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: 144
Elective courses credits: -24
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** *Roman Čmejla* ***Roman Čmejla*** *Roman Čmejla (Gar.)*	Z,ZK	6	2P+2L	L	P
BEMPROJ6	**Diploma Project** *Petr Pošík*	Z	6	0p+6s		P
BEAM33ZSL	**Medical Imaging Systems** *Jan Kybic, Jan Hering* ***Jan Kybic*** *Jan Kybic (Gar.)*	Z,ZK	6	2P+2C	L	P
BEAM31LET	**Medical Instrumentation and Devices**	Z,ZK	6	2P+2C	Z	P
BE4M36SAN	**Statistical data analysis** *Jiří Kléma* ***Jiří Kléma*** *Jiří Kléma (Gar.)*	Z,ZK	6	2P+2C	Z	P

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
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.			
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			
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.			
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.			

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	P

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 elective courses
Minimal number of credits of the block: 84
The role of the block: PV

Code of the group: 2018_MBIOEPV
Name of the group: Compulsory subjects of the programme
Requirement credits in the group: In this group you have to gain 54 credits
Requirement courses in the group: In this group you have to complete 9 courses
Credits in the group: 54
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	PV
BE4M33PAL	**Advanced Algorithms** *Marko Genyk-Berezovskyj, Daniel Průša **Daniel Průša** Daniel Průša (Gar.)*	Z,ZK	6	2P+2C	Z	PV
BE2M31DSP	**Advanced DSP methods** *Pavel Sovka, Petr Pollák **Pavel Sovka** Pavel Sovka (Gar.)*	Z,ZK	6	2P+2C	L	PV
BEAM31ZAS	**Analog Signal Processing**	Z,ZK	6	2P+2C	L	PV
BEAM17EPM	**Applications of Electromagnetic Fields in Medicine**	Z,ZK	6	2P+2L	L	PV
BEAM31AOL	**Applied optoelectronics in medicine**	Z,ZK	6	2P+2C	L	PV
BEAM36BIN	**Bioinformatics** *Jiří Kléma, Filip Železný **Filip Železný** Jiří Kléma (Gar.)*	Z,ZK	6	2P+2C	L	PV
BEAM02BIO	**Biosensors**	Z,ZK	6	2P+2L	Z	PV
BE4M35KO	**Combinatorial Optimization** *Zdeněk Hanzálek **Zdeněk Hanzálek***	Z,ZK	6	3P+2C	L	PV
BE4M33MPV	**Computer Vision Methods** *Milan Šulc, Jiří Matas, Jan Čech, Ondřej Drbohlav **Ondřej Drbohlav** Jiří Matas (Gar.)*	Z,ZK	6	2P+2C	L	PV
BEAM38KLS	**Construction of Medical Systems**	Z,ZK	6	2P+2L	Z	PV
BEAM17EMC	**Introduction to Electromagnetic Compatibility** *Tomáš Kořínek **Tomáš Kořínek** Tomáš Kořínek (Gar.)*	Z,ZK	6	2P+2L	Z	PV
BEAM33ZMO	**Medical Image Processing** *Jan Kybic **Jan Kybic** Jan Kybic (Gar.)*	Z,ZK	6	2P+2C	Z	PV
BEAM33MOS	**Modeling and Simulation** *Jiří Kofránek **Petr Pošík** Jiří Kofránek (Gar.)*	Z,ZK	6	2P+2C	Z	PV
BEAM31MOA	**Modeling and analysis of brain activity**	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** ***Jiří Kofránek***	Z,ZK	6	2P+2C	L	PV
BEAM31NPG	**Neurophysiology**	Z,ZK	6	2P+2C	Z	PV
BEAM02FPT	**Physics for Diagnostics and Therapy**	Z,ZK	6	2P+2L		PV
BE4M33SSU	**Statistical Machine Learning** *Jan Drchal, Vojtěch Franc, Boris Flach **Vojtěch Franc** Boris Flach (Gar.)*	Z,ZK	6	2P+2C	Z	PV
BE4M36SMU	**Symbolic Machine Learning** *Filip Železný, Ondřej Kuželka **Filip Železný** Filip Železný (Gar.)*	Z,ZK	6	2P+2C	L	PV

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

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.			
BE4M33PAL	Advanced Algorithms	Z,ZK	6
Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching.			
BE2M31DSP	Advanced DSP methods	Z,ZK	6
The course follows the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn the methods 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 signals. They will became familiar with methods of signal decomposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability to interpret the results of signal analyses.			
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.			
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.			
BEAM31AOL	Applied optoelectronics in medicine	Z,ZK	6
BEAM36BIN	Bioinformatics	Z,ZK	6
BEAM02BIO	Biosensors	Z,ZK	6
This course introduces general principle of biosensors and their physical, electronic and biological mechanisms. It provides information on past, present and future technologies. Different mechanisms and concepts of sensors for specific applications such as glucose, urea, proteins, cells, bacteria, etc. will be explained. In addition, the course introduces the use of modern nanostructures and nanomaterials in biosensors to provide convenient, reliable and sensitive devices for point of care diagnosis as well as for food and environmental monitoring. Finally, this course will discuss current challenges and future perspectives in various biosensor applications.			
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 production lines, message routing, scheduling in parallel computers.			
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.			
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.			
BEAM17EMC	Introduction to Electromagnetic Compatibility	Z,ZK	6
The subject dwells on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - electromagnetic interference, susceptibility and testing methods. The subject leads to gain professional skills in the field of electrical engineering.			
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.			
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.			
BEAM31MOA	Modeling and analysis of brain activity	Z,ZK	6
BE4M36MBG	Molecular Biology and Genetics	Z,ZK	6
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.			
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.			
BEAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
BE4M33SSU	Statistical Machine Learning	Z,ZK	6
The aim of statistical machine learning is to develop systems (models and algorithms) able to learn 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.			
BE4M36SMU	Symbolic Machine Learning	Z,ZK	6
The course will explain methods through which an intelligent agent can learn, that is, improve its behavior from observed data and background knowledge. The learning scenarios will include on-line learning and learning from i.i.d. data (along with the PAC theory of learnability), as well as the active and reinforcement learning scenarios. Symbolic knowledge representations (mainly through logic and graphs) will be used where possible. The course is given in English to all students.			

Code of the group: 2018_MBIOEPV1
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
BE4M33PAL	**Advanced Algorithms** *Marko Genyk-Berezovskyj, Daniel Průša* ***Daniel Průša*** *Daniel Průša (Gar.)*	Z,ZK	6	2P+2C	Z	PV
BEAM36BIN	**Bioinformatics** *Jiří Kléma, Filip Železný* ***Filip Železný*** *Jiří Kléma (Gar.)*	Z,ZK	6	2P+2C	L	PV
BE4M35KO	**Combinatorial Optimization** *Zdeněk Hanzálek* ***Zdeněk Hanzálek***	Z,ZK	6	3P+2C	L	PV
BE4M36MBG	**Molecular Biology and Genetics** *Martin Pospíšek* ***Martin Pospíšek*** *Martin Pospíšek (Gar.)*	Z,ZK	6	3P+1C	L	PV
BE4M33SSU	**Statistical Machine Learning** *Jan Drchal, Vojtěch Franc, Boris Flach* ***Vojtěch Franc*** *Boris Flach (Gar.)*	Z,ZK	6	2P+2C	Z	PV

Characteristics of the courses of this group of Study Plan: Code=2018_MBIOEPV1 Name=Compulsory subjects of the programme

BE4M33PAL	Advanced Algorithms	Z,ZK	6
Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching.			
BEAM36BIN	Bioinformatics	Z,ZK	6
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 production lines, message routing, scheduling in parallel computers.			
BE4M36MBG	Molecular Biology and Genetics	Z,ZK	6
BE4M33SSU	Statistical Machine Learning	Z,ZK	6
The aim of statistical machine learning is to develop systems (models and algorithms) able to learn 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: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: 2018_MBIOEVOL
Name of the group: Elective subjects
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: ~Student can choose arbitrary subject of the magister's program (EEM - Electrical Engineering, Power Engineering and Management, EK - Electronics and Communications, KYR - Cybernetics and 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 find a selection of optional courses organized by the departments on the web site http://www.fel.cvut.cz/cz/education/volitelne-predmety.html

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.			

BE2M31DSP	Advanced DSP methods	Z,ZK	6
The course follows the basic course in signal processing and introduces advanced methods of analysis and digital signal processing. Graduates will learn the methods 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 signals. They will became familiar with methods of signal decomposition and independent component analysis and the time-frequency transformations. Emphasis will be placed on an ability to interpret the results of signal analyses.			
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.			
BE4M33PAL	Advanced Algorithms	Z,ZK	6
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) able to learn 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.			
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 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 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
The course will explain methods through which an intelligent agent can learn, that is, improve its behavior from observed data and background knowledge. The learning scenarios will include on-line learning and learning from i.i.d. data (along with the PAC theory of learnability), as well as the active and reinforcement learning scenarios. Symbolic knowledge representations (mainly through logic and graphs) will be used where possible. The course is given in English to all students.			
BEAM02BIO	Biosensors	Z,ZK	6
This course introduces general principle of biosensors and their physical, electronic and biological mechanisms. It provides information on past, present and future technologies. Different mechanisms and concepts of sensors for specific applications such as glucose, urea, proteins, cells, bacteria, etc. will be explained. In addition, the course introduces the use of modern nanostructures and nanomaterials in biosensors to provide convenient, reliable and sensitive devices for point of care diagnosis as well as for food and environmental monitoring. Finally, this course will discuss current challenges and future perspectives in various biosensor applications.			
BEAM02FPT	Physics for Diagnostics and Therapy	Z,ZK	6
BEAM17EMC	Introduction to Electromagnetic Compatibility	Z,ZK	6
The subject dwells on problems of electromagnetic compatibility. Students obtain the basic knowledges in the field of electromagnetic compatibility - electromagnetic interference, susceptibility and testing methods. The subject 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
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			
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 medical electrical appliances. Classification classes of instruments. Electromagnetic Compatibility of Medical Devices. Modern component base. Design and construction of basic blocks of medical devices.			
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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