

## Recommended pass through the study plan

### Name of the pass: Branch Nets of the Electronic Communication - Passage through study

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Telecommunications Engineering

Pass through the study plan: Komunikace, multimédia a elektronika - Sítě elektronických komunikací\_145248

Branch of study guaranteed by the department: Networks of Electronic Communication

Guarantor of the study branch: doc. Ing. Jiří Vodrážka, Ph.D.

Program of study: Communications, Multimedia, Electronics

Type of study: Follow-up master combined

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
AD2M17BP3	<b>Safety in Electrical Engineering 3</b>	Z		2+2j	Z	P
AD2M37DKM	<b>Digital communications</b> Jan Sýkora	Z,ZK	4	21+3c	Z	P
AD2M32MKS	<b>Mobile Communication Systems</b>	Z,ZK	4	14P + 6L	Z	P
AD2M01PMS	<b>Probability and Statistics</b>	Z,ZK	8	28+6	Z	P
AD2M34SIS	<b>Integrated System Structures</b>	Z,ZK	5	14KP+6KC	Z	P
AD2M99CZS	<b>Digital Signal processing</b>	Z,ZK	5	14KP+6KC	Z	P
MKMEEM-K	<b>Ekonomicko manažerské předměty</b> AD0M16EKE,AD0M16EET,..... (see the list of groups below)	Min. cours. 1	Min/Max 4/14			V

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
AD2M17AEK	<b>Antennas and EMC in Radiowave Communication</b>	Z,ZK	5	14+6L	L	P
AD2M99MAM	<b>Microprocessors and microcomputers</b>	Z,ZK	6	14KP+6KL	L	P
AD2M32OSS	<b>Optical Systems and Networks</b>	Z,ZK	5	14P + 6L	L	PO
AD2M31RAT	<b>Speech technology in telecommunications</b>	Z,ZK	6	14KP+6KC	Z	PO
AD2M32RKP	<b>Communication Processes Control</b>	Z,ZK	5	14P + 6C	L	PO
MKMEH-K	<b>Humanitní předměty</b> AD0M16FI2,AD0M16HT2,..... (see the list of groups below)	Min. cours. 1	Min/Max 4/20			V

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
AD2M32MDS	<b>Modeling and Dimensioning of Networks</b>	Z,ZK	6	21P + 3L	Z	P
AD2M32VAD	<b>Development of Applications and DSP</b>	Z,ZK	5	14P + 6L	Z	PO
MKMEPRO-K	<b>Projekt</b> AD2M32IND,AD2M31IND,..... (see the list of groups below)	Min. cours. 1	Min/Max 6/6			P

		Max. cours.					
		1					
MKMEVOLPRE-K	<b>Volitelné předměty</b> AD4M33TDV,AD0M14AML,..... (see the list of groups below)	Min. cours.	Min/Max				V
		0	0/999				

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
MKMEVOLPRE-K	<b>Volitelné předměty</b> AD4M33TDV,AD0M14AML,..... (see the list of groups below)	Min. cours.	Min/Max			V
		0	0/999			

### 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>MKMEEM-K</b>	<b>Ekonomicko manažerské předměty</b>		<b>Min. cours.</b> <b>1</b>	<b>Min/Max</b> 4/14			<b>V</b>
AD0M16EKE	Economy of Power Industry	AD0M16EET	Economics of Electro and Telecom ...	AD0M16MGM	Management		
<b>MKMEH-K</b>	<b>Humanitní předměty</b>		<b>Min. cours.</b> <b>1</b>	<b>Min/Max</b> 4/20			<b>V</b>
AD0M16FI2	Philosophy II	AD0M16HT2	History of science and technolog ...	AD0M16MPS	Psychology		
AD0M16TE1	Theology	A003TV	Physical Education				
<b>MKMEPRO-K</b>	<b>Projekt</b>		<b>Min. cours.</b> <b>1</b>	<b>Min/Max</b> 6/6			<b>P</b>
AD2M32IND	Individual Project	AD2M31IND	Project	AD2M34PMI	Individual Project		
AD2M37IND	Individual Project	AD2M17IND	Individual Project				
<b>MKMEVOLPRE-K</b>	<b>Volitelné předměty</b>		<b>Min. cours.</b> <b>0</b>	<b>Min/Max</b> 0/999			<b>V</b>
AD4M33TDV	3D Computer Vision	AD0M14AML	Aerodynamics and Mechanics of FI ...	AD0M31ASN	Algorithms and Structures of Neu ...		
AD4M39APG	Algorithms of Computer Graphics	AD4M38AVS	Embedded Systems Application	AD4M36AOS	Service Oriented Architectures		
AD4M33AAU	Automatic Reasoning	AD4M33BIA	Bio Inspired Algorithms	AD1M16CTR	Controlling		
AD3M38DIT	Diagnostics and Testing	AD0M14DGP	Electric Drive Diagnostics	AD4M33DZO	Digital image		
AD1M16DES	Power Transport Systems	AD0M37DUP	Satellite navigation systems	AD0M14DMP	Dynamics of mechanical parts of ...		
AD1M16EKL	Ecology and economy	AD1M13EMP	Ekologie materiálů a procesů	AD1M16EUE	Economy of Energy Use		
AD1M14PO2	Electric Drives and Traction 2	AD1M14SP2	Electric Machinery and Apparatus ...	AD1M15EST	Electrical Light and Heat		
AD0M15EZS	Electrical Sources and Systems	AD1M13EZF	Electrochemical Sources and Phot ...	AD0M34EZS	Electronic Security Systems		
AD1M15ENY	Power Plants	AD1M14ESZ	Power Machine Equipment	AD1M16FIM	Financial Management		
AD1M16FIU	Financial Accounting	AD0M32IBE	Informační bezpečnost	AD4M34SIC	Systems on Chip		
AD3M33IRO	Intelligent robotics	AD4M35KO	Combinatorial Optimization	AD4M38KRP	Computer Interfaces		
AD0M14KSP	Drive Communication Systems	AD0M13KTM	Construction and Technology of M ...	AD1M16MES	Management and Economics of Powe ...		
AD1M16MAV	Production Management	AD1M16MEE	Management of Power Production	AD1M16MAR	Marketing		
AD1M01MPE	Mathematics for Economy	AD3M01MKI	Mathematics for Cybernetics	AD4M33MPV	Computer Vision Methods		
AD3M33MKR	Mobile and Collective Robotics	AD0M14MDS	Simulation of dynamic systems	AD0M13MKV	Advanced Components of Power Ele ...		
AD0M37MOT	Advanced areas in image and vide ...	AD3M38MSZ	Modern Sensors and Signal Proces ...	AD4M36MAS	Multiagent Systems		
AD4M39MMA	Multimedia and Computer Animatio ...	AD3M35NES	Nonlinear Systems and Chaos	AD4M33NMS	Design and Modeling of Software ...		
AD0M14KOP	Electric Drive Component Design	AD0M34NNZ	Design of Power Supplies for Ele ...	AD0M34NSV	VLSI System Design		
AD4M39NUR	User Interface Design	AD4M35OSP	Open-source programming	AD1M16OVY	Operations Research		
AD3M35ORR	Optimal and robust control	AD4M36PAH	Planning and game playing	AD1M16LOG	Business Logistics		
AD3M33PRO	Advanced robotics	AD4M36PAP	Advanced Computer Architectures	AD4M33RZN	Advanced Methods for Knowledge R ...		
AD0M32PST	Advanced Network Technologies	AD3M35PSR	Real-Time Systems Programming	AD1M16PMG	Project Management		
AD0M32PRD	Data Communication Means	AD3M99PTO	Team Work	AD0M13PRE	Industrial electronics		
AD0M35PII	Industrial Informatics and Inter ...	AD0M33PIS	Industrial Information Systems	AD1M15PRE	Transmission and Distribution of ...		
AD1M16RES	Development of Energy Systems	AD3M38SPD	Data Acquisition and Transfer	AD1M14SOP	Simulation and Optimization in D ...		
AD1M13SVS	Simulation of Production Sytems	AD0M15SZS	Reliability and Security of Powe ...	AD1M16STA	Statistical methods in economics		
AD1M14SSE	Machinery structures of power pl ...	AD4M33SAD	Machine Learning and Data Analys ...	AD1M16SIR	System Analysis and Decision Mak ...		
AD1M15TVN	High Voltage Engineering	AD1M13TPR	Technological Project Planning	AD0M13TKS	Technology of Cables and Optical ...		
AD1M32TSY	Telecommunication Systems	AD4M33TZ	Theoretical foundations of compu ...	AD4M01TAL	Theory of Algorithms		

AD3M35TDS	Theory of Dynamical Systems	AD4M33TVS	Software Verification and Testin ...	AD3M33UI	Artificial Intelligence
AD3M38VBM	Videometry and Contactless Measu ...	AD3M38VIP	Virtual Instruments	AD4M39VIZ	Visualization
AD1M14VE2	Power Electronics 2	AD4M39VG	Computational Geometry	AD1M13VES	Manufacturing of Electrical Comp ...
AD1M16VEN	Power and Heat Production	AD3M38ZDS	Analog Signal Processing and Dig ...	AD0M37ZV2	Audio Technology 2
AD4M39DPG	Data Structures for Computer Gra ...	AD3M35RIS	Control Systems	AD1M14RPO	Electric Drive Control
AD1M15RES	Control of Power Systems	AD1M16JAK	Quality management		

### List of courses of this pass:

Code	Name of the course	Completion	Credits
A003TV	Physical Education	Z	2
AD0M13KTM	Construction and Technology of Microcomputers 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.	Z,ZK	5
AD0M13MKV	Advanced Components of Power Electronic 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.	Z,ZK	5
AD0M13PRE	Industrial electronics Electronic components, resistors, capacitors, HF coils, transformers Semiconductor devices Mounting technologies Sensore, regulating equipments Power converters. HF heating equipments. Electromagnetic compatibility in power electronic.	Z,ZK	5
AD0M13TKS	Technology of Cables and Optical waveguides - 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	Z,ZK	5
AD0M14AML	Aerodynamics and Mechanics of Flight 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.	Z,ZK	4
AD0M14DGP	Electric Drive Diagnostics 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	Z,ZK	5
AD0M14DMP	Dynamics of mechanical parts of drives 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.	Z,ZK	4
AD0M14KOP	Electric Drive Component Design 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	Z,ZK	5
AD0M14KSP	Drive Communication Systems 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	Z,ZK	5
AD0M14MDS	Simulation of dynamic systems 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	Z,ZK	4
AD0M15Ezs	Electrical Sources and Systems 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.	Z,ZK	5
AD0M15SZS	Reliability and Security of Power Systems 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.	Z,ZK	5
AD0M16EET	Economics of Electro and Telecommunication Engineering The basic information about the economical system in information and telecommunication branch. The brief repetition of the basic economics terms from point of view the market behavior of monopoly firm. Problems of the market segmentation, optimal tariffication and the evaluation of business plans efficiency. Legal framework of the enterprise in the informatics and telecommunication branch in Czech Republic in comparison with other developed countries. There are explained categories of economics of business (firm, utility) and branch (industry). There are taken up the systems of firm management (marketing in telecommunication) and there are provided the know how of optimal development of information systems.	Z,ZK	5

AD0M16EKE	Economy of Power Industry Fundamentals of financing of power companies. Cost structure of power generation and distribution. Prices and tariff systems for power, heat and gas production and distribution. Examples of economic evaluation and investment appraisal of the typical project in power sector. Renewable energy sources, externalities. Energy policy and energy law in CR. Liberalization and power market development.	KZ	4
AD0M16FI2	Philosophy II The course is oriented on the transdisciplinary aspects of philosophy, informatics, physics, mathematics and biology.	Z,ZK	4
AD0M16HT2	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
AD0M16MGM	Management The methods and procedures of effective management for company leading in competitors area.	Z,ZK	5
AD0M16MPS	Psychology	Z,ZK	4
AD0M16TE1	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
AD0M31ASN	Algorithms and Structures of Neurocomputers 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,	Z,ZK	5
AD0M32IBE	Informační bezpečnost 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.	KZ	5
AD0M32PRD	Data Communication Means	Z,ZK	5
AD0M32PST	Advanced Network Technologies Subject Advanced Network Technologies expands students' knowledge of modern network technologies. The course is practically oriented and focused on explaining the function of advanced network protocols as used in modern data networks of today and tomorrow. Students will gain practical experience with the issues like Internet routing, software-defined networks, multicast routing, IPv6, and MPLS networks. Part of the course is also devoted to a detailed explanation of transport protocols TCP/UDP and a manner in which software applications can access transportation services of TCP/IP data networks.	Z,ZK	5
AD0M33PIS	Industrial Information Systems 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 requirements, with focus to stability, planning, security and quality management.	Z,ZK	6
AD0M34EZS	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	5
AD0M34NNZ	Design of Power Supplies for Electronics 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.	Z,ZK	5
AD0M34NSV	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	4
AD0M35PII	Industrial Informatics and Internet 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.	Z,ZK	6
AD0M37DUP	Satellite navigation systems 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.	Z,ZK	4
AD0M37MOT	Advanced areas in image and video technology 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.	KZ	5
AD0M37ZV2	Audio Technology 2 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.	Z,ZK	4
AD1M01MPE	Mathematics for Economy Aim of this subject is to give the basic informations about probability, mathematical statistics and Markov chains and to show their applications, mainly in insurance mathematics. At the end of the course, bases of cluster analysis will be shown.	Z,ZK	6
AD1M13EMP	Ekologie materiálů a procesů Electrical Technology from the perspective of ecology. Environmental assessment of the various types of surface protection. Environmental aspects of protective systems used in electronics. Environmental impacts of electrical production. Ekodesign proposal of the electrical product. Principles of the proposal product for a difficult operating environment. Disposal of electrical waste.	Z,ZK	5

AD1M13EZF	<b>Electrochemical Sources and Photovoltaics</b>	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.			
AD1M13SVS	<b>Simulation of Production Systems</b>	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.			
AD1M13TPR	<b>Technological Project Planning</b>	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, resources, quality and knowledge. Standards for exchange of product and business data. Enterprise ontology.			
AD1M13VES	<b>Manufacturing of Electrical Components</b>	KZ	4
Technology of electric components in general. Basic technology in use. Type of components: resistors, potentiometers, capacitors with foil dielectric. Ceramic and electrolytic capacitors. Electromechanical devices. Semiconductors, fabrication of vertical and horizontal structures. Packaging.			
AD1M14ESZ	<b>Power Machine Equipment</b>	Z,ZK	4
Analysis of basic functions and operational accidents for power engineering. Quantitative and qualitative balance energy of machine equipment. Analysis of influence breakdowns of machine equipment, modes of regulation power output of power machine equipment. Operating optimisation. Operation properties of power machine equipment of power plant.			
AD1M14PO2	<b>Electric Drives and Traction 2</b>	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			
AD1M14RPO	<b>Electric Drive Control</b>	Z,ZK	5
Controlled electric drive, control computer of electric drive - system view, modulation methods, scalar control, quantity transformation, FOC control, DTC control, compatible rectifier, servo-drives, digital signal processing, discrete function, difference equation, digital filters, digital controllers, PSD controller, derivation and difference equation coefficients calculation, fixed point and floating point calculations, relative units and quantity normalization, digital signal processors, modulator hardware support, control algorithm implementation, microprocessor control system hardware implementation, protection circuitry, debugging, testing and monitoring			
AD1M14SOP	<b>Simulation and Optimization in Drives</b>	Z,ZK	5
Models of dynamical systems. Methods and process of simulation. Program Pspice. Matlab/Simulink environment. State models of systems and solutions. Control circuits, controllers, and determination of parameters. Circuit models of power converters. Dynamical models in average values of power electronic converters. Models of converters and machines for high frequencies. Method of finite elements and use for optimization of magnetic field in electric machine. Process and SW tools for design of main types of electric machines.			
AD1M14SP2	<b>Electric Machinery and Apparatus 2</b>	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			
AD1M14SSE	<b>Machinery structures of power plants</b>	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.			
AD1M14VE2	<b>Power Electronics 2</b>	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			
AD1M15ENY	<b>Power Plants</b>	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.			
AD1M15EST	<b>Electrical Light and Heat</b>	Z,ZK	5
The aim of the first part of the course is to make students acquainted with most frequent applications of optical radiation, modern photometric and colorimetric devices used in practice, fundamentals of light control and design of dynamic lighting including new trends in light sources and luminaire progress. The aim of the second part of the course is to become students acquainted with heat transfer laws, heat pumps and problems of global optimization on electrical power engineering.			
AD1M15PRE	<b>Transmission and Distribution of Electricity</b>	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.			
AD1M15RES	<b>Control of Power Systems</b>	Z,ZK	5
The subject introduces electrification system physical and economical characteristics and models. It deals with modes optimization, active and reactive power control in isolated and interconnected systems, extraordinary states solving and reliability evaluation. It describes also the current situation of the energy market liberalization and sources operation in it.			
AD1M15TVN	<b>High Voltage Engineering</b>	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.			
AD1M16CTR	<b>Controlling</b>	Z,ZK	6
Course primary objective is in introducing the Management Control (Controlling) as the up-to-date approach to management of the organization (enterprise, institution). To explain its changing role in management on its development in past decades from functional form, over reporting period, to integral concept of the management control of the organization. Both points of view - the recent theoretical bibliography and context of advanced practice are considered. The course focuses on key linkages among functional areas, key processes and activities in management control system. The course deals with managerial methods and other managerial tools to be applied in management of single entities of management control system and in their interrelated actions.			

AD1M16DES	<b>Power Transport Systems</b>	Z,ZK	5
Economical aspects of energy transport. Electricity transportation through lines. Heat, gas and oil lines. There are ment also universal transport systems as railway, roads and ships with considering of energy transport. After technical introduction it is dealt with problems of economical design of transport lines and economical operation			
AD1M16EKL	<b>Ecology and economy</b>	Z,ZK	5
Development of environmental protection. Sustainable development. Global environmental problems and their aspects. Greenhouse effect and climate changes. Fossil fuels, nuclear fuel cycle and environmental impacts. Support schemes for renewable energy sources utilization. Economic effectiveness of renewable energy sources projects. Regulatory and economic instruments for economic activities regulation. Externalities. Environmental indicators.			
AD1M16EUE	<b>Economy of Energy Use</b>	Z,ZK	5
Organization and energy management of company, buildings or energy systems. Energy need and consumption, energy balance. Energy characterization of aggregate, secondary energy sources. Energy audit and feasibility study, optimization of energy management of energy systems. Prices and tariffs, economy and financial analysis.			
AD1M16FIM	<b>Financial Management</b>	Z,ZK	6
Principles of finance, present value and alternative cost of capital, net present value, valuation of bonds and stocks, investment decision and net present value, risk and alternative cost of capital, risk and return, lease or buy, taxes, inflation and return, financial and real options, option valuation and application, hedging, short term finance, cash flow management.			
AD1M16FIU	<b>Financial Accounting</b>	Z,ZK	5
Principles of accounting. Assets, inventory and financial investment book keeping. Debt and equity capital. Cost, revenues and profit. Tax system and accounting. Balance sheet, profit and loss account. Cash flow statement. Analysis of company's financial position. International accounting standards. Auditing, consolidated statements.			
AD1M16JAK	<b>Quality management</b>	Z,ZK	5
Concept of Quality, History of quality management (QM), Current approaches to QM, Approach to quality in EU and CR, Quality management system (QMS) based on ISO 9001, Process management, Quality planning, Metrology in QM, Control of documents and records, Internal audits of QMS, Continual improvement of QMS, Integrated management, Statistic methods in QM, Accreditation and certification			
AD1M16LOG	<b>Business Logistics</b>	Z,ZK	5
Logistics as an integrated system in the structure of business management. Logistics as a part of business strategy. Fundamentals of modern concepts and approaches in logistics. Management, cooperation in supply chain logistics, integrated control systems. Methods applied to flow control and evaluation of elementary parameters of logistics. Logistics market. Logistics integration including its legal, ecological and economical aspects.			
AD1M16MAR	<b>Marketing</b>	Z,ZK	5
The role and functions of the marketing management. Marketing research and marketing information system. Concepts of marketing strategy. The use of product life cycle and portfolio. Marketing-mix. Product and service policy, pricing and contractation policy, communication, distribution. Controlling and audit.			
AD1M16MAV	<b>Production Management</b>	Z,ZK	5
The role of production process in promoting the marketing concept of the firm and the competitive advantage. The system of operational planning with respect to production typology. Standardized basis of production management, standardization. Controlling, production management methods.			
AD1M16MEE	<b>Management of Power Production</b>	Z,ZK	5
Power plants and mining industry management and economics, energy balances and costs calculations of power production - electricity, steam, hot water, coal, liquid fuels, gas, economic loading of power plants, cost analysis			
AD1M16MES	<b>Management and Economics of Power Systems</b>	Z,ZK	6
This course will give an overview of the various aspects of power supply with special emphasis on power management. The course characterises energy costs and marginal costs for determination of prices and tariffs. Energy market principles and operational decision making are integral parts of the course as well.			
AD1M16OVY	<b>Operations Research</b>	Z,ZK	5
Art of modeling and elements of decision models, Linear programming, Transportation problem, Integer linear programming, Introduction to graphs theory, Nonlinear programming, Dynamic programming, Monte Carlo simulation, Project management (CPM, PERT.			
AD1M16PMG	<b>Project Management</b>	KZ	5
Processes and techniques for the preparation of entrepreneurial projects. Principles and methods of planning and operating of projects realization. Operating of the integration and project area. Operating of time, costs, sources, duality, human sources, communication, risks. Case study in the program Microsoft Project.			
AD1M16RES	<b>Development of Energy Systems</b>	Z,ZK	5
AD1M16SIR	<b>System Analysis and Decision Making</b>	Z,ZK	5
System approach and decision making, Decision models, Games theory, Decision making under uncertainty and risk, Decisions with multiple objectives, Stochastic programming, Expert systems.			
AD1M16STA	<b>Statistical methods in economics</b>	Z,ZK	5
Basic Concepts. Statistical series. Assortment. Distributions of frequencies. One-dimensional descriptive characteristics. Measures of variables, coefficient of skewness, coefficient of excess. Points estimates of basic characteristics. Interval estimates of basic characteristics. Hypothesis testing of basic characteristics. Individual indexes number. Aggregative indexes. Variable-structure indexes. Multifactor indexes . Correlation and regression, Basic Concepts. Measurement of dependence intensity. Time series, concepts, qualities. Chronological average . Time series - trends and extrapolation.			
AD1M16VEN	<b>Power and Heat Production</b>	KZ	5
Power sources, energy processes, general power plant, power balance and charakteristic curves. Review of energy production technologies (conventional and non conventional) - electricity, steam, hot water, coal, liquid fuels, gas. Power generation stations, their basic parts, their basic operational charakteristic curves and calculations, operation, control. Enviromental effects of power generating and actions of their minimization.			
AD1M32TSY	<b>Telecommunication Systems</b>	Z,ZK	4
The subject discusses telecommunication networks from different perspectives - physical principles, structure, applications, etc. Students are introduced to elementary concepts and principles in the area of communications. The presented principles and methods are illustrated using examples of specific communication networks - ISDN, data transmission networks, fixed as well as mobile ones. Emphasis is put on applications related to power lines.			
AD2M01PMS	<b>Probability and Statistics</b>	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.			
AD2M17AEK	<b>Antennas and EMC in Radiowave Communication</b>	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.			

AD2M17BP3	<b>Safety in Electrical Engineering 3</b> The purpose of the course is to give the students basic knowledge of electrical equipment and installation as to avoid danger arising from operation of it, safety work with electrical equipment, basics of the first aid at injury by electric current. Students receive qualification that enables them to work on electrical equipment which is necessary for their work in the Faculty of Electrical Engineering, Czech Technical University (Dean's order No. 1/2007).	Z	
AD2M17IND	<b>Individual 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. Projects deals with microwave technique, antennas, propagation, optical communications, EMC, and medical applications.	KZ	6
AD2M31IND	<b>Project</b>	KZ	6
AD2M31RAT	<b>Speech technology in telecommunications</b> 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/ad2m31rat">http://noel.feld.cvut.cz/vyu/ad2m31rat</a> and at <a href="http://moodle.kme.feld.cvut.cz">http://moodle.kme.feld.cvut.cz</a>	Z,ZK	6
AD2M32IND	<b>Individual 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.	KZ	6
AD2M32MDS	<b>Modeling and Dimensioning of Networks</b> 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.	Z,ZK	6
AD2M32MKS	<b>Mobile Communication Systems</b> 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.	Z,ZK	4
AD2M32OSS	<b>Optical Systems and Networks</b> 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.	Z,ZK	5
AD2M32RKP	<b>Communication Processes Control</b> 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.	Z,ZK	5
AD2M32VAD	<b>Development of Applications and DSP</b> The subject makes familiar with selected parts of the digital signal processing in communication. The digital image processing is emphasized.	Z,ZK	5
AD2M34PMI	<b>Individual Project</b> Independent work in the form of a project. A student will choose a topic related to his or her branch of study, which will be specified department or branch departments. The project will be defended within the framework of a subject.	KZ	6
AD2M34SIS	<b>Integrated System Structures</b> 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 optoelectrical integrated circuits, fabrication process and technologies, materials, design and testing.	Z,ZK	5
AD2M37DKM	<b>Digital communications</b> 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.	Z,ZK	4
AD2M37IND	<b>Individual 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.	KZ	6
AD2M99CZS	<b>Digital Signal processing</b> 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.	Z,ZK	5
AD2M99MAM	<b>Microprocessors and microcomputers</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
AD3M01MKI	<b>Mathematics for Cybernetics</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.	Z,ZK	8
AD3M33IRO	<b>Intelligent robotics</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.	Z,ZK	7
AD3M33MKR	<b>Mobile and Collective Robotics</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.	Z,ZK	6

AD3M33PRO	Advanced robotics	Z,ZK	6
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.			
AD3M33UI	Artificial Intelligence	Z,ZK	6
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.			
AD3M35NES	Nonlinear Systems and Chaos	Z,ZK	6
AD3M35ORR	Optimal and robust control	Z,ZK	6
This advanced course will cover modern methods for optimal and robust control design. Emphasis will be put on practical computational design skills and realistic application problem formulations. Unifying concept of this course is that of minimizing a system norm. Depending on which norm is minimized, different properties of the resulting controller are guaranteed. Minimizing the H2 system norm leads to the celebrated LQ/LQG optimal control trading off the performance and the effort, while minimizing H $\infty$ norm shifts the focus to robustness against uncertainties in the model. $H_2$ -synthesis is an extensions to the H $\infty$ ; optimal control design methodology than takes the structure of the uncertainty into consideration. Methods for time-optimal and suboptimal control will be presented as well as they proved useful in applications with strict time constraints like positioning of a hard disk drive RW head. As a self-contained add-on to the course, introduction to the topic of semidefinite programming and linear matrix inequalities (LMI) will be made, as these constitute a very elegant theoretical and a powerful computational tool for solving all the previously introduced tasks in optimal and robust control. Methods for reduction of model and controller order complete the course.			
AD3M35PSR	Real-Time Systems Programming	Z,ZK	6
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.			
AD3M35RIS	Control Systems	Z,ZK	6
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.			
AD3M35TDS	Theory of Dynamical Systems	Z,ZK	8
The purpose of this course is to introduce mathematical tools for the description, analysis, and partly also synthesis, of dynamical systems. The focus will be on linear time-invariant multi-input multi-output systems and their properties such as stability, controllability, observability and state realization. State feedback, state estimation, and the design of stabilizing controllers will be explained in detail. Partially covered will be also time-varying and nonlinear systems. Some of the tools introduced in this course are readily applicable to engineering problems such as the analysis of controllability and observability in the design of flexible space structures, the design of state feedback in aircraft control, and the estimation of state variables. The main motivation, however, is to pave the way for the advanced courses of the study program. The prerequisites for this course include undergraduate level linear algebra, differential equations, and Laplace and z transforms.			
AD3M38DIT	Diagnostics and Testing	Z,ZK	7
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.			
AD3M38MSZ	Modern Sensors and Signal Processing	Z,ZK	6
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".			
AD3M38SPD	Data Acquisition and Transfer	Z,ZK	6
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.			
AD3M38VBM	Videometry and Contactless Measurement	Z,ZK	6
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.			
AD3M38VIP	Virtual Instruments	Z,ZK	6
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.			
AD3M38ZDS	Analog Signal Processing and Digitalization	Z,ZK	6
The course is dedicated to methods for preprocessing, digitalization and reconstruction of continuous 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.			
AD3M99PTO	Team Work	KZ	6
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.			
AD4M01TAL	Theory of Algorithms	Z,ZK	6
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.			
AD4M33AU	Automatic Reasoning	Z,ZK	6
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.			



AD4M33BIA	<b>Bio Inspired Algorithms</b>	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.			
AD4M33DZO	<b>Digital image</b>	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.			
AD4M33MPV	<b>Computer Vision Methods</b>	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.			
AD4M33NMS	<b>Design and Modeling of Software Systems</b>	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.			
AD4M33RZN	<b>Advanced Methods for Knowledge Representation</b>	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.			
AD4M33SAD	<b>Machine Learning and Data Analysis</b>	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.			
AD4M33TDV	<b>3D Computer Vision</b>	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.			
AD4M33TVS	<b>Software Verification and Testing</b>	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.			
AD4M33TZ	<b>Theoretical foundations of computer vision, graphics, and interaction</b>	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.			
AD4M34ISC	<b>Systems on Chip</b>	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.			
AD4M35KO	<b>Combinatorial Optimization</b>	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.			
AD4M35OSP	<b>Open-source programming</b>	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.			
AD4M36AOS	<b>Service Oriented Architectures</b>	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.			
AD4M36MAS	<b>Multiagent Systems</b>	Z,ZK	6
AD4M36PAH	<b>Planning and game playing</b>	Z,ZK	6
AD4M36PAP	<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.			

AD4M38AVS	<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.			
AD4M38KRP	<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.			
AD4M39APG	<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.			
AD4M39DPG	<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.			
AD4M39MMA	<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).			
AD4M39NUR	<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).			
AD4M39VG	<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.			
AD4M39VIZ	<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.			
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.			

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

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