

## Study plan

### Name of study plan: Electrical Engineering, Power Engineering and Management - Electrical Drives

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: 61

The role of the block: P

Code of the group: 2018\_MEEMDIP

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BDIP25	<b>Diploma Thesis</b>	Z	25	22s	L	P

#### Characteristics of the courses of this group of Study Plan: Code=2018\_MEEMDIP 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.		
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Code of the group: 2018\_MEEMH

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
B0M16FIL	<i>Peter Zamarovský Peter Zamarovský Peter Zamarovský (Gar.)</i>	Z,ZK	5	2P+2S	Z,L	P
B0M16HVT	<b>History of science and technology 2</b> <i>Marcela Efmertová, Jan Mikeš Marcela Efmertová Marcela Efmertová (Gar.)</i>	Z,ZK	5	2P+2S	Z,L	P
B0M16HSD1	<b>History of economy and social studies</b> <i>Marcela Efmertová</i>	Z,ZK	5	2P+2S	Z,L	P
B0M16PSM	<b>Psychology</b> <i>Jan Fiala Jan Fiala Jan Fiala (Gar.)</i>	Z,ZK	5	2P+2S	Z,L	P
A003TV	<b>Physical Education</b> <i>Jiří Drnek</i>	Z	2	0+2	L,Z	P
B0M16TEO	<b>Theology</b> <i>Vladimír Sláma ka Vladimír Sláma ka Vladimír Sláma ka (Gar.)</i>	Z,ZK	5	2P+2S	Z,L	P

#### Characteristics of the courses of this group of Study Plan: Code=2018\_MEEMH Name=Humanities subjects

B0M16FIL		Z,ZK	5
B0M16HVT	History of science and technology 2 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	Z,ZK	5
B0M16HSD1	History of economy and social studies 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.	Z,ZK	5
B0M16PSM	Psychology	Z,ZK	5
A003TV	Physical Education	Z	2
B0M16TEO	Theology 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 grows our civilization up.	Z,ZK	5

Code of the group: 2018\_MEEMP

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
B1M16EKE1	<b>Economy of Power Industry</b> <i>Ji í Vaší ek, Old ich Starý, Tomáš Králík Tomáš Králík Old ich Starý (Gar.)</i>	Z,ZK	5	2P+2C	L	P
B1M15IAP	<b>Engineering Applications</b> <i>Jan Kyncl Jan Kyncl (Gar.)</i>	Z,ZK	5	2P+2C	Z	P
B1M13JAS1	<b>Quality and Reliability</b> <i>Pavel Mach, Denis Froš, Martin Molhanec Pavel Mach Pavel Mach (Gar.)</i>	Z,ZK	6	2P+2C	Z	P
B1MPROJ	<b>Individual project</b> <i>Ji í Vaší ek, Old ich Starý, Jan Kyncl, Jan Jandera, Karel Künzel, Zden k Müller, Jaroslav Knápek, Iva Mrkvi ková, Josef ernohous, ..... Josef ernohous Jan Jandera (Gar.)</i>	Z	5	0p+4s	Z	P
B1M15PPE1	<b>Elements and Operation of Electrical Power Systems</b> <i>Zden k Müller, Ivo Doležel Zden k Müller (Gar.)</i>	Z,ZK	5	2P+2S	Z	P
B1M14SSE	<b>Machinery and Structures of Power Plants</b> <i>Petr Ko árník, Ji í Š astný Petr Ko árník Petr Ko árník (Gar.)</i>	Z,ZK	5	2P+2C	Z	P

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

B1M16EKE1	Economy of Power Industry 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.	Z,ZK	5
B1M15IAP	Engineering Applications	Z,ZK	5
B1M13JAS1	Quality and Reliability 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.	Z,ZK	6
B1MPROJ	Individual project 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.	Z	5
B1M15PPE1	Elements and Operation of Electrical Power Systems	Z,ZK	5
B1M14SSE	Machinery and Structures of Power Plants 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.	Z,ZK	5

Name of the block: Povinné p edm ty zam ení

Minimal number of credits of the block: 45

The role of the block: PZ

Code of the group: 2018\_MEEMPPS1

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 Elektrické pohony

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
B1M14DEP	<b>Digital Control of Electric Drives</b> Jan Bauer, Jiří Zdeněk Jiří Zdeněk (Gar.)	Z,ZK	5	2P+2L	L	PZ
B1M14EPT1	<b>Electric Drives and Traction</b> Jan Bauer, Jiří Lettl Jan Bauer Jiří Lettl (Gar.)	Z,ZK	5	2P+2L	Z	PZ
B1M14REP	<b>Control and Regulation of Electric Drives</b> Radek Havlíček, Evžen Thöndel Evžen Thöndel	Z,ZK	5	2P+2L	Z	PZ

**Characteristics of the courses of this group of Study Plan: Code=2018\_MEEMPPS1 Name=Compulsory subjects of the specialization**

B1M14DEP	Digital Control of Electric Drives	Z,ZK	5	The course deals with basic blocks of control computer for electric drive. It is also discussed the issue of discretization drive control and software and hardware resources needed for developing and debugging control program for electric drive.		
B1M14EPT1	Electric Drives and Traction	Z,ZK	5	The first part of the course focuses on the basics of designing AC drives with AC motors at different power supply types and loads, their reliability, design for potentially explosive atmospheres and for special purposes as well as the necessary technical documentation. In the second part, students are introduced to mathematical modeling, control strategies (vector control, direct torque control) and basic techniques of induction motor parameter estimation. Furthermore, the control and nonlinear behavior of a two-level voltage-source inverter equipped with IGBT elements as the most commonly used power converter for induction motors is analyzed.		
B1M14REP	Control and Regulation of Electric Drives	Z,ZK	5	The course is an introduction to the problems of the theory of continuous control of electrical drives and power converters. During the semester are discussed the basics of feedback control, transmission system, determining the stability of the system, including controller types and methods of tuning.		

Code of the group: 2018\_MEEMPS

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
B1M13ASS	<b>Solar Systems Application</b> Vít zslav Benda, Jakub Holovský Jakub Holovský Vít zslav Benda (Gar.)	Z,ZK	5	2P+2L	Z	PZ
B1M13EKP	<b>Ecology and materials</b> Ivan Kudláček, Eva Horynová, Jan Weinzettel, Branislav Dzurák Ivan Kudláček Ivan Kudláček (Gar.)	Z,ZK	5	2P+2L	Z	PZ
B1M14ESP	<b>Electric Machinery and Apparatus</b> Ondřej Lipák, Pavel Mindl Pavel Mindl Pavel Mindl (Gar.)	Z,ZK	5	2P+2L	Z	PZ
B1M15PRE1	<b>Transmission and Distribution of Electricity</b> Zdeněk Müller, Ivo Doležal, Ladislav Musil Zdeněk Müller (Gar.)	Z,ZK	5	2P+2S	Z	PZ
B1M15TVN	<b>High Voltage Engineering</b> Jan Koller, Jan Hlaváček	Z,ZK	5	2P+2L	L	PZ
B1M14TVM	<b>Theory and Application of Power Converters</b> Jiří Lettl Jiří Lettl Jiří Lettl (Gar.)	Z,ZK	5	2P+2L	L	PZ

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

B1M13ASS	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.		
B1M13EKP	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.		
B1M14ESP	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.		
B1M15PRE1	Transmission and Distribution of Electricity	Z,ZK	5			
B1M15TVN	High Voltage Engineering	Z,ZK	5			
B1M14TVM	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.		

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 10

The role of the block: PV

Code of the group: 2018\_MEEMPV1

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
B1M16EUE1	<b>Economy of Energy Use</b> Ji í Beranovský Ji í Beranovský Ji í Beranovský (Gar.)	Z,ZK	5	2P+2S	L	PV
B1M15ELS	<b>Electrical Light</b> Petr Žák	Z,ZK	5	2P+2L	L	PV
B1M14MDS1	<b>Modeling of Dynamical Systems</b> Petr Ko árnik Petr Ko árnik Petr Ko árnik (Gar.)	Z,ZK	5	2P+2C	L	PV
B1M13VSE	<b>Power components in electrical engineering</b> Václav Papež Václav Papež Václav Papež (Gar.)	Z,ZK	5	2P+2L	L	PV

Characteristics of the courses of this group of Study Plan: Code=2018\_MEEMPV1 Name=Compulsory elective subjects of the specialization

B1M16EUE1	Economy 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.	Z,ZK	5
B1M15ELS	Electrical Light	Z,ZK	5
B1M14MDS1	Modeling of Dynamical Systems 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.	Z,ZK	5
B1M13VSE	Power components in electrical engineering 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.	Z,ZK	5

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: MTV

Name of the group: Physical education

Requirement credits in the group:

Requirement courses in the group:

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
TVV	<b>Physical education</b>	Z	0	0+2	Z,L	v
A003TV	<b>Physical Education</b> Ji í Drnek	Z	2	0+2	L,Z	v
TV-V1	<b>Physical education</b>	Z	1	0+2	Z,L	v
TVV0	<b>Physical education</b>	Z	0	0+2	Z,L	v
TVKLV	<b>Physical Education Course</b>	Z	0	7dní	L	v
TVKZV	<b>Physical Education Course</b>	Z	0	7dní	Z	v

Characteristics of the courses of this group of Study Plan: Code=MTV Name=Physical education

A003TV	Physical Education	Z	2
TVV	Physical education	Z	0
TV-V1	Physical education	Z	1
TVV0	Physical education	Z	0
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0

Code of the group: 2018\_MEEMVOL

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
A003TV	Physical Education	Z	2
B0M16FIL		Z,ZK	5
B0M16HSD1	History of economy and social studies 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.	Z,ZK	5
B0M16HVT	History of science and technology 2 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	Z,ZK	5
B0M16PSM	Psychology	Z,ZK	5
B0M16TEO	Theology 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 grows our civilization up.	Z,ZK	5
B1M13ASS	Solar Systems Application 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.	Z,ZK	5
B1M13EKP	Ecology and materials 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.	Z,ZK	5
B1M13JAS1	Quality and Reliability 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.	Z,ZK	6
B1M13VSE	Power components in electrical engineering 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.	Z,ZK	5
B1M14DEP	Digital Control of Electric Drives The course deals with basics blocks of control computer for electric drive. It is also discussed the issue of discretization drive control and software and hardware resources needed for developing and debugging control program for electric drive.	Z,ZK	5
B1M14EPT1	Electric Drives and Traction The first part of the course focuses on the basics of designing AC drives with AC motors at different power supply types and loads, their reliability, design for potentially explosive atmospheres and for special purposes as well as the necessary technical documentation. In the second part, students are introduced to mathematical modeling, control strategies (vector control, direct torque control) and basic techniques of induction motor parameter estimation. Furthermore, the control and nonlinear behavior of a two-level voltage-source inverter equipped with IGBT elements as the most commonly used power converter for induction motors is analyzed.	Z,ZK	5
B1M14ESP	Electric Machinery and Apparatus 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.	Z,ZK	5
B1M14MDS1	Modeling of Dynamical Systems 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.	Z,ZK	5
B1M14REP	Control and Regulation of Electric Drives The course is an introduction to the problems of the theory of continuous control of electrical drives and power converters. During the semester are discussed the basics of feedback control, transmission system, determining the stability of the system, including controller types and methods of tuning.	Z,ZK	5
B1M14SSE	Machinery and Structures of Power Plants 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.	Z,ZK	5

B1M14TVM	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.			
B1M15ELS	Electrical Light	Z,ZK	5
B1M15IAP	Engineering Applications	Z,ZK	5
B1M15PPE1	Elements and Operation of Electrical Power Systems	Z,ZK	5
B1M15PRE1	Transmission and Distribution of Electricity	Z,ZK	5
B1M15TVN	High Voltage Engineering	Z,ZK	5
B1M16EKE1	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.			
B1M16EUE1	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.			
B1MPROJ	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.			
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.			
TV-V1	Physical education	Z	1
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0

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

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