Recomended pass through the study plan

Name of the pass: Specialization Bioinformatics - Passage through study

Faculty/Institute/Others: Faculty of Electrical Engineering
Department:
Pass through the study plan: Medical Electronics and Bioinformatics - Specialization Bioinformatics
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	P
BEEZM	**Safety in Electrical Engineering for a master´s degree** *Vladimír Kůla, Ivana Nová, Josef Černohous, Radek Havlíček **Radek Havlíček** Vladimír Kůla (Gar.)*	Z	0	2BP+2BC	Z	P
BE4M36SAN	**Statistical data analysis** *Jiří Kléma **Jiří Kléma** Jiří Kléma (Gar.)*	Z,ZK	6	2P+2C	Z	P
BEAM31NPG	**Neurophysiology** *Přemysl Jiruška, Helena Pivoňková **Přemysl Jiruška** Přemysl Jiruška (Gar.)*	Z,ZK	6	2P+2C	Z	PV
2018_MBIOEPPV1	**Compulsory elective ubjects of the programme** *BEAM31ADA,BEAM31ZAS,..... (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 Čmejla, Michal Novotný **Roman Čmejla** Roman Čmejla (Gar.)*	Z,ZK	6	2P+2L	L	P
BEAM33ZSL	**Medical Imaging Systems** *Jan Kybic, Vít Herynek, André Sopczak **Jan Kybic** Jan Kybic (Gar.)*	Z,ZK	6	2P+2C	L	P
BEAM31ZAS	**Analog Signal Processing** *Jiří Hospodka **Jiří Hospodka** Jiří Hospodka (Gar.)*	Z,ZK	6	2P+2C	L	PV
2018_MBIOEPPV1	**Compulsory elective ubjects of the programme** *BEAM31ADA,BEAM31ZAS,..... (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 Čmejla, Petr Pošík **Petr Pošík** Roman Čmejla (Gar.)*	Z	6	0p+6s	Z,L	P

BEAM31ADA	**Adaptive signal processing**	Z,ZK	6	2P+2C	Z	PV
BEAM31MOA	**Modeling and analysis of brain activity** *Jaroslav Hlinka* ***Jaroslav Hlinka*** *Jaroslav Hlinka (Gar.)*	Z,ZK	6	2P+2C	Z	PV
2018_MBIOEPPV1	**Compulsory elective ubjects of the programme** *BEAM31ADA,BEAM31ZAS,..... (see the list of groups below)*	Min. cours. 4 Max. cours. 4	Min/Max 24/24			PV
2018_MBIOEVOL	**Elective subjects**	Min. cours. 0	Min/Max 0/999			V

Number of semester: 4

Code	Name of the course / Name of the group of courses ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BDIP30	**Diploma Thesis**	Z	30	22s	L	P

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

Kód	Name of the group of courses and codes of members of this group (for specification see here or below the list of courses)	Completion	Credits	Scope	Semester	Role
2018_MBIOEPPV1	**Compulsory elective ubjects of the programme**	**Min. cours. 4** **Max. cours. 4**	**Min/Max** 24/24			**PV**

BEAM31ADA	Adaptive signal processing	BEAM31ZAS	Analog Signal Processing	BEAM17EPM	Applications of Electromagnetic ...
BEAM31AOL	Applied optoelectronics in medic ...	BEAM02BIO	Biosensors	BE4M33MPV	Computer Vision Methods
BEAM38KLS	Construction of Medical Systems	BE2M31DSPA	Digital Signal Processing	BEAM17EMC	Introduction to Electromagnetic ...
BEAM33ZMO	Medical Image Processing	BEAM31MOA	Modeling and analysis of brain a ...	BEAM33MOS	Modeling and Simulation
BEAM33NIN	Neuroinformatics	BEAM31NPG	Neurophysiology	BEAM02FPT	Physics for Diagnostics and Ther ...
BE4M36SMU	Symbolic Machine Learning				

2018_MBIOEVOL	**Elective subjects**	**Min. cours. 0**	**Min/Max** 0/999			**V**

List of courses of this pass:

Code	Name of the course	Completion	Credits
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.			
BE2M31DSPA	Digital Signal Processing	Z,ZK	6
The subject gives overview about basic methods of digital signal processing and their applications (examples from speech and biological signal processing): disrete-time signals and systems, signal characteristics in time and frequency domain, Fourier transform, fast algorithms for DFT computation, introduction to digital filter design, digital filtering in time and frequency domain, decimation and interpolation and their usage in filter banks, basics of LPC analysis. Further details can be found at http://noel.feld.cvut.cz/vyu/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 matching, image stitching, detection, recognition and segmentation of objects in images and videos, image retrieval from large databases and tracking of objects in video sequences. This course is also part 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 field of artificial intelligence. More information is available at https://prg.ai/minor.			
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 statistical counterpart to machine learning and data mining courses.			
BE4M36SMU	Symbolic Machine Learning	Z,ZK	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 environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover			

	fundamental topics from 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 introduction to several topics from the computational learning theory, including the online and batch learning settings.		
BEAM02BIO	Biosensors	Z,ZK	6
	This course introduces the physical, electronic, biological principles of biosensors and provides information on past, present and future technologies. Various mechanisms and sensor concepts for specific applications (such as detection of glucose, urea, proteins, cells, bacteria, etc.) are explained. In addition, the course introduces the use of modern nanostructures and nanomaterials in biosensors to achieve reliable and sensitive devices for diagnosis at the point of care, in food safety or environmental monitoring. We will also discuss current challenges and future perspectives for various applications of biosensors.		
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 space is devoted to electrotherapeutic methods, therapeutic ultrasound and phototherapy. Furthermore, advanced neurorehabilitation methods, especially transcranial brain stimulation methods (repetitive transcranial magnetic stimulation of the brain - rTMS, transcranial electrical stimulation of the brain - tDCS and electroconvulsive therapy - ECT) are discussed. In the second half 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, etc.).		
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 - electromagnetic interference, susceptibility and testing methods. The course leads to gain professional skills in the field of electrical engineering.		
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 limits, clinical usage of EM field effects on biological systems, microwave hyperthermia, measurement of dielectric parameters of biological tissues, EM exposure of mobile phone users, magnetic resonance imaging, interaction of optical radiation with biological tissue.		
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 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.		
BEAM31AOL	Applied optoelectronics in medicine	Z,ZK	6
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 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 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.		
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.		
BEAM31ZAS	Analog Signal Processing	Z,ZK	6
	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.		
BEAM33MOS	Modeling and Simulation	Z,ZK	6
	The modelling techniques being frequently used in biomedical engineering and corresponding software tools: Matlab-Simulink, Modelica. Techniques of modelling and processes associated with them. Types of models, continuous and discrete time models, linear and nonlinear models with lumped parameters, models and their implementation in program environment. Formalization and model creation for a selected system, its identification, verification and interpretation. Equilibrium states (homeostasis) and their inquiry by simulation. Models of open and feedback systems. Use of fuzzy-neuronal models in biomedicine. Models of separate systems and whole constellations being defined in biomedical engineering. Models of cellular and physiological control, population models. Application of models for artificial organs production.		
BEAM33NIN	Neuroinformatics	Z,ZK	6
	The Neuroinformatics Course concentrates on modelling of neurons, stochastic learning on cellular level, information coding and decoding in brain and single unit processing. Examples from clinical practices are provided throughout the course. The labs focus on signal neuron analysis from human and animal brain.		
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 concentrate 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 medical data. The students 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 taught together this year.		
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 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		
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 medical electrical appliances. Classification classes of instruments. Electromagnetic Compatibility of Medical Devices. Modern component base. Design and construction of basic blocks of medical devices.		
BEEZM	Safety in Electrical Engineering for a master´s degree	Z	0
	The course provides for students of all programs periodic training guidelines for health and occupational safety and gives knowledge of electrical hazard of given branch of study. Students receive indispensable qualification according to the 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 specified by branch department or branch departments. The project will be defended within the framework of a subject.			

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