

## Recommended pass through the study plan

### Name of the pass: Branch Technological Systems - Passage through study

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Electrotechnology

Pass through the study plan: Elektrotechnika, energetika a management - Technologické systémy

Branch of study guaranteed by the department: Technological Systems

Guarantor of the study branch: doc. Ing. Pavel Mach, CSc.

Program of study: Electrical Engineering, Power Engineering and Management

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
A1M13BP3	Safety in Electrical Engineering 3	Z	0	2+2j	Z,L	P
A0M16EKE	Economy of Power Industry	KZ	4	2+2s	Z,L	P
A1M14SP2	Electric Machinery and Apparatus 2	Z,ZK	5	2+2L	Z	P
A1M13JAS	Quality and Reliability	Z,ZK	5	2P+2C	Z	P
A1M01MPS	Probability and Statistics	Z,ZK	8	4+2	Z	P
A1M14SSE	Machinery structures of power plants	Z,ZK	4	2+2s	Z	P
A1M13SVS	Simulation of Production Sytems	Z,ZK	5	2P+2C	Z	PO

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
A1M13EMP	Ecology of materials and processes	Z,ZK	5	2P+2L	L	P
A1M14PO2	Electric Drives and Traction 2	Z,ZK	5	2+2L	L	P
A1M13TP1	Team Project	Z	5	2P+2S	L	P
A1M15PRE	Transmission and Distribution of Electricity	Z,ZK	5	2+2s	L	P
A1M15TVN	High Voltage Engineering	Z,ZK	5	2+2L	L	P
A1M13TPR	Technological Project Planning	Z,ZK	5	2P+2S	L	PO

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
A1M13EZF	Electrochemical Sources and Photovoltaics	Z,ZK	5	2P+2L	Z	P
A1M15ENY	Power Plants	Z,ZK	5	2+2c	Z	P
A1M13IND	Individual Project	Z	6	4L	Z	P
A1M14VE2	Power Electronics 2	Z,ZK	5	2+2L	Z	P
MEEMH	<b>Humanitní předměty</b> <i>A0B16FIL,A0M16FI2,..... (see the list of groups below)</i>	Min. cours. 1	Min/Max 4/28			V
MEEMVOLPRE	<b>Volitelné předměty</b> <i>A4M33TDV,A0M14AML,..... (see the list of groups below)</i>	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) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
ADIP25	Diploma Thesis	Z	25	36s	L	P
MEEMVOLPRE	Volitelné předměty A4M33TDV, A0M14AML, ..... (see the list of groups below)	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
<b>MEEMH</b>	<b>Humanitní předměty</b>			<b>Min. cours. 1</b>	<b>Min/Max 4/28</b>			<b>V</b>
A0B16FIL	Philosophy	A0M16FI2	Philosophy II	A0B16HTE	History of technology and econom ...			
A0M16HT2	History of science and technolog ...	A0M16MPS	Psychology	A0B16MPL	Management psychology			
A0M16TE1	Theology	A003TV	Physical Education					
<b>MEEMVOLPRE</b>	<b>Volitelné předměty</b>			<b>Min. cours. 0</b>	<b>Min/Max 0/999</b>			<b>V</b>
A4M33TDV	3D Computer Vision	A0M14AML	Aerodynamics and Mechanics of FI ...	A0M31ASN	Algorithms and Structures of Neu ...			
A4M39APG	Algorithms of Computer Graphics	A2M17AEK	Antennas and EMC in Radiowave Co ...	A4M38AVS	Embedded Systems Application			
A4M36AOS	Service Oriented Architectures	A0M31ACS	Architectures of Digital System ...	A4M33AU	Automatic Reasoning			
A4M33BIA	Bio Inspired Algorithms	A5M17BUP	Biological Effects of Electromag ...	A2M17CAD	CAD and Microwave Circuits			
A4M39DPG	Data Structures for Computer Gra ...	A3M38DIT	Diagnostics and Testing	A0M14DGP	Electric Drive Diagnostics			
A2M37DKM	Digital communications	A4M33DZO	Digital image	A0M37DUP	Satellite navigation systems			
A0M14DMP	Dynamics of mechanical parts of ...	A1M16EKM	Ekonometrie	A0M15EZS	Electrical Sources and Systems			
A0M31EOF	Electronic Circuits and Filters	A0M34EZS	Electronic Security Systems	A0M33EOA	Evolutionary Optimization Algori ...			
A2M31IAS	Implementation of Analog Systems	A4M34ISC	Systems on Chip	A3M33IRO	Intelligent robotics			
A4M35KO	Combinatorial Optimization	A4M38KRP	Computer Interfaces	A0M14KSP	Drive Communication Systems			
A0M13KTM	Construction and Technology of M ...	A2M37KDK	Coding in digital communications	A0M38MAP	Magnetic Elements and Magnetic M ...			
A0M16MGM	Management	A1M16MAM	Decision Modelling	A1M16MAS	Marketing Strategies			
A0X36MOOC	Massive Open Online Course	A3M01MKI	Mathematics for Cybernetics	A4M33MPV	Computer Vision Methods			
A0M38MET	Metrology	A2M99MAM	Microprocessors and microcompute ...	A2M34MST	Microsystems			
A2M34MIM	Microsystems in Multimedia	A2M17MOS	Microwave Circuits and Subsystem ...	A3M33MKR	Mobile and Collective Robotics			
A2M32MKS	Mobile Communication Networks	A2M32MDS	Modeling and Dimensioning of Net ...	A0M14MDS	Simulation of dynamic systems			
A0M13MKV	Advanced Components of Power Ele ...	A0M37MOT	Advanced areas in image and vide ...	A3M38MSZ	Modern Sensors and Signal Proces ...			
A4M36MAS	Multiagent Systems	A4M39MMA	Multimedia and Computer Animatio ...	A2M34NAN	Nanoelectronics and Nanotechnolo ...			
A0M17NKA	Antenna Design and Technology	A4M33NMS	Design and Modeling of Software ...	A0M34NFO	Design of Photonic Circuits			
A2M34NIS	Integrated Systems Design	A0M14KOP	Electric Drive Component Design	A0M34NNZ	Design of Power Supplies for Ele ...			
A0M34NSV	VLSI System Design	A4M39NUR	User Interface Design	A2M37OBT	Image Technology			
A0M38OSE	Image Sensors	A0M33OSW	Ontologies and Semantic Web	AE0M33OSW	Ontologies and Semantic Web			
A4M35OSP	Open-source programming	A2M32OSS	Optical Systems and Networks	A4M36PAH	Planning and game playing			
A3M33PRO	Advanced robotics	A4M36PAP	Advanced Computer Architectures	A4M33RZN	Advanced Methods for Knowledge R ...			
A2M17PDS	Terrestrial and Satellite Radio ...	A2M17PMP	Computer Aided Modeling of Field	A2M01PMS	Probability and Statistics			
A3M35PSR	Real-Time Systems Programming	A0M32PRD	Data Communication Means	A3M99PTO	Team Work			
A1M16PPP	Business Law II	A0M13PRE	Industrial electronics	A0M35PII	Industrial Informatics and Inter ...			
A0M33PIS	Industrial Information Systems	A2M37RSY	Radio systems	A3M38SPD	Data Acquisition and Transfer			
A2M31SMU	Signals in multimedia	A0M15SZS	Reliability and Security of Powe ...	A4M33SAD	Machine Learning and Data Analys ...			
A2M34SIS	Integrated System Structures	A0M37SEK	Synchronization and equalization ...	A0M13TKS	Technology of Cables and Optical ...			
A4M33TZ	Theoretical foundations of compu ...	A4M01TAL	Theory of Algorithms	A4M33TVS	Software Verification and Testin ...			
A0M17TMS	Perspectives in Millimetre and S ...	A3M33UI	Artificial Intelligence	A3M38VBM	Videometry and Contactless Measu ...			
A3M38VIP	Virtual Instruments	A4M39VIZ	Visualization	A4M39VG	Computational Geometry			
A2M32VAD	Design of Applications and DSP	A3M38ZDS	Analog Signal Processing and Dig ...	A2M31ZRE	Speech processing			
A2M37ZVT	Audio Technology	A0M37ZV2	Audio Technology 2	A0M31ZLE	Basics of Medical Electronics			
A0M37CIR	Implementation of the digital ci ...	A2M99CZS	Digital Signal processing	A2M31RAT	Speech technology in telecommuni ...			
A3M35RIS	Control Systems	A2M32RKP	Communication Processes Control					

## List of courses of this pass:

Code	Name of the course	Completion	Credits
A003TV	Physical Education	Z	2
A0B16FIL	Philosophy	ZK	2
A0B16HTE	History of technology and economic	ZK	2
A0B16MPL	Management psychology	ZK	2
Psychology of personality, psychology of work and organization. Psychology in human resources management. The manager, his role and competencies. Motivation and engagement. Skills development. Communication and conflict resolution. Work group and team, conducting meetings. Time management and delegation. Dealing with stress and emotions. Company culture and organizational change.			
A0M13KTM	Construction and Technology of Microcomputers	Z,ZK	5
Microcomputers for control of technological systems, architecture, timing, instructions, basic parts, embedded microprocessors, input/output. Supplementary circuits. Control of technological systems. Microprocessor development system, design of microcomputer and application. Industrial standards. Design of microcomputers - modular and built-in systems, industrial PC. SCADA systems.			
A0M13MKV	Advanced Components of Power Electronic	Z,ZK	5
Power semiconductor device (diodes, BJTs, thyristors, MOSFETs and IGBTs) and integrated structures (modules). Structures, function, characteristics and parameters, conditions for reliable operation. Connection of devices in parallel and in series. Operating reliability of power components and equipments.			
A0M13PRE	Industrial electronics	Z,ZK	5
Electronic components, resistors, capacitors, HF coils, transformers Semiconductor devices Mounting technologies Sensore, regulating equipments Power converters. HF heating equipments. Electromagnetic compatibility in power electronic.			
A0M13TKS	Technology of Cables and Optical waveguides	Z,ZK	5
- Cable engineering-materials, machines and production methods - The engineering and properties of metal cables - The technology and properties of optical fibres and cables - The fibre connectors evaluation - Ending end branching of power cables - The power cables and optical fibres diagnostics			
A0M14AML	Aerodynamics and Mechanics of Flight	Z,ZK	4
Subject clarifies substantial relations and effects of force influence of flowing fluid on surface of airfoil, wing or complete airplane at subsonic or supersonic airspeeds. Further, subject deals with basic tasks of airplane performance and necessary conditions for airplane stability and control.			
A0M14DGP	Electric Drive Diagnostics	Z,ZK	5
Power electronics control computer structure, digital signal processor and ALU added features for fast real time calculations. Interrupt system and DMA system, analog signal measurement, fast impulse signal measurement, fast impulse generation support, inter-computer communication, system and power management, programming languages for power systems software development, programming techniques, software development tools (simulators, emulators, monitors), input signal conditioning circuitry, conversion from analog signals to digital processing, time sampling, amplitude quantization, power electronics control block design and implementation, difference equations and control algorithms, fixed and floating point calculations, debugging methods, program parametrization, guides and rules for implementation and application of power system control computers. Real time operating system, scheduler, dispatcher and another features and guides for application			
A0M14DMP	Dynamics of mechanical parts of drives	Z,ZK	4
Subject is oriented to mathematical description and solving of dynamic processes in mechanic parts of machines and drives. Dynamics of rotational and general plane motion, effects of inertial forces on body, balancing of rotors. Vector and analytic methods of composing equations of motion of systems and their solving. Vibration in machine set and vibration effects reducing. Stress and deformation in rotating parts, critical speed of rotors. Drives characteristics and transient events in systems with driving aggregates.			
A0M14KOP	Electric Drive Component Design	Z,ZK	5
Theoretical principles and pragmatic procedures in main types electric drives for transport, automation and manipulating technics design. Selection, dimensioning and realisation of drives components: power supply, switching devices, protection, semiconductor converter, electric motor. Project, verification of dimensioning and testing of drive components, realisation of selected part on model drive, experimental parameters examination. Semestrial project optionally fixed on theoretical design, realisation or experimental parameters verification			
A0M14KSP	Drive Communication Systems	Z,ZK	5
Electric drive distributed control system - system view, serial communication primer, computer network topology, point-to-point, bus, loop, bus access methods, master-slave, peer-to-peer, CSMA/CD, CSMA/CR, addressed transmission, broadcasting, baud-rate, synchronous and asynchronous transmission, channel bandwidth, transmission synchronization, bit and character stuffing/destuffing, modulation, bit encoding, frame, transfer protocol, protocol overhead, error detection, acknowledged and unacknowledged communication, transmission media and environment, OSI model and other layered models, overview of industrial communication technologies utilized in drives and their features, UART, USART, Profibus, HDLC, SDLC, Bitbus, LIN bus, CAN bus, CANOpen, LonWorks, EIB/KNX, Ethernet, TCN-MVB/WTB, Microwire, SPI, I2C, USB. Communication services programming and their implementation inside overall control computer software architecture. Communication development tools, communication services debugging, monitoring and logging. Noise resistance, cabling, connectors			
A0M14MDS	Simulation of dynamic systems	Z,ZK	4
Aim of subject is simulation of nonlinear problems from fields of dynamics of rigid bodies, fluid mechanics, aerodynamics, thermodynamics and their mutual combinations. In scope of subject is given overview of substantial derivations, relations, formulas and numeric methods. Seminars are focused on assembling of numeric models in program Matlab-Simulink			
A0M15EZS	Electrical Sources and Systems	Z,ZK	5
The subject is focused on the task of power quality, its operational criteria and improvement possibilities. There are also discussed specific tasks of dispersed generation and electrical systems. The student is then informed about basic electrical energy renewable sources and their connection possibilities to the system.			
A0M15SZS	Reliability and Security of Power Systems	Z,ZK	5
The aim of the subject is acquiring basic knowledge of security and reliability of power electrical systems based on the deterministic and mainly probabilistic analysis. After the introductory summarisation and extension of the mathematical tools for probabilistic and statistic calculations, the methodology of evaluation of the reliability of the systems is mainly discussed starting from the reliability of its particular elements in various operation regimes. Attention is also paid to problems of maintenance and mathematical simulation of the destructive tests.			
A0M16EKE	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.			
A0M16FI2	Philosophy II	Z,ZK	4
The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.			

A0M16HT2	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			
A0M16MGM	Management	Z,ZK	5
The methods and procedures of effective management for company leading in competitors area.			
A0M16MPS	Psychology	Z,ZK	4
A0M16TE1	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.			
A0M17NKA	Antenna Design and Technology	Z,ZK	5
Basics of practical design of antennas for specific frequency bands, modeling, design and construction of antennas. Modeling on professional software tools for antenna design.			
A0M17TMS	Perspectives in Millimetre and Submillimetre Technology	Z,ZK	5
The subject gives practical knowledge dealing with emerging technology in new progressive frequency bands. It gives the basement of millimeter and submillimeter technology and mutual interactions submm and optical technology. In frame of the subject the theoretical principles as well as specific approaches to solution of transmission lines, subsystems and links in mm and submm region are mentioned.			
A0M31ACS	Architectures of Digital Systems	Z,ZK	4
Types of processor architectures, singlechip and multichip computers. Processor structures for real-time digital signal processing. Data flow driven computers. Artificial neural nets. Structures designed in accordance with procedures of data processing, architectonical considerations. Design of circuits for digital signal processing and arithmetic operations, design of processors and peripherals, low-power design techniques. Data synchronization and communication between asynchronous clock-domains			
A0M31ASN	Algorithms and Structures of Neurocomputers	Z,ZK	5
Information about the basic principles and possibility of the application of the neural informative technology for the signal processing are the main topic. The lectures are devoted to the introduction into the artificial neural networks (NN) theory and applications, to the choice and the optimisation of the structures, the choice of the data, and to the solutions of the classification. The neural network applications at the speech and image processing are investigated in detail. Some neural network applications in the biomedical engineering and hardware realization of the SOM are described. The applications are o focused to EEG and ECG processing, also to possibilities of applications ANN at physiotherapy,			
A0M31EOF	Electronic Circuits and Filters	Z,ZK	5
Subject deepens and consolidates knowledge in the field of analog electronic circuits and frequency-selection filters. Analytical procedures are the gist that lead from complete models of analog integrated circuit structures, through the simplification, to a deeper understanding of their characteristic. Design fundamental is obtained by the analysis of the dominant influences to the circuit activities. Design and realizations of analog filters is introduced in the next part.			
A0M31ZLE	Basics of Medical Electronics	Z,ZK	4
Students will study fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electronic circuits of diagnostical and therapeutical medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anesthesiology, intensive and critical healthcare, equipments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including dilution) and pulse oxymetry.			
A0M32PRD	Data Communication Means	Z,ZK	5
A0M33EOA	Evolutionary Optimization Algorithms	Z,ZK	6
The course aims at issues related to the application of evolutionary algorithms in practice and at the methods used to solve them. Evolutionary algorithms are optimization metaheuristics that use analogies with natural evolution to solve complex optimization tasks. The course builds on and extends knowledge from the course Bio-inspired algorithms. In the seminar and lab lectures, the students will get hands-on tutorials and will be obliged to implement their own evolutionary algorithm to solve an optimization task as part of their project.			
A0M33OSW	Ontologies and Semantic Web	KZ	4
The course "Ontologies and Semantic Web" will guide students through current trends and technologies in the semantic web field. Students will learn designing complex ontologies, thesauri, formalizing them in a suitable formal language, querying them and creating semantic web applications on their top. The second part of the course will be devoted to the efficient management of ontological data and other selected topics.			
A0M33PIS	Industrial Information Systems	Z,ZK	6
The aim of this course is to make students familiar with IT support of industrial systems controlled and integrated with computational systems, and teach students to consider respective system requirements. The course deals with IT infrastructure support, modeling of business systems, their data flow, functional models and methods for modeling of non-functional requiremets, with focus to stability, planing, security and quality management.			
A0M34Ezs	Electronic Security Systems	Z,ZK	5
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.			
A0M34NFO	Design of Photonic Circuits	Z,ZK	4
Students obtain practical skills with design of photonics devices and their applications in photonics systems. Students acquaint with BMP, FULL WAVE and TCAD programs. These software allowed design optics structures and devices using for controlling and distribution optical signals. Software TCAD is used for design of injection optical sources. Optoelectronic integrated circuits will be design by WINMIDE and ORCAD programes.			
A0M34NNZ	Design of Power Supplies for Electronics	Z,ZK	5
The subject describes the basic principles and concepts of power supplies. The subject explains the behavior of linear stabilizers, basic switching regulators, supplies protections, electrochemical supply cells and trends in power supply designs. The subject is meant for diploma project students designing the switching power supplies. It treats the switching power supply design programs and switching regulators component using PC. A special attention is devoted to EMC requirements in switch-mode power supplies as well as to the cost versus operational efficiency ratio. Design of a switch-mode power supply.			
A0M34NSV	VLSI System Design	Z,ZK	4
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.			
A0M35PII	Industrial Informatics and Internet	Z,ZK	6
The use of Internet technologies in informatics and industry. Communication protocols in the Internet distributed applications, database systems and their management, enterprise management systems. Web services, mobile network, security and reliability, critical applications.			
A0M37CIR	Implementation of the digital circuits in Radio	Z,ZK	5
The course is base for student, which want practically designed circuits of the digital signal processing with the signal processors and specialised circuits. Attention is concentration to realisation of the modulators and circuit of the numerical conversion of the signal, algorithms coding/decoding, which contains in the communication chain. Dominantly is concentration to effective realization with minimal computing power.			

A0M37DUP	Satellite navigation systems	Z,ZK	4
Existing, future and past radio satellite navigation systems. Course is addressed to students without knowledge of radio engineering. Attention is paid to measurements and practical tasks in laboratory and to experimental receiver programming.			
A0M37MOT	Advanced areas in image and video technology	KZ	5
This course presents the state-of-the-art techniques for digital image and video technology. These techniques and their applications cover almost all areas of technical professions dealing with human interaction. The content of lectures is being updated rapidly and continuously according to a remarkable progress in this field. The course deals with the principal functional blocks of mentioned systems both hardware and software implemented.			
A0M37SEK	Synchronization and equalization in digital communications	Z,ZK	4
We explain principles of the receiver signal processing (synchronization and equalization) for the parametric channel including variety of the implementation possibilities. We focus on the essential particular forms of the channel phase, frequency and timing parameterization, channels with multipath propagation and MIMO channels. We develop the ideas of synchronization and equalization in the context of the data decoding in the parametric channel. All basic categories of the CSE algorithms are targeted: feed-forward, feed-back, iterative and recursive, including the theoretical background of the parameter estimation theory, and theory of the feed-back and iterative systems.			
A0M37ZV2	Audio Technology 2	Z,ZK	4
This course deals with advanced topics related to audio technology in recording studios, namely room acoustics, multichannel signal recording and reproduction, digital audio signal processing, its impact on auditory perception, audio signal optimization from the psychoacoustic point of view. Measuring methods related to these topics are also presented.			
A0M38MAP	Magnetic Elements and Magnetic Measurements	Z,ZK	5
Measurement of magnetic field, NMR. Typical soft and hard magnetic materials. Measurement of properties of soft and hard magnetic materials. DC and AC magnetised circuits, circuits with permanent magnet. Current and voltage instrument transformers, current comparators. Sources of magnetic field. Magnetic shielding.			
A0M38MET	Metrology	Z,ZK	5
After a brief description of the role of the most important domestic and foreign metrological organizations and institutions, explanation is focused on units of measurable quantities and possibilities of their definition, realization, conservation and reproduction by means of measurement standards. After that, attention is paid to measurement methods and techniques for evaluating and increasing measurement accuracy. Facilities and methods applicable to precision measurements of both active and passive electrical quantities are described.			
A0M38OSE	Image Sensors	Z,ZK	5
This course explains the topics of optoelectronic image sensors, especially CCD and CMOS sensors, optical system, illuminators and their application in the computer vision.			
A0X36MOOC	Massive Open Online Course	Z	2
See <a href="https://cw.fel.cvut.cz/b172/courses/a0x36mooc/start">https://cw.fel.cvut.cz/b172/courses/a0x36mooc/start</a> for additional details.			
A1M01MPS	Probability and Statistics	Z,ZK	8
The course covers probability and basic statistics. First classical probability is introduced, then theory of random variables is developed including examples of the most important types of discrete and continuous distributions. Next chapters contain moment generating functions and moments of random variables, expectation and variance, conditional distributions and correlation and independence of random variables. Statistical methods for point estimates and confidence intervals are investigated.			
A1M13BP3	Safety in Electrical Engineering 3	Z	0
The course introduces students to the risks and causes of electric shock, with the safety regulations for handling and working on electrical equipment, protection against electric shock, to practice safer behaviors when working with high voltage and first aid for electric shock. Students will gain the necessary qualifications for the electrical activity of the CTU (c.1/2007 Dean of Instruction).			
A1M13EMP	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.			
A1M13EZF	Electrochemical Sources and Photovoltaics	Z,ZK	5
Photovoltaic sources. Operating principles, characteristics. Solar modules, construction and technology. Basic types of photovoltaic systems and their applications. Electrochemical sources of the electric power - overview. Primary cells and accumulators. Methods of accumulator charging. Sources for electrochemical production processes and their control. Automotive applications. Environmental aspects of the electrochemical sources and production processes.			
A1M13IND	Individual 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.			
A1M13JAS	Quality and Reliability	Z,ZK	5
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.			
A1M13SVS	Simulation of Production Systems	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.			
A1M13TP1	Team Project	Z	5
Teamwork in the form of a project. A team will choose a topic from a range of topics related to its branch of study, which will be specified by branch department or branch departments. The project will be defended within the framework of a subject.			
A1M13TPR	Technological Project Planning	Z,ZK	5
What is a project management? What is a life cycle of product and project? Project phases: Initial, Construct, Delivery and Support. Organisational structure. SWOT, PEST and 5P analyses. Workflow and business processes. Schedule, GANTT, PERT. Enterprise and project modelling. Management of documentation, recourses, quality and knowledge. Standards for exchange of product and business data. Enterprise ontology.			
A1M14PO2	Electric Drives and Traction 2	Z,ZK	5
Electro mobiles and hybrid cars. Tire train and rolling resistance. Adhesion. Traction power. Locomotive traction power calculation for defined train load and track. Mass transportation vehicles. Tramway with resistive control, pulse control and induction motors. Tramway power-electronic converters. Trolley-busses. Metro. Electric locomotives - various designs. Locomotive power-converters. DC, AC and multi-system locomotives. AC motor locomotives. Diesel-electric locomotives			
A1M14SP2	Electric Machinery and Apparatus 2	Z,ZK	5
Contacts and semiconductor switching apparatus in LV networks. Basic topology of 3-phase switches and power load of its components. Power switches and systems with progressive semiconductor devices and its control circuits. Protective circuits of semiconductor switching devices. Electric apparatus testing. Continue. Fundamentals of general theory of electric machine. Magnetic field. Fundamentals of commutation. Transformer, efficiency, volt drop. Transient phenomena - switch to the network, cut-off. Mathematical model of synchronous			

and induction machine. Rotating magnetic field. Induction machine, starting and speed control. Magnetic field harmonics and their influence. Single-phase induction motor. Operation of the synchronous machine on the network. Torque, stability, overload capacity. Transient phenomena, cut-off			
A1M14SSE	Machinery structures of power plants	Z,ZK	4
The aim of subject is to acquaint with natural relations of energy conversions at power-producing premises, to describe functions of power-producing equipment, their structure, properties and characteristics.			
A1M14VE2	Power Electronics 2	Z,ZK	5
Rectifiers with active load, discontinuous and continuous current, multiple commutation, three-phase AC/AC converters, electrostatic separators, welding rectifiers, battery chargers, superconductive magnetic energy reservoir, induction heating, reactive power compensation, contactless switches, softstarters, resistor pulse control, cathodic prevention, power transistor in switching mode, snubbers, structure and control principles of modern controlled drive, pulse width modulation methods, principles of vector control and direct control, pulse width modulated rectifiers, matrix converters, converter protection against current overload and against overvoltage			
A1M15ENY	Power Plants	Z,ZK	5
The subject introduces power plants of all kinds dimensioning and functions. It describes diagrams topologies, operational modes, control and safety problems solutions. It models dynamics and control of main part in all power plants types. It evaluates and describes control qualities and programmes.			
A1M15PRE	Transmission and Distribution of Electricity	Z,ZK	5
The subject gives a complex overview about the electricity transmission and distribution task. It deals with particular elements technical parameters and gives information about the total behaviour in steady and transient states. Students are informed about supporting devices enabling safe and reliable operation.			
A1M15TVN	High Voltage Engineering	Z,ZK	5
The subject introduces students with high voltage technique from point of view of its application in power engineering. It brings information about high voltage testing sources and the possibilities of measuring high voltages and big currents. It informs about high voltage insulation systems and methods for determining their states. There are explained particular types of electrical discharges and the possibilities of their elimination. Practical seminars are based on measurements in the high voltage laboratory.			
A1M16EKM	Ekonometrie	Z,ZK	5
History of Econometrics, econometric models, input-output models, modelling of demand, time series models, production functions, linear regression models, simultaneous equations models, econometric analysis of economic situation			
A1M16MAM	Decision Modelling	Z,ZK	5
Other methods of Operations Research and System Analysis: Queueing models, Inventory models, Models of optimal location, Advanced graph models, Markovian processes, Renewal theory, Simulation languages, Practical use of simulation models.			
A1M16MAS	Marketing Strategies	Z,ZK	5
Broadening of basic knowledge of marketing. The analysis of marketing strategies in different market situations. The firm's behaviour under competition and competitive advantage. Case studies in the field of product policy, price and condition policy, communication policy and distribution policy.			
A1M16PPP	Business Law II	Z	4
Introduction to constitutional system in the Czech Republic. Introduction to general Eu structure, legal system of European Union. Administrative Law and administrative procedure. Administrative justice and execution of the administrative decisions. Introduction to building regulation - basic concepts, rights and duties of the parts, material and local competency of administrative bodies, public control. Introduction to copyright law - basic concepts, copyright obligation relationships, physical and legal entities, public control. Introduction to Criminal Law - basic Concepts, rights and duties legal remedies, public control. International Law protection in criminal law matters, the territorial principle in European Union, execution of the decisions, extradition.			
A2M01PMS	Probability and Statistics	Z,ZK	8
The course covers probability and basic statistics. First classical probability is introduced, then theory of random variables is developed including examples of the most important types of discrete and continuous distributions. Next chapters contain moment generating functions and moments of random variables, expectation and variance, conditional distributions and correlation and independence of random variables. Statistical methods for point estimates and confidence intervals are investigated.			
A2M17AEK	Antennas and EMC in Radiowave Communication	Z,ZK	5
Student obtains the knowledge of basic analysis and design of the individual type of the antennas (wire, planar, reflector and lens antennas, and radomes) and antenna arrays. He obtains the basic experience in antenna and communication technique, antenna measurement technique including training in specialized antenna anechoic laboratory. He also obtains the basic knowledge in the field of electromagnetic compatibility - electromagnetic interference and susceptibility including testing methods and criteria of selecting of antennas for given fixed, mobile, ground and satellite service.			
A2M17CAD	CAD and Microwave Circuits	Z,ZK	6
This course provides its students with principles and techniques used in modern microwave circuits as well as with basic design methods used in such systems. Basic overview of elements and detailed information on selected circuit design is provided. Students gain design experience during exercises.			
A2M17MOS	Microwave Circuits and Subsystems	Z,ZK	5
The subject provides wide theoretical and practical knowledge both for scientific-research work and carrier profession in the field of rf. and microwave region. It makes students familiar with rf. and microwave passive and active circuits realized in planar and monolithic structures - lines, directional couplers, power dividers, resonant circuits, filters and CAD tools for design of rf. and microwave circuits. It also contains basis of microwave transistors, bipolar, MESFET and HEMPT, design of low noise, power, narrow band and wideband amplifiers, diode and transistor oscillators, detectors, mixer and frequency multipliers			
A2M17PDS	Terrestrial and Satellite Radio Links	Z,ZK	6
The goal of the course is to teach the student to design basic types of wireless links from the antennas and propagation point of view, including interference analyses for both fixed links and radio networks and frequency coordination. The design principles are primarily based on international ITU-R recommendations. In addition, the attention is given to prospective wireless systems as well, e.g., intelligent antenna systems.			
A2M17PMP	Computer Aided Modeling of Field	Z,ZK	5
The subject prepares students for independent work with professional software tools for design of elements of radio communication systems on the base of state of art. Knowledge of numerical methods and methods of optimization are parts of the education. The subject also gives the knowledge of the maths for RF radio communication systems and introduces some modern parts on maths together with design of radio communications subsystems.			
A2M31IAS	Implementation of Analog Systems	Z,ZK	6
The aim of this subject is to present new ways and principles of analog circuit design, especially with respect to the analog signal conditioning for digital processing and transmission systems. A special attention is devoted to design procedures and their implementation in application-specific integrated circuits (ASICs). The subject deals with analog and sampled-data functional blocks, including their modeling and simulation. Specifically, circuits for the design of amplifiers, filters, and data converters are focused as the main point of interest. Concurrent design trends are discussed, introducing the testing issues of analog and mixed-signal ASICs. Electronic system design essentials are presented, taking into account up-to-date technology aspects demonstrated in professional software for modern ASIC design.			
A2M31RAT	Speech technology in telecommunications	Z,ZK	6
The subject is devoted to basis of speech processing addressed to students of master program with special focus on communication applications as speech technology has currently many applications in communication systems. Further information can be found at <a href="http://noel.feld.cvut.cz/vyu/a2m31rat">http://noel.feld.cvut.cz/vyu/a2m31rat</a> . Detailed information for registered students can be found at teaching portal <a href="http://moodle.kme.feld.cvut.cz">http://moodle.kme.feld.cvut.cz</a> .			
A2M31SMU	Signals in multimedia	Z,ZK	5
Course brings information about methods of sinal processing used in multimedia including 2-D analysis and modern methods.			

A2M31ZRE	Speech processing	Z,ZK	6
The subject is devoted to basis of speech processing addressed to students of master program with special focus on multimedia applications. Discussed speech technology is currently applied in many systems in different fields (e.g. information dialogue systems, voice controlled devices, dictation systems or transcription of audio-video recordings, support for language teaching, etc.). Further information can be found at <a href="http://noel.feld.cvut.cz/vyu/a2m31zre">http://noel.feld.cvut.cz/vyu/a2m31zre</a> . Detailed information for registered students can be found at teaching portal <a href="http://moodle.kme.feld.cvut.cz">http://moodle.kme.feld.cvut.cz</a> .			
A2M32MDS	Modeling and Dimensioning of Networks	Z,ZK	6
The aim of the course is to present an overlook of dimensioning of telecommunications net-works on the basis of results of the queuing theory (QT). Introduce possibilities of simulation and modeling networks both from the point of view of grade of service GoS and quality of service QoS as well. Results of the QT are applied on different service systems and telecommunication networks deploying and operating at time being. Theoretical knowledge about models of service systems can be utilized for dimensioning of different service systems in real life - not only on the telecommunications one.			
A2M32MKS	Mobile Communication Networks	Z,ZK	4
The goal of the course is to provide an overall overview of mobile communications in the variety of analog and digital systems. The main emphasis is put onto contemporary GSM network (including new supplementary technologies) and onto the transition towards 3rd generation networks (UMTS, LTE, ...). It also deals with the area of mobile communications based on employment of telecommunication satellites; public and private radio / paging systems and radio networks are discussed as well.			
A2M32OSS	Optical Systems and Networks	Z,ZK	5
The course deals with the use of optical radiation for the transmission of information. The aim is to acquaint students with the functions of important components used in an advanced optical communication systems and networks. Students will learn how to design practical optical fiber link and the network. Students will receive theoretical knowledge for the implementation of a all-optical photonic networks in the future, which will be based on a combination of wavelength multiplex with an all-optical switching.			
A2M32RKP	Communication Processes Control	Z,ZK	5
Subject Telecommunication Processes Control presents review of solution principles for switching systems. It contains solutions for switching fields, control systems and review of signalisations for switching control (in central office as well in networks). Deals mainly with digital switching systems with circuit commutation as well as transport of IP packets. Also contains basic consideration about convergence of voice and data services and networks including functional principles of new generation networks with respect to philosophy and services of intelligence network.			
A2M32VAD	Design of Applications and DSP	Z,ZK	5
The subject makes familiar with selected parts of the digital signal processing in communication. The digital image processing is emphasized.			
A2M34MIM	Microsystems in Multimedia	Z,ZK	5
The subject solves systems working in interdisciplinary areas, the most frequently in the energy interface - optical, thermal, mechanical, electrical). There are explained physical principles of any sensors, especially of optical and mechanical quantities, principle of biometric pick-up information, principle of tactile display, etc. There re solved the basic methods of the signal pre-processing. Basic principles of actuators are described, ones are using for the control in instruments and systems of multimedia applications. The attention is focused on MEMS elements and systems and their applicability in modern instrument technology.			
A2M34MST	Microsystems	Z,ZK	5
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.			
A2M34NAN	Nanoelectronics and Nanotechnology	Z,ZK	5
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.			
A2M34NIS	Integrated Systems Design	Z,ZK	5
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. Frond End and Back End design. Floorplanning, place and route, layout, parasitic extraction, time analysis, testbenches design and verification.			
A2M34SIS	Integrated System Structures	Z,ZK	5
Design methodologies of analog, digital and optoelectronics integrated systems. Description of integrated circuits fabrication process; CMOS technologies and its modern sub-micron trends; design rules and layout design. Design and fabrication process of micro-electro-mechanical systems (MEMS); polymer based technologies; optical and optoelectronic integrated circuits, fabrication process and technologies, materials, design and testing.			
A2M37DKM	Digital communications	Z,ZK	4
The course focuses on the area of digital modulation, coding and physical layer signal processing in communication systems. The exposition is systematically built along the theoretical line which allows to reveal all inner connections and principles. This allows the students to develop the knowledge in an active way and use it in a design and construction of the communication systems. In a broad area of the digital communications, we focus on the essential principles. Those are further extended in the optional courses.			
A2M37KDK	Coding in digital communications	Z,ZK	5
The course extends and deepens the topics of the basic DKM course in the following main areas. 1) The information theory builds a fundamental framework for thorough understanding the principles of the channel coding, adaptation, sharing, and diversity/multiplexing of the MIMO systems. 2) We develop advanced coding technique, particularly turbo-codes, LDPC codes and space-time codes for MIMO. 3) We explain essential principles of iterative decoding methods for turbo and LDPC codes.			
A2M37OBT	Image Technology	Z,ZK	6
This course deals with multimedia technology and it is focused mainly on acquisition, processing and reproduction of image information. It covers area of measurements in photometry, radiometry and colorimetry; design of objective lenses, image sensors and displays including their parameters. Further the course deals with cinematography, photography and with other special methods of image reproduction, e.g. polygraphy and digital printing techniques. Studied problems are completed with explanation of advanced methods of image processing (preprocessing, compression, image reconstruction, etc.).			
A2M37RSY	Radio systems	Z,ZK	6
Radio systems and their parameters, radar and position determination systems especially. Principles, properties, parameters and applications.			
A2M37ZVT	Audio Technology	Z,ZK	5
The course deals with topics from electro acoustics, sound reinforcement, related signal processing in conjunction with psychoacoustic aspects. It prepares experts for studio practice, design of sound reinforcement and specialized field in signal processing.			
A2M99CZS	Digital Signal processing	Z,ZK	5
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.			

<b>A2M99MAM</b>	<b>Microprocessors and microcomputers</b>	<b>Z,ZK</b>	<b>6</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.			
<b>A3M01MKI</b>	<b>Mathematics for Cybernetics</b>	<b>Z,ZK</b>	<b>8</b>
The goal is to explain basic principles of complex analysis and its applications. Fourier transform, Laplace transform and Z-transform are treated in complex field. Finally random processes (stacinary, markovian, spectral density) are treated.			
<b>A3M33IRO</b>	<b>Intelligent robotics</b>	<b>Z,ZK</b>	<b>7</b>
The subject teaches principles allowing to build robots perceiving surrounding world and activities in it including the abilities to modify it. Various architectures of robots with cognitive abilities and their realizations will be studied. Students will experiment with robots in practical assignments. Studied material is applicable more widely while building intelligent machines.			
<b>A3M33MKR</b>	<b>Mobile and Collective Robotics</b>	<b>Z,ZK</b>	<b>6</b>
The course introduces basic mobile robot structure design together with control methods aimed to achieve autonomous and collective behaviors for robots. Methods and tool s for data acquisition and processing are presented herein with the overall goal to resolve the task of autonomous navigation for mobile robots comprising the tasks of sensor fusion, environmental modeling including Simultaneous Localization And Mapping (SLAM) approaches. Besides sensor-processing related tasks, methods for robot trajectory planning will be introduced. The central topic of the course stands in specific usage of the afore methods capable of execution with groups of robots and taking the advantage of their cooperation and coordination in groups. Labs and seminars are organized in a form of an Open Laboratory whereas the students will resolve the given problem in simulated environments as well as with a real robot HW.			
<b>A3M33PRO</b>	<b>Advanced robotics</b>	<b>Z,ZK</b>	<b>6</b>
We will explain and demonstrate techniques for modelling, analyzing and identifying robot kinematics. We will explain more advanced principles of the representation of motion in space and the robot descriptions suitable for identification of kinematic parameters from measured data. We will explain how to solve the inverse kinematic task of 6DOF serial manipulators and how it can be used to identify its kinematic parameters. Theory will be demonstrated on simulated tasks and verified on a real industrial robot.			
<b>A3M33UI</b>	<b>Artificial Intelligence</b>	<b>Z,ZK</b>	<b>6</b>
The course is aimed at providing theoretically deeper knowledge in the area of Artificial Intelligence in the extent needed to study the branch of study Robotics. It is organized around several topics: pattern recognition and machine learning, theory of multi-agent systems and artificial life. The linkage between the theoretical and practical applications is rather stressed.			
<b>A3M35PSR</b>	<b>Real-Time Systems Programming</b>	<b>Z,ZK</b>	<b>6</b>
The goal of this subject is to give students basic knowledge in the area of software design for embedded systems with real-time operating systems (RTOS) with emphasis to practical experience. Students will solve several simple tasks to get basic knowledge about RTOS VxWorks and to measure timing parameters of the RTOS and hardware, which are necessary when choosing a platform for a given application. Then a more complicated task (motor control) will be solved, which will fully utilize means of RTOS VxWorks. During lectures, students will become familiar with real-time systems theory, which can be used to formally prove the timing correctness of the applications. Moreover, some software engineering techniques, which help with increasing of quality of safety-critical systems will be discussed.			
<b>A3M35RIS</b>	<b>Control Systems</b>	<b>Z,ZK</b>	<b>6</b>
Process control using industrial control systems, programmable logic controllers, visualisation of technological processes. Hierarchical control systems, industrial communications for factory and process automation. Open software technologies, safety and reliability of control applications.			
<b>A3M38DIT</b>	<b>Diagnostics and Testing</b>	<b>Z,ZK</b>	<b>7</b>
The course introduces the fundamentals of the fault-diagnosis and testing systems, machine condition monitoring, vibrodiagnostics and advanced signal processing methods, non-destructive testing and testing of analog and digital circuits. In laboratory will be demonstrated selected diagnostic tools, and solved an individual project related to diagnostics and/or testing.			
<b>A3M38MSZ</b>	<b>Modern Sensors and Signal Processing</b>	<b>Z,ZK</b>	<b>6</b>
The course is aimed to broaden the sensors basics by topics necessary for design of sensors and sensor systems. Prospective sensor types are covered as well as methods of the processing of the sensor signal. Sensors and sensor systems are shown in applications and by case design studies. The labs are concentrated to the complex measurement of the sensor parameters and to FEM modeling and its experimental verification. Optical sensors and their applications are covered in detail by following course "Videometry".			
<b>A3M38SPD</b>	<b>Data Acquisition and Transfer</b>	<b>Z,ZK</b>	<b>6</b>
Subject is devoted to distributed and centralized DAQ systems and to the design of their elements. Selected industrial interfaces and buses (CAN, Profibus, HART, Modbus, Ethernet), VXI/PXI systems, USB and wireless sensor networks (ZigBee, WiFi) are presented in detail in order to provide information required for efficient design of their components. Project-oriented laboratories provide students with practical experience in the implementation of modern DAQ systems.			
<b>A3M38VBM</b>	<b>Videometry and Contactless Measurement</b>	<b>Z,ZK</b>	<b>6</b>
This course explains the topics of optoelectronic sensors, especially CCD sensors, and their application in the videometry based contactless measurements. The problems of CCD line and area sensors, design of measuring cameras and the methods of signal processing are presented.			
<b>A3M38VIP</b>	<b>Virtual Instruments</b>	<b>Z,ZK</b>	<b>6</b>
A subject deals with programming virtual instruments based on standardized interfaces (PCI, PXI, VXI). Lectures are focused on application of up-to-date standards for data acquisition systems programming (VXIplug&play, VISA, IVI) and selected software techniques in Windows and Linux operating systems. Assigned software tasks in laboratories are solved using C/C++ language or LabVIEW environment.			
<b>A3M38ZDS</b>	<b>Analog Signal Processing and Digitalization</b>	<b>Z,ZK</b>	<b>6</b>
The course is dedicated to methods for preprocessing, digitalization and reconstruction of continuis signals. It is focused to the methods for achieving of high precision of transmission and suppression of spurious components. The laboratory exercises are divided into two parts: the first part is classical tasks; the second one is individual project of design of typically data acquisition system. The teaching is supported by the CAD system for measuring circuits.			
<b>A3M99PTO</b>	<b>Team Work</b>	<b>KZ</b>	<b>6</b>
The aim of this course is to get the students knowledgeable to work in teams. How to manage the team and methodology of the team work will be guided by specialists from the industry during lectures. Students will be working on real problems during labs.			
<b>A4M01TAL</b>	<b>Theory of Algorithms</b>	<b>Z,ZK</b>	<b>6</b>
The course brings theoretical background of the theory of algorithms with the focus at first on the time and space complexity of algorithms and problems, secondly on the correctness of algorithms. Further it is dealt with the theory of complexity; the classes P, NP, NP-complete, PSPACE and NPSPACE are treated and properties of them investigated. Probabilistic algorithms are studied and the classes RP and ZPP introduced.			
<b>A4M33AU</b>	<b>Automatic Reasoning</b>	<b>Z,ZK</b>	<b>6</b>
Theorem proving is no more restricted to mathematics, but it is ever more often used in situations, when one needs to make sure that the suggested procedure meets the initial requirements it is used in deductive databases as well as for verification of SW or HW components. The process of proof construction has to be automated for that purpose. The course reviews current systems of 1st order theorem proving and their practical applications. There are explained underlying theoretical principles (model checking, resolution, tableaux) together with their practical and theoretical constraints. Special attention is devoted to gaining experience in choosing the best tool to solve a specific problem, in identification of mistakes in input or in strengthening the obtained results.			



A4M33BIA	Bio Inspired Algorithms	Z,ZK	6
The students will learn some of the unconventional methods of computational intelligence aimed at solving complex tasks of classification, modeling, clustering, search and optimization. Bio-inspired algorithms take advantage of analogies to various phenomena in the nature and society. The main topics of the subject are artificial neural networks and evolutionary algorithms.			
A4M33DZO	Digital image	Z,ZK	6
First, the subject teaches how to process two-dimensional image as a signal without interpretation. Image acquisition, linear and nonlinear preprocessing methods and image compression will be studied. Second, image segmentation and registration methods will be taught. Studied topics will be practised on practical examples in order to obtain also practical skills.			
A4M33MPV	Computer Vision Methods	Z,ZK	6
The course covers selected computer vision problems: search for correspondences between images via interest point detection, description and matching, image stitching, detection, recognition and segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences.			
A4M33NMS	Design and Modeling of Software Systems	Z,ZK	6
The subject introduces to the design process of a software system from requirements gathering to a detailed object-oriented design. It is based on existing development methodologies, especially object-oriented, and the UML language will be used as a dominant formalism. The subject is oriented mainly on reliability analysis and formal and informal methods to reduce error rate in design phases.			
A4M33RZN	Advanced Methods for Knowledge Representation	Z,ZK	6
This course aims to deepen understanding of knowledge representation principles beyond the predicate logic formalism. Firstly, the course presents ontologies and description logic, the principle elements of semantic web. Then, attention will be paid to statements whose validity varies in time. Uncertainty makes the next issue to be discussed. Modal logic extends the classical logic with additional modalities, namely, possibility, probability, and necessity. Probabilistic graphical models associate the classical probabilistic theory with the graph theory. Fuzzy sets allow to represent vagueness.			
A4M33SAD	Machine Learning and Data Analysis	Z,ZK	6
The course explains machine learning methods helpful for getting insight into data by automatically discovering interpretable data models such as graph- and rule-based. The course will also address a theoretical framework explaining why/when the explained algorithms can in principle be expected to work. The lectures are given in English.			
A4M33TDV	3D Computer Vision	Z,ZK	6
This course introduces methods and algorithms for 3D geometric scene reconstruction from images. The student will understand these methods and their essence well enough to be able to build variants of simple systems for reconstruction of 3D objects from a set of images or video, for inserting virtual objects to video-signal source, or for computing ego-motion trajectory from a sequence of images. The labs will be hands-on, the student will be gradually building a small functional 3D scene reconstruction system.			
A4M33TVS	Software Verification and Testing	Z,ZK	6
This course will introduce the theoretical foundations and mathematical concepts necessary for rigorous software testing, including the definitions of fundamental system characteristics, such as reliability, robustness and correctness of the software system. We will emphasize the techniques and abstract tools necessary for validation of the correctness and reliability characteristics of the software. In the first part of the course, we will introduce the existing techniques and paradigms for system testing (black/white box, formal methods, structural analysis), including the methods for test number reduction and automation. The second part of the course will concentrate on formal methods for system verification. We will introduce the formal frameworks necessary for the dynamic description of system properties (Z-notation, temporal logic) and the applicable verification methods (model checking, theorem proving) working on these representations.			
A4M33TZ	Theoretical foundations of computer vision, graphics, and interaction	Z,ZK	6
We will explain fundamentals of image and space geometry including Euclidean, affine and projective geometry, the model of a perspective camera, image transformations induced by camera motion, and image normalization for object recognition. Then we will study methods of calculating geometrical objects in images and space, estimating geometrical models from observed data, and for calculating geometric and physical properties of observed objects. The theory will be demonstrated on practical task of creating mosaics from images, measuring the geometry of objects by a camera, and reconstructing geometrical and physical properties of objects from their projections. We will build on linear algebra, probability theory, numerical mathematics and optimization and lay down foundation for other subjects such as computational geometry, computer vision, computer graphics, digital image processing and recognition of objects in images.			
A4M34ISC	Systems on Chip	Z,ZK	6
Main responsibilities of integrated circuits designer; design abstraction levels - Y chart. Specification designation, feasibility study, criteria for technology and design kits selection. Analogue and digital integrated systems design and simulation methodologies. Main features of application specific ICs - full custom design, gate arrays, standard cells, programmable array logic. Design aspects mobile and low power systems. Hardware Description languages (HDL). Logic and physical synthesis. Front End and Back End design. Floorplanning, place and route, layout, parasitic extraction, time analysis, testbenche construction and verification.			
A4M35KO	Combinatorial Optimization	Z,ZK	6
The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers.			
A4M35OSP	Open-source programming	Z,ZK	6
The subject provides insight into world of open-source projects and techniques proved to be usefull for larger applications and operating systems development. Reasons leading to the founding of GNU project is discussed and possible andwantages of this approach for cooperation even for commercial subjects is shown. Usual tools used for development, debugging and source code control and functional testing are described. Description of POSIX type operating system structure and introduction to the driver development, user-space libraries and user graphics environments comes next. The last topic is introduction how to use earlier described techniques and support for embedded applications development and real-time control.			
A4M36AOS	Service Oriented Architectures	Z,ZK	6
The lecture focuses on service-oriented computing (SOC) and service-oriented architecture (SOA). Basic concepts of SOC will be explained on the service level (service description, discovery and invocation) and process level (business process formalization, service composition, transaction mechanisms) with respect to SOC utilization for flexible business applications implementation in (semi-)open environment (intra- i inter-enterprise). Besides basic web-services specifications and technologies (SOAP, WSDL, UDDI, BPEL) the up-to-date technologies for semantic web-services will be introduced. Great emphasis will be put on representation and modeling formalisms (RDF, RDFS, OWL). Open environment operation aspects will be also presented (reputation, trust, quality-of-service, privacy). The goal of the course is to bring general overview, but particular SOA platforms and tools (Sun Glassfish, JBoss) will be also introduced including comparison to older distributed systems architectures (CORBA, DCOM) and related domain of multi-agent systems. The design methodology, implementation, and deployment will be explained with relation to existing business processes and organizational structures.			
A4M36MAS	Multiagent Systems	Z,ZK	6
This course provides foundations of multi-agent systems and agent technologies. It provides a formal model of an agent, the concept of reactive, deliberative and deductive agent, BDI architecture, basics of inter agent communication and coordination. Introduction to distributed decision making and game theory will be also provided.			
A4M36PAH	Planning and game playing	Z,ZK	6
This course provides an introduction to classical AI planning (linear, nonlinear planning, graph-plan planning, heuristic planning, SAT-based planning) and game-tree representation and methods of adversarial search (such as minimax and alpha/beta pruning).			

A4M36PAP	<b>Advanced Computer Architectures</b>	Z,ZK	6
This course extends knowledge of modern computer architecture. Mainly the architecture of nowadays processors utilizing instruction and/or thread level parallelism and advanced pipelining is in the center of our attention. A special emphasis will be devoted to the implementation of parallelism in hardware, parallel program design, and advanced instruction scheduling and execution.			
A4M38AVS	<b>Embedded Systems Application</b>	Z,ZK	6
This course presents applications of embedded systems and their specifics. It is expected that the students have had a programming course, and thus the course is more oriented on explaining and describing the blocks and functions of embedded systems and their use in signal processing, rather than writing code. After completing this course, students should have an overview of usability and power of available processors, and their peripherals, on the basis of which, they should be able to independently design embedded systems for a wide spectrum of applications.			
A4M38KRP	<b>Computer Interfaces</b>	Z,ZK	6
Students are acquainted with common computer interfaces and design of peripherals. Selected PC interfaces (USB, PCI, PCI Express, IEEE1394, ExpressCard), metallic and wireless networks (IEEE802.x standards) and industrial interfaces (EIA-485, EIA-232, CAN ) are explained in detail. Project-oriented laboratories are focused on design and implementation of selected communication interface.			
A4M39APG	<b>Algorithms of Computer Graphics</b>	Z,ZK	6
In this course you will get acquainted with basic problems and their solutions in computer graphics. The main topic of the course are graphics primitives in 2D and 3D for modeling and rendering, color models, image representations, and basic photorealistic rendering algorithms.			
A4M39DPG	<b>Data Structures for Computer Graphics</b>	Z,ZK	6
This course provides you with the fundamentals of data structures commonly used in computer graphics. In contrast to standard binary search trees used in one dimension, the presented theory focuses on multidimensional data used to describe 3D scenes. In addition to the theory, the course emphasizes individual and team projects, where the importance and advantages of multidimensional data are demonstrated on practical examples. The students will gain practical experience through their own individual projects.			
A4M39MMA	<b>Multimedia and Computer Animation</b>	Z,ZK	6
The course is focused on methods often applied in the area of computer animation. Students will get an overview of algorithms and methods solving typical problems of 3D animation (inverse kinematics, animation of human body, dynamics, etc.). Part of the course is devoted to principles used during creative work with sound. The last part of lectures will give information about methods and technologies used in movie production (MOCAP, stereoscopy, visual effects).			
A4M39NUR	<b>User Interface Design</b>	Z,ZK	6
Students will get acquainted with the theory of human-computer communication and interaction (formal description of user interfaces, formal user models, the fundamentals of perception, cognition, and user information evaluation).			
A4M39VG	<b>Computational Geometry</b>	Z,ZK	6
The goal of computational geometry is analysis and design of efficient algorithms for determining properties and relations of geometric entities. The lecture focuses on geometric search, point location, convex hull construction for sets of points in d-dimensional space, searching nearest neighbor points, computing intersection of polygonal areas, geometry of parallelograms. New directions in algorithmic design. Computational geometry is applied not only in geometric applications, but also in common database searching problems.			
A4M39VIZ	<b>Visualization</b>	Z,ZK	6
In this course, you will get the knowledge of theoretical background for visualization and the application of visualization in real-world examples. The visualization methods are aimed at exploiting both the full power of computer technologies and the characteristics (and limits) of human perception. Well-chosen visualization methods can help to reveal hidden dependencies in the data that are not evident at the first glance. This in turn enables a more precise analysis of the data, or provides a deeper insight into the core of the particular problem represented by the data.			
A5M17BUP	<b>Biological Effects of Electromagnetic Field</b>	KZ	4
Biophysical Aspects of Electromagnetic Fields (EF) coupling of Various Biological Systems (BS). Interaction of EF with BS - overview. Mechanism of Interaction and Biological Effects. Experimental Results and Hypotheses of Biological Effects of Static and Stationary Electrical, Magnetic and Nonstationary Fields. Mathematical Solution of Interaction. EF generated by living Organism. Applications of EF in Medicine. Hygienic Standards.			
ADIP25	<b>Diploma Thesis</b>	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.			
AE0M33OSW	<b>Ontologies and Semantic Web</b>	KZ	4
The course "Ontologies and Semantic Web" will guide students through current trends and technologies in the semantic web field. Students will learn designing complex ontologies, thesauri, formalizing them in a suitable formal language, querying them and creating semantic web applications on their top. The second part of the course will be devoted to the efficient management of ontological data and other selected topics. All course materials are in English. In case all attendees are Czech speaking Czech can be spoken.			

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

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