# Recomended pass through the study plan

# Name of the pass: Specialization Signal processing - Passage through study

Faculty/Institute/Others: Faculty of Electrical Engineering

Department:

Pass through the study plan: Medical Electronics and Bioinformatics - Specialization Signal Processing

Branch of study guranteed by the department: Welcome page

Guarantor of the study branch:

Program of study: Medical Electronics and Bioinformatics

Type of study: Follow-up master full-time

Note on the pass:

Coding of roles of courses and groups of courses:

P - compulsory courses of the program, PO - compulsory courses of the branch, Z - compulsory courses, S - compulsory elective courses, PV - compulsory elective courses, F - elective specialized courses, V - elective courses, T - physical training courses

Coding of ways of completion of courses (KZ/Z/ZK) and coding of semesters (Z/L):

KZ - graded assesment, Z - assesment, ZK - examination, L - summer semester, Z - winter semester

### Number of semester: 1

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BEAM31LET	Medical Instrumentation and Devices Jan Havlík Jan Havlík Jan Havlík (Gar.)	Z,ZK	6	2P+2L	Z	Р
BEEZM	Safety in Electrical Engineering for a master's degree Vladimír K la, Ivana Nová, Josef ernohous, Radek Havlí ek Radek Havlí ek Vladimír K la (Gar.)	Z	0	2BP+2BC	Z	Р
BE4M36SAN	Statistical data analysis Ji í Kléma Ji í Kléma Ji í Kléma (Gar.)	Z,ZK	6	2P+2C	Z	Р
BEAM31NPG	Neurophysiology	Z,ZK	6	2P+2C	Z	PS
2018_MBIOEPPV4	Compulsory elective subjects of the programme BE4M33PAL,BEAM17EPM, (see the list of groups below)	Min. cours. 4 Max. cours. 4	Min/Max 24/24			PV

#### Number of semester: 2

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BEAM31BSG	Biological signals Petr Ježdík, Roman mejla, Michal Novotný Roman mejla Roman mejla (Gar.)	Z,ZK	6	2P+2L	L	Р
BEAM33ZSL	Medical Imaging Systems  Jan Kybic, Robert Holaj, André Sopczak, Jan Petr, André Sopczak Jan Kybic  Jan Kybic (Gar.)	Z,ZK	6	2P+2C	L	Р
BEAM31ZAS	Analog Signal Processing Ji í Hospodka Ji í Hospodka (Gar.)	Z,ZK	6	2P+2C	L	PS
BE2M31DSPA	Digital Signal Processing Petr Pollák Petr Pollák Petr Pollák (Gar.)	Z,ZK	6	2P+2C	Z	PS
2018_MBIOEPPV4	Compulsory elective subjects of the programme BE4M33PAL,BEAM17EPM, (see the list of groups below)	Min. cours. 4 Max. cours. 4	Min/Max 24/24			PV

Number of semester: 3

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BEMPROJ6	Diploma Project Jan Kybic, Vratislav Fabián, Roman mejla, Petr Pošík Petr Pošík Jan Kybic (Gar.)	Z	6	0p+6s	Z,L	Р
BEAM31ADA	Adaptive signal processing Pavel Sovka Radoslav Bortel Radoslav Bortel (Gar.)	Z,ZK	6	2P+2C	Z	PS
BEAM31MOA	Modeling and analysis of brain activity  Jaroslav Hlinka Jaroslav Hlinka (Gar.)	Z,ZK	6	2P+2C	Z	PS
2018_MBIOEPPV4	Compulsory elective subjects of the programme BE4M33PAL,BEAM17EPM, (see the list of groups below)	Min. cours. 4 Max. cours. 4	Min/Max 24/24			PV
2018_MBIOEVOL	Elective subjects	Min. cours.	Min/Max 0/999			V

### Number of semester: 4

	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

## List of groups of courses of this pass with the complete content of members of individual groups

Kód		Name of the group o group (for specification)	f courses and	codes of members of this below the list of courses)	Com	pletion	Credits	Scope	Semester	Role
2018_MBIC	EPPV4	Compulsory el	ective subjec	ts of the programme		cours. 4 . cours. 4	<b>Min/Ma</b> 24/24	x		PV
BE4M33PAL	Advanced	Algorithms	BEAM17EPM	Applications of Electromagnetic		BEAM31	31AOL Applied optoelectronics in me		edic	
BEAM36BIN	Bioinforma	itics	BEAM02BIO	Biosensors		BE4M35I	KO C	ombinatorial	Optimization	
BE4M33MPV	Computer	Vision Methods	BEAM38KLS	Construction of Medical Systems		BEAM17	EMC II	ntroduction to	Electromagne	etic
BEAM33ZMO	Medical Im	nage Processing	BEAM33MOS	Modeling and Simulation		BE4M36I	BE4M36MBG Molecular Biology and Ger		ogy and Gene	tics
BEAM33NIN	Neuroinfor	matics	BEAM02FPT	Physics for Diagnostics and Ther	. BE0M37FAV		FAV F	Physiology and modeling of hea		heari
BE4M33SSU	Statistical	Machine Learning	BE4M36SMU	Symbolic Machine Learning						
2018_MBI	DEVOL		Elective sub	jects	Min.	cours.	<b>Min/Ma</b> 0/999	x		٧

## List of courses of this pass:

Code	Name of the course							
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 b	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.							
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 most important								
communication channels, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field of human vision and hearing								
physiology and, at	physiology and, at the same time, presents their description using mathematical models using the latest computational tools and procedures, including Machine Learning (ML). Deep							

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 most important communication channels, i.e., Human Auditory System (HAS) and Human Visual System (HVS). The course summarizes current knowledge in the field of human vision and hearing 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 application area is the audiovisual technology related to human perception, but the direct employment of the acquired knowledge also includes the areas of multimedia technology, control systems, automation, robotics, safety and security technology, bioinspired systems, etc. At the same time, students gain a general overview of information processing in biological systems. A separate part is the 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 simulation of vision and hearing processes.

E2M31DSPA		/ / N	6
	Digital Signal Processing overview about basic methods of digital signal processing and their applications (examples from speech and biological signal processin	Z,ZK	1
	characteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter design,		-
systems, signar c	frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found a	-	in time and
	href=http://noel.feld.cvut.cz/vyu/be2m31dspa>http://noel.feld.cvut.cz/vyu/be2m31dspa>	αι αιι,α	
E4M33MPV		Z,ZK	6
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	selected computer vision problems: search for correspondences between images via interest point detection, description and matching	-	-
-	d segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences. This c	-	
nter-university pr	rogramme prg.ai Minor. It pools the best of AI education in Prague to provide students with a deeper and broader insight into the field of	artificiai inteilig	ence. Mor
	information is available at https://prg.ai/minor.		
BE4M33PAL	Advanced Algorithms	Z,ZK	6
Basic	graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pat	tern matching.	
E4M33SSU	Statistical Machine Learning	Z,ZK	6
he aim of statisti	ical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior	knowledge abo	ut the tasl
is includes typic	al tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concept:	s such as risk n	ninimisatio
ximum likelihoo	d estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification	and regression	and to sh
	how they can be learned by those concepts.	· ·	
BE4M35KO	Combinatorial Optimization	Z,ZK	6
	·	•	1
-	vithe problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term ope		-
	inear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming,		
igorithms and s	tate space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, plan	ning of human	resources
	scheduling in production lines, message routing, scheduling in parallel computers.		
4M36MBG	Molecular Biology and Genetics	Z,ZK	6
4M36SAN	Statistical data analysis	Z,ZK	6
	on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly a	•	1
	elling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a pur		
,	machine learning and data mining courses.	,	
4142661411	· · · · · · · · · · · · · · · · · · ·	Z.ZK	6
E4M36SMU		,	6
	sists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its en		
	earning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference		
ındamental topi	ics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, th	e last part will	provide a
	introduction to several topics from the computational learning theory, including the online and batch learning settings.		
EAM02BIO	Biosensors	Z,ZK	6
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	uces the physical, electronic, biological principles of biosensors and provides information on past, present and future technologies. Vario		
s course introdu		us mechanism	s and ser
s course introdu scepts for specif	ic applications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the us	us mechanism e of modern na	s and ser
s course introdu cepts for specif	ic applications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the us ls in biosensors to achieve reliable and sensitive devices for diagnosis at the point of care, in food safety or environmental monitoring. W	us mechanism e of modern na	s and ser
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EAM31ADA and course in troduction in the course of the course dwelver in the course in	is applications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the us is in biosensors to achieve reliable and sensitive devices for diagnosis at the point of care, in food safety or environmental monitoring. We challenges and future perspectives for various applications of biosensors.  Physics for Diagnostics and Therapy ents will be introduced to the problems of locomotive organs diseases and musculoskeletal pain in the first seven lectures. Great space is deutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial pain stimulation method of the brain - TMS, transcranial electrical stimulation of the brain - TMS and electroconvulsive therapy - ECT) are discussed. In the stion is paid to the possibilities of using ionizing electromagnetic fields in medical diagnostics and therapy (eg X-ray, proton therapy, radic Introduction to Electromagnetic Compatibility  Is on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electrical engineering.  Applications of Electromagnetic Fields in Medicine  assectives its to give to students a basic overview of biophysical aspects of EM fields in different biological systems, including an overvie y limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of biological systems, including an overvie y limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of biological parameters of problems of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.  Adaptive signal processing  dies a basic discourse on adaptive algorithms for filtering, decorrelation, separation and beamforming. The course explains adaptive algorithms for processing in magnetic resonance imaging, interaction of optical radiation with biological signals and pr	us mechanisme e of modern na /e will also disconsideration will also discon	s and set inostructivus curre 6 6 ortherape anscrania he seme:  6 applicate M expose 6 mation a signals. List of 6 diagnos and criticate oxymet 6 ortherape 6 ortherape 6 ortherape 7 oxymet 6 ortherape 7 oxymet

BEAM31ZAS	Analog Signal Processing	Z,ZK	6
The course deals w	ith analog input-output blocks for signal transmission and processing. They discussed circuit solution of amplifiers and filters, including t	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 cour	se describes the d	esign and
implementa	ation of analog filters, including discrete-time circuits. The conclusion is devoted to the possibilities of computer optimization of electrons	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	rocesses
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 (homeostasis)	and their inquiry by	simulation.
Models of open an	d feedback systems. Use of fuzzy-neuronal models in biomedicine. Models of separate systems and whole constellations being defir	ned in biomedical e	ngineering.
	Models of cellular and physiological control, population models. Application of models for artificial organs production.		
BEAM33NIN	Neuroinformatics	Z,ZK	6
The Neuroinformati	cs Course concentrates on modelling of neurons, stochastic learning on cellular level, information coding and decoding in brain and si	ngle unit processing	g. Examples
	from clinical practices are provided throughout the course. The labs focus on signal neuron analysis from human and animal b	rain.	
BEAM33ZMO	Medical Image Processing	Z,ZK	6
This subject describ	bes algorithms for digital image processing of 2D and 3D images, with emphasis on biomedical applications. We shall therefore conc	entrate on the mos	t often used
techniques in me	edical image processing: segmentation, registration, and classification. The methods will be illustrated by a range of examples on me	dical data. The stu	dents will
implement some of	the algorithms during the practice sessions. Because of the very large overlap between courses A6M33ZMO and A4M33ZMO, the	courses will be tauç	ght together
	this year.		
BEAM33ZSL	Medical Imaging Systems	Z,ZK	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	and imaging system	ns, including
advanced topics su	ch as Doppler ultrasound. We will also study tomographic (3D) imaging systems: computed tomography (CT), magnetic resonance ima	iging (MRI) includin	ng functional
	MRI (fMRI) and nuclear imaging methods (PET,SPECT). For more information see https://cw.fel.cvut.cz/wiki/courses/zsl		
BEAM36BIN	Bioinformatics	Z,ZK	6
BEAM38KLS	Construction of Medical Systems	Z,ZK	6
General principles	and design and construction of medical devices and systems. Technical standards and requirements for the design, construction and	operation of medic	cal electrical
appliances. Class	sification classes of instruments. Electromagnetic Compatibility of Medical Devices. Modern component base. Design and construction	on of basic blocks o	of medical
	devices.		
BEEZM	Safety in Electrical Engineering for a master's degree	Z	0
The course provi	des for students of all programs periodic training guidelines for health and occupational safety and gives knowledge of electrical haz	ard of given branch	of study.
	Students receive indispensable qualification according to the current Directive of the Dean.		
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 speci	fied by branch dep	artment or
	branch departments. The project will be defended within the framework of a subject.		

For updated information see <a href="http://bilakniha.cvut.cz/en/f3.html">http://bilakniha.cvut.cz/en/f3.html</a> Generated: day 2024-05-21, time 13:06.