Study plan

Name of study plan: Biomedical and Clinical Engineering

Faculty/Institute/Others: Department: Branch of study guaranteed by the department: Welcome page Garantor of the study branch: Program of study: Biomedical and Clinical Engineering Type of study: Follow-up master full-time Required credits: 120 Elective courses credits: 0 Sum of credits in the plan: 120 Note on the plan:

Name of the block: Compulsory courses Minimal number of credits of the block: 99 The role of the block: Z

Code of the group: F7AMB POV 20 Name of the group: Biomedical and Clinical Engineering compulsory course Requirement credits in the group: In this group you have to gain 99 credits Requirement courses in the group: In this group you have to complete 16 courses Credits in the group: 99 Note on the group:

Note on the gro	pup:					
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
F7AMBAF	Applied Physics Milan Ši or Milan Ši or Milan Ši or (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBAM	Applied Mathematics Karel Roubík, Martin Rožánek, Ji í Hozman, Ond ej Fišer Ond ej Fišer Martin Rožánek (Gar.)	KZ	4	2P+1C	Z	Z
17ABOZP	Occupational Safety and Health, Fire Protection and First Aid Petr Kudrna Petr Kudrna Petr Kudrna (Gar.)	Z	0	1P	Z	Z
F7AMBBB	Biomechanics and Biomaterials Matej Daniel, Martin Otáhal Matrin Otáhal Matej Daniel (Gar.)	Z,ZK	5	2P+2L	Z	Z
F7AMBCZS	Digital Signal Processing Marek Piorecký, Václava Piorecká, Jan Štrobl Václava Piorecká Václava Piorecká (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBDP	Diploma Thesis Jakub Ráfl, Jan Vrba Jakub Ráfl	Z	30	364ZP	L	Z
F7AMBSDP	Diploma Seminar Jakub Ráfl Martin Rožánek Martin Rožánek (Gar.)	Z	4	4C	Z	Z
F7AMBELEG	European Legislation and Management in Health Care Peter Kneppo, Vojt ch Kamenský, Ond ej Gajdoš Vojt ch Kamenský Peter Kneppo (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBLPT	Medical Devices and Equipment Martin Rožánek, Petr Kudrna Petr Kudrna Martin Rožánek (Gar.)	Z,ZK	5	2P+2L	L	Z
F7AMBLZS	Imaging Systems in Medicine Martin Rožánek, Ji í Hozman, Tomáš Díž al Martin Rožánek Martin Rožánek (Gar.)	Z,ZK	5	2P+2C	L	Z
F7AMBMPV	Mathematical Methods in Research Jakub Ráfi Jakub Ráfi Karel Roubík (Gar.)	Z,ZK	6	2P+2C	Z	Z
F7AMBMAR	Measurement and Control in Biomedicine Peter Kneppo, Jana Mat jková, Roman Mat jka Roman Mat jka Peter Kneppo (Gar.)	Z,ZK	5	2P+2L	L	Z
F7AMBPIZ	Methodology of Research and Information Sources Jakub Ráfl, Šimon Walzel Jakub Ráfl Jakub Ráfl (Gar.)	KZ	5	2P+2C	L	Z
F7AMBSPMM	Software for Mathematical Modeling Bartolom j Biskup Bartolom j Biskup Bartolom j Biskup (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBSF	Systemic Physiology Ian Azarov, Ksenia Sedova Pavel Ku era Pavel Ku era (Gar.)	Z,ZK	5	2P+2L	Z	Z

F7AMBTANPEquipment for Anesthesia and Critical Care Karel Roubík, Václav Ort Jakub Ráfi Karel Roubík (Gar.)Z,ZK5	2P+2L	Z	Z
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Characteristics of the courses of this group of Study Plan: Code=F7AMB POV 20 Name=Biomedical and Clinical Engineering compulsory course **F7AMBAF Applied Physics** Z,ZK 5 Fundamentals of thermodynamics, the kinetic theory of gases. Transport phenomena in gases and in liquids. Electromagnetic field and interaction with matter. Electronic structure of atoms and molecules. Physics of low temperatures and superconductivity. Magnetic resonance and its application. Foundations of X-rays diffraction and X-ray structure analysis. F7AMBAM **Applied Mathematics** ΚZ 4 The course deals with the practical applications of mathematics and its demonstration with examples from the field of biomedical engineering. 17ABOZP Occupational Safety and Health, Fire Protection and First Aid Ζ 0 **F7AMBBB Biomechanics and Biomaterials** Z,ZK 5 The aim of the course is to introduce students to the areas of biomechanics. These are circuits of clinical, sports and orthopaedic biomechanics. In particular, the students will be introduced to methods of measurement in experimental biomechanics, biomechanics of the musculoskeletal system, assessment of movement in biomechanics and rehabilitation, assessment of gait and standing still, assessment of work and performance, force and moment effects, anthropometry, material properties, loading methods, deformation and modelling of biomaterials, rheological models of tissues. Students will also learn about the areas of orthosis and prosthesis design and ergonomics in relation to biomechanics Z,ZK 5 **F7AMBCZS Digital Signal Processing** The course deals with the following topics - characteristics of signals, linear time invariant systems (LTI), stationary, non-stationary signals, deterministic, ergodic and stochastic processes, description of signals in continuous and discrete domains, A/D conversions and converters, sampling and quantization problems, aliasing and Nyquist's theorem, noise suppression and data preprocessing, fast and discrete Fourier transforms, efficient FFT estimation methods, other discrete transforms: z-transform, its properties and applications in DSP, inverse transforms, poles and zeros of the system, frequency response, correlation and convolution, introduction to digital filter design, FIR and IIR filters and adaptive filters, spectral analysis and spectrum estimation methods, current methods of analysis in time and frequency domain, coherence and phase characteristics, parametric and non-parametric methods, periodogram and AR spectrum. F7AMBDP Diploma Thesis 7 30 Independent work of the student at the end of the study, when the student has to demonstrate the ability to independently and comprehensively process the given topic using the knowledge acquired during the study. The student chooses the topic of the thesis from the topics offered by the department that guarantees the study programme. The student is obliged to write the thesis at the beginning of the 4th semester. In this semester the thesis is submitted and defended. The student defends his/her thesis in front of the SZZ committee. This thesis is evaluated by the supervisor and the opponent according to the ECTS grading scale. Subsequently, the evaluation and the result of the final state examination from the thematic areas are included in one final evaluation. **F7AMBSDP** Ζ **Diploma Seminar** 4 The diploma seminar serves as a support for the start of work on the diploma thesis. During the semester, students present the intended aims and methods of their thesis and the partial results of their work **F7AMBELEG** European Legislation and Management in Health Care Z,ZK 5 The course focuses on an overview of legislative regulations in the healthcare sector with a subsequent focus on medical devices. The course will cover theoretical and practical issues of patients' rights in healthcare, ethics in biomedicine, healthcare systems, marketing of medical devices, technical standardization systems and industrial property protection. F7AMBLPT Medical Devices and Equipment Z.ZK 5 The course develops the initial knowledge in the field of biophysics and human physiology and applies it to the problems of instrumental medical technology. In particular, the course deals with the principles of operation and current possibilities of technology in medicine. The content is chosen to be sufficient for understanding and mastering the issues in subsequent courses. The course deals with diagnostic devices, devices for monitoring and evaluation of vital functions, therapeutic devices, including equipment for specialized departments such as ICU, operating rooms, etc. **F7AMBLZS** 5 Imaging Systems in Medicine Z,ZK The course deals with advanced imaging techniques, which are used mainly for diagnostic purposes in clinical practice. Emphasis will be placed on the technical principle of the devices, on the possibilities and limitations of individual modalities. The issue of image reconstruction in tomographic imaging systems will also be addressed. F7AMBMPV Mathematical Methods in Research 7.7K 6 The course deals with the following topics: methods of statistical analysis intended primarily for medical research - clinical, biological, biochemical, biophysical and other studies. methods of descriptive and inductive statistics, statistical epidemiological methods, hypothesis testing, group comparison (parametric and non-parametric methods), ANOVA, correlation and simple regression analysis, multivariate regression models, multivariate linear models, logistic regression, discriminant analysis, survival analysis etc., model calculations and interpretation of results Z.ZK **F7AMBMAR** Measurement and Control in Biomedicine 5 The course deals with the following topics - measurement of electrical and non-electrical quantities using conventional laboratory instruments, industrial A/D converters and digitizing cards such as DAQ, low-cost solutions with MCUs such as Arduino, as well as factors affecting the accuracy and stability of measurements both at the level of the sensors and converters themselves, as well as the correct interpretation of these data and the expression of measurement uncertainty and calibration, Machine vision, with a focus on camera systems and standards, and the basics of image recognition, control will include the fundamentals of automation, design of state and sequential automata, addressing transport delay and design of threshold and proportional controllers, demonstrations on biomedical applications, and new trends in measurement, control and automation using FPGA and real-time gate array technology F7AMBPIZ Methodology of Research and Information Sources ΚZ 5 The course deals with the following topics: characteristics of research and science, types of research, links to legislation and financial resources, research projects, grant applications and grant process; basic characteristics and specifics of a scientific text, content of individual sections; publishing practices, publication ethics, citations sources, information sources; typographic rules, mathematical typesetting, text corrections; principles for creating presentations, presentation of results in the form of tables, graphs and diagrams. F7AMBSPMM Software for Mathematical Modeling Z,ZK 5 **F7AMBSF** Systemic Physiology Z.ZK 5 The course deals with the following themes: functional organisation of living systems, basic concepts of system approach to integrated functions of the human organism, importance of systems offering the use for biomedical technicians and engineers, examples of some experimental and investigative methods and modern technologies used in physiology and medicine. Lectures contain also problem solving. **F7AMBTANP** Equipment for Anesthesia and Critical Care Basic concept or resuscitation. Importance of circulation, respiration, consciousness and internal environment, their control. Equipment overview, common requirements. Specific requirements for equipment at intensive care units (ICU) and departments of anaesthesia and critical care medicine (ACCM). Blood gases, their measurement and interpretation. Modelling of the fluidic systems, parameters and properties of the fluidic models. Principles and adverse effects of artificial lung ventilation (ALV). Conventional and unconventional lung ventilation, corresponding ventilators. Equipment for anaesthesia. Anaesthetic vaporisers, their thermodynamic principles. Humidification of ventilatory gases. Equipment for monitoring and support of blood circulation. Dilution methods. Bed-side monitors. Other diagnostic and therapeutic equipment at ICU and ACCM. Design of ICU and ACCM.

Name of the block: Compulsory elective courses

Code of the group: F7AMB PV 2S 20

Name of the group: Biomedical and Clinical Engineering compulsory optional course Requirement credits in the group: In this group you have to gain at least 10 credits (at most 18) Requirement courses in the group: In this group you have to complete at least 3 courses (at most 5) Credits in the group: 10

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
F7AMBBLS	Biological Signals Marek Piorecký, Václava Piorecká Václava Piorecká Marek Piorecký (Gar.)	ZK	3	2P	L	S
F7AMBDAE	Design and Ergonomics of the Medical Products Václava Piorecká Václava Piorecká Václava Piorecká (Gar.)	Z	4	4C	L	S
F7AMBKB	Clinical Biochemistry and Laboratory Examination Methods	Z,ZK	4	2P+2L	L	S
F7AMBPOD	Entrepreneurship	KZ	4	2P+2C	L	S
F7AMBTTZS	Television, Termovision and Endoscopy Systems Ji í Hozman, Tomáš D íž al Ji í Hozman Ji í Hozman (Gar.)	Z	3	1P+1L	L	S

Characteristics of the courses of this group of Study Plan: Code=F7AMB PV 2S 20 Name=Biomedical and Clinical Engineering compulsory optional course

F7AMBBLS Biological Signals	ZK	3				
The subject deals with origins and description of the most important electric and non-electric biological signals. The principles of generation, recor	ing and basic prope	erties are studied				
in all the signals. The studied signals involve native and evoked biosignals, including biological signals of the heart, brain, muscles, nervous system, auditory signals, visual system,						
signals from the gastro-intestinal system etc.						
F7AMBDAE Design and Ergonomics of the Medical Products	Z	4				
The subject deals with the following topics - the concept of design and its definition, basic concepts of design theory, design classification, function	of design. Design	as a science,				
design process, design approaches, design methods. Design analysis. Design and marketing, brand policy. Perspective view, geometric forms, pr	blems of shape per	rception and				
composition. Ergonomics - definitions, terms. The role and place of ergonomics in design. Ergonomics in the workplace. Human (patient) - its phy	ical characteristics,	dimensions,				
human body, sensations and perceptions, reflexes, human psychological characteristics, interpersonal relationships, voluntary act, motivation, eff	ciency, work organiz	zation. Handicap.				
Human and medical product. Aids, instruments and tools. Climate conditions. Lighting. Noise. Vibration and shock. Safety. Interior of medical facility	(color, lighting, mat	erials). Universal				
design / Design for all, 7 basic principles. Design of medical devices, principles of design in healthcare.						
F7AMBKB Clinical Biochemistry and Laboratory Examination Methods	Z,ZK	4				
The course deals with the following topics - biochemistry of the human organism, important metabolic and regulatory pathways and disorders of t	iese processes, po	ssibilities of				
diagnosis of these disorders and procedures of relevant laboratory tests, activities of the clinical laboratory, processing of data from methods use	in clinical laborato	ries.				
F7AMBPOD Entrepreneurship	KZ	4				
Students will get a general overview of the company and its key functional areas. Students will be able to identify the elements of success of entro	preneurial ventures	, consider the				
legal and financial conditions for starting a business venture, also evaluate the effectiveness of different entrepreneurial strategies. Finally studen	s will be able to spe	cify the basic				
performance indicators of entrepreneurial activity and explain the importance of marketing and management in businesses. At the end of the cou	se students will inte	erpret their own				
business plan.						
F7AMBTTZS Television, Termovision and Endoscopy Systems	Z	3				
History of television systems. Overview of television systems. Scene representation (linear transformation in 3D space, lens representation as collin	ation, projection). Ir	mage information				
(light, photometry, colorimetry, light sources, vision, quantitative description of image information, image spectrum). Television system. Physical lir	itations of resolutio	n and correlation				
of image characteristics and system characteristics. TV system resolution. Creating video signal. Non-standard TV shooting. Black and white vers	us color TV system.	Application of				
TV imaging systems in medicine. Physical quantities describing radiation and light. Physical laws for heat emitter. Principle of the operation of infrar	ed imaging system a	and its diagnostic				
importance. Specifics of thermal imaging systems. Block diagram. Description of individual blocks and circuits. History of endoscopes. Types of er	doscopes. Fundam	entals of theory				
and practice of optical fibers. Flexible fibroscopes. Flexible video endoscopes. Light sources for flexible endoscopes. Image sensors used for endo	scopes. Image proc	essors. Monitors				
for video endoscopes. Endosonographic systems. Sterilization equipment. Automatic disinfectors for endoscopes. Standard procedures. Possible p	oblems. Capsule in	naging. Principle.				
Block arrangement. Wireless transmission and data processing. Possible complications.						

Code of the group: F7AMB PV 3S 20

Name of the group: Biomedical and Clinical Engineering compulsory optional course Requirement credits in the group: In this group you have to gain at least 11 credits (at most 32) Requirement courses in the group: In this group you have to complete at least 3 courses (at most 9) Credits in the group: 11

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
F7AMBAEM	Electromagnetic Field in Medicine Jan Vrba, David Vrba, Tomáš Pokorný Jan Vrba Jan Vrba (Gar.)	Z,ZK	3	1P+1L	Z	S
F7AMBEKH	Economical-clinical Assessment	Z,ZK	5	2P+2C	Z	S

F7AMBKHZP	Clinical Trials and Assessment of Medical Devices Vojt ch Kamenský	Z,ZK	3	1P+1C	Z	S
F7AMBMTV	Management of Hospital Technical Infrastructure Petr Kudrna	Z,ZK	4	2P+1C	Z	S
F7AMBMTB	Fluid Mechanics in Biomedicine Karel Roubík	Z,ZK	5	2P+1C+1L	Z	S
F7AMBMZOS	Methods and Devices for Processing, Compression and Recording of Image Signal Ji í Hozman, Tomáš D íž al, Marek Novák Tomáš D íž al Tomáš D íž al (Gar.)	Z	3	1P+1C	Z	S
F7AMBPMZD	Advanced Methods of Data Analysis and Processing Marek Piorecký, Václava Piorecká, Jan Štrobl Václava Piorecká Václava Piorecká (Gar.)	ΚZ	3	1P+1C	Z	s
F7AMBRT	Respiratory Care Václav Ort, Lenka Horáková Lenka Horáková	KZ	3	1P+1L	Z	S
F7AMBZMR	Magnetic Resonance Imaging and Electrical Impedance Tomography Tomáš D íž al, David Vrba David Vrba	Z	3	1P+1L	Z	s

Characteristics of the courses of this group of Study Plan: Code=F7AMB PV 3S 20 Name=Biomedical and Clinical Engineering compulsory optional course

F7AMBAEM	Electromagnetic Field in Medicine	Z,ZK	3
The major aim of these	lectures is to explain to students the present and probable future possibilities of microwave medical applications. Biological t	nermal and non-th	ermal effects of
electromagnetic field as	well as safety limits are discussed. Microwave thermotherapy applied to cancer and other diseases is described. Details of mic	crowave thermoth	erapy apparatus
are given, especially fro	m the point of view of applicators for local, intracavitary and regional treatment.		
F7AMBEKH	Economical-clinical Assessment	Z,ZK	5
In this course students	vill learn about the issues of economic and clinical evaluation. Students will theoretically get acquainted with cost analyses a	nd all inputs nece	ssary for their
processing. All knowled	ge will be practically tested on practical examples in the exercises. The final part of the course will be devoted to the field of h	lealth Technology	Assessment
and students will learn p	ractically the structure of studies prepared in the framework of HTA.		
F7AMBKHZP	Clinical Trials and Assessment of Medical Devices	Z,ZK	3
The course focuses on f	he process of clinical evaluation of medical devices when placing a medical device on the market. The course covers theoret	ical and practical	ssues of clinical
trials, clinical evaluation	using literature searches, and preclinical trials.		
F7AMBMTV	Management of Hospital Technical Infrastructure	Z,ZK	4
The aim of the course is	to teach students how to formulate and solve requirements in terms of ensuring the operation of technologies used in health	ncare, explain the	applicable
legislation and manage	heir quality selection and service. In addition, the student will learn the principles of acquiring technologies, both medical and n	on-medical. In pra	ictical exercises,
the learned knowledge	of HB HTA will be verified by creating a simulated example of a healthcare facility to which technologies will be procured. In the	wo term papers, s	tudents first
design the technology to	be acquired using HB HTA and then "tender" it in a selection process.		
F7AMBMTB	Fluid Mechanics in Biomedicine	Z,ZK	5
The course deals with th	e following topics - modelling and measurement of fluid flow in respiratory care and cardiovascular system, creation of models	s of respiratory an	d cardiovascular
system, application of fl	uid mechanics principles in research and development as well as in clinical practice.		
system, application of fl F7AMBMZOS	uid mechanics principles in research and development as well as in clinical practice. Methods and Devices for Processing, Compression and Recording of Image Signal	Z	3
F7AMBMZOS			-
F7AMBMZOS The course deals with the	Methods and Devices for Processing, Compression and Recording of Image Signal	on and representa	ation of digital
F7AMBMZOS The course deals with the images, aliasing, transfe	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization	on and representa	ation of digital s, frame-grabber.
F7AMBMZOS The course deals with the images, aliasing, transfe	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record	on and representa	ation of digital s, frame-grabber.
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record	on and representa	ation of digital s, frame-grabber.
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantizati r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice.	on and representa o signal converters ing standards for i KZ	ation of digital s, frame-grabber. mage recording, 3
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehen	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing	on and representa o signal converters ing standards for i KZ thods and algorith	ation of digital s, frame-grabber. mage recording, 3 mms for biosignal
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehen- processing, analysis and	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Methods	on and representation o signal converters ing standards for i KZ sthods and algorith s. Use of modern	ation of digital s, frame-grabber. mage recording, 3 mms for biosignal spectral analysis
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehen- processing, analysis and methods. Visualisation of	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Met evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis	on and representation o signal converters ing standards for i KZ sthods and algorith s. Use of modern als is discussed. A	ation of digital s, frame-grabber. mage recording, 3 mrs for biosignal spectral analysis Application of
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehene processing, analysis and methods. Visualisation of methods using artificial is	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Me evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis if results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary signal	on and representation o signal converters ing standards for i KZ thods and algorith s. Use of modern als is discussed. A I neural networks	ation of digital s, frame-grabber. mage recording, 3 ams for biosignal spectral analysis application of (ANN). Practical
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehene processing, analysis and methods. Visualisation of methods using artificial is	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization r properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Methods of polycela signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis if results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary sign ntelligence. Methods of automated signal classification - supervised/unsupervised, cluster analysis, learning classifier. Artificia	on and representation o signal converters ing standards for i KZ thods and algorith s. Use of modern als is discussed. A I neural networks	ation of digital s, frame-grabber. mage recording, 3 ams for biosignal spectral analysis application of (ANN). Practical
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehene processing, analysis and methods. Visualisation of methods using artificial i application of biosignal presented. F7AMBRT	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization reproperties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Me d evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis if results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary sign- ntelligence. Methods of automated signal classification - supervised/unsupervised, cluster analysis, learning classifier. Artificia processing. Case studies of ANN application on epileptogenic recordings and neural recordings in general. Genetic algorithm Respiratory Care	on and represent o signal converters ing standards for i KZ thods and algorith s. Use of modern als is discussed. A il neural networks as and simulated KZ	ation of digital s, frame-grabber. mage recording, 3 mms for biosignal spectral analysis Application of (ANN). Practical annealing is 3
F7AMBMZOS The course deals with th images, aliasing, transfe HW and SW for image p specifics for applications F7AMBPMZD This course comprehene processing, analysis and methods. Visualisation of methods using artificial i application of biosignal presented. F7AMBRT	Methods and Devices for Processing, Compression and Recording of Image Signal ne following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization reproperties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video rocessing, compression methods, compression standards, signal recording methods, digital signal recording, selected record is in clinical practice. Advanced Methods of Data Analysis and Processing ds/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Me d evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis if results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary sign- ntelligence. Methods of automated signal classification - supervised/unsupervised, cluster analysis, learning classifier. Artificia processing. Case studies of ANN application on epileptogenic recordings and neural recordings in general. Genetic algorithm	on and represent o signal converters ing standards for i KZ thods and algorith s. Use of modern als is discussed. A il neural networks as and simulated KZ	ation of digital s, frame-grabber. mage recording, 3 mms for biosignal spectral analysis Application of (ANN). Practical annealing is 3
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List of courses of this pass:

Code	Name of the course	Completion	Credits		
17ABOZP	Occupational Safety and Health, Fire Protection and First Aid	Z	0		
F7AMBAEM	Electromagnetic Field in Medicine	Z,ZK	3		
The major aim of the	The major aim of these lectures is to explain to students the present and probable future possibilities of microwave medical applications. Biological thermal and non-thermal effects of				
electromagnetic field as well as safety limits are discussed. Microwave thermotherapy applied to cancer and other diseases is described. Details of microwave thermotherapy apparatus					
	are given, especially from the point of view of applicators for local, intracavitary and regional treatment.				

	Applied Physics	Z,ZK	5
Fundamentals of t	thermodynamics, the kinetic theory of gases. Transport phenomena in gases and in liquids. Electromagnetic field and interaction with	matter. Electronic	structure of
atoms and mole	cules. Physics of low temperatures and superconductivity. Magnetic resonance and its application. Foundations of X-rays diffraction a	and X-ray structure	analysis.
F7AMBAM	Applied Mathematics	KZ	4
	The course deals with the practical applications of mathematics and its demonstration with examples from the field of biomedical en	ngineering.	
F7AMBBB	Biomechanics and Biomaterials	Z,ZK	5
The aim of the c	ourse is to introduce students to the areas of biomechanics. These are circuits of clinical, sports and orthopaedic biomechanics. In pa	articular, the studer	nts will be
	thods of measurement in experimental biomechanics, biomechanics of the musculoskeletal system, assessment of movement in bior		
-	and standing still, assessment of work and performance, force and moment effects, anthropometry, material properties, loading metho		-
	erials, rheological models of tissues. Students will also learn about the areas of orthosis and prosthesis design and ergonomics in relative		
F7AMBBLS	Biological Signals	ZK	3
	with origins and description of the most important electric and non-electric biological signals. The principles of generation, recording an		
In all the signals.	The studied signals involve native and evoked biosignals, including biological signals of the heart, brain, muscles, nervous system, au signals from the gastro-intestinal system etc.	uditory signals, visu	iai system,
		7 71/	F
F7AMBCZS	Digital Signal Processing Is with the following topics - characteristics of signals, linear time invariant systems (LTI), stationary, non-stationary signals, determini	Z,ZK	5
	iption of signals in continuous and discrete domains, A/D conversions and converters, sampling and quantization problems, aliasing a		
-	data preprocessing, fast and discrete Fourier transforms, efficient FFT estimation methods, other discrete transforms: z-transform, its		
	isforms, poles and zeros of the system, frequency response, correlation and convolution, introduction to digital filter design, FIR and I		
	ind spectrum estimation methods, current methods of analysis in time and frequency domain, coherence and phase characteristics, p		
	methods, periodogram and AR spectrum.		F
F7AMBDAE	Design and Ergonomics of the Medical Products	Z	4
	s with the following topics - the concept of design and its definition, basic concepts of design theory, design classification, function of		-
	design approaches, design methods. Design analysis. Design and marketing, brand policy. Perspective view, geometric forms, proble	a a	
	onomics - definitions, terms. The role and place of ergonomics in design. Ergonomics in the workplace. Human (patient) - its physical		
	ations and perceptions, reflexes, human psychological characteristics, interpersonal relationships, voluntary act, motivation, efficiency		
Human and medica	al product. Aids, instruments and tools. Climate conditions. Lighting. Noise. Vibration and shock. Safety. Interior of medical facility (colo	r, lighting, materials	s). Universal
	design / Design for all, 7 basic principles. Design of medical devices, principles of design in healthcare.		
F7AMBDP	Diploma Thesis	Z	30
	rk of the student at the end of the study, when the student has to demonstrate the ability to independently and comprehensively proce	ess the given topic	1
	ired during the study. The student chooses the topic of the thesis from the topics offered by the department that guarantees the study		-
obliged to write the	e thesis at the beginning of the 4th semester. In this semester the thesis is submitted and defended. The student defends his/her thesis	s in front of the SZZ	committee.
This thesis is eval	luated by the supervisor and the opponent according to the ECTS grading scale. Subsequently, the evaluation and the result of the fin	nal state examination	on from the
	thematic areas are included in one final evaluation.		
F7AMBEKH	Economical-clinical Assessment	Z,ZK	5
In this course stud	dents will learn about the issues of economic and clinical evaluation. Students will theoretically get acquainted with cost analyses and	d all inputs necessa	ary for their
processing. All kr	nowledge will be practically tested on practical examples in the exercises. The final part of the course will be devoted to the field of He	ealth Technology As	ssessment
	and students will learn practically the structure of studies prepared in the framework of HTA.		
F7AMBELEG		Z,ZK	5
The course focuses	European Legislation and Management in Health Care s on an overview of legislative regulations in the healthcare sector with a subsequent focus on medical devices. The course will cover t	theoretical and prac	ctical issues
The course focuse of patients' right	European Legislation and Management in Health Care s on an overview of legislative regulations in the healthcare sector with a subsequent focus on medical devices. The course will cover t this in healthcare, ethics in biomedicine, healthcare systems, marketing of medical devices, technical standardization systems and ind	theoretical and prac	ctical issues
The course focuses of patients' righ	European Legislation and Management in Health Care s on an overview of legislative regulations in the healthcare sector with a subsequent focus on medical devices. The course will cover t nts in healthcare, ethics in biomedicine, healthcare systems, marketing of medical devices, technical standardization systems and ind Clinical Biochemistry and Laboratory Examination Methods	theoretical and practical and practical and practical and property products and property products and practical an	ctical issues otection. 4
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F7AMBMTV	Management of Hospital Technical Infrastructure	Z,ZK	4
The aim of the c	ourse is to teach students how to formulate and solve requirements in terms of ensuring the operation of technologies used in health	care, explain the ar	oplicable
legislation and man	age their quality selection and service. In addition, the student will learn the principles of acquiring technologies, both medical and non-	medical. In practica	l exercises,
the learned know	rledge of HB HTA will be verified by creating a simulated example of a healthcare facility to which technologies will be procured. In two	o term papers, stud	dents first
	design the technology to be acquired using HB HTA and then "tender" it in a selection process.		
F7AMBMZOS	Methods and Devices for Processing, Compression and Recording of Image Signal	Z	3
The course deals	with the following topics: general image processing system, basics of image acquisition using image sensors, sampling, quantization	and representation	n of digital
images, aliasing, tra	ansfer properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video sig	inal converters, fran	ne-grabber.
HW and SW for ima	age processing, compression methods, compression standards, signal recording methods, digital signal recording, selected recording s	standards for image	e recording,
	specifics for applications in clinical practice.		
F7AMBPIZ	Methodology of Research and Information Sources	KZ	5
The course deals w	with the following topics: characteristics of research and science, types of research, links to legislation and financial resources, research	ch projects, grant a	applications
and grant process;	basic characteristics and specifics of a scientific text, content of individual sections; publishing practices, publication ethics, citations	sources, information	on sources;
typographi	c rules, mathematical typesetting, text corrections; principles for creating presentations, presentation of results in the form of tables, g	graphs and diagram	ns.
F7AMBPMZD	Advanced Methods of Data Analysis and Processing	KZ	3
This course compre	hends/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Method	ds and algorithms f	or biosignal
processing, analysi	s and evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis. U:	se of modern spect	ral analysis
methods. Visualis	ation of results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary signals	s is discussed. App	lication of
methods using artif	icial intelligence. Methods of automated signal classification - supervised/unsupervised, cluster analysis, learning classifier. Artificial ne	ural networks (ANN	N). Practical
application of bio	signal processing. Case studies of ANN application on epileptogenic recordings and neural recordings in general. Genetic algorithms	and simulated anr	nealing is
	presented.		
F7AMBPOD	Entrepreneurship	KZ	4
Students will get a	a general overview of the company and its key functional areas. Students will be able to identify the elements of success of entrepren	eurial ventures, co	nsider the
legal and financia	I conditions for starting a business venture, also evaluate the effectiveness of different entrepreneurial strategies. Finally students will	be able to specify	the basic
performance indic	ators of entrepreneurial activity and explain the importance of marketing and management in businesses. At the end of the course stu	udents will interpre	t their own
	business plan.		
F7AMBRT	Respiratory Care	KZ	3
The aim of the cour	se is to provide students with a comprehensive knowledge of the technical provision of respiratory therapy, current protective ventilation	on modes and tech	niques and
unconventional tec	hniques of artificial lung ventilation. Attention is also given to monitoring artificial pulmonary ventilation and the use of respiratory sys	tem models in vent	tilators and
	ventilation monitors.		
F7AMBSDP	Diploma Seminar	Z	4
The diploma sem	inar serves as a support for the start of work on the diploma thesis. During the semester, students present the intended aims and me	thods of their thesi	s and the
	partial results of their work.		
F7AMBSF	Systemic Physiology	Z,ZK	5
The course deals	with the following themes: functional organisation of living systems, basic concepts of system approach to integrated functions of the l	human organism, i	mportance
of systems offerin	g the use for biomedical technicians and engineers, examples of some experimental and investigative methods and modern technolo	ogies used in physi	ology and
	medicine. Lectures contain also problem solving.		
F7AMBSPMM	Software for Mathematical Modeling	Z,ZK	5
F7AMBTANP	Equipment for Anesthesia and Critical Care	Z,ZK	5
Basic concept or	resuscitation. Importance of circulation, respiration, consciousness and internal environment, their control. Equipment overview, com	mon requirements	. Specific
requirements for	equipment at intensive care units (ICU) and departments of anaesthesia and critical care medicine (ACCM). Blood gases, their meas	surement and interr	pretation.
Modelling of the fl	uidic systems, parameters and properties of the fluidic models. Principles and adverse effects of artificial lung ventilation (ALV). Conv	entional and uncor	nventional
lung ventilation,	corresponding ventilators. Equipment for anaesthesia. Anaesthetic vaporisers, their thermodynamic principles. Humidification of ventil	latory gases. Equip	ment for
monitoring and	d support of blood circulation. Dilution methods. Bed-side monitors. Other diagnostic and therapeutic equipment at ICU and ACCM. D	esign of ICU and A	CCM.
F7AMBTTZS	Television, Termovision and Endoscopy Systems	Z	3
History of television	systems. Overview of television systems. Scene representation (linear transformation in 3D space, lens representation as collineation,	projection). Image	information
(light, photometry, o	colorimetry, light sources, vision, quantitative description of image information, image spectrum). Television system. Physical limitation	is of resolution and	correlation
	ristics and system characteristics. TV system resolution. Creating video signal. Non-standard TV shooting. Black and white versus co		
	s in medicine. Physical quantities describing radiation and light. Physical laws for heat emitter. Principle of the operation of infrared ima		٠ •
	ics of thermal imaging systems. Block diagram. Description of individual blocks and circuits. History of endoscopes. Types of endosco		-
	cal fibers. Flexible fibroscopes. Flexible video endoscopes. Light sources for flexible endoscopes. Image sensors used for endoscope	0 1	
tor video endoscop	es. Endosonographic systems. Sterilization equipment. Automatic disinfectors for endoscopes. Standard procedures. Possible problem	is. Capsule imaging	g. Principle.
	Block arrangement. Wireless transmission and data processing. Possible complications.	r	
F7AMBZMR	Magnetic Resonance Imaging and Electrical Impedance Tomography	Z	3
The course deals w	vith the following topics: nuclear magnetic resonance and electrical impedance tomography, theoretical foundations, principles of image	ging methods and	their use in
	clinical practice with respect to the limitations of technical parameters.		

For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2025-06-01, time 17:12.