courses in the group: In this group you have to complete 6 courses
Credits in the group: 31
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
BE1M16EKE1	**Economy of Power Industry** *Tomáš Králík, Július Bemš* ***Tomáš Králík*** *Tomáš Králík (Gar.)*	Z,ZK	5	2P+2S	L	P
BE1M15PPE1	**Elements and Operation of Electrical Power Systems** *Zdeněk Müller, Jan Hlaváček Zdeněk Müller (Gar.)*	Z,ZK	5	2P+2S	Z	P
BE1M15IAP	**Engineering Applications** *Jan Kyncl, Ladislav Musil*	Z,ZK	5	2P+2C	Z	P
BE1MPROJ	**Individual project** *Jiří Vašíček, Zdeněk Müller, Jan Kyncl, Jan Jandera, Josef Černohous* ***Josef Černohous*** *Jan Jandera (Gar.)*	Z	5	0p+4s	Z	P
BE1M14SSE	**Machinery and Structures of Power Plants** *Evžen Thöndel* ***Evžen Thöndel***	Z,ZK	5	2P+2C	Z	P
BE1M13JAS1	**Quality and Reliability** *Pavel Mach, Martin Molhanec* ***Pavel Mach*** *Pavel Mach (Gar.)*	Z,ZK	6	2P+2C	Z,L	P

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEP Name=Compulsory subjects of the programme

BE1M16EKE1	Economy of Power Industry	Z,ZK	5
Fundamentals of financing of power companies. Cost structure of power generation and distribution. Prices and tariff systems for power, heat and gas production and distribution. Examples of economic evaluation and investment appraisal of the typical project in power sector. Renewable energy sources, externalities. Energy policy and energy law in CR. Liberalization and power market development.			
BE1M15PPE1	Elements and Operation of Electrical Power Systems	Z,ZK	5
The course introduces basic technical principles of electricity transmission and distribution. There are explained parameters of power systems key elements, steady states, transient and failure phenomena, main principles of dimensioning and protecting, power quality and its control and electrical machines characteristics and utilization.			
BE1M15IAP	Engineering Applications	Z,ZK	5
The aim of the course is to get an overview of solving basic mathematical problems occurring in engineering practice using computer algebra systems			
BE1MPROJ	Individual project	Z	5
Independent work in the form of a project. A student will choose a topic from a list of topics specified by branch department. The project will be defended within the framework of a subject.			
BE1M14SSE	Machinery and Structures of Power Plants	Z,ZK	5
The aim of the course is to acquaint students with forms of energy transformation in power plants, describing the function of power facilities, their structure, properties and characteristics.			
BE1M13JAS1	Quality and Reliability	Z,ZK	6
Terminology and definitions from the area of quality and reliability and their control, philosophy of quality, systems of quality control in the world. Reliability as a part of quality. Basic definitions from the area of reliability, basic distributions used in reliability and their basic characteristics. Back-up using a warm and cold standby, types of warm and cold standbys. Reliability of components and systems, calculation of reliability using composition and decomposition. and using a method of a list. Basic statistical methods and tools joined with quality control, managerial tools for quality control. Techniques FMEA and QFFD, house of quality. Capability of a process. Taguchi loss function. Audits. Statistical inspection.			

Code of the group: 2018_MEEMEDIP
Name of the group: Diploma Thesis
Requirement credits in the group: In this group you have to gain 25 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 25
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
BDIP25	**Diploma Thesis**	Z	25	22s	L	P

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEDIP Name=Diploma Thesis

BDIP25	Diploma Thesis	Z	25

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.

Name of the block: Povinné předměty zaměření
Minimal number of credits of the block: 45
The role of the block: PZ

Code of the group: 2018_MEEMEPS
Name of the group: Compulsory subjects of the specialization
Requirement credits in the group: In this group you have to gain 30 credits
Requirement courses in the group: In this group you have to complete 6 courses
Credits in the group: 30
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BE1M13EKP	**Ecology and Materials** *Pavel Žák, Zuzana Šaršounová, Jan Weinzettel, Eva Horynová, Branislav Dzurňák, Michael Fridrich **Jan Weinzettel** Ivan Kudláček (Gar.)*	Z,ZK	5	2P+2L	Z	PZ
BE1M14ESP	**Electric Machinery and Apparatus** *Pavel Mindl, Miroslav Chomát **Miroslav Chomát** Pavel Mindl (Gar.)*	Z,ZK	5	2P+2L	Z	PZ
BE1M15TVN	**High Voltage Engineering** *Jan Hlaváček*	Z,ZK	5	2P+2L	L	PZ
BE1M13ASS	**Solar Systems Application** *Rupendra Kumar Sharma, Jakub Holovský, Vítězslav Benda, Arao Minamau Pambo **Jakub Holovský** Vítězslav Benda (Gar.)*	Z,ZK	5	2P+2L	Z	PZ
BE1M14TVM	**Theory and Application of Power Converters** *Jiří Lettl **Jiří Lettl** Jiří Lettl (Gar.)*	Z,ZK	5	2P+2L	L	PZ
BE1M15PRE1	**Transmission and Distribution of Electricity** *Zdeněk Müller, Ladislav Musil **Zdeněk Müller** Zdeněk Müller (Gar.)*	Z,ZK	5	2P+2S	Z	PZ

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEPS Name=Compulsory subjects of the specialization

BE1M13EKP	Ecology and Materials	Z,ZK	5

Electrical Technology from the perspective of ecology. Environmental assessment of the various types of surface protection. Environmental aspects of protective systems used in electronics. Environmental impacts of electrical production. Ekodesign proposal of the electrical product. Principles of the proposal product for a difficult operating environment. Disposal of electrical waste.

BE1M14ESP	Electric Machinery and Apparatus	Z,ZK	5

The course is focused on contact and solid-state switching devices in LV networks. Basic topologies AC switches and stress of their components, systems with modern semiconductor devices and their protection circuits, testing electrical devices. The course also deals with the general theory of electrical machines. Magnetic field. Fundamentals of commutation. The transformer efficiency, voltage drop. Transients - switch to the network, a short circuit. Mathematical model of synchronous and asynchronous machines. A rotating magnetic field. Induction machine, starting and speed control. Influence of harmonic magnetic field. Single-phase induction motor. Work synchronous machine on a network. Torque, stability, overload capacity.

BE1M15TVN	High Voltage Engineering	Z,ZK	5

The course contains the fundamental theories of high voltage engineering with respect to application in electrical power engineering. The knowledge of high voltage generators, measurement technique of high voltages and currents, properties of insulation systems, diagnostics methods and electrical discharges and their elimination. The practical laboratory exercises in high voltage laboratory are included.

BE1M13ASS	Solar Systems Application	Z,ZK	5

Solar energy. Photovoltaic phenomena. Photovoltaic cells and modules and their characteristics. Photovoltaic systems and their applications. Photo-thermal phenomena.Photo-thermal power stations. Significance, economic and environmental aspects of solar energy exploitation.

BE1M14TVM	Theory and Application of Power Converters	Z,ZK	5

The course focuses on typical applications of power semiconductor converters on their sizing, switching and protection of power semiconductor converters. It also summarizes the basics of modulation and control strategies of power semiconductor converters and modern trends in their application in electric drives and other applications.

BE1M15PRE1	Transmission and Distribution of Electricity	Z,ZK	5

The course introduces particular topics concerning transmission and distribution systems, mainly load flow solutions, specific aspects of system steady states and possibilities to control these states. The course also deals with synchronous generators characteristics in different operational states.

Code of the group: 2018_MEEMEPPS3
Name of the group: Compulsory subjects of the specialization
Requirement credits in the group: In this group you have to gain 15 credits
Requirement courses in the group: In this group you have to complete 3 courses
Credits in the group: 15
Note on the group: Specializace Technologické systémy

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
BE1M13AEZ	**Application of Electrochemical Sources**	Z,ZK	5	2P+2L	Z	PZ
BE1M13MAD	**Control methods and testing in electrotechnology**	Z,ZK	5	2P+2L	L	PZ
BE1M13SVS	**Simulation of Production Sytems** ***Pavel Mach***	Z,ZK	5	2P+2C	Z	PZ

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEPPS3 Name=Compulsory subjects of the specialization

BE1M13AEZ	Application of Electrochemical Sources	Z,ZK	5

After a brief introduction to chemical reactions commonly present in electrochemical sources, the technologies and manufacturing of commonplace accumulator batteries and primary cells are discussed in detail. In the course, there is presented the current state of the field of batteries for different types of applications - electromobility, stationary backup systems and energetics. Emphasis is also placed on the trends in simultaneously using of battery storage for balancing network characteristics, especially in combination with the RES.

BE1M13MAD	Control methods and testing in electrotechnology	Z,ZK	5

The course follows the needs of electrical production and research. It discussed diagnostic of materials and measurements of material properties, including measurement of important parameters of production and work environment. The subject also includes testing safe function of products and evaluating the obtained data.

BE1M13SVS	Simulation of Production Sytems	Z,ZK	5

The course is focused at methods of static and dynamic models of processes and systems forming. Basic types of models are described and characterized. Models are built up using an analytical way on the basis of knowledge of relationships between parameters, or using an experimental way. Factorial experiments for qualitative variables are presented. Computer aided generation of mathematical models and simulation of dynamic behavior of processes and systems are described. Basic methods of component models compilation, assembly of a complete model are presented. The application on computer modeling and simulation of electrical, thermal and mechanical systems in power electrical engineering completes the lectures.

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 15
The role of the block: PV

Code of the group: 2018_MEEMEPV1
Name of the group: Compulsory elective subjects of the specialization
Requirement credits in the group: In this group you have to gain at least 10 credits (at most 20)
Requirement courses in the group: In this group you have to complete at least 2 courses (at most 4)
Credits in the group: 10
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
BE1M16EUE1	**Economy of Energy Use** *Jiří Beranovský, Michaela Valentová **Michaela Valentová** Jiří Beranovský (Gar.)*	Z,ZK	5	2P+2S	L	PV
BE1M15ELS	**Electrical Light** *Marek Bálský*	Z,ZK	5	2P+2L	L	PV
BE1M14MDS1	**Modeling of Dynamical Systems**	Z,ZK	5	2P+2C	L	PV
BE1M13VSE	**Power components in electrical engineering**	Z,ZK	5	2P+2L	L	PV

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEPV1 Name=Compulsory elective subjects of the specialization

BE1M16EUE1	Economy of Energy Use	Z,ZK	5

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.

BE1M15ELS	Electrical Light	Z,ZK	5

The aim of the course is to make students acquainted with most frequent applications of optical radiation and with theoretical and practical principles of resolving lighting systems for indoor and outdoor areas, respecting necessary visual performance with emphasis on energy efficiency solutions and aspects of health and safety.

BE1M14MDS1	Modeling of Dynamical Systems	Z,ZK	5
The course deals with combining knowledge of the dynamics of rigid bodies, fluid mechanics, aerodynamics, gas dynamics and thermodynamics in the compilation of nonlinear models of dynamic systems. Seminars are focused on assembling of numeric models in Matlab / Simulink.			
BE1M13VSE	Power components in electrical engineering	Z,ZK	5
Power semiconductor device (diodes, BJTs, thyristors, MOSFETs and IGBTs) and integraed structures (modules). Structures, function, characteristics and parameters, Passive components of powet electronic. Connection of devices in parallel and in series.			

Code of the group: 2018_MEEMEH
Name of the group: Humanities subjects
Requirement credits in the group: In this group you have to gain 5 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 5
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
BE0M16HSD1	**History of economy and social studies**	Z,ZK	5	2P+2S	Z,L	PV
BE0M16HVT	**History of science and technology 2**	Z,ZK	5	2P+2S	Z,L	PV
BE0M16FIL	**Philosophy 2** *Peter Zamarovský* ***Peter Zamarovský*** *Peter Zamarovský (Gar.)*	Z,ZK	5	2P+2S	Z,L	PV
BE0M16PSM	**Psychology**	Z,ZK	5	2P+2S	Z,L	PV
BE0M16TEO	**Theology**	Z,ZK	4	2P+2S	L	PV

Characteristics of the courses of this group of Study Plan: Code=2018_MEEMEH Name=Humanities subjects

BE0M16HSD1	History of economy and social studies	Z,ZK	5
This subject deals with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims and achieved results as well as the social and cultural development and coexistence of the various ethnical groups in the Czech countries.			
BE0M16HVT	History of science and technology 2	Z,ZK	5
This subject traces historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate students' interest in the history and traditions of the subject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life and the influence of technical engineers			
BE0M16FIL	Philosophy 2	Z,ZK	5
BE0M16PSM	Psychology	Z,ZK	5
BE0M16TEO	Theology	Z,ZK	4
This subject provides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the basic theologic disciplines are gone through. The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who want to get know Christianity - religion from which graws our civilization up.			

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: 2018_MEEMEVOL
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: ~Student can choose arbitrary subject of themagister's program (EEM - Electrical Engineering, Power Engineering and Management, EK - Electronics and Communications, KYR - Cybernetics and Robotics, OI - Open Informatics, OES - Open Electronics Systems) which is not part of his curriculum. Student can choose with consideration of recommendation of the branch guarantee.You can find a selection of optional courses organized by the departments on the web site http://www.fel.cvut.cz/cz/education/volitelne-predmety.html

List of courses of this pass:

Code	Name of the course	Completion	Credits
BDIP25	Diploma Thesis	Z	25
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.			
BE0M16FIL	Philosophy 2	Z,ZK	5
BE0M16HSD1	History of economy and social studies	Z,ZK	5
This subject deals with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims and achieved results as well as the social and cultural development and coexistence of the various ethnical groups in the Czech countries.			
BE0M16HVT	History of science and technology 2	Z,ZK	5
This subject traces historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate students' interest in the history and traditions of the subject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life and the influence of technical engineers			
BE0M16PSM	Psychology	Z,ZK	5
BE0M16TEO	Theology	Z,ZK	4
This subject provides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the basic theologic disciplines are gone through. The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who want to get know Christianity - religion from which graws our civilization up.			
BE1M13AEZ	Application of Electrochemical Sources	Z,ZK	5
After a brief introduction to chemical reactions commonly present in electrochemical sources, the technologies and manufacturing of commonplace accumulator batteries and primary cells are discussed in detail. In the course, there is presented the current state of the field of batteries for different types of applications - electromobility, stationary backup systems and energetics. Emphasis is also placed on the trends in simultaneously using of battery storage for balancing network characteristics, especially in combination with the RES.			
BE1M13ASS	Solar Systems Application	Z,ZK	5
Solar energy. Photovoltaic phenomena. Photovoltaic cells and modules and their characteristics. Photovoltaic systems and their applications. Photo-thermal phenomena.Photo-thermal power stations. Significance, economic and environmental aspects of solar energy exploitation.			
BE1M13EKP	Ecology and Materials	Z,ZK	5
Electrical Technology from the perspective of ecology. Environmental assessment of the various types of surface protection. Environmental aspects of protective systems used in electronics. Environmental impacts of electrical production. Ekodesign proposal of the electrical product. Principles of the proposal product for a difficult operating environment. Disposal of electrical waste.			
BE1M13JAS1	Quality and Reliability	Z,ZK	6
Terminology and definitions from the area of quality and reliability and their control, philosophy of quality, systems of quality control in the world. Reliability as a part of quality. Basic definitions from the area of reliability, basic distributions used in reliability and their basic characteristics. Back-up using a warm and cold standby, types of warm and cold standbys. Reliability of components and systems, calculation of reliability using composition and decomposition. and using a method of a list. Basic statistical methods and tools joined with quality control, managerial tools for quality control. Techniques FMEA and QFFD, house of quality. Capability of a process. Taguchi loss function. Audits. Statistical inspection.			
BE1M13MAD	Control methods and testing in electrotechnology	Z,ZK	5
The course follows the needs of electrical production and research. It discussed diagnostic of materials and measurements of material properties, including measurement of important parameters of production and work environment. The subject also includes testing safe function of products and evaluating the obtained data.			
BE1M13SVS	Simulation of Production Sytems	Z,ZK	5
The course is focused at methods of static and dynamic models of processes and systems forming. Basic types of models are described and characterized. Models are built up using an analytical way on the basis of knowledge of relationships between parameters, or using an experimental way. Factorial experiments for qualitative variables are presented. Computer aided generation of mathematical models and simulation of dynamic behavior of processes and systems are described. Basic methods of component models compilation, assembly of a complete model are presented. The application on computer modeling and simulation of electrical, thermal and mechanical systems in power electrical engineering completes the lectures.			
BE1M13VSE	Power components in electrical engineering	Z,ZK	5
Power semiconductor device (diodes, BJTs, thyristors, MOSFETs and IGBTs) and integraed structures (modules). Structures, function, characteristics and parameters, Passive components of powet electronic. Connection of devices in parallel and in series.			
BE1M14ESP	Electric Machinery and Apparatus	Z,ZK	5
The course is focused on contact and solid-state switching devices in LV networks. Basic topologies AC switches and stress of their components, systems with modern semiconductor devices and their protection circuits, testing electrical devices. The course also deals with the general theory of electrical machines. Magnetic field. Fundamentals of commutation. The transformer efficiency, voltage drop. Transients - switch to the network, a short circuit. Mathematical model of synchronous and asynchronous machines. A rotating magnetic field. Induction machine, starting and speed control. Influence of harmonic magnetic field. Single-phase induction motor. Work synchronous machine on a network. Torque, stability, overload capacity.			
BE1M14MDS1	Modeling of Dynamical Systems	Z,ZK	5
The course deals with combining knowledge of the dynamics of rigid bodies, fluid mechanics, aerodynamics, gas dynamics and thermodynamics in the compilation of nonlinear models of dynamic systems. Seminars are focused on assembling of numeric models in Matlab / Simulink.			
BE1M14SSE	Machinery and Structures of Power Plants	Z,ZK	5
The aim of the course is to acquaint students with forms of energy transformation in power plants, describing the function of power facilities, their structure, properties and characteristics.			
BE1M14TVM	Theory and Application of Power Converters	Z,ZK	5
The course focuses on typical applications of power semiconductor converters on their sizing, switching and protection of power semiconductor converters. It also summarizes the basics of modulation and control strategies of power semiconductor converters and modern trends in their application in electric drives and other applications.			
BE1M15ELS	Electrical Light	Z,ZK	5
The aim of the course is to make students acquainted with most frequent applications of optical radiation and with theoretical and practical principles of resolving lighting systems for indoor and outdoor areas, respecting necessary visual performance with emphasis on energy efficiency solutions and aspects of health and safety.			
BE1M15IAP	Engineering Applications	Z,ZK	5
The aim of the course is to get an overview of solving basic mathematical problems occurring in engineering practice using computer algebra systems			

BE1M15PPE1	Elements and Operation of Electrical Power Systems	Z,ZK	5
The course introduces basic technical principles of electricity transmission and distribution. There are explained parameters of power systems key elements, steady states, transient and failure phenomena, main principles of dimensioning and protecting, power quality and its control and electrical machines characteristics and utilization.			
BE1M15PRE1	Transmission and Distribution of Electricity	Z,ZK	5
The course introduces particular topics concerning transmission and distribution systems, mainly load flow solutions, specific aspects of system steady states and possibilities to control these states. The course also deals with synchronous generators characteristics in different operational states.			
BE1M15TVN	High Voltage Engineering	Z,ZK	5
The course contains the fundamental theories of high voltage engineering with respect to application in electrical power engineering. The knowledge of high voltage generators, measurement technique of high voltages and currents, properties of insulation systems, diagnostics methods and electrical discharges and their elimination. The practical laboratory exercises in high voltage laboratory are included.			
BE1M16EKE1	Economy of Power Industry	Z,ZK	5
Fundamentals of financing of power companies. Cost structure of power generation and distribution. Prices and tariff systems for power, heat and gas production and distribution. Examples of economic evaluation and investment appraisal of the typical project in power sector. Renewable energy sources, externalities. Energy policy and energy law in CR. Liberalization and power market development.			
BE1M16EUE1	Economy of Energy Use	Z,ZK	5
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.			
BE1MPROJ	Individual project	Z	5
Independent work in the form of a project. A student will choose a topic from a list of topics specified by branch department. The project will be defended within the framework of a subject.			

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