## Study plan

## Name of study plan: Medical electronics and bioinformatics

Faculty/Institute/Others: Faculty of Electrical Engineering

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Medical Electronics and Bioinformatics

Type of study: Follow-up master full-time

Required credits: 114
Elective courses credits: 6
Sum of credits in the plan: 120

Note on the plan: Specializace Bioinformatika

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 60

The role of the block: P

Code of the group: 2018\_MBIODIP Name of the group: Diploma Thesis

Requirement credits in the group: In this group you have to gain 30 credits Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 30 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)	Completion	Credits	Scope	Semester	Role
	Tutors, authors and guarantors (gar.)					
BDIP30	Diploma Thesis	Z	30	22s	L	Р

### Characteristics of the courses of this group of Study Plan: Code=2018\_MBIODIP Name=Diploma Thesis

BDIP30	Diploma Thesis	Z	30					
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								
he enseified by brench	he specified by branch department or branch departments. The diplome thesis will be defended in front of the board of examiners for the comprehensive final examination							

Code of the group: 2018\_MBIOP

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete 5 courses

Credits in the group: 30

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
BAM31BSG	Biological signals Roman mejla Roman mejla (Gar.)	Z,ZK	6	2P+2L	L	Р
BMPROJ6	Diploma Project Roman mejla, Jan Kybic, Vratislav Fabián, Petr Pošík Petr Pošík Roman mejla (Gar.)	Z	6	0p+6s	Z,L	Р
BAM31LET	Medical Instrumentation and Devices Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	Z	Р
B4M36SAN	Statistical Data Analysis Ji í Kléma <b>Ji í Kléma</b> Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	Z	Р
BAM33ZSL	Medical Imaging Systems Jan Kybic, Vít Herynek, André Sopczak Jan Kybic Jan Kybic (Gar.)	Z,ZK	6	2P+2C	L	Р

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

			 <u> </u>		 		
BAM31BSG	Biological signals					Z,ZK	6
BMPROJ6	Diploma Project					Z	6

BAM31LET Medical Instrumentation and Devices

Students will study fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electronic circuits of diagnostical and therapeutical medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestesiology, intensive and critical healthcare, equipments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including dilution) and pulse oxymetry.

Statistical Data Analysis

This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses.

Medical Imaging Systems

The course covers the principles, design and properties of currently used medical imaging devices. We shall deal with 2D microscopic, X-ray and ultrasound imaging systems, including advanced topics such as Doppler ultrasound. We will also study tomographic (3D) imaging systems: computed tomography (CT), magnetic resonance imaging (MRI) including functional MRI (fMRI) and nuclear imaging methods (PET,SPECT). For more information see https://cw.fel.cvut.cz/wiki/courses/zsl

Name of the block: Compulsory courses in the specialization

Minimal number of credits of the block: 30

The role of the block: PS

Code of the group: 2018 MBIOPS1

Name of the group: Compulsory subjects of specialization

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete 5 courses

Credits in the group: 30 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
BAM36BIN	Bioinformatics Ji í Kléma <b>Ji í Kléma</b> Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	Г	PS
В4М35КО	Combinatorial Optimization Zden k Hanzálek Zden k Hanzálek (Gar.)	Z,ZK	6	3P+2C	L	PS
B4M36MBG	Molecular Biology and Genetics  Martin Pospíšek Martin Pospíšek Martin Pospíšek (Gar.)	Z,ZK	6	3P+1C	L	PS
B4M33PAL	Advanced algorithms  Marko Genyk-Berezovskyj, Daniel Pr ša, Ond ej Drbohlav Daniel Pr ša  Daniel Pr ša (Gar.)	Z,ZK	6	2P+2C	Z	PS
BE4M33SSU	Statistical Machine Learning Jan Drchal, Vojt ch Franc Vojt ch Franc (Gar.)	Z,ZK	6	2P+2C	Z	PS

#### Characteristics of the courses of this group of Study Plan: Code=2018 MBIOPS1 Name=Compulsory subjects of specialization

BAM36BIN	Bioinformatics	Z,ZK	6				
B4M35KO	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

B4M36MBG	Molecular Biology and Genetics	Z,ZK	6					
B4M33PAL	Advanced algorithms	Z,ZK	6					
Basic graph algorithms	Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching.							
BE4M33SSU	Statistical Machine Learning	Z,ZK	6					

The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts.

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 24

The role of the block: PV

Code of the group: 2018 MBIOPPV1

Name of the group: Compulsory subjects of the programme

Requirement credits in the group: In this group you have to gain 24 credits

Requirement courses in the group: In this group you have to complete 4 courses

Credits in the group: 24

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
BAM31ADA	Adaptive signal processing Radoslav Bortel, Pavel Sovka Radoslav Bortel (Gar.)	Z,ZK	6	2P+2C	Z	PV
B2M31AEDA	Experimental Data Analysis Jan Rusz Jan Rusz Jan Rusz (Gar.)	Z,ZK	6	2P+2C	Z	PV
BAM17EPM	Applications of Electromagnetic Fields in Medicine  Jan Vrba, Ladislav Oppl Jan Vrba Jan Vrba (Gar.)	Z,ZK	6	2P+2L	L	PV
BAM31AOL	Applied optoelectronics in medicine Jan Havlík Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	L	PV
BAM02BIO	Biosensors Bohuslav Rezek Bohuslav Rezek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM02FPT	Physics for Diagnostics and Therapy Vratislav Fabián, Jan Vrba, Ladislav Oppl Vratislav Fabián Vratislav Fabián (Gar.)	Z,ZK	6	2P+2L		PV
B0M37FAV	Physiology and modeling of hearing and vision Miloš Klíma, Václav Vencovský, Petr Maršálek, Karel Fliegel Karel Fliegel Václav Vencovský (Gar.)	Z,ZK	6	2P+2C+4D	Z	PV
ВЗМЗЗНRO	Humanoid robots Mat j Hoffmann, Lukáš Rustler <b>Mat j Hoffmann</b> Mat j Hoffmann (Gar.)	Z,ZK	6	2P+2C	L	PV
B4B01JAG	Languages, Automats and Gramatics Marie Demlová, Ji í Demel Marie Demlová Marie Demlová (Gar.)	Z,ZK	6	2P+2S	Z	PV
B2M37KASA	Compression of images and signals Václav Vencovský, Karel Fliegel, František Rund, Stanislav Vítek Karel Fliegel Stanislav Vítek (Gar.)	Z,ZK	6	2P+2C	L	PV
BAM38KLS	Construction of Medical Systems Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	6	2P+2L	Z	PV
B4M33MPV	Computer Vision Methods Georgios Tolias, Ji í Matas, Jan ech, Dmytro Mishkin Ond ej Drbohlav Ji í Matas (Gar.)	Z,ZK	6	2P+2C	L	PV
B2M37MAM	Microprocessors Stanislav Vítek, Petr Skalický Stanislav Vítek Stanislav Vítek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM31MOA	Modeling and analysis of brain activity  Jaroslav Hlinka Jaroslav Hlinka (Gar.)	Z,ZK	6	2P+2C	Z	PV
B2M37MOTA	Advanced areas in image and video technology Karel Fliegel Karel Fliegel (Gar.)	Z,ZK	6	2P+2L	Z	PV
B3M38MSE	Modern Sensors	Z,ZK	6	2P+2L	Z	PV
B2M34ZETA	Custom Electronics Design Vít Záhlava Vít Záhlava Vít Záhlava (Gar.)	KZ	6	2P+2L	Z	PV
BAM31NPG	Neurophysiology P emysl Jiruška, Helena Pivo ková P emysl Jiruška P emysl Jiruška (Gar.)	Z,ZK	6	2P+2C	Z	PV
BAM33NIN	Neuroinformatics Giulia D'Angelo, Ji í Hammer, Daniel Novák, Eduard Bakštein, Karla Št pánová, Ján Antolík, David Kala Daniel Novák Daniel Novák (Gar.)	Z,ZK	6	2P+2C	L	PV
B2M17OPM	Optical Measurements Stanislav Vítek, Mat j Komanec, Stanislav Zvánovec Mat j Komanec Stanislav Zvánovec (Gar.)	Z,ZK	6	2P+2L	L	PV
B2M31DSP	Advanced DSP methods Pavel Sovka, Petr Pollák Pavel Sovka Pavel Sovka (Gar.)	Z,ZK	6	2P+2C	Z,L	PV
B2M37SSPA	Statistical Signal Processing Pavel Sovka, Jan Sýkora Jan Sýkora Jan Sýkora (Gar.)	Z,ZK	6	4P+0C	L	PV
B4M36SMU	Symbolic Machine Learning Filip Železný, Ond ej Kuželka, Gustav Šír Ond ej Kuželka Ond ej Kuželka (Gar.)	Z,ZK	6	2P+2C	L	PV
BAM17EMC	Introduction to electromagnetic compatibility Tomáš Ko ínek Tomáš Ko ínek Tomáš Ko ínek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BAM31ZAS	Analog Signal Processing Ji í Hospodka <b>Ji í Hospodka</b> Ji í Hospodka (Gar.)	Z,ZK	6	2P+2L	L	PV
BAM33ZMO	Medical Image Processing Jan Kybic, Oleksandr Shekhovtsov Jan Kybic Jan Kybic (Gar.)			Z	PV	
Characteristics of th	e courses of this group of Study Plan: Code=2018_MBIOPPV1 N	Name=Comp	ulsory sı	ubjects o	of the progr	amme
BAM31ADA A	daptive signal processing ic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforn	•			Z,ZK	6
<del></del>	xperimental Data Analysis	9.		7	Z,ZK	6

BAM31ADA	Adaptive signal processing	Z,ZK	6				
This course provides a	pasic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.						
B2M31AEDA	Experimental Data Analysis	Z,ZK	6				
In the course of subject "Experimental Data Analysis", students will acquire knowledge regarding fundamental methods for data analysis and machine learning for evaluation and							
interpretation of data. In	the course of practical lectures, students will solve individual tasks using real data from signal processing in neuroscience re	search. In the cou	rse of semestral				
project, student will solv	e complex task and present obtained results. The aim of the subject is to introduce practical application of fundamental statis	stical methods as	well as to teach				
students to use critical t	hinking and to acquire additional knowledge in solution of practical tasks.						
BAM17EPM	Applications of Electromagnetic Fields in Medicine	Z,ZK	6				
The major aim of these I	ectures is to give to students a basic overview of biophysical aspects of EM fields in different biological systems, including an c	verview of microw	ave applications				
in medicine. Safety limit	s, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters o	f biological tissues	s, EM exposure				
of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.							
BAM31AOL	Applied optoelectronics in medicine	Z,ZK	6				

BAM02BIO	Biosensors	Z,ZK	6
BAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
-	vill be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great space		-
methods, therapeutic ult	rasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods	hods (repetitive tr	ranscranial
-	the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In		of the semester,
	ossibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, radiotherapy,		
B0M37FAV	Physiology and modeling of hearing and vision course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects a	Z,ZK	6
· · · · · ·	s, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the fig		
	ame time, presents their description using mathematical models using the latest computational tools and procedures, including		- 1
Learning (DL) and Artific	cial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main a	application area is	the audiovisual
	man perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, contri	=	
	nology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological s		
	sual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree i mental experiments to determine the most important characteristics of HAS and HVS, including computational models and si		
processes.	mental experiments to determine the most important ordinateristics of 1770 and 1770, including computational models and si	mulation of vision	and nearing
B3M33HRO	Humanoid robots	Z,ZK	6
The course focuses on I	numan-centered robotics: humanoid robots and human-robot interaction. Motivated by the vision of robot companions in our h	, ,	e introduces
	ogy and its specific challenges and opportunities: (i) design, kinematics and inverse kinematics of humanoids, (ii) multimodal	•	
	walking and balancing, and (ii) grasping. The second part of the course centers on human-robot interaction (HRI), which inclu	des physical HRI	(safety aspects,
	d cognitive/social HRI - how to design robots and behaviors to be acceptable for people.	7.71/	
B4B01JAG	Languages, Automats and Gramatics  ory of finite automata and grammars: deterministic and non deterministic finite automata, languages accepted by finite automata	Z,ZK	6
	by or milite automata and grammars, deterministic and non-deterministic limite automata, ranguages accepted by finite automata and planting machines.	i, regulai express	ions. Oranimais
B2M37KASA	Compression of images and signals	Z,ZK	6
	ompression methods and techniques. Main goal is to introduce basic concepts of lossless and lossy compresion of audiovisual		-
and irrelevancy). Within	the laboratory exercises students will work with implementations of particular algorithms, including objective and subjective n	nethods of quality	evaluation.
BAM38KLS	Construction of Medical Systems	Z,ZK	6
B4M33MPV	Computer Vision Methods	Z,ZK	6
	cted computer vision problems: search for correspondences between images via interest point detection, description and mat		-
-	tation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences. This		
information is available	me prg.ai Minor. It pools the best of AI education in Prague to provide students with a deeper and broader insight into the fiel at https://prg.ai/minor	a or artificial intell	igerice. More
B2M37MAM	Microprocessors	Z,ZK	6
	ents acquainted with the properties of microprocessor systems, make students familiar with on-chip peripherals, connect ext		-
	of the memory or I/O space address extension. Next, taught the students to make simple program in the assembly language		
both. After completion of	f this subject student should be able to design and implement simpler microprocessor system including connection of necess	ary peripherals a	nd software
design.			
BAM31MOA	Modeling and analysis of brain activity	Z,ZK	6
B2M37MOTA	Advanced areas in image and video technology	Z,ZK	6
	the state-of-the-art techniques for digital image and video technology. These techniques and their applications cover almost a raction. A significant part of the course is focused on the methods of image signal processing and main hardware and softwa		
=	m of the laboratory exercises is to familiarize with advanced methods for capturing, processing and reproduction of image info		
	of the lectures and exercises is being continuously updated.		. 3
B3M38MSE	Modern Sensors	Z,ZK	6
An overview of sensors	of physical quantities used in industry and in research and methods of signal processing.	<u>'</u>	
B2M34ZETA	Custom Electronics Design	KZ	6
	ne design methodology of advanced custom electronics. The aim is to convert theoretical knowledge of previous studies into		
	e getting familiar with the problems encountered in the professional electronic design and manufacturing. This course is based of	n real experience	in development
BAM31NPG	the latest technological trends and component base.	7 7V	6
BAM33NIN	Neurophysiology Neuroinformatics	Z,ZK Z,ZK	6 6
	purse concentrates on modelling of neurons, stochastic learning on cellular level, information coding and decoding in brain and		-
	re provided throughout the course. The labs focus on signal neuron analysis from human and animal brain.	onigio unii proces	Soing. Examples
B2M17OPM	Optical Measurements	Z,ZK	6
B2M31DSP	Advanced DSP methods	Z,ZK	6
	asic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will le		of digital signals
analysis and be able to	practically use them. They learn to know the conditions of use of correlation, spectral and coherent analysis of random signal	s. They will becar	ne familiar with
=	mposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability	y to interpret the r	esults of signal
analyses.	Chatistical Circust Processins	7.71/	
B2M37SSPA	Statistical Signal Processing damentals in three main domains of the statistical signal processing: 1) estimation theory, 2) detection theory, 3) optimal and	Z,ZK	6 The statistical
•	pre theory with many applications ranging from digital communications, audio and video processing, radar and radio navigations.		
evaluation, etc.		,	
B4M36SMU	Symbolic Machine Learning	Z,ZK	6
	four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its		
_	This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inferer	-	
· ·	natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally	, the last part will	provide an
	opics from the computational learning theory, including the online and batch learning settings.	7 714	
BAM17EMC	Introduction to electromagnetic compatibility roblems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility -	Z,ZK	6 nterference
	problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - in the field of electrical engineering.	Journay Telle II	nonoronoe,
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Analog Signal Processing BAM31ZAS

The course deals with analog input-output blocks for signal transmission and processing. They discussed circuit solution of amplifiers and filters, including their design process, simulation and measurement. Students learn the circuit concepts and possibilities for solving the contemporary analogue structures. The second part of the course describes the design and implementation of analog filters, including discrete-time circuits. The conclusion is devoted to the possibilities of computer optimization of electronic circuits and filters

Medical Image Processing

This course covers the most used advanced image analysis methods, with emphasis on images from medical and biological modalities, from microscopy, to ultrasound, MRI, or CT, including time sequences.

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: 2018\_MBIOH

Name of the group: Humanities subjects

Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0 Note on the group

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
B0M16FIL	Peter Zamarovský Peter Zamarovský Peter Zamarovský (Gar.)	Z,ZK	5	2P+2S	Z,L	V
B0M16HVT	History of science and technology 2 Marcela Efmertová, Jan Mikeš Marcela Efmertová (Gar.)	Z,ZK	5	2P+2S	Z,L	V
B0M16HSD1	History of economy and social studies  Marcela Efmertová	Z,ZK	5	2P+2S	Z,L	V
B0M16PSM	Psychology Jan Fiala Jan Fiala (Gar.)	Z,ZK	5	2P+2S	Z,L	V
A003TV	Physical Education Ji í Drnek	Z	2	0+2	L,Z	V
B0M16TEO	Theology Vladimír Sláme ka Vladimír Sláme ka (Gar.)	Z,ZK	5	2P+2S	Z,L	V

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

B0M16FIL		Z,ZK	5
B0M16HVT	History of science and technology 2	Z,ZK	5

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

B0M16HSD1	History of economy and social studies	Z,ZK	5
This subject deals with	the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its air	ms and achieved r	esults as well as

the social and cultural development and coexistence of the various ethnical groups in the Czech countries.

B0M16PSM	Psychology	Z,ZK	5
A003TV	Physical Education	Z	2
B0M16TEO	Theology	Z,ZK	5

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 graws our civilization up.

Code of the group: 2018\_MBIOVOL 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: ~Nabídku volitelných předmětů uspořádaných podle kateder najdete na webových stránkách

http://www.fel.cvut.cz/cz/education/volitelne-predmety.html\\

# List of courses of this pass:

Name of the course

Code

Completion Credits

Jour	Name of the course	Completion	Orcaito
A003TV	Physical Education	Z	2
B0M16FIL		Z,ZK	5
B0M16HSD1	History of economy and social studies	Z,ZK	5
	with the history of the Czech society in the 19th - 21th centuries. It follows the forming of the Czech political representation, its aims an the social and cultural development and coexistence of the various ethnical groups in the Czech countries.	·	ts as well as
B0M16HVT	History of science and technology 2	Z,ZK	5
This subject traces	s historical developments in electrical engineering branches in the world and in the Czech Lands. Its ultimate goal is to stimulate studer ubject, while highlighting the developments in technical education and professional organizations, the process of shaping scientific life a engineers	nts' interest in the	-
B0M16PSM	Psychology	Z,ZK	5
B0M16TEO	Theology	Z,ZK	5
	ides to students the basic orientation in christian theology and requires no special previous education. After short philosophic lecture the The subject is determined not only to believer students who want to know the reliable theologic grounding but also above all to ones who religion from which graws our civilization up.	_	-
B0M37FAV	Physiology and modeling of hearing and vision	Z,ZK	6
communication cha physiology and, at the Learning (DL) and the technology related the safety and securith objectification of an	of the course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects as two hannels, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field of the same time, presents their description using mathematical models using the latest computational tools and procedures, including Not attificial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main applied to human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, control sority technology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological systems audiovisual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree in te	of human vision a Machine Learning ication area is the ystems, automatic tems. A separate echnical fields. The	and hearing (ML), Deep audiovisual on, robotics, part is the e exercises
will be devoted to	o fundamental experiments to determine the most important characteristics of HAS and HVS, including computational models and simu processes.	liation of vision ar	na nearing
B2M17OPM		Z,ZK	6
B2M31AEDA	·	Z,ZK	6
	ata. In the course of practical lectures, students will solve individual tasks using real data from signal processing in neuroscience researd	ch. In the course o	of semestral
project, student will	ill solve complex task and present obtained results. The aim of the subject is to introduce practical application of fundamental statistical students to use critical thinking and to acquire additional knowledge in solution of practical tasks.	I methods as well	as to teach
B2M31DSP The course follows analysis and be ab	ill solve complex task and present obtained results. The aim of the subject is to introduce practical application of fundamental statistical students to use critical thinking and to acquire additional knowledge in solution of practical tasks.  Advanced DSP methods s the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn lible to practically use them. They learn to know the conditions of use of correlation, spectral and coherent analysis of random signals. The subject is to introduce practically use them.	Z,ZK the methods of digital became for	as to teach  6 igital signals familiar with
B2M31DSP The course follows analysis and be ab methods of signal of B2M34ZETA	ill solve complex task and present obtained results. The aim of the subject is to introduce practical application of fundamental statistical students to use critical thinking and to acquire additional knowledge in solution of practical tasks.  Advanced DSP methods s the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn table to practically use them. They learn to know the conditions of use of correlation, spectral and coherent analysis of random signals. To decomposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability to analyses.  Custom Electronics Design	Z,ZK the methods of dichey will became for interpret the resu	6 as to teach 6 agital signals familiar with alts of signal
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B4B01JAG Basic notions of the the			
Basic notions of the the	Languages, Automats and Gramatics	Z,ZK	6
	eory of finite automata and grammars: deterministic and non deterministic finite automata, languages accepted by finite automata, re and languages generated by grammars with emphasis to context free grammars. A very brief introduction of Turing machine	- '	. Grammars
B4M33MPV	Computer Vision Methods	Z,ZK	6
	ected computer vision problems: search for correspondences between images via interest point detection, description and matchi		
•	gmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences.This amme prg.ai Minor. It pools the best of Al education in Prague to provide students with a deeper and broader insight into the field	•	
	information is available at https://prg.ai/minor.		
B4M33PAL	Advanced algorithms  ph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - p	Z,ZK	6
B4M35KO	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 of	perations research	). Following
	r algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programmin space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, plants are the same and the same are the same and the same are the same		
algorithms and state	scheduling in production lines, message routing, scheduling in parallel computers.	arming or naman re	
B4M36MBG	Molecular Biology and Genetics	Z,ZK	6
B4M36SAN	Statistical Data Analysis	Z,ZK	6
	ne skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly 3, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a p		
	machine learning and data mining courses.		·
B4M36SMU	Symbolic Machine Learning sof four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its e	Z,ZK	6
	ng. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inferer		
fundamental topics fi	rom natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally,	, the last part will p	rovide an
BAM02BIO	introduction to several topics from the computational learning theory, including the online and batch learning settings.  Biosensors	Z,ZK	6
BAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
	will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great space is	·	
•	c ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods and phototherapy. FCT) are discussed by the brain of th		
<del>-</del>	f the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In the is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, ra-		e semesier,
BAM17EMC	Introduction to electromagnetic compatibility	Z,ZK	6
The subject dwells of	n problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - e susceptibility and testing methods. The subject leads to gain professional skills in the field of electrical engineering.	lectromagnetic inte	erference,
BAM17EPM	Applications of Electromagnetic Fields in Medicine	Z,ZK	6
	lectures is to give to students a basic overview of biophysical aspects of EM fields in different biological systems, including an overview	· · · · · · · · · · · · · · · · · · ·	
in medicine. Safety lim	its, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of biological tissue of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue	ological tissues, EN	
in medicine. Safety lim BAM31ADA	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing	ological tissues, EN	
BAM31ADA	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing  This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.	Z,ZK	A exposure
BAM31ADA BAM31AOL	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine	Z,ZK	A exposure  6
BAM31ADA BAM31AOL BAM31BSG	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine  Biological signals	Z,ZK Z,ZK Z,ZK	6 6 6
BAM31ADA BAM31AOL BAM31BSG BAM31LET	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine	Z,ZK Z,ZK Z,ZK Z,ZK	6 6 6 6
BAM31ADA  BAM31AOL  BAM31BSG  BAM31LET  Students will study fundand therapeutical me	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine Biological signals  Medical Instrumentation and Devices damental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes	Z,ZK  Z,ZK  Z,ZK  Z,ZK  ectronic circuits of ciology, intensive ar	6 6 6 6 diagnostical
BAM31ADA  BAM31AOL  BAM31BSG  BAM31LET  Students will study fund and therapeutical mealthcare, equipmen	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine Biological signals  Medical Instrumentation and Devices  damental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes into for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including of the contraction of the point of view of functional blocks and electical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes into for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including of the contraction of the principle into the provided into the provided into the principle into the principle into the provided into the principle into the prin	Z,ZK  Z,ZK  Z,ZK  Z,ZK  cetronic circuits of ciology, intensive ardilution) and pulse	6 6 6 diagnostical oxymetry.
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BAM31ADA  BAM31AOL  BAM31BSG  BAM31LET  Students will study fund and therapeutical mealthcare, equipmen	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming.  Applied optoelectronics in medicine Biological signals  Medical Instrumentation and Devices  damental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and electical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes into for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including of the contraction of the point of view of functional blocks and electical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes into for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including of the contraction of the principle into the provided into the provided into the principle into the principle into the provided into the principle into the prin	Z,ZK  Z,ZK  Z,ZK  Z,ZK  cetronic circuits of ciology, intensive ardilution) and pulse	6 6 6 diagnostical ad critical oxymetry. 6
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maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts.

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Diploma Project

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