

# Study plan

## Name of study plan: Electronics and Communications - Electronics

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Microelectronics

Branch of study guaranteed by the department:

Garantor of the study branch:

Program of study: Electronics and Communications

Type of study: Follow-up master full-time

Required credits: 109

Elective courses credits: 11

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: 109

The role of the block: P

Code of the group: 2018\_MEKEP1

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 84 credits

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

Credits in the group: 84

Note on the group:

Specializace elektronika

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
BE2M17CADA	<b>CAD in HF Technique</b> Zbyn k Škvor <b>Zbyn k Škvor</b> Zbyn k Škvor (Gar.)	Z,ZK	6	2P+2C	L	P
BE2M34ZETA	<b>Custom Electronics Design</b> Vladimír Janík <b>Vladimír Janík</b> Vladimír Janík (Gar.)	KZ	6	2P+2L	Z	P
BE2M34NIS	<b>Design of Integrated Circuits</b> Vladimír Janík, Jiří Jakovenko <b>Vladimír Janík</b> Jiří Jakovenko (Gar.)	Z,ZK	6	2P+2C	L	P
BE2M31DSPA	<b>Digital Signal Processing</b> Petr Pollák <b>Petr Pollák</b> Petr Pollák (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2M34EZSA	<b>Electronic Security Systems</b> Miroslav Husák <b>Miroslav Husák</b> Miroslav Husák (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2M34SIS	<b>Integrated System Structures</b> Vladimír Janík, Jiří Jakovenko <b>Vladimír Janík</b> Jiří Jakovenko (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2M37MAM	<b>Microprocessors</b> Stanislav Vítek <b>Stanislav Vítek</b> Stanislav Vítek (Gar.)	Z,ZK	6	2P+2L	Z	P
BE2M34MST	<b>Microsystems</b> Miroslav Husák, Adam Bou a Miroslav Husák (Gar.)	Z,ZK	6	2P+2L	L	P
BE2M34NANA	<b>Nanoelectronics and Nanotechnology</b> Jan Voves <b>Jan Voves</b> Jan Voves (Gar.)	Z,ZK	6	2P+2C	L	P
BE2M34PIOA	<b>Planar Integrated Optics</b> Vít zslav Je ábek, Václav Prajzler <b>Václav Prajzler</b> Vít zslav Je ábek (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2MPROJ6	<b>Project</b> Jan Šístek, Pavel Máša, Ivan Pravda, Lubor Jirásek, Zdeněk Bevá, František Rund <b>František Rund</b> František Rund (Gar.)	Z	6	0p+6s		P
BE2M34SST	<b>Solid State Physics</b> Jan Voves <b>Jan Voves</b> Jan Voves (Gar.)	Z,ZK	6	3P+1L	Z	P
BE2M34NSV	<b>VLSI System Design</b> Pavel Hazdra <b>Pavel Hazdra</b> Pavel Hazdra (Gar.)	Z,ZK	6	2P+2L	Z	P
BE2M32BTSA	<b>Wireless Technologies</b> Zdeněk Bevá, Lukáš Vojtch, Zbyněk Kocur <b>Lukáš Vojtch</b> Zdeněk Bevá (Gar.)	Z,ZK	6	2P + 2L	Z,L	P

Characteristics of the courses of this group of Study Plan: Code=2018\_MEKEP1 Name=Compulsory subjects of the programme

BE2M17CADA	CAD in HF Technique	Z,ZK	6
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Introduction into principles and techniques used in modern microwave circuit design.

BE2M34ZETA	Custom Electronics Design	KZ	6
The course deals with the design methodology of advanced custom electronics. The aim is to convert theoretical knowledge of previous studies into specific proposals for practical applications. Student are getting familiar with the problems encountered in the professional electronic design and manufacturing. This course is based on real experience in development and production, showing the latest technological trends and component base.			
BE2M34NIS	Design of Integrated Circuits	Z,ZK	6
Main tasks of integrated circuits designer; design abstraction levels - Y chart. Definitions of specification, feasibility study, criteria for technology and design kits selection. Integrated systems design and simulation methodologies. Main features of full custom design, gate array, standard cells, programmable array logic. Design aspects of RF and mobile low power systems. Verilog-A, Verilog-AMS, VHDL-A. Logic and physical synthesis. Front End and Back End design. Floorplanning, place and route, layout, parasitic extraction, time analysis, testbenches design and verification.			
BE2M31DSPA	Digital Signal Processing	Z,ZK	6
The subject gives overview about basic methods of digital signal processing and their applications (examples from speech and biological signal processing): discrete-time signals and systems, signal characteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter design, digital filtering in time and frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found at &lt;a href=http://noel.feld.cvut.cz/vyu/be2m31dspa&gt;http://noel.feld.cvut.cz/vyu/be2m31dspa&lt;/a&gt; .			
BE2M34EZSA	Electronic Security Systems	Z,ZK	6
The subject describes the system design, electronic solutions, conception characteristics, reliability and its increasing of electronic security and safety systems. It reports solutions of electronic sensor systems and methods of security system design, usage of modern electronic components and microprocessors. It offers practical applications suitable for safety systems of houses, cars, industry companies.			
BE2M34SIS	Integrated System Structures	Z,ZK	6
Student learn main design methodologies of analog, digital and optoelectronic integrated systems; Detailed description of the technological process for the IC production; CMOS technologies and its advanced sub-micron trends; IC chip topology, layout and design rules; Technology of micro-electro-mechanical systems MEMS.			
BE2M37MAM	Microprocessors	Z,ZK	6
The aim is to make students acquainted with the properties of microprocessor systems, make students familiar with on-chip peripherals, connect external circuit to the processor bus, and with implementation of the memory or I/O space address extension. Next, taught the students to make simple program in the assembly language, C language and combination of both. After completion of this subject student should be able to design and implement simpler microprocessor system including connection of necessary peripherals and software design.			
BE2M34MST	Microsystems	Z,ZK	6
The course deals with system integration applied in the design of digital and analog systems. It demonstrates the new possibilities of implementation and application of integrated microelectronic devices based on various physical and biochemical principles. It presents primarily MEMS technology that increases reliability with all its attributes. The course presents the modern action elements and microactuators, whose operation is based on fundamental physical and biochemical principles, including basic applications in micromanipulation, microrobots, microdrives, microsurgery, multimedia, medical, industrial control, automotive, etc. In the course are presented the principles of touch screens, microgenerators of electrical energy. There are mentioned basic elements of the use of nanotechnology and nanoelectronic structures and basic microsystem technologies.			
BE2M34NANA	Nanoelectronics and Nanotechnology	Z,ZK	6
The subject is oriented on the present nanotechnologies in the connection with their electronic, photonic and spintronic applications. Quantum theory basics are used to explain the effects observed in nanostructures. Basic nanoelectronic structures are described with their possible applications. Modern computer methods and models, which are able to simulate the operation of nanoelectronic structures and which are the important tools for their design and optimisation, are studied.			
BE2M34PIOA	Planar Integrated Optics	Z,ZK	6
The subject describes theoretical and technological principles and design of planar integrated optics and optoelectronics as optical dividers, The students get acquainted with the principles of the light propagation in planar waveguide and with basic devices and structures of integrated optics and optoelectronics as coupling elements, optical microresonators, planar optical transmitters an receivers with SS-LD, WG-PD . In the course are integrated devices and structures for telecommunication for multiplexing and signal processing. There are optical elements for physical and chemical sensor application and basic important measurement and diagnostic methods.			
BE2MPROJ6	Project	Z	6
Independent work in the form of a project. 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 project will be defended within the framework of a subject. List of possible topics: <a href="http://www.fel.cvut.cz/en/education/semestral-projects.html">http://www.fel.cvut.cz/en/education/semestral-projects.html</a>			
BE2M34SST	Solid State Physics	Z,ZK	6
The subject is aimed on solid state physics including some parts of statistical physics.			
BE2M34NSV	VLSI System Design	Z,ZK	6
Introduction to basic building blocks, architecture and design methodologies of advanced VLSI systems. Structure and design of digital and analogue integrated circuit subsystems. Integrated system description and synthesis using cell libraries and IP cores. Synchronization, power consumption and parasitics reduction issues. Testing and reliability of integrated systems. In seminars and labs, the hardware description language VHDL will be explained and used for practical design, synthesis and testing of a system on chip.			
BE2M32BTSA	Wireless Technologies	Z,ZK	6
The lectures give overview of fundamental principles of wireless networks in various areas of their application. Students will understand architecture, principles and protocols used in different wireless technologies and learn how these technologies can be exploited in real world applications. The goal is to teach students how to solve problems related to deployment of wireless networks, their operation or development of wireless networks components.			

Code of the group: 2018\_MEKEDIP

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

Code of the group: 2018\_MEKEVOL  
 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>

Code of the group: 2018\_MEKEH  
 Name of the group: Humanities subjects  
 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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
AE0M32KMP	<b>Communications and Media Law</b> <i>Zden k Brabec, Petr Ondrá ek Zden k Brabec Zden k Brabec (Gar.)</i>	Z,ZK	4	2P + 2C	Z,L	v
BE0M16HSD	<b>History of economy and social studies</b>	Z,ZK	4	2P+2S	L	v
BE0M16HT2	<b>History of science and technology 2</b>	Z,ZK	4	2P+2S	L	v
BE0M16FI2	<b>Philosophy II</b>	Z,ZK	4	2P+2S	L	v
BE0M16MPS	<b>Psychology</b>	Z,ZK	4	2P+2S	L	v
BE0M16TE1	<b>Theology</b>	Z,ZK	4	2P+2S	L	v

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

AE0M32KMP	Communications and Media Law	Z,ZK	4
A complex course dedicated to interdisciplinary problems - the legal aspects of electronic communications (information and communications systems), as well as media from the viewpoint of European and national law. It analyses the areas of informatics, electronic communications, information society services, copyright and general intellectual property rights, the protection of identity, introduction to software law and the Internet as a global communication and information system.			
BE0M16HSD	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.			
BE0M16HT2	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			
BE0M16FI2	Philosophy II	Z,ZK	4
The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.			
BE0M16MPS	Psychology	Z,ZK	4
BE0M16TE1	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.			

## List of courses of this pass:

Code	Name of the course	Completion	Credits
AE0M32KMP	Communications and Media Law A complex course dedicated to interdisciplinary problems - the legal aspects of electronic communications (information and communications systems), as well as media from the viewpoint of European and national law. It analyses the areas of informatics, electronic communications, information society services, copyright and general intellectual property rights, the protection of identity, introduction to software law and the Internet as a global communication and information system.	Z,ZK	4
BDIP25	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25
BE0M16FI2	Philosophy II The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.	Z,ZK	4
BE0M16HSD	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
BE0M16HT2	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
BE0M16MPS	Psychology	Z,ZK	4
BE0M16TE1	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
BE2M17CADA	CAD in HF Technique Introduction into principles and techniques used in modern microwave circuit design.	Z,ZK	6
BE2M31DSPA	Digital Signal Processing The subject gives overview about basic methods of digital signal processing and their applications (examples from speech and biological signal processing): discrete-time signals and systems, signal characteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter design, digital filtering in time and frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found at &lt;a href=http://noel.feld.cvut.cz/vyu/be2m31dspa&gt;http://noel.feld.cvut.cz/vyu/be2m31dspa&lt;/a&gt; .	Z,ZK	6
BE2M32BTSA	Wireless Technologies The lectures give overview of fundamental principles of wireless networks in various areas of their application. Students will understand architecture, principles and protocols used in different wireless technologies and learn how these technologies can be exploited in real world applications. The goal is to teach students how to solve problems related to deployment of wireless networks, their operation or development of wireless networks components.	Z,ZK	6
BE2M34EZSA	Electronic Security Systems The subject describes the system design, electronic solutions, conception characteristics, reliability and its increasing of electronic security and safety systems. It reports solutions of electronic sensor systems and methods of security system design, usage of modern electronic components and microprocessors. It offers practical applications suitable for safety systems of houses, cars, industry companies.	Z,ZK	6
BE2M34MST	Microsystems The course deals with system integration applied in the design of digital and analog systems. It demonstrates the new possibilities of implementation and application of integrated microelectronic devices based on various physical and biochemical principles. It presents primarily MEMS technology that increases reliability with all its attributes. The course presents the modern action elements and microactuators, whose operation is based on fundamental physical and biochemical principles, including basic applications in micromanipulation, microrobots, microdrives, microsurgery, multimedia, medical, industrial control, automotive, etc. In the course are presented the principles of touch screens, microgenerators of electrical energy. There are mentioned basic elements of the use of nanotechnology and nanoelectronic structures and basic microsystem technologies.	Z,ZK	6
BE2M34NANA	Nanoelectronics and Nanotechnology The subject is oriented on the present nanotechnologies in the connection with their electronic, photonic and spintronic applications. Quantum theory basics are used to explain the effects observed in nanostructures. Basic nanoelectronic structures are described with their possible applications. Modern computer methods and models, which are able to simulate the operation of nanoelectronic structures and which are the important tools for their design and optimisation, are studied.	Z,ZK	6
BE2M34NIS	Design of Integrated Circuits Main tasks of integrated circuits designer; design abstraction levels - Y chart. Definitions of specification, feasibility study, criteria for technology and design kits selection. Integrated systems design and simulation methodologies. Main features of full custom design, gate array, standard cells, programmable array logic. Design aspects of RF and mobile low power systems. Verilog-A, Verilog-AMS, VHDL-A. Logic and physical synthesis. Front End and Back End design. Floorplanning, place and route, layout, parasitic extraction, time analysis, testbenches design and verification.	Z,ZK	6
BE2M34NSV	VLSI System Design Introduction to basic building blocks, architecture and design methodologies of advanced VLSI systems. Structure and design of digital and analogue integrated circuit subsystems. Integrated system description and synthesis using cell libraries and IP cores. Synchronization, power consumption and parasitics reduction issues. Testing and reliability of integrated systems. In seminars and labs, the hardware description language VHDL will be explained and used for practical design, synthesis and testing of a system on chip.	Z,ZK	6
BE2M34PIOA	Planar Integrated Optics The subject describes theoretical and technological principles and design of planar integrated optics and optoelectronics as optical dividers, The students get acquainted with the principles of the light propagation in planar waveguide and with basic devices and structures of integrated optics and optoelectronics as coupling elements, optical microresonators, planar optical transmitters an receivers with SS-LD, WG-PD . In the course are integrated devices and structures for telecommunication for multiplexing and signal processing. There are optical elements for physical and chemical sensor application and basic important measurement and diagnostic methods.	Z,ZK	6
BE2M34SIS	Integrated System Structures Student learn main design methodologies of analog, digital and optoelectronic integrated systems; Detailed description of the technological process for the IC production; CMOS technologies and its advanced sub-micron trends; IC chip topology, layout and design rules; Technology of micro-electro-mechanical systems MEMS.	Z,ZK	6

BE2M34SST	<b>Solid State Physics</b> The subject is aimed on solid state physics including some parts of statistical physics.	Z,ZK	6
BE2M34ZETA	<b>Custom Electronics Design</b> The course deals with the design methodology of advanced custom electronics. The aim is to convert theoretical knowledge of previous studies into specific proposals for practical applications. Student are getting familiar with the problems encountered in the professional electronic design and manufacturing. This course is based on real experience in development and production, showing the latest technological trends and component base.	KZ	6
BE2M37MAM	<b>Microprocessors</b> The aim is to make students acquainted with the properties of microprocessor systems, make students familiar with on-chip peripherals, connect external circuit to the processor bus, and with implementation of the memory or I/O space address extension. Next, taught the students to make simple program in the assembly language, C language and combination of both. After completion of this subject student should be able to design and implement simpler microprocessor system including connection of necessary peripherals and software design.	Z,ZK	6
BE2MPROJ6	<b>Project</b> Independent work in the form of a project. 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 project will be defended within the framework of a subject. List of possible topics: <a href="http://www.fel.cvut.cz/en/education/semestral-projects.html">http://www.fel.cvut.cz/en/education/semestral-projects.html</a>	Z	6

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

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