Recomended pass through the study plan

Name of the pass: Biomedical and Clinical Engineering 20/21, 21/22, 22/23, 23/24, 24/25, 25/26

Faculty/Institute/Others:

Department:

Pass through the study plan: Biomedical and Clinical Engineering

Branch of study guranteed by the department: Welcome page

Guarantor of the study branch:

Program of study: Biomedical and Clinical Engineering

Type of study: Follow-up master full-time

Note on the pass: Information on prescribed minimum number of compulsory optional (PV) subjects for each specific semester can be found in the relevant study plan of the study programme.

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 semes	ster: 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
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.)	КZ	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 Martin Otáhal Matej Daniel (Gar.)	Z,ZK	5	2P+2L	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
F7AMBMPV	Mathematical Methods in Research Jakub Ráfi Jakub Ráfi Karel Roubík (Gar.)	Z,ZK	6	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

Number of semes	ster: 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
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 D íž al Martin Rožánek Martin Rožánek (Gar.)	Z,ZK	5	2P+2C	L	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
F7AMBBLS	Biological Signals Václava Piorecká, Marek Piorecký 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	κz	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

Number of seme	ster: 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
F7AMBCZS	Digital Signal Processing Václava Piorecká, Marek Piorecký, Jan Štrobl Václava Piorecká Václava Piorecká (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBSDP	Diploma Seminar Jakub Ráfl Martin Rožánek Martin Rožánek (Gar.)	Z	4	4C	Z	Z
F7AMBSPMM	Software for Mathematical Modeling Bartolom j Biskup Bartolom j Biskup Bartolom j Biskup (Gar.)	Z,ZK	5	2P+2C	Z	Z
F7AMBTANP	Equipment for Anesthesia and Critical Care Karel Roubík, Václav Ort Jakub Ráfl Karel Roubík (Gar.)	Z,ZK	5	2P+2L	Z	Z
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 Václava Piorecká, Marek Piorecký, Jan Štrobl Václava Piorecká Václava Piorecká (Gar.)	КZ	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

Number of semes	ster: 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
F7AMBDP	Diploma Thesis Jakub Ráfl, Jan Vrba Jakub Ráfl	Z	30	364ZP	L	Z

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

List of courses of this pass:

Code	Name of the course		Credits			
17ABOZP	OZP Occupational Safety and Health, Fire Protection and First Aid					
F7AMBAEM	Electromagnetic Field in Medicine	Z,ZK	3			
The major aim of th	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.					
F7AMBAF	AF Applied Physics		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	KZ	4			
	The course deals with the practical applications of mathematics and its demonstration with examples from the field of biomedical engineering.					

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 bior	nechanics. In particula	r, the studen	ts will be			
introduced to methods of measurement in experimental biomechanics, biomechanics of the musculoskeletal system, assessment of m	ovement in biomecha	nics and reha	bilitation,			
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 erg	onomics in relation to	biomechanie	cs.			
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 generati	on, recording and bas	c properties	are studied			
in all the signals. The studied signals involve native and evoked biosignals, including biological signals of the heart, brain, muscles, nerv	ous system, auditory	signals, visua	al system,			
signals from the gastro-intestinal system etc.						
F7AMBCZS Digital Signal Processing		Z.ZK	5			
The course deals with the following topics - characteristics of signals, linear time invariant systems (LTI), stationary, non-stationary sig	gnals, deterministic, ei	godic and st	ochastic			
processes, description of signals in continuous and discrete domains, A/D conversions and converters, sampling and quantization prol	lems, aliasing and Ny	quist's theore	em, noise			
suppression and data preprocessing, fast and discrete Fourier transforms, efficient FFT estimation methods, other discrete transforms:	z-transform, its proper	ties and appl	lications in			
DSP, inverse transforms, poles and zeros of the system, frequency response, correlation and convolution, introduction to digital filter de	esign, FIR and IIR filte	rs and adapt	ive filters,			
spectral analysis and spectrum estimation methods, current methods of analysis in time and frequency domain, coherence and phase c	haracteristics, parame	tric and non-	parametric			
methods, periodogram and AR spectrum.						
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 classificat	ion, function of design	. Design as a	science,			
design process, design approaches, design methods. Design analysis. Design and marketing, brand policy. Perspective view, geometr	ic forms, problems of	shape percep	otion and			
composition. Ergonomics - definitions, terms. The role and place of ergonomics in design. Ergonomics in the workplace. Human (patient	nt) - its physical chara	cteristics, dim	nensions,			
human body, sensations and perceptions, reflexes, human psychological characteristics, interpersonal relationships, voluntary act, motiv	ation, efficiency, work	organization	. Handicap.			
Human and medical product. Aids, instruments and tools. Climate conditions. Lighting. Noise. Vibration and shock. Safety. Interior of medi	cal facility (color, lighti	ng, materials). Universal			
design / Design for all, 7 basic principles. Design of medical devices, principles of design in healt	hcare.					
F7AMBDP Diploma Thesis		Ζ	30			
Independent work of the student at the end of the study, when the student has to demonstrate the ability to independently and compre	hensively process the	given topic u	using the			
knowledge acquired during the study. The student chooses the topic of the thesis from the topics offered by the department that guarantee to the topics offered by the department that guarantee to the topic of the thesis from the topics offered by the department that guarantee to the topic of the topics of topics of topics of topics of the topics of	intees the study progr	amme. The s	tudent is			
obliged to write the thesis at the beginning of the 4th semester. In this semester the thesis is submitted and defended. The student defended	Is his/her thesis in fror	nt 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 stat	e examinatio	n from the			
thematic areas are included in one final evaluation.						
Economical-clinical Assessment		Z,ZK	5			
In this course students will learn about the issues of economic and clinical evaluation. Students will theoretically get acquainted with co	st analyses and all inp	outs necessai	ry for their			
processing. All knowledge will be practically tested on practical examples in the exercises. The final part of the course will be devoted to	o the field of Health Te	chnology As	sessment			
and students will learn practically the structure of studies prepared in the framework of HIA						
European Legislation and Management in Health Care		Z,ZK	5			
The course tocuses on an overview of legislative regulations in the healthcare sector with a subsequent focus on medical devices. The co	urse will cover theoret	ical and prac	tical issues			
of patients' rights in healthcare, ethics in biomedicine, healthcare systems, marketing of medical devices, technical standardization s	ystems and industrial	property pro	tection.			
F/AMBKB 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 d	isorders of these proc	esses, possil	oilities of			
diagnosis of these disorders and procedures of relevant laboratory tests, activities of the clinical laboratory, processing of data fro	n methods used in cil		ories.			
Clinical Irials and Assessment of Medical Devices		Z,ZK	3			
The course focuses on the process of clinical evaluation of medical devices when placing a medical device on the market. The course co	vers theoretical and p	ractical issue	s of clinical			
EZAMPLET		7 71/	F			
F7AWDLP1 Wedical Devices and Equipment		Z,ZN	C bo cource			
The course develops the initial knowledge in the herd of biophysics and number physiology and applies it to the products of instrumental deals with the principles of operation and current possibilities of technology in medicine. The course to be sufficient for understa	nding and mastering t	ho issues in s				
deals with the principles of operation and earlier possibilities of technology in mediate. The contents chosen to be subject to deal under state of the principles of operational devices including and evaluation of vital functions therapolitic devices including and evaluation of vital functions.	equipment for specia	lized denartr	nents such			
as ICU operating rooms etc.						
EZAMBLZS		7 7K	5			
TRIVIDEZO TRIVID	laced on the technical	$\Delta, \Delta R $	J he devices			
on the possibilities and limitations of individual modalities. The issue of image reconstruction in tomographic imaging systems	stems will also be add	ressed	10 001000,			
E7AMBMAR Measurement and Control in Biomedicine		7 7K	5			
The course deals with the following topics - measurement of electrical and non-electrical quantities using conventional laboratory instru	nents_industrial_A/D_c	∠,∠ı (onverters an	d diaitizina			
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 of	n camera sve	stems and			
standards, and the basics of image recognition, control will include the fundamentals of automation, design of state and sequential auto	mata, addressing trar	sport delay a	and design			
of threshold and proportional controllers, demonstrations on biomedical applications, and new trends in measurement, control and auto	mation using FPGA a	nd real-time	gate array			
technology.	Ū					
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, biophysi	cal and other	studies,			
methods of descriptive and inductive statistics, statistical epidemiological methods, hypothesis testing, group comparison (parametric and	non-parametric metho	ds), ANOVA,	correlation			
and simple regression analysis, multivariate regression models, multivariate linear models, logistic regression, discriminant analysis, s	urvival analysis etc., n	nodel calcula	tions and			
interpretation of results.						
F7AMBMTB Fluid Mechanics in Biomedicine		Z,ZK	5			
The course deals with the following topics - modelling and measurement of fluid flow in respiratory care and cardiovascular system, creati	on of models of respira	atory and car	diovascular			
system, application of fluid mechanics principles in research and development as well as in clinical	practice.	-				
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 technologie	s used in healthcare.	explain the ac	plicable			
legislation and manage their quality selection and service. In addition, the student will learn the principles of acquiring technologies, both m	edical and non-medic	al. In practica	l 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 two term	papers, stud	ents first			
design the technology to be acquired using HB HTA and then "tender" it in a selection process	SS					

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, transfer properties of the imaging system, color image acquisition, overview of image formats, digitizing rasters, video signal, A/D video signal converters, frame-grabber.						
HW and SW for image processing, compression methods, compression standards, signal recording methods, digital signal recording, selected recording standards for image recording,						
specifics for applications in clinical practice.						
F7AMBPIZ Methodology of Research and Information Sources	KZ	5				
The course deals with the following topics: characteristics of research and science, types of research, links to legislation and financial resources, resear	ch projects, grant a	pplications				
and grant process; basic characteristics and specifics of a scientific text, content of individual sections; publishing practices, publication ethics, citations	sources, informatio	on sources;				
typographic rules, mathematical typesetting, text corrections; principles for creating presentations, presentation of results in the form of tables,	graphs and diagram	ns.				
F7AMBPMZD Advanced Methods of Data Analysis and Processing	KZ	3				
This course comprehends/deals methods of biosignal generation, biosignal acquisition and basic parameters of biosignals required for diagnostics. Metho	ds and algorithms fo	or biosignal				
processing, analysis and evaluation used for biological signals, mainly electrophysiological signals. Preprocessing, filtering, time and frequency analysis. U	se of modern spect	ral analysis				
methods. Visualisation of results, topographic mapping, method of compressed spectral arrays (CSA). Adaptive segmentation of non-stationary signal	s is discussed. App	lication of				
methods using artificial intelligence. Methods of automated signal classification - supervised/unsupervised, cluster analysis, learning classifier. Artificial ne	ural networks (ANN	I). Practical				
application of biosignal 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 general overview of the company and its key functional areas. Students will be able to identify the elements of success of entreprer	eurial ventures, co	nsider the				
legal and financial conditions for starting a business venture, also evaluate the effectiveness of different entrepreneurial strategies. Finally students will	I be able to specify	the basic				
performance indicators of entrepreneurial activity and explain the importance of marketing and management in businesses. At the end of the course st	udents will interpret	t their own				
business plan.						
F7AMBRT Respiratory Care	KZ	3				
The aim of the course is to provide students with a comprehensive knowledge of the technical provision of respiratory therapy, current protective ventilati	on modes and tech	niques and				
unconventional techniques of artificial lung ventilation. Attention is also given to monitoring artificial pulmonary ventilation and the use of respiratory sys	tem models in vent	ilators and				
ventilation monitors.						
F7AMBSDP Diploma Seminar	Z	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 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	human organism, ii	mportance				
of systems offering the use for biomedical technicians and engineers, examples of some experimental and investigative methods and modern technolo	ogies used in physic	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, con	mon requirements.	. Specific				
requirements for equipment at intensive care units (ICU) and departments of anaesthesia and critical care medicine (ACCM). Blood gases, their measurements	surement and interp	pretation.				
Modelling of the fluidic 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 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, colorimetry, light sources, vision, quantitative description of image information, image spectrum). Television system. Physical limitation	is of resolution and	correlation				
of image characteristics and system characteristics. TV system resolution. Creating video signal. Non-standard TV shooting. Black and white versus co	lor TV system. App	lication of				
TV imaging systems in medicine. Physical quantities describing radiation and light. Physical laws for heat emitter. Principle of the operation of infrared imagination and light.	ging system and its	diagnostic				
importance. Specifics of thermal imaging systems. Block diagram. Description of individual blocks and circuits. History of endoscopes. Types of endosco	opes. Fundamental	s of theory				
and practice of optical fibers. Flexible fibroscopes. Flexible video endoscopes. Light sources for flexible endoscopes. Image sensors used for endoscopes. Image processors. Monitors						
for video endoscopes. Endosonographic systems. Sterilization equipment. Automatic disinfectors for endoscopes. Standard procedures. Possible problems. Capsule imaging. Principle.						
Block arrangement. Wireless transmission and data processing. Possible complications.						
F7AMBZMR Magnetic Resonance Imaging and Electrical Impedance Tomography	Z	3				
The course deals with the following topics: nuclear magnetic resonance and electrical impedance tomography, theoretical foundations, principles of ima						
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For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2025-05-11, time 17:18.