

Study plan

Name of study plan: Open Informatics - Computer Vision and Image Processing

Faculty/Institute/Others: Faculty of Electrical Engineering

Department: Department of Cybernetics

Branch of study guaranteed by the department: Computer Vision and Image Processing

Garantor of the study branch: doc. Dr. Ing. Radim Šára

Program of study: Open Informatics

Type of study: Follow-up master full-time

Required credits: 89

Elective courses credits: 31

Sum of credits in the plan: 120

Note on the plan:

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 49

The role of the block: P

Code of the group: MOIEP

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 18 credits

Requirement courses in the group: In this group you have to complete at least 3 courses

Credits in the group: 18

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
AE4M33PAL	Advanced algorithms	Z,ZK	6	2P+2C	Z	P
AE4M35KO	Combinatorial Optimization	Z,ZK	6	3P+2C	L	P
AE4M01TAL	Theory of Algorithms	Z,ZK	6	3P+1S	L	P

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

AE4M33PAL	Advanced algorithms	Z,ZK	6	Basic graph algorithms and graph representation. Application of formal languages theory in computer science - syntax analysis and pattern matching. Selected topics of floating-point arithmetic.		
AE4M35KO	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.		
AE4M01TAL	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.		

Code of the group: MDIPE

Name of the group: Diploma Thesis

Requirement credits in the group: In this group you have to gain at least 25 credits (at most 375)

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

Credits in the group: 25

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
AE0M14DIP	Diploma Project	Z	25		L	P

AE0M13DIP	Diploma Thesis	Z	25	36S	L	P
AE0M38DIP	Diploma Thesis	Z	25	0P+36C	L	P
AE0M37DIP	Diploma Thesis	Z	25	36s	L	P
AE0M35DIP	Diploma Thesis	Z	25	36S	L	P
AE0M17DIP	Diploma Thesis <i>Miloš Mazánek</i>	Z	25	36s	L	P
AE0M34DIP	Diploma Thesis <i>Miroslav Husák</i>	Z	25	36C	L	P
AE0M33DIP	Diploma Thesis	Z	25	36S	L	P
AE0M32DIP	Diploma project	Z	25	0P + 36S	L	P
AE0M16DIP	Diploma thesis	Z	25	36s	L,Z	P
ADIP25	Diploma Thesis	Z	25	36s	L	P
AE4M99DIP	Master Thesis	Z	25		L	P
AE0M15DIP	Master's thesis	Z	25	36s	L	P

Characteristics of the courses of this group of Study Plan: Code=MDIPE Name=Diploma Thesis

AE0M14DIP	Diploma Project	Z	25			
AE0M13DIP	Diploma Thesis Independent final comprehensive work for the Master's degree study program. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25			
AE0M38DIP	Diploma Thesis	Z	25			
AE0M37DIP	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25			
AE0M35DIP	Diploma Thesis	Z	25			
AE0M17DIP	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination. Diploma projects deals with microwave technique, antennas, propagation, optical communications, EMC, and medical applications.	Z	25			
AE0M34DIP	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25			
AE0M33DIP	Diploma Thesis	Z	25			
AE0M32DIP	Diploma project Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25			
AE0M16DIP	Diploma thesis	Z	25			
ADIP25	Diploma Thesis Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.	Z	25			
AE4M99DIP	Master Thesis	Z	25			
AE0M15DIP	Master's thesis	Z	25			

Code of the group: MOIEPRO

Name of the group: Project

Requirement credits in the group: In this group you have to gain 6 credits

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 6

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
AE4M36SVP	Software or Research Project <i>Sebastian Basterrech, Pavel Strnad, Jan Drchal</i>	KZ	6		Z,L	P
AE4M33SVP	Software or Research Project	KZ	6		Z,L	P

Characteristics of the courses of this group of Study Plan: Code=MOIEPRO Name=Project

AE4M36SVP	Software or Research Project Individual project work under the advisors supervision. During this course it is possible (usual) to work on a particular problem within the Diploma thesis. Therefore, we advise students to choose the subject of the Diploma thesis already at the beginning of the 3rd semester and not to underestimate this timely choice. To pass the course Software and research project the result of the work has to be clearly defined, e.g. technical report or the piece of software (program), that will be awarded the assessment. Important note: In general, it is not possible to pass more than one course of this type/with such characteristics. An exception can be granted by guarantor of the major specialization. Possible reason for an exception could be a fact, that the work/project has got a different subject and is supervised by a different advisor. Typically, it can be a project done during the studies abroad. For further information please contact: oi@fel.cvut.cz	KZ	6			
AE4M33SVP	Software or Research Project	KZ	6			

Code of the group: MOIEBME

Name of the group: Safety of the master's studies

Requirement credits in the group:

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

Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
AE4M14BP3	Safety in Electrical Engineering 3	Z	0	2+2j	Z	P

Characteristics of the courses of this group of Study Plan: Code=MOIEBME Name=Safety of the master's studies

AE4M14BP3	Safety in Electrical Engineering 3	Z	0
The course provides for students of programme Open informatics periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the Directive of the Dean No. 1/2007.			

Name of the block: Compulsory courses of the specialization

Minimal number of credits of the block: 36

The role of the block: PO

Code of the group: MOIEPO3

Name of the group: Compulsory subjects of the branch

Requirement credits in the group: In this group you have to gain 36 credits

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 36

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
AE4M33TDV	3D Computer Vision	Z,ZK	6	2P+2C	Z	PO
AE4M39VG	Computational Geometry	Z,ZK	6	2P+2S	Z	PO
AE4M33MPV	Computer Vision Methods	Z,ZK	6	2P+2C	L	PO
AE4M33DZO	Digital image	Z,ZK	6	2P+2C	Z	PO
AE4M33GVG	Geometry of Computer Vision and Graphics	Z,ZK	6	2P+2C	L	PO
AE4M33SAD	Machine Learning and Data Analysis	Z,ZK	6	2P+2C	Z	PO

Characteristics of the courses of this group of Study Plan: Code=MOIEPO3 Name=Compulsory subjects of the branch

AE4M33TDV	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.	
AE4M39VG	Computational Geometry	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.	
AE4M33MPV	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.	
AE4M33DZO	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.	
AE4M33GVG	Geometry of Computer Vision and Graphics	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.	
AE4M33SAD	Machine Learning and Data Analysis	Z,ZK	6	The class is taught jointly in English with M33SAD. See the latter for course info.	

Name of the block: Elective courses

Minimal number of credits of the block: 4

The role of the block: V

Code of the group: MOIEVOLPRE

Name of the group: Elective subjects

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group: ~Student can choose arbitrary subject of the master's program (EEM - Electrical Engineering, Power Engineering and Management, KME - Communications, Multimedia and Electronics, KYR - Cybernetics and Robotics, OI - Open Informatics) which is not part of his curriculum. Student can choose with consideration of recommendation of the branch guarantee. \\\

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
AE0M32PST	Advanced Network Technologies	Z,ZK	5	2P + 2L	L	v
AE0M13MKV	Advanced Components of Power Electronic	Z,ZK	5	2P+2L	L	v
AE4M33RZN	Advanced Methods for Knowledge Representation	Z,ZK	6	2P+2C	Z	v
AE0M37MOT	Advanced areas in image and video technology	KZ	5	2+2L	Z	v
AE3M33PRO	Advanced robotics	Z,ZK	6	2P+2L	Z	v
AE0M14AML	Aerodynamics and Mechanics of Flight	Z,ZK	4	2+2s	Z	v
AE3M38ZDS	Analog Signal Processing and Digitalization	Z,ZK	6	2P+2L	Z	v
AE2M17AEK	Antennas and EMC in Radiowave Communication <i>Pavel Hazdra, Miloš Mazánek, Hynek Bártík Pavel Hazdra (Gar.)</i>	Z,ZK	5	2+2L	L	v
AE2M32VAD	Applications Development and DSP	Z,ZK	5	2P + 2L	L	v
AE3M33UI	Artificial Intelligence	Z,ZK	6	2P+2C	L	v
AE2M37ZVT	Audio Technology	Z,ZK	5	2+2L	L	v
AE0M37ZV2	Audio Technology 2	Z,ZK	4	2+2L	Z	v
AE1M16LOG	Business Logistics	Z,ZK	5	2+2s	Z	v
AE2M17CAD	CAD and Microwave Circuits	Z,ZK	6	2+2c	Z	v
AE2M37KDK	Coding in digital communications <i>Jan Sýkora</i>	Z,ZK	5	3+1c	L	v
AE2M32RKP	Communication Processes Control	Z,ZK	5	2P + 2L	L	v
AE0M32KMP	Communications and Media Law <i>Zdeněk Brabec, Petr Ondráček Zdeněk Brabec Zdeněk Brabec (Gar.)</i>	Z,ZK	4	2P + 2C	Z,L	v
AE2M17PMP	Computer Aided Modeling of Field <i>Miloš Mazánek</i>	Z,ZK	5	2+2c	L	v
AE4M39PGR	Computer Graphics	Z,ZK	6	2P+2C	L	v
AE0M13KTM	Construction and Technology of Microcomputers	Z,ZK	5	2P+2L	Z	v
AE3M35RIS	Control Systems	Z,ZK	6	2P+2L	Z	v
AE1M15RES	Control of Power Systems	Z,ZK	5	2+2c	L	v
AE1M16CTR	Controlling	Z,ZK	6	2+2s	Z	v
AE3M38SPD	Data Acquisition and Transfer	Z,ZK	6	2P+2L	Z	v
AE0M32PRD	Data Communication Means	Z,ZK	5	2P + 2L	Z	v
AE0M34NFO	Design of Photonic Circuits	Z,ZK	4	2P+2L	L	v
AE0M34NNZ	Design of Power Supplies for Electronics	Z,ZK	5	2P+2L	L	v
AE1M16RES	Development of Energy Systems	Z,ZK	5	2+2s	Z	v
AE3M38DIT	Diagnostics and Testing	Z,ZK	7	3P+2L	L	v
AE2M99CZS	Digital Signal Processing	Z,ZK	5	2P+2C	Z	v
AE2M37DKM	Digital communications	Z,ZK	4	3+1s	Z	v
AE0M14KSP	Drive Communication Systems	Z,ZK	5	2+2c	L	v
AE0M14DMP	Dynamics of mechanical parts of drives	Z,ZK	4	2+2s	Z	v
AE1M16EKL	Ecology and economy <i>Jaroslav Knápek</i>	Z,ZK	5	3+1s	L	v
AE1M13EMP	Ecology of materials and processes	Z,ZK	5	2P+2L	L	v

AE1M16EUE	Economy of Energy Use	Z,ZK	5	2+2s	L	v
AE0M14KOP	Electric Drive Component Design	Z,ZK	5	2+2L	Z	v
AE1M14RPO	Electric Drive Control	Z,ZK	5	2+2L	L	v
AE0M14DGP	Electric Drive Diagnostics	Z,ZK	5	2+2L	L	v
AE1M14PO2	Electric Drives and Traction 2	Z,ZK	5	2+2L	L	v
AE1M14SP2	Electric Machinery and Apparatus 2	Z,ZK	5	2+2L	Z	v
AE1M15EST	Electrical Light and Heat	Z,ZK	5	2+2c	Z	v
AE0M15Ezs	Electrical Sources and Systems	Z,ZK	5	2+2s	Z	v
AE1M13EZF	Electrochemical Sources and Photovoltaics	Z,ZK	5	2P+2L	Z	v
AE0M34Ezs	Electronic Security Systems <i>Miroslav Husák Miroslav Husák (Gar.)</i>	Z,ZK	5	2P+2L	Z	v
AE3M35OFD	Estimation, filtering and detection	Z,ZK	6	3P+1C	Z	v
AE1M16FIU	Financial Accounting	Z,ZK	5	2+2s	Z	v
AE1M16FIM	Financial Management	Z,ZK	6	2+2c	L	v
AE0M32ZST	Fundamentals of Network Technologies	Z,ZK	5	2P + 2L	Z	v
AE1M15TVN	High Voltage Engineering	Z,ZK	5	2+2L	L	v
AE2M37OBT	Image Technology	Z,ZK	6	2+2c	Z	v
AE2M31IAS	Implementation of Analog Systems	Z,ZK	6	2P+2S	L	v
AE0M13PRE	Industrial electronics	Z,ZK	5	2P+2L	Z	v
AE2M34SIS	Integrated System Structures <i>Jiří Jakovenko, Vladimír Janiček Jiří Jakovenko Jiří Jakovenko (Gar.)</i>	Z,ZK	5	2P+2C	Z	v
AE2M34NIS	Integrated Systems Design <i>Jiří Jakovenko, Vladimír Janiček Vladimír Janiček Jiří Jakovenko (Gar.)</i>	Z,ZK	5	2P+2C	L	v
AE3M33IRO	Intelligent robotics	Z,ZK	7	3P+2C	L	v
BE4M36NLP	Introduction to Natural Language Processing	Z,ZK	6	2P+2C	Z	v
AE4M33SAD	Machine Learning and Data Analysis	Z,ZK	6	2P+2C	Z	v
AE1M14SSE	Machinery structures of power plants	Z,ZK	4	2+2s	Z	v
AE1M16MES	Management and Economics of Power Systems	Z,ZK	6	2+2s	Z	v
AE1M16MEE	Management of Power Production	Z,ZK	5	2+2s	L	v
AE1M13VES	Manufacturing of Electrical Components	KZ	4	2P+2L	Z	v
AE1M13VEZ	Manufacturing of Electronic Equipment	Z,ZK	5	2P+2L	Z	v
AE1M16MAR	Marketing	Z,ZK	5	2+2s	Z	v
AE3M01MKI	Mathematics for Cybernetics	Z,ZK	8	4P+2S	Z	v
AE1M01MPE	Mathematics for Economy	Z,ZK	6	4+2	Z	v
AE0M38MET	Metrology	Z,ZK	5	2+2L	Z	v
AE2M99MAM	Microprocessors and microcomputers	Z,ZK	6	2P+2L	L	v
AE2M34MST	Microsystems <i>Miroslav Husák, Adam Bouřa Miroslav Husák Miroslav Husák (Gar.)</i>	Z,ZK	5	2P+2L	Z	v
AE2M34MIM	Microsystems in Multimedia <i>Miroslav Husák, Adam Bouřa Miroslav Husák (Gar.)</i>	Z,ZK	5	2P+2C	L	v
AE2M17MOS	Microwave Circuits and Subsystems	Z,ZK	5	2+2c	L	v
AE2M32MKS	Mobile Communication Networks	Z,ZK	4	2P + 2L	Z	v
AE3M33MKR	Mobile and Collective Robotics	Z,ZK	6	2P+2L	Z	v
AE2M32MDS	Modeling and Dimensioning of Networks	Z,ZK	6	3P + 1L	Z	v
AE3M38MSZ	Modern Sensors and Signal Processing	Z,ZK	6	2P+2L	L	v
AE2M34NAN	Nanoelectronics and Nanotechnology <i>Jan Voves Jan Voves Jan Voves (Gar.)</i>	Z,ZK	5	2P+2C	L	v
AE3M35NES	Nonlinear Systems and Chaos	Z,ZK	6	3P+1C	Z	v
AE1M16OVY	Operations Research	Z,ZK	5	2+2c	L	v
AE2M32OSS	Optical Systems and Networks	Z,ZK	5	2P + 2L	L	v
AE3M35ORR	Optimal and robust control	Z,ZK	6	3P+1C	L	v
AE1M14VE2	Power Electronics 2	Z,ZK	5	2+2L	Z	v
AE1M14ESZ	Power Machine Equipment	Z,ZK	4	2+2c	Z	v
AE1M15ENY	Power Plants	Z,ZK	5	2+2c	Z	v
AE1M16DES	Power Transport Systems	Z,ZK	5	2+2s	Z	v
AE1M16VEN	Power and Heat Production	KZ	5	2+2s	Z	v

AE1M01MPS	Probability and Statistics	Z,ZK	8	4+2	Z	v
AE2M01PMS	Probability and Statistics	Z,ZK	8	4+2	Z	v
AE1M16MAV	Production Management	Z,ZK	5	2+2s	L	v
AE1M16PMG	Project Management	KZ	5	2+2s	L	v
AE1M16JAK	Quality management	Z,ZK	5	2+2s	Z	v
AE2M37RSY	Radio systems	Z,ZK	6	2+2L	Z	v
AE3M35PSR	Real-Time Systems Programming	Z,ZK	6	2P+2C	Z	v
AE0M15SZS	Reliability and Security of Power Systems	Z,ZK	5	2+2s	L	v
AE0M37DUP	Satellite navigation systems	Z,ZK	4	2+2L	Z	v
AE0M38SPP	Signal Processors in Practice	Z,ZK	5	2P+2L	Z	v
AE2M31SMU	Signals in multimedia	Z,ZK	5	2P+2C	L	v
AE1M14SOP	Simulation and Optimization in Drives	Z,ZK	5	2+2L	Z	v
AE1M13SVS	Simulation of Production Systems	Z,ZK	5	2P+2C	Z	v
AE0M14MDS	Simulation of dynamic systems	Z,ZK	4	2+2s	L	v
AE2M31ZRE	Speech processing	Z,ZK	6	2P+2C	L	v
AE2M31RAT	Speech technology in telecommunications	Z,ZK	6	2P+2C	L	v
AE1M16STA	Statistical methods in economics	Z,ZK	5	2+2c	L	v
AE0M37SEK	Synchronization and Equalization in Digital Communications <i>Jan Sýkora Jan Sýkora Jan Sýkora (Gar.)</i>	Z,ZK	4	3P+1S	Z	v
AE1M16SIR	System Analysis and Decision Making	Z,ZK	5	2+2c	Z	v
AE3M99PTO	Team Work	KZ	6	1P+3C	L	v
AE1M13TPR	Technological Project Planning	Z,ZK	5	2P+2S	L	v
AE0M13TKS	Technology of Cables and Optical waveguides	Z,ZK	5	2P+2L	L	v
AE1M32TSY	Telecommunication Systems and Networks	Z,ZK	4	2P + 2L	Z	v
AE2M17PDS	Terrestrial and Satellite Radio Links	Z,ZK	6	2+2c	Z	v
AE3M35TDS	Theory of Dynamical Systems	Z,ZK	8	4P+2C	Z	v
AE1M15PRE	Transmission and Distribution of Electricity	Z,ZK	5	2+2s	L	v
AE0M34NSV	VLSI System Design <i>Pavel Hazdra Pavel Hazdra Pavel Hazdra (Gar.)</i>	Z,ZK	4	2P+2L	Z	v
AE3M38VBM	Videometry and Contactless Measurement	Z,ZK	6	2P+2L	L	v
AE0M38VIP	Virtual Instruments	Z,ZK	5	2P+2L	Z	v
AE3M38VIP	Virtual Instruments	Z,ZK	6	2P+2L	Z	v

Characteristics of the courses of this group of Study Plan: Code=MOIEVOLPRE Name=Elective subjects

AE4M33SAD	Machine Learning and Data Analysis The class is taught jointly in English with M33SAD. See the latter for course info.	Z,ZK	6
AE0M32PST	Advanced Network Technologies The course Advanced Network Technologies extends practical knowledge in the field of data networks design. The course is practically orientated and focused on advanced configuration of switches and routers. The students will master advanced topics like IPv6, MPLS, TCP and BGP.	Z,ZK	5
AE0M13MKV	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
AE4M33RZN	Advanced Methods for Knowledge Representation 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.	Z,ZK	6
AE0M37MOT	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
AE3M33PRO	Advanced robotics 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.	Z,ZK	6
AE0M14AML	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
AE3M38ZDS	Analog Signal Processing and Digitalization 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.	Z,ZK	6

AE2M17AEK	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.			
AE2M32VAD	Applications Development 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.			
AE3M33UI	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.			
AE2M37ZVT	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.			
AE0M37ZV2	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.			
AE1M16LOG	Business Logistics	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.			
AE2M17CAD	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.			
AE2M37KDK	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.			
AE2M32RKP	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.			
AE0M32KMP	Communications and Media Law	Z,ZK	4
A complex course dedicated to interdisciplinary problems - the legal aspects of electronic communications (information and communications systems), as well as media from the viewpoint of European and national law. It analyses the areas of informatics, electronic communications, information society services, copyright and general intellectual property rights, the protection of identity, introduction to software law and the Internet as a global communication and information system.			
AE2M17PMP	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.			
AE4M39PGR	Computer Graphics	Z,ZK	6
Graphical libraries are used for realistic rendering of 3D scenes. The main goal of this course is to introduce students to to the Application Programming Interface (API) for 3D graphics and learn them how to program a simple interactive OpenGL based 3D graphical applications. Naturally, the course describes the fundamentals of computer graphics such as rendering pipeline, geometric transformations, texturing, scene modeling, shading and illumination models, etc. Lectures also cover advanced modeling techniques (parametric curves and surfaces) and selected topics related to the scientific visualization. Practices are focused on the work on given tasks and individual projects that help students to get practical experience with the OpenGL graphics library.			
AE0M13KTM	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.			
AE3M35RIS	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.			
AE1M15RES	Control of Power Systems	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.			
AE1M16CTR	Controlling	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.			
AE3M38SPD	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.			
AE0M32PRD	Data Communication Means	Z,ZK	5
AE0M34NFO	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.			

AE0M34NNZ	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.			
AE1M16RES	Development of Energy Systems	Z,ZK	5
AE3M38DIT	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.			
AE2M99CZS	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. Further details can be found at http://noel.feld.cvut.cz/vyu/ae2m99czs&gt;http://noel.feld.cvut.cz/vyu/ae2m99czs&lt;/a&gt; .			
AE2M37DKM	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.			
AE0M14KSP	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/desuffing, 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			
AE0M14DMP	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.			
AE1M16EKL	Ecology and economy	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.			
AE1M13EMP	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.			
AE1M16EUE	Economy of Energy Use	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.			
AE0M14KOP	Electric Drive Component Design	Z,ZK	5
Theoretical principles and pragmatic procedures in main types electric drives for transtort, automatisasion 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 the theoretical design, realisation or experimental parameters verification			
AE1M14RPO	Electric Drive Control	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			
AE0M14DGP	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 quatzation, 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			
AE1M14PO2	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			
AE1M14SP2	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			
AE1M15EST	Electrical Light and Heat	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.			

AE0M15EZZ	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.			
AE1M13EZF	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.			
AE0M34EZZ	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.			
AE3M35OFD	Estimation, filtering and detection	Z,ZK	6
This course will cover description of the uncertainty of hidden variables (parameters and state of a dynamic system) using the probability language and methods for their estimation. Based on bayesian prblem formulation principles of rational behaviour under uncertainty will be analysed and used to develop algorithms for estimation of parameters of ARX models and Kalman filtering including the extensions. We will demonstrate numerically robust implementation of the algorithms applicable in real life problems for the areas of industrial process control, robotics and avionics. We will extend the methods for linear gaussian systems to a more generic problems using Monte Calro approach. The course will also cover multimodel approach and its use for the fault detection and isolation and introduction to adaptive control.			
AE1M16FIU	Financial Accouting	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.			
AE1M16FIM	Financial Management	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.			
AE0M32ZST	Fundamentals of Network Technologies	Z,ZK	5
The course Fundamentals of Network Technologies is focused on principles of data networks. It describes functionality of the three bottom layers of the ISO/OSI network layer model. Students will learn the basics of the configuration of network devices with regards to routing, dynamic routing protocols and addressing in IPv4 including VLSM.			
AE1M15TVN	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.			
AE2M37OBT	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.).			
AE2M31IAS	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.			
AE0M13PRE	Industrial electronics	Z,ZK	5
Electronic components , resistors, capacitors, HF coils, transformers Semiconductor devices Mounting technologies Senzore, regulating equipments Power converters.HF heating equipments. Electromagnetic compatibility in power electronic.			
AE2M34SIS	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.			
AE2M34NIS	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.			
AE3M33IRO	Intelligent robotics	Z,ZK	7
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.			
BE4M36NLP	Introduction to Natural Language Processing	Z,ZK	6
AE1M14SSE	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.			
AE1M16MES	Management and Economics of Power Systems	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.			
AE1M16MEE	Management of Power Production	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			
AE1M13VES	Manufacturing of Electrical Components	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.			
AE1M13VEZ	Manufacturing of Electronic Equipment	Z,ZK	5
Mechanical and electrical design. The electric contact. Joining of conductors. Cooling of components and equipment Printed circuit boards fabrication. Soldering in electronics. Electromagnetic compatibility of electronic equipment. Protection of components and equipment, sensitive on electrostatic field. Certification, accreditation, quality control and quality assurance.			

AE1M16MAR	Marketing	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 contraction policy, communication, distribution. Controlling and audit.			
AE3M01MKI	Mathematics for Cybernetics	Z,ZK	8
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.			
AE1M01MPE	Mathematics for Economy	Z,ZK	6
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.			
AE0M38MET	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.			
AE2M99MAM	Microprocessors and microcomputers	Z,ZK	6
The aim is to make students acquainted with the properties of microprocessor systems, make students familiar with on-chip peripherals, connect external circuit to the processor bus, and with implementation of the memory or I/O space address extension. Next, taught the students to make simple program in the assembly language, C language and combination of both. After completion of this subject student should be able to design and implement simpler microprocessor system including connection of necessary peripherals and software design.			
AE2M34MST	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.			
AE2M34MIM	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.			
AE2M17MOS	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.			
AE2M32MKS	Mobile Communication Networks	Z,ZK	4
The lectures introduce principles and functionalities of mobile networks with special focus on currently deployed technologies and future mobile networks. Furthermore, architecture and fundamental principles of GSM, UMTS, LTE and LTE-A will be explained. Then, selected key technologies for future mobile networks (e.g., 5G) will be explained.			
AE3M33MKR	Mobile and Collective Robotics	Z,ZK	6
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.			
AE2M32MDS	Modeling and Dimensioning of Networks	Z,ZK	6
The aim of the course is to present an overlook of dimensioning of service systems in telecommunications networks on the basis of results of the queuing theory (QT). Introduce possibilities of simulation and modelling service systems and its networks both from the point of view of grade of service GoS and quality of service QoS. Results of the QT are applied on different service systems and telecommunication networks deploying and operating at time being. It is shown that models derived for telecommunications systems can be utilized for dimensioning of service systems in real life.			
AE3M38MSZ	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".			
AE2M34NAN	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 optimalisation, are studied.			
AE3M35NES	Nonlinear Systems and Chaos	Z,ZK	6
AE1M16OVY	Operations Research	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).			
AE2M32OSS	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.			
AE3M35ORR	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∞ norm shifts the focus to robustness against uncertainties in the model. ?-synthesis is an extensions to the H∞ 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 theoretial 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.			

AE1M14VE2	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			
AE1M14ESZ	Power Machine Equipment	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.			
AE1M15ENY	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.			
AE1M16DES	Power Transport Systems	Z,ZK	5
Economic aspects of energy transport. Electricity transportation through lines. Heat, gas and oil lines. There are mentioned 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			
AE1M16VEN	Power and Heat Production	KZ	5
Power sources, energy processes, general power plant, power balance and characteristic 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 characteristic curves and calculations, operation, control. Environmental effects of power generating and actions of their minimization.			
AE1M01MPS	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.			
AE2M01PMS	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.			
AE1M16MAV	Production Management	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.			
AE1M16PMG	Project Management	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.			
AE1M16JAK	Quality management	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			
AE2M37RSY	Radio systems	Z,ZK	6
Radio systems and their parameters, radar and position determination systems especially. Principles, properties, parameters and applications.			
AE3M35PSR	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.			
AE0M15SZS	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.			
AE0M37DUP	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.			
AE0M38SPP	Signal Processors in Practice	Z,ZK	5
Basic architecture of digital signal processors, main features and properties, description of important processor blocks (ALU, MAC). Development and supporting tools for design and debug. Fundamental method of digital signal processing including practise implementation on digital signal processor (DSP). Demonstration of HW design with application of DSP. Within laboratory exercises, realisation of scheduled or own complex project.			
AE2M31SMU	Signals in multimedia	Z,ZK	5
Course brings information about methods of signal processing used in multimedia including 2-D analysis and modern methods.			
AE1M14SOP	Simulation and Optimization in Drives	Z,ZK	5
Models of dynamical systems. Methods and process of simulation. Program Pspice. Matlab/Simulink environment. State models of systems and solutions. Control circuits, controllers, and determination of parameters. Circuit models of power converters. Dynamical models in average values of power electronic converters. Models of converters and machines for high frequencies. Method of finite elements and use for optimization of magnetic field in electric machine. Process and SW tools for design of main types of electric machines.			
AE1M13SVS	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.			
AE0M14MDS	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			

AE2M31ZRE	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 http://noel.feld.cvut.cz/vyu/a2m31zre and at http://moodle.kme.feld.cvut.cz			
AE2M31RAT	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 http://noel.feld.cvut.cz/vyu/ae2m31rat . Detailed information for registered students can be found at teaching portal http://moodle.kme.feld.cvut.cz .			
AE1M16STA	Statistical methods in economics	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.			
AE0M37SEK	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.			
AE1M16SIR	System Analysis and Decision Making	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.			
AE3M99PTO	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.			
AE1M13TPR	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.			
AE0M13TKS	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			
AE1M32TSY	Telecommunication Systems and Networks	Z,ZK	4
The subject discusses principles of telecommunication systems - mainly digital transmission systems and digital switching systems. The subject will provide students with the overview of the entire telecommunication domain, so that they can solve particular problems related to network traffic. They will also obtain basic knowledge of technologies that are used in modern wired and wireless networks. Results of the survey (students' opinions) concerning the subject can be found here: https://www.fel.cvut.cz/cz/anketa/aktualni/courses/AE1M32TSY			
AE2M17PDS	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.			
AE3M35TDS	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.			
AE1M15PRE	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.			
AE0M34NSV	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.			
AE3M38VBM	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.			
AE0M38VIP	Virtual Instruments	Z,ZK	5
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, Linux and Phar Lap operating systems. Assigned software tasks in laboratories are solved using C/C++ language or LabVIEW environment.			
AE3M38VIP	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.			

Code of the group: MOIEHEM

Name of the group: Humanities, economically-managment subjects

Requirement credits in the group: In this group you have to gain at least 4 credits (at most 40)

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

Credits in the group: 4

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
AE0B16EPD	Business economics Tomáš Podivínský Tomáš Podivínský Tomáš Podivínský (Gar.)	KZ	4	2+2s	Z,L	v
A0M16EKE	Economy of Power Industry	KZ	4	2+2s	Z,L	v
A0M16FI2	Philosophy II	Z,ZK	4	2+2s	L	v
A0M16HT2	History of science and technology 2	Z,ZK	4	2+2s	L	v
A0M16MGM	Management Jaroslav Knápek, Milana Hrubá Jaroslav Knápek (Gar.)	Z,ZK	5	2P+2S	Z,L	v
A0M16MPS	Psychology Jan Fiala Jan Fiala Jan Fiala (Gar.)	Z,ZK	4	2+2s	Z,L	v
A0M16TE1	Theology Vladimír Slámečka Vladimír Slámečka Vladimír Slámečka (Gar.)	Z,ZK	4	2+2s	L	v
A003TV	Physical Education	Z	2	0+2	L,Z	v

Characteristics of the courses of this group of Study Plan: Code=MOIEHEM Name=Humanities, economically-management subjects

AE0B16EPD	Business economics	KZ	4	Basic course of Business Economics deals with the subject from wide angle of view, discussing all particular aspects of Business Economics, and relationships between them.		
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.		
A003TV	Physical Education	Z	2			

Code of the group: METV

Name of the group: Physical Training

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
03TV	Physical Education	Z	1	2s	Z,L	v
A0M03TVI	Physical Education I	Z	1	2s	Z	v
A0M03TVII	Physical Education II	Z	1	2s	L	v
A0M03TVIII	Physical Education III	Z	1	2s	Z	v
A0M03TVIV	Physical Education IV	Z	1	2s	L	v
A0M03TVK	Physical Education Course	Z	1	7dní	Z,L	v

Characteristics of the courses of this group of Study Plan: Code=METV Name=Physical Training

03TV	Physical Education	Z	1	The student can be enlisted in the subject P.E. 03TV (7 times at maximum), the student gets one (1) credit (max. 7 credits during the whole study at F.E.E.) after finishing the optional P.E. subject. The syllabi of each sport disciplin can be found on the Internet address: http://www.Feld.cvut.cz/fee/K303		
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A0M03TVI	Physical Education I	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVII	Physical Education II	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVIII	Physical Education III	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVIV	Physical Education IV	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVK	Physical Education Course	Z	1

List of courses of this pass:

Code	Name of the course	Completion	Credits
03TV	Physical Education	Z	1
The student can be enlisted in the subject P.E. 03TV (7 times at maximum), the student gets one (1) credit (max. 7 credits during the whole study at F.E.E.) after finishing the optional P.E. subject. The syllabi of each sport disciplin can be found on the Internet address: http://www.Feld.cvut.cz/fee/K303			
A003TV	Physical Education	Z	2
A0M03TVI	Physical Education I	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVII	Physical Education II	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVIII	Physical Education III	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVIV	Physical Education IV	Z	1
The main goal of the physical training is to improve and extend locomotive skills which students have been earned within previous stages of their education as well as gain basic knowledge connected with kinantropology, hygienics and physiotherapy. Special attention is paid on the healthy lifestyle forming and compensation of sedentary occupation of students as a part of combat with civilization diseases. Within different study programmes, the Department of Physical Education and Sport offers following disciplines: aerobics, aikido, basketball, beach volleyball, badminton, bowling, skating, budo, floorball, football, frisbee, golf, in-line skating, canoeing, karate, fitness, downhill skiing, ice hockey, climbing, shooting bow, ninjutsu, swimming, softball, spinning, squash, table tennis, tennis, hiking, volleyball and health physical education. Students may choose one of above described sport disciplines according to their own interest and available capacity.			
A0M03TVK	Physical Education Course	Z	1

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.			
ADIP25	Diploma Thesis	Z	25
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.			
AE0B16EPD	Business economics	KZ	4
Basic course of Business Economics deals with the subject from wide angle of view, discussing all particular aspects of Business Economics, and relationships between them.			
AE0M13DIP	Diploma Thesis	Z	25
Independent final comprehensive work for the Master's degree study program. 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.			
AE0M13KTM	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.			
AE0M13MKV	Advanced Components of Power Electronic	Z,ZK	5
Power semiconductor device (diodes, BJTs, thyristors, MOSFETs and IGBTs) and integraed 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.			
AE0M13PRE	Industrial electronics	Z,ZK	5
Electronic components , resisttors, capacitors, HF coils, transformers Semiconductor devices Mounting technologies Senzore, regulating equipments Power converters.HF heating equipments. Electromagnetic compatibility in power electronic.			
AE0M13TKS	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			
AE0M14AML	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.			
AE0M14DGP	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 quatization, 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			
AE0M14DIP	Diploma Project	Z	25
AE0M14DMP	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 .			
AE0M14KOP	Electric Drive Component Design	Z,ZK	5
Theoretical principles and pragmatic procedures in main types electric drives for transtort, automatISATION and manipulating technics design. Selection, dimensionning and realisation of drives components: power supply, switching devices, protection, semiconductor converter, electric motor. Project, verification of dimensionning and testing of drive components, realisation of selected part on model drive, experimental parameters examination. Semestrial project optionally fixed on theoterical design, realisation or experimental parameters verification			
AE0M14KSP	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, baude-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			
AE0M14MDS	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			
AE0M15DIP	Master's thesis	Z	25

AE0M15EZS	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.			
AE0M15SZS	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.			
AE0M16DIP	Diploma thesis	Z	25
AE0M17DIP	Diploma Thesis	Z	25
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination. Diploma projects deals with microwave technique, antennas, propagation, optical communications, EMC, and medical applications.			
AE0M32DIP	Diploma project	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.			
AE0M32KMP	Communications and Media Law	Z,ZK	4
A complex course dedicated to interdisciplinary problems - the legal aspects of electronic communications (information and communications systems), as well as media from the viewpoint of European and national law. It analyses the areas of informatics, electronic communications, information society services, copyright and general intellectual property rights, the protection of identity, introduction to software law and the Internet as a global communication and information system.			
AE0M32PRD	Data Communication Means	Z,ZK	5
AE0M32PST	Advanced Network Technologies	Z,ZK	5
The course Advanced Network Technologies extends practical knowledge in the field of data networks design. The course is practically orientated and focused on advanced configuration of switches and routers. The students will master advanced topics like IPv6, MPLS, TCP and BGP.			
AE0M32ZST	Fundamentals of Network Technologies	Z,ZK	5
The course Fundamentals of Network Technologies is focused on principles of data networks. It describes functionality of the three bottom layers of the ISO/OSI network layer model. Students will learn the basics of the configuration of network devices with regards to routing, dynamic routing protocols and addressing in IPv4 including VLSM.			
AE0M33DIP	Diploma Thesis	Z	25
AE0M34DIP	Diploma Thesis	Z	25
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.			
AE0M34Ezs	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.			
AE0M34NFO	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 programmes.			
AE0M34NNZ	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.			
AE0M34NSV	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.			
AE0M35DIP	Diploma Thesis	Z	25
AE0M37DIP	Diploma Thesis	Z	25
Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination.			
AE0M37DUP	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.			
AE0M37MOT	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.			
AE0M37SEK	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.			
AE0M37ZV2	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.			
AE0M38DIP	Diploma Thesis	Z	25
AE0M38MET	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.			

AE0M38SPP	Signal Processors in Practice	Z,ZK	5
Basic architecture of digital signal processors, main features and properties, description of important processor blocks (ALU, MAC). Development and supporting tools for design and debug. Fundamental method of digital signal processing including practise implementation on digital signal processor (DSP). Demonstration of HW design with application of DSP. Within laboratory exercises, realisation of scheduled or own complex project.			
AE0M38VIP	Virtual Instruments	Z,ZK	5
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, Linux and Phar Lap operating systems. Assigned software tasks in laboratories are solved using C/C++ language or LabVIEW environment.			
AE1M01MPE	Mathematics for Economy	Z,ZK	6
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.			
AE1M01MPS	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.			
AE1M13EMP	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.			
AE1M13EZF	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.			
AE1M13SVS	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.			
AE1M13TPR	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.			
AE1M13VES	Manufacturing of Electrical Components	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.			
AE1M13VEZ	Manufacturing of Electronic Equipment	Z,ZK	5
Mechanical and electrical design. The electric contact. Joining of conductors. Cooling of components and equipment Printed circuit boards fabrication. Soldering in electronics. Electromagnetic compatibility of electronic equipment. Protection of components and equipment, sensitive on electrostatic field. Certification, accreditation, quality control and quality assurance.			
AE1M14ESZ	Power Machine Equipment	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.			
AE1M14PO2	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			
AE1M14RPO	Electric Drive Control	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			
AE1M14SOP	Simulation and Optimization in Drives	Z,ZK	5
Models of dynamical systems. Methods and process of simulation. Program Pspice. Matlab/Simulink environment. State models of systems and solutions. Control circuits, controllers, and determination of parameters. Circuit models of power converters. Dynamical models in average values of power electronic converters. Models of converters and machines for high frequencies. Method of finite elements and use for optimization of magnetic field in electric machine. Process and SW tools for design of main types of electric machines.			
AE1M14SP2	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			
AE1M14SSE	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.			
AE1M14VE2	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			

AE1M15ENY	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.			
AE1M15EST	Electrical Light and Heat	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.			
AE1M15PRE	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.			
AE1M15RES	Control of Power Systems	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.			
AE1M15TVN	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.			
AE1M16CTR	Controlling	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.			
AE1M16DES	Power Transport Systems	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			
AE1M16EKL	Ecology and economy	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.			
AE1M16EUE	Economy of Energy Use	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.			
AE1M16FIM	Financial Management	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.			
AE1M16FIU	Financial Accounting	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.			
AE1M16JAK	Quality management	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			
AE1M16LOG	Business Logistics	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.			
AE1M16MAR	Marketing	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.			
AE1M16MAV	Production Management	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.			
AE1M16MEE	Management of Power Production	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			
AE1M16MES	Management and Economics of Power Systems	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.			
AE1M16OVY	Operations Research	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).			
AE1M16PMG	Project Management	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.			
AE1M16RES	Development of Energy Systems	Z,ZK	5
AE1M16SIR	System Analysis and Decision Making	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.			

AE1M16STA	Statistical methods in economics	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.			
AE1M16VEN	Power and Heat Production	KZ	5
Power sources, energy processes, general power plant, power balance and characteristic 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 characteristic curves and calculations, operation, control. Environmental effects of power generating and actions of their minimization.			
AE1M32TSY	Telecommunication Systems and Networks	Z,ZK	4
The subject discusses principles of telecommunication systems - mainly digital transmission systems and digital switching systems. The subject will provide students with the overview of the entire telecommunication domain, so that they can solve particular problems related to network traffic. They will also obtain basic knowledge of technologies that are used in modern wired and wireless networks. Results of the survey (students' opinions) concerning the subject can be found here: https://www.fel.cvut.cz/cz/anketa/aktualni/courses/AE1M32TSY			
AE2M01PMS	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.			
AE2M17AEK	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.			
AE2M17CAD	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.			
AE2M17MOS	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.			
AE2M17PDS	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.			
AE2M17PMP	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.			
AE2M31IAS	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.			
AE2M31RAT	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 http://noel.feld.cvut.cz/vyu/ae2m31rat . Detailed information for registered students can be found at teaching portal http://moodle.kme.feld.cvut.cz .			
AE2M31SMU	Signals in multimedia	Z,ZK	5
Course brings information about methods of signal processing used in multimedia including 2-D analysis and modern methods.			
AE2M31ZRE	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 http://noel.feld.cvut.cz/vyu/a2m31zre and at http://moodle.kme.feld.cvut.cz			
AE2M32MDS	Modeling and Dimensioning of Networks	Z,ZK	6
The aim of the course is to present an overlook of dimensioning of service systems in telecommunications networks on the basis of results of the queuing theory (QT). Introduce possibilities of simulation and modelling service systems and its networks both from the point of view of grade of service GoS and quality of service QoS. Results of the QT are applied on different service systems and telecommunication networks deploying and operating at time being. It is shown that models derived for telecommunications systems can be utilized for dimensioning of service systems in real life.			
AE2M32MKS	Mobile Communication Networks	Z,ZK	4
The lectures introduce principles and functionalities of mobile networks with special focus on currently deployed technologies and future mobile networks. Furthermore, architecture and fundamental principles of GSM, UMTS, LTE and LTE-A will be explained. Then, selected key technologies for future mobile networks (e.g., 5G) will be explained.			
AE2M32OSS	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.			
AE2M32RKP	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.			

AE2M32VAD	Applications Development and DSP The subject makes familiar with selected parts of the digital signal processing in communication. The digital image processing is emphasized.	Z,ZK	5
AE2M34MIM	Microsystems in Multimedia 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.	Z,ZK	5
AE2M34MST	Microsystems The course deals with system integration applied in the design of digital and analog systems. It demonstrates the new possibilities of implementation and application of integrated microelectronic devices based on various physical and biochemical principles. It presents primarily MEMS technology that increases reliability with all its attributes. The course presents the modern action elements and microactuators, whose operation is based on fundamental physical and biochemical principles, including basic applications in micromanipulation, microrobots, microdrives, microsurgery, multimedia, medical, industrial control, automotive, etc. In the course are presented the principles of touch screens, microgenerators of electrical energy. There are mentioned basic elements of the use of nanotechnology and nanoelectronic structures and basic microsystem technologies.	Z,ZK	5
AE2M34NAN	Nanoelectronics and Nanotechnology The subject is oriented on the present nanotechnologies in the connection with their electronic, photonic and spintronic applications. Quantum theory basics are used to explain the effects observed in nanostructures. Basic nanoelectronic structures are described with their possible applications. Modern computer methods and models, which are able to simulate the operation of nanoelectronic structures and which are the important tools for their design and optimisation, are studied.	Z,ZK	5
AE2M34NIS	Integrated Systems Design 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.	Z,ZK	5
AE2M34SIS	Integrated System Structures 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.	Z,ZK	5
AE2M37DKM	Digital communications 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
AE2M37KDK	Coding in digital communications 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.	Z,ZK	5
AE2M37OBT	Image Technology 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.).	Z,ZK	6
AE2M37RSY	Radio systems Radio systems and their parameters, radar and position determination systems especially. Principles, properties, parameters and applications.	Z,ZK	6
AE2M37ZVT	Audio Technology 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.	Z,ZK	5
AE2M99CZS	Digital Signal Processing The subject gives overview about basic methods of digital signal processing and their applications (examples from speech and biological signal processing): discrete-time signals and systems, signal characteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter design, digital filtering in time and frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found at <a 428="" 567="" 959="" 976"="" data-label="Page-Footer" href="http://noel.feld.cvut.cz/vyu/ae2m99czs&gt;http://noel.feld.cvut.cz/vyu/ae2m99czs&lt;/a&gt; .</td> <td>Z,ZK</td> <td>5</td> </tr> <tr> <td>AE2M99MAM</td> <td>Microprocessors and microcomputers
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.</td> <td>Z,ZK</td> <td>6</td> </tr> <tr> <td>AE3M01MKI</td> <td>Mathematics for Cybernetics
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.</td> <td>Z,ZK</td> <td>8</td> </tr> <tr> <td>AE3M33IRO</td> <td>Intelligent robotics
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.</td> <td>Z,ZK</td> <td>7</td> </tr> <tr> <td>AE3M33MKR</td> <td>Mobile and Collective Robotics
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.</td> <td>Z,ZK</td> <td>6</td> </tr> <tr> <td>AE3M33PRO</td> <td>Advanced robotics
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.</td> <td>Z,ZK</td> <td>6</td> </tr> </table> </div> <div data-bbox="> <p>Page 20 out of 22</p> 		

AE3M33UI	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.			
AE3M35NES	Nonlinear Systems and Chaos	Z,ZK	6
AE3M35OFD	Estimation, filtering and detection	Z,ZK	6
This course will cover description of the uncertainty of hidden variables (parameters and state of a dynamic system) using the probability language and methods for their estimation. Based on bayesian prblem formulation principles of rational behsavour under uncertainty will be analysed and used to develp algorithms for estimation of parameters of ARX models and Kalman filtering including the extensions. We will demonstrate numerically robust implementation of the algorithms applicable in real life problems for the areas of industrial process control, robotics and avionics. We will extend the methods for linear gaussian systems to a more generic problems using Monte Calro approach. The course will also cover multimodel approach and its use for the fault detection and isolation and introduction to adaptive control.			
AE3M35ORR	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 ∞ ; norm shifts the focus to robustness against uncertainties in the model. H_{∞} -synthesis is an extensions to the H ∞ ; 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 theoretial 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.			
AE3M35PSR	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.			
AE3M35RIS	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.			
AE3M35TDS	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.			
AE3M38DIT	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.			
AE3M38MSZ	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".			
AE3M38SPD	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 elements. Project-oriented laboratories provide students with practical experience in the implementation of modern DAQ systems.			
AE3M38VBM	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.			
AE3M38VIP	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.			
AE3M38ZDS	Analog Signal Processing and Digitalization	Z,ZK	6
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.			
AE3M99PTO	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.			
AE4M01TAL	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.			
AE4M14BP3	Safety in Electrical Engineering 3	Z	0
The course provides for students of programme Open informatics periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the Directive of the Dean No. 1/2007.			
AE4M33DZO	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.			

AE4M33GVG	Geometry of Computer Vision and Graphics 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.	Z,ZK	6
AE4M33MPV	Computer Vision Methods 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.	Z,ZK	6
AE4M33PAL	Advanced algorithms Basic graph algorithms and graph representation. Application of formal languages theory in computer science - syntax analysis and pattern matching. Selected topics of floating-point arithmetic.	Z,ZK	6
AE4M33RZN	Advanced Methods for Knowledge Representation 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.	Z,ZK	6
AE4M33SAD	Machine Learning and Data Analysis The class is taught jointly in English with M33SAD. See the latter for course info.	Z,ZK	6
AE4M33SVP	Software or Research Project	KZ	6
AE4M33TDV	3D Computer Vision 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.	Z,ZK	6
AE4M35KO	Combinatorial Optimization 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.	Z,ZK	6
AE4M36SVP	Software or Research Project Individual project work under the advisors supervision. During this course it is possible (usual) to work on a particular problem within the Diploma thesis. Therefore, we advise students to choose the subject of the Diploma thesis already at the beginning of the 3rd semester and not to underestimate this timely choice. To pass the course Software and research project the result of the work has to be clearly defined, e.g. technical report or the piece of software (program), that will be awarded the assessment. Important note: In general, it is not possible to pass more than one course of this type/with such characteristics. An exception can be granted by guarantor of the major specialization. Possible reason for an exception could be a fact, that the work/project has got a different subject and is supervised by a different advisor. Typically, it can be a project done during the studies abroad. For further information please contact: oi@fel.cvut.cz	KZ	6
AE4M39PGR	Computer Graphics Graphical libraries are used for realistic rendering of 3D scenes. The main goal of this course is to introduce students to the Application Programming Interface (API) for 3D graphics and learn them how to program a simple interactive OpenGL based 3D graphical applications. Naturally, the course describes the fundamentals of computer graphics such as rendering pipeline, geometric transformations, texturing, scene modeling, shading and illumination models, etc. Lectures also cover advanced modeling techniques (parametric curves and surfaces) and selected topics related to the scientific visualization. Practices are focused on the work on given tasks and individual projects that help students to get practical experience with the OpenGL graphics library.	Z,ZK	6
AE4M39VG	Computational Geometry 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.	Z,ZK	6
AE4M99DIP	Master Thesis	Z	25
BE4M36NLP	Introduction to Natural Language Processing	Z,ZK	6

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

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