Study plan

Name of study plan: Medical Electronics and Bioinformatics - Specialization Signal Processing

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:

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_MBIOEP 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
BEAM31BSG	Biological signals Petr Ježdík, Roman mejla, Michal Novotný Roman mejla Roman mejla (Gar.)	Z,ZK	6	2P+2L	L	Р
BEMPROJ6	Diploma Project Roman mejla, Petr Pošík, Jan Kybic, Vratislav Fabián Petr Pošík Roman mejla (Gar.)	Z	6	0p+6s	Z,L	Р
BEAM33ZSL	Medical Imaging Systems Jan Kybic, Vít Herynek, André Sopczak Jan Kybic Jan Kybic (Gar.)	Z,ZK	6	2P+2C	L	Р
BEAM31LET	Medical Instrumentation and Devices Jan Havlík Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	Z	Р
BE4M36SAN	Statistical data analysis Ji í Kléma Ji í Kléma Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	Z	Р

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

BEAM31BSG Biological signals	Z,ZK	6					
The course is focused to the native and evoked biosignals used in clinical medicine and current methods of capturing, processing, recording and evaluating in the time and frequency							
domains. For important biological signals, the students are introduced with their genesis, and nature and physiological characteristics of the signals required for construction of							
instruments. Students are introduced also with the physical and mathematical models. In laboratory exercises, students have the opportunity to captu	re their own biolo	gical signals and					
their subsequent processing in MATLAB.							
BEMPROJ6 Diploma Project	Z	6					
Independent work in the form of a project. A student will choose a topic from a range of topics related to his or her branch of study, which will be spe	cified by branch c	lepartment or					
branch departments. The project will be defended within the framework of a subject.							
BEAM33ZSL Medical Imaging Systems	Z,ZK	6					
The course covers the principles, design and properties of currently used medical imaging devices. We shall deal with 2D microscopic, X-ray and ultra	sound imaging sy	stems, including					
advanced topics such as Doppler ultrasound. We will also study tomographic (3D) imaging systems: computed tomography (CT), magnetic resonance	imaging (MRI) inc	luding functional					
MRI (fMRI) and nuclear imaging methods (PET,SPECT). For more information see https://cw.fel.cvut.cz/wiki/courses/zsl							
BEAM31LET Medical Instrumentation and Devices	Z,ZK	6					
Students will study fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks an	d electronic circuit	is of diagnostical					
and therapeutical medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for aneste	siology, intensive	and critical					
healthcare, equipments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including dilution) and pulse oxymetry.							
BE4M36SAN Statistical data analysis	Z,ZK	6					
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 statistica	al counterpart to					
machine learning and data mining courses							

Code of the group: 2018_MBIOEDIP 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) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BDIP30	Diploma Thesis	Z	30	22s	L	Р

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOEDIP 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						
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.						

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_MBIOEPS4

Name of the group: Compulsory subjects of specialization - specialization Signal processing 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
BEAM31ADA	Adaptive signal processing	Z,ZK	6	2P+2C	Z	PS
BEAM31ZAS	Analog Signal Processing Ji í Hospodka Ji í Hospodka Ji í Hospodka (Gar.)	Z,ZK	6	2P+2C	L	PS
BE2M31DSPA	Digital Signal Processing Petr Pollák Petr Pollák (Gar.)	Z,ZK	6	2P+2C	Z	PS
BEAM31MOA	Modeling and analysis of brain activity Jaroslav Hlinka Jaroslav Hlinka Jaroslav Hlinka (Gar.)	Z,ZK	6	2P+2C	Z	PS
BEAM31NPG	Neurophysiology Pemysl Jiruška, Helena Pivo ková Pemysl Jiruška Pemysl Jiruška (Gar.)	Z,ZK	6	2P+2C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOEPS4 Name=Compulsory subjects of specialization - specialization Signal processing

BEAM31ADA	Adaptive signal processing	Z,ZK	6		
This course provides a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming. The course explains adaptive algorithms for estimation and					
prediction, including and	prediction, including analysis, implementation and practical applications. Next, it describes the algorithms for adaptive decorrelation and separation of multidimensional signals. Last,				
the course provides analysis of adaptive beamforming techniques.					
BEAM31ZAS	Analog Signal Processing	Z,ZK	6		
The course deals with a	nalog input-output blocks for signal transmission and processing. They discussed circuit solution of amplifiers and filters, includi	ng their design pro	ocess, simulation		
and measurement. Stud	lents learn the circuit concepts and possibilities for solving the contemporary analogue structures. The second part of the contemporary analogue structures and possibilities for solving the contemporary analogue structures.	urse describes the	e design and		
implementation of analo	g filters, including discrete-time circuits. The conclusion is devoted to the possibilities of computer optimization of electronic of	circuits and filters.			
BE2M31DSPA	Digital Signal Processing	Z,ZK	6		
The subject gives overv	iew about basic methods of digital signal processing and their applications (examples from speech and biological signal proc	cessing): disrete-ti	me signals and		
systems, signal charact	eristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter des	ign, digital filterin	g in time and		
frequency domain, deci	mation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found at <a< td=""><td></td><td></td></a<>				
href=http://noel.feld.cvu	t.cz/vyu/be2m31dspa>http://noel.feld.cvut.cz/vyu/be2m31dspa .				
BEAM31MOA	Modeling and analysis of brain activity	Z,ZK	6		
BEAM31NPG	Neurophysiology	Z,ZK	6		
The course will provide an introduction to the structure and function of the neural system and the mechanisms behind major diseases of the human brain. It will combine topics from					
various disciplines ranging from electrophysiology, neurobiology, neuroanatomy, neurology, psychiatry to biophysics and bioengineering. Understanding the principles how the human					
brain works in health and disease represents a crucial prerequisite for the development and implementation of modern engineering technologies to better diagnose and treat brain					
disorders					

Name of the block: Compulsory elective courses Minimal number of credits of the block: 24

Code of the group: 2018_MBIOEPPV4 Name of the group: Compulsory elective 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:

inder on and 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
BE4M33PAL	Advanced Algorithms Ond ej Drbohlav, Marko Genyk-Berezovskyj, Daniel Pr ša Daniel Pr ša Daniel Pr ša (Gar.)	Z,ZK	6	2P+2C	Z	PV
BEAM17EPM	Applications of Electromagnetic Fields in Medicine Jan Vrba Jan Vrba Jan Vrba (Gar.)	Z,ZK	6	2P+2L	L	PV
BEAM31AOL	Applied optoelectronics in medicine Jan Havlík	Z,ZK	6	2P+2C	L	PV
BEAM36BIN	Bioinformatics Ji í Kléma Ji í Kléma Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	L	PV
BEAM02BIO	Biosensors Bohuslav Rezek Bohuslav Rezek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BE4M35KO	Combinatorial Optimization Zden k Hanzálek Zden k Hanzálek Zden k Hanzálek (Gar.)	Z,ZK	6	3P+2C	L	PV
BE4M33MPV	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
BEAM38KLS	Construction of Medical Systems Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	6	2P+2L	Z	PV
BEAM17EMC	Introduction to Electromagnetic Compatibility Tomáš Ko ínek Tomáš Ko ínek Tomáš Ko ínek (Gar.)	Z,ZK	6	2P+2L	Z	PV
BEAM33ZMO	Medical Image Processing Jan Kybic, Oleksandr Shekhovtsov Jan Kybic Jan Kybic (Gar.)	Z,ZK	6	2P+2C	Z	PV
BEAM33MOS	Modeling and Simulation Petr Pošík	Z,ZK	6	2P+2C	Z	PV
BE4M36MBG	Molecular Biology and Genetics Martin Pospíšek Martin Pospíšek Martin Pospíšek (Gar.)	Z,ZK	6	3P+1C	L	PV
BEAM33NIN	Neuroinformatics Giulia D'Angelo, Karla Št pánová, Ján Antolík, Daniel Novák, Eduard Bakštein, David Kala, Ji í Hammer Daniel Novák Daniel Novák (Gar.)	Z,ZK	6	2P+2C	L	PV
BEAM02FPT	Physics for Diagnostics and Therapy Vratislav Fabián, Jaroslav Jíra Vratislav Fabián Vratislav Fabián (Gar.)	Z,ZK	6	2P+2L		PV
BE0M37FAV	Physiology and modeling of hearing and vision Václav Vencovský, Miloš Klíma, Karel Fliegel, Petr Maršálek Karel Fliegel Václav Vencovský (Gar.)	Z,ZK	6	2P+2C+4E	Z	PV
BE4M33SSU	Statistical Machine Learning Jan Drchal, Vojt ch Franc Vojt ch Franc (Gar.)	Z,ZK	6	2P+2C	Z	PV
BE4M36SMU	Symbolic Machine Learning Filip Železný, Ond ej Kuželka, Gustav Šír Ond ej Kuželka Ond ej Kuželka (Gar)	Z,ZK	6	2P+2C	L	PV

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOEPPV4 Name=Compulsory elective subjects of the programme

programmo						
BE4M33PAL	Advanced Algorithms	Z,ZK	6			
Basic graph algorithms	and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern ma	tching.				
BEAM17EPM	Applications of Electromagnetic Fields in Medicine	Z,ZK	6			
The major aim of these lectures is to give to students a basic overview of biophysical aspects of EM fields in different biological systems, including an overview of microwave applications						
in medicine. Safety limit	s, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of	biological tissues	s, EM exposure			
of mobile phone users,	magnetic resonance imaging, interaction of optical radiation with biological tissue.					
BEAM31AOL	Applied optoelectronics in medicine	Z,ZK	6			
BEAM36BIN	Bioinformatics	Z,ZK	6			
BEAM02BIO	Biosensors	Z,ZK	6			
This course introduces i	he physical, electronic, biological principles of biosensors and provides information on past, present and future technologies.	Various mechan	isms and sensor			
concepts for specific ap	plications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the	ne use of moderr	n nanostructures			
and nanomaterials in bi	osensors to achieve reliable and sensitive devices for diagnosis at the point of care, in food safety or environmental monitoring	g. We will also di	scuss current			
challenges and future p	erspectives for various applications of biosensors.					
BE4M35KO	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 productior	scheduling in production lines, message routing, scheduling in parallel computers.					

BE4M33MPV Computer Vision Methods	Z,ZK	6 ching detection
recognition and segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences. This	s course is also p	art of the
inter-university programme prg.ai Minor. It pools the best of AI education in Prague to provide students with a deeper and broader insight into the fie	ld of artificial intel	lligence. More
information is available at https://prg.ai/minor.	7 71/	<u> </u>
BEAM38KLS CONSTRUCTION OF MEDICAL SYSTEMS	Z,ZK and operation of r	b nedical electrical
appliances. Classification classes of instruments. Electromagnetic Compatibility of Medical Devices. Modern component base. Design and construct	ion of basic block	s of medical
devices.		
BEAM17EMC Introduction to Electromagnetic Compatibility	Z,ZK	6
The course dwells on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - suscentibility and testing methods. The course leads to gain professional skills in the field of electrical engineering.	electromagnetic ii	nterference,
BEAM33ZMO Medical Image Processing	Z.ZK	6
This subject describes algorithms for digital image processing of 2D and 3D images, with emphasis on biomedical applications. We shall therefore c	oncentrate on the	most often used
techniques in medical image processing: segmentation, registration, and classification. The methods will be illustrated by a range of examples on m	edical data. The st	tudents will
this vear.	he courses will be	e taugnt togetner
BEAM33MOS Modeling and Simulation	Z,ZK	6
The modelling techniques being frequently used in biomedical engineering and corresponding software tools: Matlab-Simulink, Modelica. Technique	s of modelling and	d processes
associated with them. Types of models, continuous and discrete time models, linear and nonlinear models with lumped parameters, models and the	r implementation	in program
Models of open and feedback systems. Use of fuzzy-neuronal models in biomedicine. Models of separate systems and whole constellations being d	efined in biomedic	cal engineering.
Models of cellular and physiological control, population models. Application of models for artificial organs production.		
BE4M36MBG Molecular Biology and Genetics	Z,ZK	6
BEAM33NIN Neuroinformatics	Z,ZK	
from clinical practices are provided throughout the course. The labs focus on signal neuron analysis from human and animal brain.	a single unit proce	ssing. Examples
BEAM02FPT Physics for Diagnostics and Therapy	Z,ZK	6
In this course, students will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great spa	ice is devoted to el	lectrotherapeutic
methods, therapeutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods, especially transcranial brain stimulation methods and electroconvulsive therapy - ECT) are discussed.	thods (repetitive t	of the semester
attention is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, radiotherapy	y, etc.).	er ale contector,
BE0M37FAV Physiology and modeling of hearing and vision	Z,ZK	6
The primary aim of the course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects	as two central and	d most important
physiology and, at the same time, presents their description using mathematical models using the latest computational tools and procedures, includ	ing Machine Lear	ning (ML), Deep
Learning (DL) and Artificial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main	application area is	s the audiovisual
technology related to human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, con	trol systems, auto	mation, robotics,
objectification of audiovisual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree	in technical fields.	The exercises
will be devoted to fundamental experiments to determine the most important characteristics of HAS and HVS, including computational models and s	simulation of visior	n and hearing
processes.	7 71/	<u> </u>
BE4W335SU Statistical Machine Learning 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	Z,ZK $ $	bout the task
This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning co	ncepts such as ris	sk minimisation,
maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classific	cation and regress	sion and to show
how they can be learned by those concepts.	7.74	6
This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its	∠,∠∩ s environment, als	o known as
reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference	nce. The third par	rt will cover
fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Final	ly, the last part wil	ll provide an
Name of the block: Elective courses		
Minimal number of credits of the block: 0		
The rele of the block: V		
Cada of the group: 2018 MPIOE//OI		
Name of the group. 2018_WibiOE VOL		
Name of the group. Elective subjects		
Requirement creats in the group:		
Requirement courses in the group:		
Credits in the group: 0		
Note on the group: ~Student can choose arbitrary subject of the magister's program (EEM - Electric	al Engineerir	ng, Power
Engineering and Management, EK - Electronics and Communications, KYR - Cy	bernetics an	d Robotics,
OI - Open Informatics, OES - Open Electronics Systems) which is not part of his	curriculum.	Student can
choose with consideration of recommendation of the branch guarantee. You can fi	nu a selectio	in or optional
http://www.fel.cvut.cz/cz/education/volitelne-predmety.html		
map.//www.ioi.ovul.oz/oz/oduodilor/volitome-predifiety.html		

List of courses of this pass:

Code	Name of the course	Completion	Credits
BDIP30	Diploma Thesis	Z	30
Independent final of	comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or h	ner branch of study	, which will
be specified b	y branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the compreh-	ensive final examin	nation.
BEOM37FAV	Physiology and modeling of hearing and vision	Z,ZK	6
I ne primary aim of	the course is to study the physiology of sensors and processes of perception of audio and visual information by human subjects as the sense is a human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field	wo central and mo	st important
physiology and, at	the same time, presents their description using mathematical models using the latest computational tools and procedures, including	Machine Learning	(ML). Deep
Learning (DL) and	Artificial Intelligence (AI). Emphasis is also placed on current and prospective applications of the mentioned knowledge. The main app	lication area is the	audiovisual
technology related	o human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, control	systems, automatio	on, robotics,
safety and securit	y technology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological systems	stems. A separate	part is the
objectification of a	udiovisual information perceived quality, i.e., Quality of Experience (QoE). The course is intended for students of master's degree in t	echnical fields. The	e exercises
will be devoted to	nundamental experiments to determine the most important characteristics of HAS and HVS, including computational models and sin	iulation of vision af	id nearing
BE2M31DSPA	Digital Signal Processing	7 7K	6
The subject gives of	overview about basic methods of digital signal processing and their applications (examples from speech and biological signal process	sing): disrete-time	signals and
systems, signal cl	naracteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter desig	n, digital filtering ir	n time and
	frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be foun	d at <a< td=""><td></td></a<>	
	href=http://noel.feld.cvut.cz/vyu/be2m31dspa>http://noel.feld.cvut.cz/vyu/be2m31dspa .		
BE4M33MPV	Computer Vision Methods	Z,ZK	6
The course covers	selected computer vision problems: search for correspondences between images via interest point detection, description and matchi	ng, image stitching	, detection,
inter-university pro	segmentation of objects in images and videos, image retrieval normarge databases and tracking of objects in video sequences. This	of artificial intelline	nce More
inter university pre	information is available at https://prg.ai/minor.	or artificial intellige	nee. wore
BE4M33PAL	Advanced Algorithms	Z.ZK	6
Basic	graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - r	pattern matching.	Ũ
BE4M33SSU	Statistical Machine Learning	Z,ZK	6
The aim of statisti	cal machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some pri	or knowledge abou	ut the task.
This includes typica	al tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning conce	pts such as risk m	inimisation,
maximum likelihood	l estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification	on and regression a	and to show
	how they can be learned by those concepts.	7 71/	
BE4M35KO	Combinatorial Optimization the problems and elegatithms of combinatorial optimization (after called discrete optimization; there is a strong everlap with the term o	Z,ZK	6) Following
the courses on li	he problems and algorithms of combinational optimization (often called discrete optimization, there is a strong overlap with the term of	a. heuristics. appr	oximation
algorithms and st	ate space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, pl	anning of human r	esources,
	scheduling in production lines, message routing, scheduling in parallel computers.		
BE4M36MBG	Molecular Biology and Genetics	Z,ZK	6
BE4M36SAN	Statistical data analysis	Z,ZK	6
This course builds of	on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly	aims at multivaria	te statistical
analysis and mode	ling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a p	ourely statistical co	unterpart to
DEAMORSMUL	Symbolic Mochine Learning	7 74	6
This course cons	Symbolic Machine Leanning ists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its (∠,∠N Anvironment also	U nown as
reinforcement lea	arning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inferer	ce. The third part	will cover
fundamental topi	cs from 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
	introduction to several topics from the computational learning theory, including the online and batch learning settings.		
BEAM02BIO	Biosensors	Z,ZK	6
This course introdu	ces the physical, electronic, biological principles of biosensors and provides information on past, present and future technologies. Va	rious mechanisms	and sensor
concepts for specifi	c applications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the	use of modern nar	ostructures
and nanomaterial	s in biosensors to achieve reliable and sensitive devices for diagnosis at the point of care, in food safety of environmental monitoring challenges and future perspectives for various applications of biosensors	. we will also discu	ss current
BEAM02EPT	Physics for Diagnostics and Therany	7 7K	6
In this course, stude	ints will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great space is	s devoted to electro	otherapeutic
methods, therape	eutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation met	hods (repetitive tra	nscranial
magnetic stimulatio	n of the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In th	e second half of th	e semester,
attent	ion is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, ra	diotherapy, etc.).	
BEAM17EMC	Introduction to Electromagnetic Compatibility	Z,ZK	6
i ne course awell	s on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - e susceptibility and testing methods. The course leads to gain professional skills in the field of electrical engineering.	iectromagnetic inte	enerence,
REAM17EDM	Applications of Flectromagnetic Fields in Medicine	7 7K	6
The maior aim of the	ese lectures is to give to students a basic overview of biophysical aspects of EM fields in different biological systems. including an overview of biophysical aspects of EM fields in different biological systems.	د بے, در view of microwave	applications
in medicine. Safety	limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of bio	ological tissues, El	/ exposure
	of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.		

BEAM31ADA	Adaptive signal processing	Z,ZK	6			
This course provi	des a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming. The course explains adaptive a	algorithms for estin	nation and			
prediction, includin	g analysis, implementation and practical applications. Next, it describes the algorithms for adaptive decorrelation and separation of m	nultidimensional si	gnals. Last,			
	the course provides analysis of adaptive beamforming techniques.					
BEAM31AOL	Applied optoelectronics in medicine	Z,ZK	6			
BEAM31BSG	Biological signals	Z,ZK	6			
The course is focus	ed to the native and evoked biosignals used in clinical medicine and current methods of capturing, processing, recording and evalua	ting in the time an	d frequency			
domains. For important biological signals, the students are introduced with their genesis, and nature and physiological characteristics of the signals required for construction of						
instruments. Studer	instruments. Students are introduced also with the physical and mathematical models. In laboratory exercises, students have the opportunity to capture their own biological signals and					
	their subsequent processing in MATLAB.					
BEAM31LET	Medical Instrumentation and Devices	Z,ZK	6			
Students will study	fundamental principles applied within the modern medical devices and systems, esp. from the point of view of functional blocks and ele	ectronic circuits of	diagnostical			
and therapeutica	I medical equipments including electrocardiographs, electroencephalographs, bedside and central monitors, equipments for anestes	iology, intensive ar	nd critical			
healthcare, equip	ments for clinical laboratory, electrostimulators, cardiostimulators and defibrilators, blood pressure and flow measurement (including q	dilution) and pulse	oxymetry.			
BEAM31MOA	Modeling and analysis of brain activity	Z,ZK	6			
BEAM31NPG	Neurophysiology	Z,ZK	6			
The course will pro	wide an introduction to the structure and function of the neural system and the mechanisms behind major diseases of the human bra	in. It will combine	topics from			
various disciplines	ranging from electrophysiology, neurobiology, neuroanatomy, neurology, psychiatry to biophysics and bioengineering. Understanding	the principles how	the human			
brain works in hea	alth and disease represents a crucial prerequisite for the development and implementation of modern engineering technologies to be	tter diagnose and	treat brain			
	disorders.					
BEAM31ZAS	Analog Signal Processing	Z,ZK	6			
The course deals w	th analog input-output blocks for signal transmission and processing. They discussed circuit solution of amplifiers and filters, including the	heir design process	s, simulation			
and measuremen	t. Students learn the circuit concepts and possibilities for solving the contemporary analogue structures. The second part of the course	se describes the d	esign and			
implementa	tion of analog filters, including discrete-time circuits. The conclusion is devoted to the possibilities of computer optimization of electro	onic circuits and filt	ers.			
BEAM33MOS	Modeling and Simulation	Z,ZK	6			
The modelling te	chniques being frequently used in biomedical engineering and corresponding software tools: Matlab-Simulink, Modelica. Techniques	of modelling and p	processes			
associated with	hem. Types of models, continuous and discrete time models, linear and nonlinear models with lumped parameters, models and their	implementation in	program			
environment. Forma	alization and model creation for a selected system, its identification, verification and interpretation. Equilibrium states (nomeostasis) a	and their inquiry by	simulation.			
wodels of open an	a reedback systems. Use of fuzzy-neuronal models in biomedicine, models of separate systems and whole constellations being definition of medicine of collutions and physical actual participations medicated applications of medicine of medicine of collutions and physical actual participations and physical actual physi	ed in diomedical e	ngineering.			
	Noursistermetice	7 71/	6			
DEAIVISSININ	Neuron consecutivities on modelling of pourone, stochastic logaring on cellular level, information, and depending in train and					
The Neuroiniormali	ts course concentrates on modelling of neurons, stochastic learning on central nevel, mormation couring and decouring in oralin and sin from clinical practices are provided throughout the course. The labe focus on signal neuron analysis from human and animal h	igie unit processini rain	y. Examples			
	Modical Image Drogooping		6			
DEAIVISSZIVIO	Medical Image Processing	$\angle, \angle R$	t often upod			
techniques in me	bes algorithms for digital image processing of 2D and 3D images, with emphasis on biomedical applications. We shall merefore conce adical image processing segmentation, registration, and classification. The methods will be illustrated by a range of examples on mere-	dical data The stu	dents will			
implement some of	the algorithms during the practice sessions Because of the very large overlap between courses A6M37MO and A4M37MO the c	courses will be tau	abt together			
	this year.		gin togotiloi			
BEAM337SI	Medical Imaging Systems	7 7K	6			
The course covers	he principles, design and properties of currently used medical imaging devices. We shall deal with 2D microscopic, X-ray and ultrasou	nd imaging system	ns. includina			
advanced topics su	ch as Doppler ultrasound. We will also study tomographic (3D) imaging systems: computed tomography (CT), magnetic resonance imaging	aina (MRI) includir	a functional			
·	MRI (fMRI) and nuclear imaging methods (PET,SPECT). For more information see https://cw.fel.cvut.cz/wiki/courses/zsl	0 0 0 7	0			
BEAM36BIN	Bioinformatics	7.7K	6			
BEAM38KLS	Construction of Medical Systems	7 7K	6			
General principles	and design and construction of medical devices and systems. Technical standards and requirements for the design, construction and	operation of medic	al electrical			
appliances. Class	sification classes of instruments. Electromagnetic Compatibility of Medical Devices. Modern component base. Design and constructio	n of basic blocks of	of medical			
	devices.					
BEMPRO.J6	Diploma Project	7	6			
Independent work	in the form of a project. A student will choose a topic from a range of topics related to his or her branch of study. which will be specif	ied by branch dep	artment or			
	branch departments. The project will be defended within the framework of a subject.	,				
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For updated information see <u>http://bilakniha.cvut.cz/en/f3.html</u> Generated: day 2025-06-18, time 07:18.