

## Recommended pass through the study plan

### Name of the pass: Specialization Technology of the Internet of Things - Passage through study

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Radioelectronics

Pass through the study plan: Electronics and Communications - Technology of the Internet of Things

Branch of study guaranteed by the department:

Guarantor of the study branch:

Program of study: Electronics and Communications

Type of study: Follow-up master full-time

Note on the pass:

Coding of roles of courses and groups of courses:

P - compulsory courses of the program, PO - compulsory courses of the branch, Z - compulsory courses, S - compulsory elective courses, PV - compulsory elective courses, F - elective specialized courses, V - elective courses, T - physical training courses

Coding of ways of completion of courses (KZ/Z/ZK) and coding of semesters (Z/L):

KZ - graded assesment, Z - assesment, ZK - examination, L - summer semester, Z - winter semester

Number of semester: 1

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
BE2M32PST	<b>Advanced Networking Technologies</b> Leoš Boháč <b>Zbyněk Kocur</b> Leoš Boháč (Gar.)	Z,ZK	6	2P + 2L	Z,L	P
BE2M31DSPA	<b>Digital Signal Processing</b> Petr Pollák <b>Petr Pollák</b> Petr Pollák (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2M34SIS	<b>Integrated System Structures</b> Jiří Jakovenko, Vladimír Janíček <b>Vladimír Janíček</b> Jiří Jakovenko (Gar.)	Z,ZK	6	2P+2C	Z	P
BE2M37MAM	<b>Microprocessors</b> Stanislav Vitek <b>Stanislav Vitek</b> Stanislav Vitek (Gar.)	Z,ZK	6	2P+2L	Z	P
BE2M32MKSA	<b>Mobile Networks</b> Zdeněk Bečvář, Pavel Mach <b>Pavel Mach</b> Zdeněk Bečvář (Gar.)	Z,ZK	6	2P + 2L	Z	P
BEEZM	<b>Safety in Electrical Engineering for a master's degree</b> Vladimír Kůla, Ivana Nová, Josef Černohous <b>Vladimír Kůla</b> Vladimír Kůla (Gar.)	Z	0	2BP+2BC	Z	P

Number of semester: 2

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
BE2M34MST	<b>Microsystems</b> Miroslav Husák, Adam Bouřa Miroslav Husák (Gar.)	Z,ZK	6	2P+2L	L	P
BE2M17SBS	<b>Wave Propagation for Wireless Links</b> Jan Kraček, Miloš Mazánek, Pavel Pechač <b>Jan Kraček</b> Pavel Pechač (Gar.)	Z,ZK	6	2P+2C	L	P
BE2M32BTSA	<b>Wireless Technologies</b> Zbyněk Kocur, Zdeněk Bečvář, Lukáš Vojtěch <b>Lukáš Vojtěch</b> Zdeněk Bečvář (Gar.)	Z,ZK	6	2P + 2L	Z,L	P
2018_MEKEPV4	<b>Compulsory subjects of the programme</b> BE2M31ADAA, BE2M17ANT,..... (see the list of groups below)	Min. cours. 5 Max. cours. 5	Min/Max 30/30			PV

Number of semester: 3

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
BE2MPROJ6	<b>Project</b> Zdeněk Bečvář, Ivan Pravda, Jan Šístek, Pavel Máša, Lubor Jirásek, František Rund <b>František Rund</b> František Rund (Gar.)	Z	6	0p+6s		P

2018_MEKEPV4	<b>Compulsory subjects of the programme</b> <i>BE2M31ADAA, BE2M17ANT,..... (see the list of groups below)</i>	Min. cours. 5 Max. cours. 5	Min/Max 30/30			PV
2018_MEKEVOL	<b>Elective subjects</b>	Min. cours. 0	Min/Max 0/999			V

Number of semester: 4

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
2018_MEKEVOL	<b>Elective subjects</b>	Min. cours. 0	Min/Max 0/999			V

### List of groups of courses of this pass with the complete content of members of individual groups

Kód	Name of the group of courses and codes of members of this group (for specification see here or below the list of courses)	Completion	Credits	Scope	Semester	Role
2018_MEKEPV4	<b>Compulsory subjects of the programme</b>	Min. cours. 5 Max. cours. 5	Min/Max 30/30			PV
BE2M31ADAA	Adaptive Signal Processing	BE2M17ANT	Antennas	BE2M37KDKA	Coding in Digital Communications	
BE2M34ZETA	Custom Electronics Design	BE2M34NIS	Design of Integrated Circuits	BE2M37DKM	Digital Communications	
BE2M37OBFA	Image Photonics	BE2M32IBEA	Information Security			
2018_MEKEVOL	<b>Elective subjects</b>	Min. cours. 0	Min/Max 0/999			V

### 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.			
BE2M17ANT	Antennas	Z,ZK	6
Student will get strong knowledge about theory of electromagnetic field radiation and basic principles of antenna design. Methods of analysis are demonstrated on various types of antennas and their arrays. Seminars are both theoretical (analytical and numerical calculation using MATLAB and EM simulators CST) and practical (measurement of antenna parameters).			
BE2M17SBS	Wave Propagation for Wireless Links	Z,ZK	6
The aim of the course is to study the wireless transmission channel in real environments focusing on wave propagation for planning of terrestrial and satellite wireless links. The syllabus includes both deeper theoretical foundations of radio wave propagation in the atmosphere as well as ITU-R design procedures for terrestrial and satellite, fixed and mobile communications in various frequency bands.			
BE2M31ADAA	Adaptive Signal Processing	Z,ZK	6
This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming. The course explains adaptive algorithms for estimation and prediction, including analysis, implementation and practical applications. Next, it describes the algorithms for adaptive decorrelation and separation of multidimensional signals. Last, the course provides analysis of adaptive beamforming techniques.			
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 &t;a href=http://noel.feld.cvut.cz/vyu/be2m31dspa&t;http://noel.feld.cvut.cz/vyu/be2m31dspa&t;a&t; .			

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.			
BE2M32IBEA	Information Security	Z,ZK	6
The Information Security course provides a complete source of information on the field of security of information systems and information technologies. The most of information in today society is created, transferred, stored in electronic form so information security is very important part of it. Technical background for information security is provided by cryptology.			
BE2M32MKSA	Mobile Networks	Z,ZK	6
The lectures introduce principles and functionalities of mobile networks with special focus on currently deployed technologies and future mobile networks. Furthermore, architecture and fundamental principles of GSM, UMTS, LTE and LTE-A will be explained. Then, selected key technologies for future mobile networks (e.g., 5G) will be explained.			
BE2M32PST	Advanced Networking Technologies	Z,ZK	6
Subject Advanced Network Technologies extends student knowledge in an area of modern network technologies. The course strives to deepen student's knowledge in more advanced technical features of contemporary networking protocols in data networks. Students will get hands-on experience with topics like Internet unicast routing, multicast routing, IPv6 and design of MPLS networks using various network simulation tools.			
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.			
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.			
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.			
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.			
BE2M37DKM	Digital Communications	Z,ZK	6
The course provides fundamentals of digital communications theory: modulation, classical coding, channel models, and basic principles of decoding. The exposition is systematically built along the theoretical lines which allow to reveal all inner connections and principles. This allows students to develop the knowledge and use it in an active way in a design and construction of the communication systems. The course provides a necessary fundamental background for subsequent more advanced communications theory courses.			
BE2M37KDKA	Coding in Digital Communications	Z,ZK	6
This course extends and deepens the topics of the basic communication theory courses in the following main areas. 1) Advanced information theory in coding and Network Information Theory develop a framework for understanding the principles of the channel coding in single-user and multi-node/multi-user scenarios. 2) The algebraic coding presents classical topics of block and convolutional codes. 3) Advanced coding technique focuses on turbo, LDPC, Space-Time codes and Wireless Network Coding. 4) Advanced decoding technique, namely iterative and multi-user decoding is a fundamental tool for decoding capacity approaching channel codes.			
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.			
BE2M37OBFA	Image Photonics	Z,ZK	6
The subject offers a detailed overview of applied imaging photonic elements and systems. The subject deals with fundamentals of optics, Fourier optics and optical computing. Fourier optics. Image sensors - tube, CCD, CMOS. Image displays. Image converters and amplifiers. Photography and holography - sensitometry and densitometry. Photonic (optical) computing. Electron optics. Image processing in biosystems. Image processing for photonics.			
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>			
BEEZM	Safety in Electrical Engineering for a master's degree	Z	0
The course provides for students of all programs periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the current Directive of the Dean.			

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

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