

Study plan

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

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Electric Drives and Traction

Branch of study guaranteed by the department: Electrical Machines, Apparatus and Drives

Garantor of the study branch: prof. Ing. Jiří Lettl, CSc.

Program of study: Electrical Engineering, Power Engineering and Management

Type of study: Follow-up master full-time

Required credits: 110

Elective courses credits: 10

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: 87

The role of the block: P

Code of the group: 2015_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) 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=2015_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: 2015_MEEMP1

Name of the group: Compulsory subjects of the programme

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

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

Credits in the group: 62

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	Solar Systems Application Ladislava Černá, Vítězslav Benda, Pavel Hrzina, Jakub Holovský Jakub Holovský Vítězslav Benda (Gar.)	Z,ZK	5	2P+2L	Z	P
B1M13EMP	Ecology of materials and processes Ivan Kudláček, Jan Weinzettel Jan Weinzettel Ivan Kudláček (Gar.)	Z,ZK	5	2P+2L	L	P
B1M16EKE	Economy of Power Industry	KZ	4	2P+2S	Z	P
B1M14EPT	Electric Drives and Traction Jiří Lettl Jiří Lettl	Z,ZK	6	2P+2L	Z	P
B1M14ESP	Electric Machinery and Apparatus Pavel Mindl, Petr Voženílek Pavel Mindl Pavel Mindl (Gar.)	Z,ZK	5	2P+2L	Z	P
B1M15ENY	Power Plants Jan Špetlík, Zdeněk Müller, Stanislav Bouček Zdeněk Müller (Gar.)	Z,ZK	5	2P+2S	L	P

B1M15IAP	Engineering Applications <i>Jan Kyncl Jan Kyncl (Gar.)</i>	Z,ZK	5	2P+2C	Z	P
B1M13JAS	Quality and Reliability <i>Pavel Mach Pavel Mach Pavel Mach (Gar.)</i>	Z,ZK	6	2P+2C	Z	P
B1M15PRE	Transmission and Distribution of Electricity <i>Zdeněk Müller, Ladislav Musil Zdeněk Müller (Gar.)</i>	Z,ZK	6	2P+2S	Z	P
B1M14SSE	Machinery and Structures of Power Plants <i>Petr Kočárník, Jiří Štastný Petr Kočárník Petr Kočárník (Gar.)</i>	Z,ZK	5	2P+2C	Z	P
B1M15TVN	High Voltage Engineering <i>Radek Procházka Radek Procházka (Gar.)</i>	Z,ZK	5	2P+2L	L	P
B1M14TVM	Theory and Application of Power Converters <i>Jiří Lettl Jan Bauer Jiří Lettl (Gar.)</i>	Z,ZK	5	2P+2L	L	P

Characteristics of the courses of this group of Study Plan: Code=2015_MEEMP1 Name=Compulsory subjects of the programme

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.		
B1M13EMP	Ecology of materials and processes	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.		
B1M16EKE	Economy of Power Industry	KZ	4	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.		
B1M14EPT	Electric Drives and Traction	Z,ZK	6	The course focuses on the principles of designing electric drives with AC motors in different ways and different types of load, reliability, design for explosive environments and for special purposes and the necessary technical documentation. Students learn the basics of electric traction drives for trams in public transport systems, electric locomotives, as well as the systems of hybrid cars and electric vehicles.		
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.		
B1M15ENY	Power Plants	Z,ZK	5			
B1M15IAP	Engineering Applications	Z,ZK	5			
B1M13JAS	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.		
B1M15PRE	Transmission and Distribution of Electricity	Z,ZK	6			
B1M14SSE	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.		
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 courses of the specialization

Minimal number of credits of the block: 19

The role of the block: PO

Code of the group: 2015_MEEMPO2

Name of the group: Compulsory subjects of the branch

Requirement credits in the group: In this group you have to gain 19 credits

Requirement courses in the group: In this group you have to complete 4 courses

Credits in the group: 19

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
B1M14DEP	Digital Control of Electric Drives <i>Jan Bauer, Jiří Zdeněk Jiří Zdeněk (Gar.)</i>	Z,ZK	5	2P+2L	L	PO
B1M14IND	Individual Master Project	Z	4	0+4c	Z	PO

B1M14SOP	Simulation and Optimization in Electric Drives <i>Karel Buhr, Viktor Valouch Pavel Koblře Viktor Valouch (Gar.)</i>	Z,ZK	5	2P+2L	L	PO
B1M14REP	Control and Regulation of Electric Drives <i>Radek Havlíček, Evžen Thöndel Evžen Thöndel</i>	Z,ZK	5	2P+2L	Z	PO

Characteristics of the courses of this group of Study Plan: Code=2015_MEEMPO2 Name=Compulsory subjects of the branch

B1M14DEP	Digital Control of Electric Drives	Z,ZK	5	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.		
B1M14IND	Individual Master Project	Z	4	Individual work as a project. Student will choose from a topics listed by department. The project can be focused on preliminary solving the problems of diploma thesis.		
B1M14SOP	Simulation and Optimization in Electric Drives	Z,ZK	5	Models of dynamical systems. Methods and process of simulation. Program Pspice. Matlab/Simulink environment. State models of systems and solutions. Control circuits, controllers, and determination of parameters. Circuit models of power converters. Dynamical models in average values of power electronic converters. Models of converters and machines for high frequencies. Method of finite elements and use for optimization of magnetic field in electric machine. Process and SW tools for design of main types of electric machines.		
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.		

Name of the block: Elective courses

Minimal number of credits of the block: 4

The role of the block: V

Code of the group: 2015_MEEMH

Name of the group: Humanities subjects

Requirement credits in the group: In this group you have to gain at least 4 credits (at most 22)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 6)

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
B0M16FI2	Philosophy 2	Z,ZK	4	2P+2S	L	v
B0M16HT2	History of science and technology 2 <i>Marcela Efmertová Marcela Efmertová Marcela Efmertová (Gar.)</i>	Z,ZK	4	2P+2S	L	v
B0M16HSD	History of economy and social studies <i>Marcela Efmertová</i>	Z,ZK	4	2P+2S	L	v
B0M16MPS	Psychology <i>Jan Fiala Jan Fiala Jan Fiala (Gar.)</i>	Z,ZK	4	2P+2S	Z,L	v
B0M16TE1	Theology <i>Vladimír Slámečka Vladimír Slámečka Vladimír Slámečka (Gar.)</i>	Z,ZK	4	2P+2S	L	v
A003TV	Physical Education	Z	2	0+2	L,Z	v

Characteristics of the courses of this group of Study Plan: Code=2015_MEEMH Name=Humanities subjects

B0M16FI2	Philosophy 2	Z,ZK	4	The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.		
B0M16HT2	History of science and technology 2	Z,ZK	4	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		
B0M16HSD	History of economy and social studies	Z,ZK	4	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.		
B0M16MPS	Psychology	Z,ZK	4			
B0M16TE1	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 grows our civilization up.		
A003TV	Physical Education	Z	2			

Code of the group: MTV

Name of the group: Tělesná výchova

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	Physical education	Z	0	0+2	Z,L	v
TVV0	Physical education	Z	0	0+2	Z,L	v
TV-V1	Physical education	Z	1	0+2	Z,L	v
TVKLV	Physical Education Course	Z	0	7dní	L	v
TVKZV	Physical Education Course	Z	0	7dní	Z	v

Characteristics of the courses of this group of Study Plan: Code=MTV Name=Tělesná výchova

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

Code of the group: 2015_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
B0M16FI2	Philosophy 2 The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.	Z,ZK	4
B0M16HSD	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	4
B0M16HT2	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	4
B0M16MPS	Psychology	Z,ZK	4
B0M16TE1	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	4
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
B1M13EMP	Ecology of materials and processes 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
B1M13JAS	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
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

B1M14EPT	Electric Drives and Traction	Z,ZK	6
The course focuses on the principles of designing electric drives with AC motors in different ways and different types of load, reliability, design for explosive environments and for special purposes and the necessary technical documentation. Students learn the basics of electric traction drives for trams in public transport systems, electric locomotives, as well as the systems of hybrid cars and electric vehicles.			
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.			
B1M14IND	Individual Master Project	Z	4
Individual work as a project. Student will choose from a topics listed by department. The project can be focused on preliminary solving the problems of diploma thesis.			
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.			
B1M14SOP	Simulation and Optimization in Electric Drives	Z,ZK	5
Models of dynamical systems. Methods and process of simulation. Program Pspice. Matlab/Simulink environment. State models of systems and solutions. Control circuits, controllers, and determination of parameters. Circuit models of power converters. Dynamical models in average values of power electronic converters. Models of converters and machines for high frequencies. Method of finite elements and use for optimization of magnetic field in electric machine. Process and SW tools for design of main types of electric machines.			
B1M14SSE	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.			
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.			
B1M15ENY	Power Plants	Z,ZK	5
B1M15IAP	Engineering Applications	Z,ZK	5
B1M15PRE	Transmission and Distribution of Electricity	Z,ZK	6
B1M15TVN	High Voltage Engineering	Z,ZK	5
B1M16EKE	Economy of Power Industry	KZ	4
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.			
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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