Study plan

Name of study plan: Biomedical Technology

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Biomedical Technology

Type of study: Bachelor full-time

Required credits: 180 Elective courses credits: 0 Sum of credits in the plan: 180

Note on the plan:

Name of the block: Compulsory courses Minimal number of credits of the block: 170

The role of the block: Z

Code of the group: F7ABB POV 20

Name of the group: Biomedical Technology compulsory course

Requirement credits in the group: In this group you have to gain 170 credits

Requirement courses in the group: In this group you have to complete 56 courses

Credits in the group: 170

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
F7ABBALP	Algorithmic and Programming Theory Lenka Hanáková, Pavel Smr ka, Tomáš Veselý, Christiane Malá Pavel Smr ka Pavel Smr ka (Gar.)	KZ	4	2P+2C	Z	Z
F7ABBAF1	Anatomy and Physiology I. Anastasiya Lahutsina, Ksenia Sedova Ksenia Sedova (Gar.)	Z,ZK	4	2P+1C+1L	. Z	Z
F7ABBAF2	Anatomy and Physiology II. Anastasiya Lahutsina, Ksenia Sedova, Anastasia Sedova Anastasiya Lahutsina Ksenia Sedova (Gar.)	Z,ZK	4	2P+1C+1L	. L	Z
F7ABBA3A	English Language IIIA (part 1) Eva Moty ková Eva Moty ková Eva Moty ková (Gar.)	KZ	2	2C	Z	Z
F7ABBA3B	English Language IIIB (part 2) Eva Moty ková Eva Moty ková Eva Moty ková (Gar.)	KZ	2	2C	L	Z
F7ABBBP	Bachelor Thesis Jií Hozman Jií Hozman Jií Hozman (Gar.)	Z	6	8C	L	Z
17ABOZP	Occupational Safety and Health, Fire Protection and First Aid Petr Kudrna Petr Kudrna (Gar.)	Z	0	1P	Z	Z
F7ABBBCH	Biochemistry Martina Turchichová, Anna Ludvíková Anna Ludvíková Martina Turchichová (Gar.)	Z,ZK	2	1P+1L	Z	Z
F7ABBBLS	Biological Signals Václava Piorecká, Marek Piorecký Václava Piorecká Václava Piorecká (Gar.)	Z,ZK	4	2P+2L	L	Z
F7ABBBLG	Biology Veronika Vym talová Veronika Vym talová (Gar.)	Z,ZK	4	2P+2L	Z	Z
F7ABBBB	Biomechanics and Biomaterials Matej Daniel, Petr Volf Petr Volf Matej Daniel (Gar.)	Z,ZK	4	2P+2L	Z	Z
F7ABBBOZP	Safety Regulations and Standards in Electrical Engineering Petr Kudrna Petr Kudrna (Gar.)	Z	1	1P	Z	Z
F7ABBCHM	Chemistry Iveta Horá ková, Libor Holík Iveta Horá ková	Z,ZK	4	2P+1C+1L	. L	Z
F7ABBEM	Electrical Measurements Jan Vrba, Roman Mat jka Jan Vrba Jan Vrba (Gar.)	Z,ZK	4	2P+2C	Z	Z
F7ABBELF	Electrophysiology Ksenia Sedova, Anastasia Sedova Anastasia Sedova (Gar.)	Z,ZK	2	1P+1L	Z	Z
F7ABBEO	Electronic Circuits Pavel Máša, Tomáš D íž al, Ond ej Fišer Ond ej Fišer Pavel Máša (Gar.)	Z,ZK	4	2P+2C	Z	Z

F7ABBEBI	Ethics in Biomedical Engineering Václav Navrátil Václav Navrátil Martina Dingová Šliková (Gar.)	ZK	2	2P	L	Z
F7ABBESP	Management of Health Care Technology Ji í Hozman Ji í Hozman (Gar.)	Z,ZK	2	1P+1C	L	Z
F7ABBFY1	Physics I. Jan Mikšovský, Petr Písa ík Petr Písa ík Jan Mikšovský (Gar.)	Z,ZK	4	2P+1C+1L	Z	Z
F7ABBFY2	Physics II. Jan Mikšovský Petr Písa ík Jan Mikšovský (Gar.)	Z,ZK	6	2P+2C+2L	L	Z
F7ABBFCH	Physical Chemistry Libor Holik, Karel Roubík Karel Roubík (Gar.)	Z,ZK	4	2P+1C+1L	Z	Z
F7ABBHE	Hygiene and Epidemiology Anastasia Sedova Anastasia Sedova Emil Pavlík (Gar.)	ZK	1	1P	L	Z
F7ABBISZ	Information Systems in Health Care Zoltán Szabó, David Jirsa Zoltán Szabó Zoltán Szabó (Gar.)	Z,ZK	4	2P+2C	Z	Z
F7ABBITP	Integral Calculus Ji í Neustupa, Tomáš Parkman, Lukáš Liebzeit Tomáš Parkman Tomáš Parkman (Gar.)	Z,ZK	4	2P+2C	L	Z
F7ABBKT	Communication Technology Christiane Malá, Martin Vít zník, Karel Hána, Jan Mužík, Tomáš Funda Karel Hána Karel Hána (Gar.)	Z,ZK	2	1P+1C	Z	Z
F7ABBKZS	Conventional Imaging Systems Ji í Hozman, Tomáš D íž al, Martin Rožánek, Martin apek Ji í Hozman Ji í Hozman (Gar.)	Z,ZK	4	2P+1C+1L	L	Z
F7ABBLT	Clinical Laboratory Instrumentation Martina Turchichová Martina Turchichová (Gar.)	Z,ZK	4	2P+2L	L	Z
F7ABBLPZ1	Medical Devices and Equipment I. (Diagnostic Devices) Petr Kudrna, Karel Roubík, Martin Rožánek Petr Kudrna Martin Rožánek (Gar.)	Z,ZK	4	2P+2L	Z	z
F7ABBLPZ2	Medical Devices and Equipment II. (Therapeutical Devices) Petr Kudrna, Václav Ort, Ladislav Bis Petr Kudrna Petr Kudrna (Gar.)	Z,ZK	2	1P+1L	L	Z
F7ABBLAD	Linear Algebra and Differential Calculus Ji í Neustupa, Tomáš Parkman, Petr Maršálek Tomáš Parkman Tomáš Parkman (Gar.)	Z,ZK	6	2P+4C	Z	Z
F7ABBMAZ	Management and Admininistration in Health Care Václav Navrátil Václav Navrátil Václav Navrátil (Gar.)	KZ	1	1P	Z	Z
F7ABBMEC	Mechanics Matej Daniel, Tomáš Goldmann Matej Daniel Matej Daniel (Gar.)	Z,ZK	4	2P+2L	L	Z
F7ABBMT	Medical Terminology Václav Navrátil Václav Navrátil (Gar.)	Z	1	1C	Z	Z
F7ABBMVP	Research Methodology Marek Novák, Jakub Ráfl Jakub Ráfl (Gar.)	KZ	2	1P+1C	Z	Z
F7ABBMS	Modelling and Simulation Václav Petrák Václav Petrák (Gar.)	Z,ZK	4	2P+2C	L	Z
F7ABBNMP	Project Proposal and Management Václav Bláha Václav Bláha Václav Bláha (Gar.)	KZ	2	1P+1C	L	Z
F7ABBOIZ	Protection Against Ionizing Radiation Tomáš Veselský Tomáš Veselský Jana Hudzietzová (Gar.)	ZK	2	2P	L	Z
F7ABBPPS	Patient and Device Simulators and Testers Petr Kudrna, Martin Rožánek, Lenka Horáková Petr Kudrna Petr Kudrna (Gar.)	Z,ZK	2	1P+1L	Z	z
F7ABBPPM1	Programming in Matlab I. Christiane Malá Radim Krupi ka Christiane Malá (Gar.)	KZ	1	1C	Z	Z
F7ABBPPM2	Programming in Matlab II. Christiane Malá Radim Krupi ka Radim Krupi ka (Gar.)	KZ	2	2C	L	Z
F7ABBPNK	Design and Construction of Medical Devices/Practical Exercises Roman Mat jka, Jana Mat jková Roman Mat jka Roman Mat jka (Gar.)	KZ	4	4L	Z	z
F7ABBPMS	Probability and Mathematical Statistics Marek Piorecký, Jan Štrobl, Michaela Mrázková, Filip erný Michaela Mrázková Marek Piorecký (Gar.)	Z,ZK	4	2P+2C	Z	Z
F7ABBPP	First Aid Martin Stan k Martin Stan k Martin Stan k (Gar.)	KZ	2	1P+1C	L	Z
F7ABBPSL	Psychology Olga Shivairová Olga Shivairová (Gar.)	KZ	2	1P+1C	Z	Z
F7ABBROP	Guided Practical Training Petr Kudrna Petr Kudrna (Gar.)	Z	2	80XH	L	Z
F7ABBSPR1	Semestral Project I. Petr Kudrna Petr Kudrna (Gar.)	KZ	1	1C	L	Z
F7ABBSPR2	Semestral Project II. Petr Kudrna Petr Kudrna (Gar.)	KZ	4	4C	Z	Z
F7ABBSBP	Bachelor Thesis Seminar Ji í Hozman Ji í Hozman (Gar.)	Z	1	1C	L	Z
F7ABBSM	Sensors in Medicine David Vrba, Tomáš Pokorný, Jan Rédr David Vrba David Vrba (Gar.)	Z,ZK	4	2P+2L	L	Z
F7ABBSEL	Power Engineering Ji í Hozman, David Vrba, Ond ej Fišer, Marek Novák David Vrba David Vrba (Gar.)	Z,ZK	5	2P+3L	L	Z

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*** (**PABBLIS***) *** ***	F7ABBTEL	Pavel Máša, Tomáš Díž al, Marek Novák Tomáš Díž al Pavel Máša	Z,ZK	4	2P+2C	L	Z
FrankBuls Introduction to Signals and Systems C.ZK 4 2P42C Z Z Z Z Z Z Z Z Z	F7ABBTZS	Ji í Hozman, Tomáš D íž al, Martin Rožánek, Evgeniia Karnoub Martin	Z,ZK	4	2P+1C+1L	Z	Z
Recreated Backer Richard Backer Richard Backer (Season Use) Explicit Common Health Care and Technical Standards KZ 2 1P+1C Z 2 2 2 2 3 3 3 3 3 3	F7ABBUSS	Introduction to Signals and Systems	Z,ZK	4	2P+2C	Z	Z
Instruction	F7ABBZP		ZK	2	2P	L	Z
FABBALP Algorithmic and Programming Theory KZ 4 systems, designed that survives Isunffillers, data bytes assignment staturent, cycles. Arithmetical and logical operators. Digital representation of numbers, numeration systems, introduction to structured programming in C language. Full ding and structure of simple programs, creating of the user functions, user input and output, (the management, programming in C language). Full ding and structure of simple programs, creating of the user functions, user input and output, (the management, programment produces and the singuishmens for Campuage Recursive and theseive membods, measured by Abstract distalts, pages, data sorting and searching, implementation of basic numerical algorithms. Introduction to bitimedical data processing - programmens view, introduction to software engineers. ARBART Anatomy and Physiology I. Developed Physiology I. Provided the Physiology I. Provided in the program of the software of particular organs and their systems. **TABBARA** Anatomy and Physiology II limits to Anatomy and	F7ABBZLN		KZ	2	1P+1C	Z	Z
Signation, Antis attractures. Identifiers, data byses, assignment statement, conditional statements, cystes. Authinistical and biglest operations. Displatal preligentation of numbers, numerison systems. Principlical overview of programming to Clanguage, exclusioning and extendition, presenting algorithm quality. Abstrant distance, exemption the advantage of programment velocities overview of programment predictions to subnavare response to the programment velocities of programments. Velocities of programments of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments. Velocities of programments of programments of programments of programments of programments of programments. Velocities of programments of prog	Characteristics of the	courses of this group of Study Plan: Code=F7ABB POV 20 Na	me=Biomed	ical Tech	nology co	ompulso	ry course
years, data sorting and searching, implementation of basic numerical algorithms, Introduction to biomedical data processing - programmen view. Introduction to software engineering 7-7ABBAF1 Anatomy and Physiology II. **RabaF2 National Physiology II.** Anatomy and Physiology II.** Solidary and physiology II this to Anatomy and Physiology II.** Solidary and physiology II this to Anatomy and Physiology II.** Solidary and physiology III.** Solidary and physiology III.** Solidary and physiology II.** Solidary and physiology III.** S	Algorithm, data structures. Ide systems. Introduction to structures.	entifiers, data types. assignment statement, conditional statement, cycles. Arithmetical a ctured programming in C language - building and structure of simple programs, creatin	g of the user fun	ctions, user	representation	on of number tput, file ma	ers, numeration anagement,
FABBAFI Anatomy and Physiology I lowers functional aspects of particular organs and their systems. FABBAFE Anatomy and Physiology II links to Anatomy and Physiology II be subject covers functional aspects of particular organs and their systems. FABBASA English Language IIIA (part 1) The aim of the course is to increase students' language competence in acidemic English and professional vocabulary, along with common communication skills. Students about to the town of the course is to increase students' language competence in acidemic English and professional vocabulary, along with common communication skills. Students about to the town of the course is to increase students' language competence in acidemic English and professional vocabulary, along with common communication skills. Students about to the town of the course is to increase students' language competence in acidemic English and professional vocabulary, along with common communication skills. Students about the town of the course is to increase students are professional vocabulary, along with common communication skills. Students are subjected to a second student professional vocabulary, along with common communication skills. Students are subjected to the course of the students of	, ,						
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valuations and physiology II links to Anatomy and Physiology I. The subject covers functional aspects of particular organs and their systems. 7ABBASA English Language IIIA (gart 1) 1 and the course is to increase students' language competence in academic English and professional vocabulary, along with common communication skills. Students should be belie to work actively with academic Lext, undestand and be able to use basic terminology and be aware of the different stylistic levels of English and the associated syntactic and students' language IIIB (part 2) 7ABBASB English Language IIIB (part 2) 8 English Language IIIB (part 2) 9 English	Anatomy and physiology I co	vers functional aspects of particular organs and their systems.				'	
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FABBA3 English Language IIIB (part 2) eaching scivities in the summer sensester are project-based. Z 2 eaching scivities in the summer sensester are project-based. Z 6 Eaching Scivities Scivi	•	ademic text, understand and be able to use basic terminology and be aware of the diffe	erent stylistic leve	els of Englis	h and the ass	ociated sy	ntactic and
isaching activities in the summer semester are project-based. **TABBBP** Bachelor Thesis ABBP** Bachelor Thesis ABBBCH** Bachelor thesis delended at the end of bachelor studies. Topics are selected during the 5th term from a list. Bachelor thesis is defended at the end of the examination period. Bachelor hesis delence is a part of the state exam. Bachelor thesis can be written and defended either Czech or English. Students are supervised by a tutor during the above mentioned process. The process of the control of the part of the state exam. Bachelor thesis can be written and defended either Czech or English. Students are supervised by a tutor during the above mentioned process. Part of things systems. The interpretation goes through the basic building structures of biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems. The interpretation goes through the basic building structures of biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems. The interpretation goes through the basic building structures of biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids acids, microbandiary systems, liquids, proteins in the singuists. The studied signals in work parts acids acids acids acids acids aci		alich Language IIIR (part 2)				(7	2
Individual student projects at the end of backbor studies. Topics are selected during the 5th term from a list. Bachbor thesis is defended at the end of the examination period. Bachbor besis defence is a part of the state exam. Bachbor thesis can be written and defended either Czech or English. Students are supervised by a tutor during the above mentioned process. 17ABOZP Occupational Safety and Health, Fire Protection and First Aid. Z	-				,	\Z	2
hesis defence is a part of the state exam. Bachetor thesis can be written and defended either Czech of English. Students are supervised by a tutor during the above mentioned process. I/ABOZP Occupational Safety and Health, Fire Protection and First Aid Z						Z	6
International Safety and Health, Fire Protection and First Aid Z Q							
Dischemistry Dischemistry Dischemistry Dischemistry Dischemistry Diving systems. The interpretation goes through the basic of Biochemistry. The course builds on the knowledge gained in general chemistry and extends this knowledge about the chemistry in fiving systems. The interpretation goes through the basic building structures of biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological nembranes and molecular genetics to the most important metabolic processes. Particular attention is paid to the aspects necessary for understanding the methods of work in the solichemical adminical laboratory, which are part of the follow-up chemical discipline. The laboratories are focused on bronging the topics discussed in the lectures and their practical raining, aspecially on the determination of biomolecules and the verification of their properties. Students should become familiar with the basic laboratory techniques of Biochemistry, and the subject deals with origins and description of the most important electric and non-electric biological signals. The principles of generation, recording and basic properties are studied at 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, alignals from the gastor-intestinal system etc. Advanced methods of digital biosignal processing. Passet of the standard of the studies of the studies of the studies of the studies of artificial intelligence, features extraction, automatic absolitation, graphic presentation of results. Adaptive segmentation, artificial neural networks for signal processing. Passet incommerbrane spatters are displayed and the cellular level of organisms - from acetular through prokaryotic to eukaryotic. The viruses. Prokaryotic cells. Bacterial Bacterial diseases and their control. Eukaryotic cells. Plant and animal cell structure and function. Structure and conformation of biopolymers (ents are supervi	sed by a tuto			
Pourse participants will be introduced to the basics of Biochemistry. The course builds on the knowledge gained in general chemistry and extends this knowledge about the chemistry in fiving systems. The interpretation goes through the basic building structures of biological systems (amino acids, peptides, proteins, lipids, carbohydrates, nucleic acids), biological rembranes and molecular genetics to the most important metabolic processes. Particular attention is paid to the aspects necessary for understanding the methods of work in the inchemical and clinical laboratory, which are part of the follow-up chemical discipline. The laboratories are focused on broadening the topics discussed in the lectures and their practical arising, especially on the determination of biomolecules and the verification of their properties. Students should become familiar with the basic laboratory techniques of Biochemistry. FABBBLS Biological Signals B		•					
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Frabbble Biological Signals Biological Signals The subject deals with origins and description of the most important electric and non-electric biological signals. The principles of generation, recording and basic properties are studies all the signals. The studied signals involve native and evoked biosignals, including biological signals of the heart, brain, muscles, nervous systems, auditory signals, visual system, all the signals. The studied signals involve native and evoked biosignals processing, spectrum analysis, modern methods of artificial intelligence, leatures extraction, automatic lassification, graphic presentation of results. Adaptive segmentation, artificial neural networks for signal processing. F7ABBBLG Biology Z,ZK 4 Basic information about the cellular level of organisms - from acelullar through prokaryotic to eukaryotic. The viruses. Prokaryotic cells. Bacteria. Bacterial diseases and their control. Eukaryotic cells. Plant and animal cell structure and function. Structure and conformation of biopolymers (nucleid acids and proteins). The nucleus, plastists, mitochondria. Cytoplasm: indomembrane system: endoplasmic reticulum, the Golgi apparatus, lysosomes, vacuoles. Semiautonomic organelles: mitochondria, sites of respiration and chloroplasts, sites of intotesynthesis. The origin of eukaryoties: endosymbiotic hypothesis. Ribosomes. The cytoskeleton: microtubules, microfilaments. The cell cycle: mitotic (M) phase and interphase (G1 and C2 phases). The division of cell nucleus - amitosis, mitosis, phases of mitosis, the mitotic spindle; meiosis. The cell division - cytokinesis. Cell differentiation. Cell death. Apoptosis and necrosis. Mendelian and modern genetics: structure, function and inheritance of genes. Includes the chemistry and structure of chromatin and chromosomes. Animal tissue histology unimal cells and tissues. Human genetics. Chromosomal aberrations, genetic disorders and diseases. Genetic engineering. GMO organisms. F7ABBBB Biomechanics and Biomaterials he cours			•	•			•
The subject deals with origins and description of the most important electric and non-electric biological signals. The principles of generation, recording and basic properties are studied as 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, aignals from the gastro-intestinal system etc. Advanced methods of digital biosignal processing, spectrum analysis, modern methods of artificial intelligence, features extraction, automatic alassification, graphic presentation of results. Adaptive segmentation, artificial neural networks for signal processing. F7ABBBC Biolog Biology Biolog Biology Biolog Biology Biolog Biology Biology Biology Biology Biology Biology Biolog Biology Biolog Biology Biolog Biol	J. 1		come familiar w	th the basic			f Biochemistry.
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Measuring of electric values, principles, using, and parameters. Analogue measuring converters. Electromechanical measuring devices. Current and potential measuring. Frequency and shift phase measuring. Electric work and electric power measuring: direct current, single-phase and three-phase current. Electrical resistance and impedance measuring. Magnetic measuring. Analogue scope. Digitalization, digital signal processing, signal reconstruction. Electronic measuring devices: multimeter, digital scope. Optoelectronic measuring device.

Electrophysiology **F7ABBELF** Aim/objectives: to introduce students to the theory of electrical phenomena at the cell, organ and organism level, to the possibilities of measuring and using these manifestations. A sub-objective is to enable students to experimentally verify the knowledge. This course builds on Anatomy and Physiology I and II and requires a basic knowledge of the structure (anatomy) and function (physiology) of the following systems (excitable tissues): nervous, musculoskeletal, circulatory (especially the heart). The course deals with the problems of excitable tissues (nervous, The course deals with the physiology of nervous tissue, muscle and glandular tissue and provides knowledge of the physiology of electrical processes at different levels: cell, tissue, organ, organism. F7ABBEO **Electronic Circuits** The course provides a basic orientation in the principles of electronic circuits used in electronic laboratory and medical devices. It provides a prerequisite for the skilled operation of analogue and digital instrumentation. technology. Course entry requirements: Successful completion of Theoretical Electrical Engineering. Exit Knowledge, Skills, Abilities and Competencies: Students will become familiar with functional electronic blocks that are used in the design of laboratory and medical instruments. The course will prepare them to competently assess the basic properties and parameters of electronic devices. Ethics in Biomedical Engineering An overview of basic ethical concepts and theories in the context of applied ethics with respect to the professional orientation, maintenance, and development of humanities in technically oriented students. Prerequisites and co-requisites: Knowledge of humanities in the scope of secondary school studies (basics of philosophy, history, psychology). Acquired knowledge, skills, abilities, and competencies; Knowledge of basic concepts and controversial topics in theoretical and applied ethics, the ability to critically think, discuss, argue and defend their own views in ethical dilemma situations, developing the ability to work with literature, enhance empathy skills. F7ABBESP Management of Health Care Technology Z.ZK 2 4 F7ABBFY1 Physics I 7 7K Course Physics 1 is used to repeat and expand the basic knowledge of physics in the field of classical mechanics, thermals and optics, which is needed for further study at FBME CTU. Students will gain theoretical knowledge, the ability to solve numerical problems and practical skills associated with working in laboratories F7ABBFY2 6 The course Physics 2 follows the course Physics 1 and expands the acquired knowledge in the field of electromagnetism and the basics of atomic and nuclear physics and condensed matter physics. F7ABBFCH Physical Chemistry Physical and chemical properties of substances. Basic calculations. Principles and behavior of systems of gases and liquids. Chemical bonds. Properties of solvents. Electrolytes. Dissociation of substances. Phase equilibria, multiface systems. Behavior and properties of vapors, evaporation. Electrochemical potential, electrodes. Electrodes of first and second kind. Referent and indication electrodes, electrodes for EKG, EEG, EMG etc. Redox potential. Inert electrodes. Membranes - types, properties and applications. Osmotic pressure. Ion selective electrodes. Acidity and basicity of solutions, pH. pH measurement. Stability of materials, corrosion. Passivation and self-passivation. Electrolysis and conductivity of solutions and its measurements. Polarography. Further methods of analysis of gases and solutions in BME (Biomedical Engineering.) Optical absorption. Spectrophotometry. Fluorescence and phosphorescence. Sensors for measuring of pH, pO2, pCO2, and SaO2 working on the basis of fibre optic cables and absorption or fluorescence. Advanced analytical devices. Mass spectroscopy, nuclear magnetic resonance, flame spectroscopy. Thermodynamics of reaction systems, basic calculations. **F7ABBHE** Hygiene and Epidemiology ZK Students should learn theoretical basics of Epidemiology and Hygiene disciplines in depth covered by lecture topics. As result of this subject, student should be familiar with targets and working methods used in all disciplines of infectious and non-infectious epidemiology, environmental epidemiology and in solving of priorities and problems of Public Health Protection. Outcoming knowledge, skills, abilities and competences: Knowledge of basic methods used in preventive medical disciplines and legislation. F7ABBISZ Information Systems in Health Care Z.ZK 4 Lectures are oriented on medical informatics definition and basic characteristic of the different specialized areas. The relations between IS and health care structure, financing and controlling are analyzed as well. Some basic information technology, HW and SW tools are described in relation to IS design. A special attention is paid to medical data coding and interpretation, data and communication standards. Different types and features of clinical and hospital IS, decision support systems and regional health care IS are analyzed and discussed. Methodology of IS development, implementation and support are presented as well. Z.ZK **F7ABBITP** Integral Calculus The subject is an introduction to integral calculus and integral transforms. Integral calculus: anti-derivative, indefinite integral, properties and methods of integration (integration by parts and by substitution, partial fractions), definite integral, properties, Newton-Leibnitz fundamental theorem, simple applications of both indefinite and definite integrals, improper integral, solving differential equations (ODEs) (1st order ODEs with separable variables, linear 1st order homogenous as well as non-homogenous ODEs, 2nd order linear homogenous and non-homogenous ODEs with constant coefficients), intro to multiple integrals, particularly double integral and applications. Integral transforms: Laplace transform and inverse Laplace transform and their application for solving nth order linear ODEs with constant coefficients. 2 F7ABBKT Communication Technology Z,ZK The aim of the course is to teach the student to understand the basic principles of the function of personal computers, their peripherals and communication interfaces. They will be able to configure the network interface and configure and connect a peripheral type of a standard medical devices equipped with a wired or wireless interface. Conventional Imaging Systems Electromagnetic radiation spectrum and relationship to the modalities of medical diagnostic imaging systems. Fundamentals of imaging theory. Application of 2D FT. Transmission properties of imaging systems. Optical imaging systems including microscopic. Television imaging systems (including video endoscopic imaging systems). Basic digital image pre-processing methods. Infrared imaging systems (thermal imaging/IR imaging systems). X-ray imaging systems. Gamma imaging systems. Lectures and especially the laboratory exercises provide students with an overview of the principles of image formation in medicine for conventional imaging systems and methods. There are described methods for image data sensing, digitization and subsequent processing and principles of function and properties of sensing image devices in context, which is especially relevant from the interdisciplinary point of view of the whole course and study specialization. Knowledge, skills and competences: The student is able to explain the basic physical principle of the given modalities and knows its layout including the principle of image formation. The student is able to assess, on the basis of standard definition of technical parameters that imaging system meets the physician requirements for selected modality. Such knowledge is a prerequisite to the correct process technology selection and application of the modalities as well as the minimum necessary to ensure the required quality of the resulting image data. F7ARRIT Clinical Laboratory Instrumentation Z.ZK 4 Clinical laboratory instrumentation introduces principles of bioanalytical methods used in clinical diagnostics. Emphasis is put on optical methods (UV-VIS spectrophotometry, IR spectroscopy, AAS, AES, fluorimetry), NMR and X-ray analysis, electrochemical and electromigration methods (ion electrodes, biosensors, electrophoresis, isoelectric focusing), imunoassays and genetic methods (ELISA, PCR) as well as on chromatography and mass spectrometry. Contribution of lab automation to clinical diagnostics will be also discussed. During the laboratory course students will be introduced into the basics of work in bioanalytical laboratory and lab data processing. Medical Devices and Equipment I. (Diagnostic Devices) Z,ZK Medical devices categories. Electrical safety of medical devices. Biopotentials amplifiers. Electrocardiographs, electromyographs and electroencephalographs. Dilution methods of blood flow and cardiac output measurement. Blood pressure measurement. Cardiac frequency measurement. Phonocardiography. Pulse oximetry. Medical monitors. Electrostimulation and electrosurgery medical devices. Therapeutic medical devices. Implantable medical devices. Telemetry. Medical devices for audiology. F7ABBLPZ2 Medical Devices and Equipment II. (Therapeutical Devices) Z,ZK 2 Medical devices categories. The electrical safety of therapeutical medical devices. Artificial ventilation, introduction. Conventional ventilation. High-frequency ventilation. Extracorporeal membrane oxygenation. Hemodialysis. Drug infusion pumps (volumetric, syringe). Artificial cardiac pacemaker. Defibrillators (external, implantable). Cochlear implant. Electrosurgery units. Therapeutic ultrasound. Electro-therapy. Magneto-therapy.

F7ABBLAD	Linear Algebra and Differential Calculus	Z,ZK	6
continuity and derivative	in to differential calculus and linear algebra. Differential calculus - sets of numbers, sequences of real numbers, real functions of a function investigation of function behavior), Taylor's formula, real number series. Linear algebra - vector spaces, matrice is (solvability and solution), eigenvalues and eigenvectors of matrices, applications.		
	Management and Admininistration in Health Care	KZ	1
Getting to know the stru	ture of the health sector and financing models Health. Zoom administrative management issues various types of medical wo ion in the specific features of health facilities and European systems of health care workplaces.		ecessary
F7ABBMEC	Mechanics	Z,ZK	4
Students will get acquai	nted with the following areas of mechanics: General physical equations, Newton's laws, statics and dynamics. Force and mon	, i	mposition,
	of a force system in a plane and space - equation of equilibrium, systems into equilibrium. Reactions on statically determine	•	
	aints, solution of reactions. Static moment, center of gravity and center of area. Spatial moment of inertia - kinetic energy of ro	-	
	ervation of momentum. Second moment of area - product moment, polar moment, Mohr circle, main moments of inertia, ellips , course of internal static effects, kinematic method, statically indeterminate problems. Mechanical properties of materials - te		
	ns, Hooke's law. Stress and strain - uniaxial and biaxial stress state, simple bending, bending curve, torsional stress, cross-se		
	d stress, nonlinear models. Buckling strength - critical load, stability of members, calculation of cross section. Tests of hardness,	-	
F7ABBMT	Medical Terminology	Z	1
	quainted with particular terms flowing from latin but also greek expressions during their lectures. Students are continuously in cal procedures. Education is combined with continuous knowlegde check up through the use of tests.	formed about ter	ms of whole
F7ABBMVP	Research Methodology	KZ	2
The course introduces s	tudents to the basic methods of research work and the requirements for scientific communication. The course also introduces	s students to the	principles of
writing and presenting o			
	Modelling and Simulation	Z,ZK	4
•	d consequences of modeling and simulation. The methodology of modeling and simulation. Inverse problem. Proposal for a n		
experiment. Compartme models.	ntal models. Physiological models. Pharmacokinetics. Continuous and discrete models of population dynamics. Epidemiologic	cai models. Vene	rai disease
	Project Proposal and Management	KZ	2
l l	tudents will become familiar with topics such as project management (PM) according to IPMA, the certification process, projec	Į.	
•	as well as project initiation. They will learn about the feasibility study, project initiation, project identification document, and k		
	p project planning, scheduling, risk and risk analysis, project implementation, behavioral competencies in PM, project closure	_	
also gain practical insigh	ts from a hospital environment. During the exercises, students will master the following concepts and topics and develop relev	ant outputs: team	nwork, feasibility
	ment, logical framework, WBS (Work Breakdown Structure a hierarchical structure of tasks or activities), scheduling, risk anal		
•	s course, students have the opportunity to obtain the IPMA Level D certification, which is intended for aspiring project manag	jers, project coord	dinators, and
	ification is valid for five years.	71/	
,	Protection Against Ionizing Radiation to give students an overview of the issues of protection against ionizing radiation and dosimetry in general and in a specialize	ZK	2
	basic types of ionizing radiation, sources of ionizing radiation, interaction of gamma radiation with matter, interaction of charge	-	
	age through the matter, units used in dosimetry and radiation protection, operational units for working and environment monito		
contamination, shielding	of simple sources. Special attention is paid to the exposure control of workers, residents and patients. In course students will	give invormation	about legislative
	limits. Entry requirements of the course: Structure of matter, basic types of nuclear transformations. Properties of basic types	•	
•	ction of gamma radiation with matter, interaction of charged particles with matter, passage of photon and electron beams through	ŭ	٦
•	dge, skills, abilities and competences: Units used in dosimetry and radiation protection. Principles and goals of radiation protection, and protection, and protection and		
healthcare.	radiation and protection against internal contamination. Dose limitation system, ionizing radiation in legislation of Czech Rep	rubiic. Ioriizirig rac	diation use in
T	Patient and Device Simulators and Testers	Z,ZK	2
	imulators and testers. Basic principles of implementation, connections with other disciplines. Detailed description and implem		
a subsystem. Design an	implementation of patient and instrument simulator sub-blocks. Examples of circuit implementations of simulators and testers		
and other related proced	lures in manikin control, basic concepts and principles of anesthesiology. Other types of simulators and phantoms. Possibilitie	s. Environment, s	
			cenario creation
creation of new scenario	Connection of the simulator with other medical equipment. Simulators and testers. Implementation of an established simulating	es of use in clinic	cenario creation al practice.
	s. Collaboration between HPS and anaesthesia machine.	es of use in clinica on scenario, scer	cenario creation al practice. nario testing,
F7ABBPPM1	s. Collaboration between HPS and anaesthesia machine. Programming in Matlab I.	es of use in clinica on scenario, scen	cenario creation al practice. nario testing,
F7ABBPPM1 The aim of the course is	s. Collaboration between HPS and anaesthesia machine. Programming in Matlab I. to acquaint students with the Matlab environment and language. Students will learn how to create functions and scripts in Matlab	es of use in clinica on scenario, scen	cenario creation al practice. nario testing,
F7ABBPPM1 The aim of the course is about data structures ar	s. Collaboration between HPS and anaesthesia machine. Programming in Matlab I. to acquaint students with the Matlab environment and language. Students will learn how to create functions and scripts in Madd work with data and their vizualization. The course is followed by the course Programming in Matlab II.	es of use in clinica on scenario, scen KZ atlab language, th	cenario creation al practice. nario testing, 1 ney will learn
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F7ABBPPM1 The aim of the course is about data structures ar F7ABBPPM2 During the course the st Matlab basics from cour the basic toolboxes. As F7ABBPNK The aim of the practicall blocks and their design, documentation and boar recovery) electronic their display element with dior in addition to the analog The last part will be a se F7ABBPMS Objectives: to familiarize mathematics (linear alge competencies: The stude to practical problems the and can choose a suitab F7ABBPP The course gives a brief	Programming in Matlab I. to acquaint students with the Matlab environment and language. Students will learn how to create functions and scripts in Matlab downk with data and their vizualization. The course is followed by the course Programming in Matlab II. Programming in Matlab II. Idents will consolidate and widen their previous knowledge with the Matlab environment, programming language and with bas see Programming in Matlab I. The students will learn how to create functions and scripts in Matlab, how to manipulate and visuality the students will learn to create basic user interfaces. Design and Construction of Medical Devices/Practical Exercises or oriented course is to acquaint students with the design process of the measuring part of the device, ie basic problem analyst selection of suitable components and their values with emphasis on working with catalog sheets and application recommend design, printed circuit board, its mounting, soldering and revitalization. During the course, students will implement a function mometer, which will consist of two functional units - analog part for temperature measurement and signal conditioning (equip the bargraph (equipped with SMT components). For both products, students will implement the design of the diagram and PCB soart of the device, an application for digitizing data from the analog device using NI-DAQ cards and a cheap solution with the helevice intervention in the device (monitor of vital functions) with emphasis on safe handling and measurement of test points. Probability and Mathematical Statistics students with the basic principles of the theory of probability and mathematical statistics. Pre-requisites and entry requirements at a sequainted with the probabilistic model, basic definitions of Kolmogorov theory of probability and inductive statistics. The sit arise in other areas of professional work and can explain them sufficiently (e.g. doctors). The student is familiar with the basic method for standard statistical problems.	KZ atlab language, the KZ atlab language, the KZ atlab language, the KZ atlab language, the Latlab language latlab language latlab latl	cenario creation al practice. nario testing, 1 ney will learn 2 course requires ow to work with 4 n of functional on of electrical ting, soldering, mponents) and comment EAGLE. De implemented. 4 : Knowledge of oilities and these definitions ductive statistics

F7ABBPSL Psychology Development, methodology and methods of psychology. Mental activities and psychic processes, psychology of personality, objects of psychology and their formation and development. Modern psychology; its concept and theory, psychic processes and stages. Psychological interpretation of personality. Application of knowledge in medical situations. Relation between technicians and medical doctors, technicians and patients, technicians and nurses. Communication as a tool for good cooperation amongst people and an aid to interactions. Basic expression and communication skills. Use of elocution and gestures in personal expression. Verbal and nonverbal communication. Dialogue; types of dialogue, questions during dialogue. Model situations. Communication process as part of economics - components, tools and functions. **Guided Practical Training** Familiarization of students with the organization and provision of professional internships at the clinical workplace. Provision of contractual documents for the implementation of the ROP (supervised professional practice). The ROP will then enable the acquired practical skills and habits to be applied in the key subjects of the 3rd year. The student thus has an overview of the current technical level of hospital equipment; an overview of the organization of the work of biomedical technicians and engineers; can apply legal requirements to ensure the safe operation of medical equipment. He can communicate with technicians, but also medical staff. He is able to work in a team. F7ABBSPR1 Semestral Project I. The topic of the semester project (SPR1) must be in the field of biomedical engineering and must be related to the study field of the same name Biomedical Technician. The topics are available for the relevant academic year in the database projects.fbmi.cvut.cz Note: It is not possible to implement economic-managerial topics, topics based mainly on the creation of research, clean programming, topics purely in the field of biology, etc. The application must always be part of the work in accordance with the focus of the field. The topic must always be related to technology (medical devices, or the scope of work of a Biomedical Technician in clinical practice)! Entries that do not fall into the above areas will not be approved. F7ABBSPR2 Semestral Project II. K7 The main idea is to start work on a project which can be improved in time and finish as a Bachelor thesis. In the course will be discussed topic as basic communication and presentation skills, including teamwork and project management. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing a commented bibliographic search. The student solves topic (project) from the selection of the PROJECTS database - http://projects.fbmi.cvut.cz During the term, there are dedicated 2 hours every week for work under teacher supervising. **F7ABBSBP Bachelor Thesis Seminar** Objective(s): The aim of the course is to accentuate the realized outcomes of the projects solved in the 4th, 5th and 6th semesters of the Biomedical Technology Bachelor's degree study program. The aim of the course is also to prepare students for the defense of their bachelor thesis infront of the final state examination committee. Course entrance requirements: Prerequisite F7PBBMVP Exit Knowledge, Skills, Abilities and Competencies: Students are fully aware of the requirements for the requirements of professional reports and communications, they are proficient in the orientation in the professional literature. The students are able to understand the literature and literature on a given topic, apply scientific research methods to specific assignments. They present their proposed solutions and results, are able to interpret the results. F7ABBSM Sensors in Medicine Z,ZK 4 This subject provides information about basic electronic devices - sensors, describes their operation principle, basic circuit configuration and application. The stress is aid mainly on clarifying of basic principles and practical utilization. Integral part of this course is basic information about sensors of non-electric quantities and their read-out circuits eg. strain related sensors (force, pressure, torque, vibration, displacement, acceleration etc.) magnetic field sensors, temperature sensors, chemical sensors, optical sensors and biosensors. The stress is aid on miniaturization, integration F7ABBSEL Power Engineering Basics of power electronics, power supplies, including electrochemical sources, rectifiers, stabilizers, the most commonly used types of motors, basics of power distribution, types of electrical systems and connecting appliances with a focus on medical use. Emphasis is placed primarily on the physical nature of the problem and its understanding. knowledge will be verified on practical examples and in the laboratory. Equipment for Anaesthesiology and Resuscitation The main objective of the course is to introduce students to the basic equipment of intensive care units (ICU) and anesthesiology and resuscitation departments of hospitals. These are devices to support vital functions, especially lung ventilation, as well as patient monitors, anesthesia machines and their parts and other equipment. Another objective of the course is to integrate knowledge and skills of students from the fields of science (especially physics, chemistry and physiology) and engineering (modeling, circuit theory, pneumatic elements, etc.) in the analysis of clinical technology and in the design and implementation of functional technical systems. Theory of Electrical Engineering Z.ZK Electric current, DC and AC currents. Electrical curcuits including R, L, C. Power of electric current, thermal effect of electric current. Distribution of electrical energy. Connection of the electrical systems. Input resistance and impedance, idle voltage, inner resistance and impedance of the source, mutual loading of the source and electrical appliance, impedance matching. Properties of circuits in time and frequency domain. Transient action in DC circuits, frequency characteristics of the L/C circuit. Electrical current in semiconductor, type of the conductivity, creation of the semiconductor crossing, properties in the forward and reverse direction. Bipolar transistor - transistor effect, basic principle in elementary circuit. Unipolar transistor. Unipolar transistors with complementary vodivosti (CMOS). Electromagnetic effects (induction, magnetization, force effect). Electromagnetic wave, spreading, interference, electromagnetic compatibility. Soft and hard magnetic materials. Transformers construction and parameters. Magnetic recording and reproduction of signals. Electromotors principles. F7ABBTZS Tomographical Imaging Systems 7.7K CT systems (basic principle, schematic arrangement system, basic physical principle, developmental generations, basic principles of reconstruction). Imaging systems magnetic resonance, PET and SPECT principle. Specialized imaging systems (hybride), Ultrasound imaging systems, Doppler systems, Subject and especially laboratory exercises provide students with an insight into the principles of creating image data used in medicine, the principle of methods their scanning, digitization and subsequent processing, on the principle of function and properties of scanning image means in context, which is important especially in terms of interdisciplinarity of the subject and the field as a whole. **F7ABBUSS** Introduction to Signals and Systems Z,ZK 4 To introduce students to basics of theory of signals and systems. To explain main principles on applications from biology and medicine. To become acquainted with basic mutual relations in computer laboratories by means of MATLAB. Fundamentals of Pathology The main goal of the course is represented by continuous enlargement of anatomical, physiological and multi-disciplinary consequences in human health and disease. At the very beginning of the course the fundamentals of cell structure disorders and metabolic paths disturbances are provided to understand pathology of organ systems and complexity of disease origin and causes. The course provides a wide overview of morphological and functional conditions in pathology. The knowledge is then simply transformable to clinical and technical disciplines used in examination and health monitoring of the patients. The Course Requirements: The enrolment to the course is contingent on successful finishing of the course Anytomy and Physiology II. Release and Results: The students obtain basic outline of pathological processes in the human body. Their skills comprise definition of disease, comprehension and description of pathological changes in organs and body structure. The theoretical basis of the course is oriented to use in technical branches of biomedical engineering. Legislation in Health Care and Technical Standards Aims / aims: The aim of the course Legislation in Health Care and Technical Standards is to teach students the basic requirements and regulatory obligations in healthcare, especially in the field of medical devices. During the course, students will learn the basics of legislation process, as well as regulation related to the medical devices, lso with legislative regulations in the field of clinical trials and the operation of medical devices. Furthermore, students will learn the legal context of providing health care. The aim is to acquaint students with the rights and obligations arising from current legislation relating to health care issues. The emphasis is not on memorizing of the text of legal regulations, but on acquainting students with the main points and ideas contained in the laws, regulations and standards of the Czech Republic and EU directives in the field of healthcare. Prerequisites and co-requisites: To successfully complete the course, students should know the basics of the principles of medical devices due to the practical application of legislation in this area. Output knowledge,

Name of the block: Compulsory elective courses

skills, abilities and competences: After completing the course, the student should have a comprehensive overview of health legislation. He should be able to orientate himself in a given

problem related to legislation without any problems and he should know where he can find individual details related to legal issues in health care.

Minimal number of credits of the block: 10

The role of the block: S

Code of the group: F7ABB PV 2S 20

Name of the group: Biomedical Technology compulsory optional course

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 6)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)

Credits in the group: 2 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
F7ABBEZP	Economics of Health Services	KZ	2	1P+1C	L	S
F7ABBMAT	Marketing of Medical Technology Petra Hospodková Petra Hospodková (Gar.)	KZ	2	2P	L	S
F7ABBPPP	Programming Tools Christiane Malá, Martin Vít zník Christiane Malá	KZ	2	2C	L	S

Characteristics of the courses of this group of Study Plan: Code=F7ABB PV 2S 20 Name=Biomedical Technology compulsory optional course

course								
F7ABBEZP	Economics of Health Services	KZ	2					
Basic category of health	Basic category of health care facility economics (hospitals, public and private health care facility) as: facility effectiveness, costs and income, financial management in health care,							
health care marketing e	tc. Specifics of health care facilities. Integral view of functioning of health care companies view on health care "company". De	velopment of know	wledge and skills					
in the field of financial n	nanagement tools.							
F7ABBMAT	Marketing of Medical Technology	KZ	2					
Marketing fundamentals	s, products management, basic knowledge concerning export activities in the field of marketing and commercial health care t	technology. Practic	cal cases are					
presented including hea	alth care technology companies from the Czech Republic. Discussion and analysis of the real products are included in the ex	ercises.						
F7ABBPPP	Programming Tools	KZ	2					
Introduction to software tools on MS Windows platform and GNU/Linux platform. Short introduction of several software tools (MS Word, Excel, LateX, Powerpoint) and programming								
languages (Python, R,	languages (Python, R, Java, CSS, bash) .							

Code of the group: F7ABB PV 3S 20

Name of the group: Biomedical Technology compulsory optional course

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 6)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)

Credits in the group: 2 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
F7ABBBFT	Biophotonics Jan Mikšovský, Jan Remsa Jan Remsa Jan Mikšovský (Gar.)	KZ	2	2P	Z	S
F7ABBFVP	Multivariable Calculus Petr Maršálek Petr Maršálek (Gar.)	KZ	2	1P+1C	Z	S
F7ABBMFJ	Physical Phenomena Modeling in COMSOL MULTIPHYSICS David Vrba, Jan Vrba David Vrba David Vrba (Gar.)	KZ	2	1P+1C	Z	S

Characteristics of the courses of this group of Study Plan: Code=F7ABB PV 3S 20 Name=Biomedical Technology compulsory optional course

F7ABBBFT	Biophotonics	KZ	2					
Overview of principles and applications in the interdisciplinary sphere, connecting physics, optics and biology. Interaction of laser radiation with matter, interaction of radiation with								
tissue, biology basics, photobiology, bioimaging, basics of lasers, laser safety, optical biosensors, photodynamical therapy, optical manipulation with cells, nanotechnology for biophotonics,								
biomaterials for photonics.								

F7ABBFVP	Multivariable Calculus	KZ	2
F7ABBMFJ	Physical Phenomena Modeling in COMSOL MULTIPHYSICS	KZ	2

Numerical simulations are increasingly being used to develop new and optimize existing products and devices. Numerical simulations can greatly reduce the number of prototypes needed and thus significantly accelerate and reduce development costs. Another sector where numerical simulations are used is a sector where it is difficult to verify ongoing physical processes (eg, heating the biological tissue under electrodes for direct brain simulation). Last but not least, based on numerical simulations, we can plan treatment where, based on knowledge of material properties, we can define the amount of power delivered to the device (eg radiofrequency ablation in oncology or cardiac surgery). Computer modeling involves the creation of geometry, setting of material properties and boundary conditions and, last but not least, the choice of differential equations, the method of discretization of the computing area and the processing of results. The accuracy of the results obtained, the length of calculations and the computational power requirements are very dependent on the numerical model setting. The lectures cover the most common problems in electrical engineering, thermics, mechanics, chemistry, acoustics and fluid dynamics. The acquired knowledge will be tested by the students when designing individual parts of devices and devices.

Code of the group: F7ABB PV 4S 24

Name of the group: Biomedical Technology compulsory optional course

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 8)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 4)

Credits in the group: 2

Note on the group:

F7ABBDIZ

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
F7ABBDIZ	Detectors of Ionizing Radiation	KZ	2	2P	L	S
F7ABBMDT	Microwave Diagnostics and Therapy David Vrba, Jan Vrba Jan Vrba (Gar.)	KZ	2	1P+1L	L	S
F7ABBPTI	Principles and Practice in Tissue Engineering Roman Mat jka Roman Mat jka Roman Mat jka (Gar.)	KZ	2	0P+2C	L	S
F7ABBSJ	Scripting Languages Tomáš Kraj a Radim Krupi ka Radim Krupi ka (Gar.)	KZ	2	2C	L	S

Characteristics of the courses of this group of Study Plan: Code=F7ABB PV 4S 24 Name=Biomedical Technology compulsory optional course

Types of gas filled detectors, DC mode of IC, pulse mode of IC, proportional counters, pulse shape of proportional counter, neutron detection and spectrometry by means of nuclear reactions, principle of Geiger-Mueller counters, corona counter, preliminary of the scintillation detectors, exploitation of organic (solid and/or liquid) scintillators, Cerenkov detector, semiconductor detectors, Li compensated Ge detectors and HPGe detectors as photon detector.

F7ABBMDT | Microwave Diagnostics and Therapy | KZ | 2

Interaction of the EM field with biological tissues and its use in diagnostics and therapy. Numerical methods suitable for modeling these interactions. Basics of microwave imaging (MWI). Perspective application of microwave techniques in medical diagnostics: non-invasive monitoring of blood glucose concentration, microwave detection and classification of

and testing of applicators.

F7ABBPTI Principles and Practice in Tissue Engineering KZ 2

F7ABBSJ Scripting Languages KZ 2

cerebral vascular events and early detection of breast cancer. Therapeutic systems and applicators for microwave and RF local and regional hyperthermia. Planning treatment. Design

The aim of the course is to understand the topic of scripting languages and their applications, to understand their advantages and disadvantages and their complementarity with system languages. Students will become familiar with regular expressions and tools for word processing. The course focuses on the scripting languages within the Unix operating system and the scripting languages Python.

Code of the group: F7ABB PV 5S 20

Detectors of Ionizing Radiation

Name of the group: Biomedical Technology compulsory optional course

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 8)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 4)

Credits in the group: 2

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
F7ABBAZD	Biomedical Data Analysis and Processing Jan Kauler	KZ	2	1P+1C	Z	S
F7ABBMTB	Microprocessors in Biomedicine Lenka Hanáková, Pavel Smr ka, Karel Hána, Jan Broulím Karel Hána Pavel Smr ka (Gar.)	KZ	2	1P+1L	Z	S
F7ABBTA	Technical Audiology	KZ	2	1P+1L	Z	S
F7ABBZOD	Image Data Processing Zoltán Szabó Zoltán Szabó Zoltán Szabó (Gar.)	KZ	2	1P+1C	Z	S

Characteristics of the courses of this group of Study Plan: Code=F7ABB PV 5S 20 Name=Biomedical Technology compulsory optional course

F7ABBAZD	Biomedical Data Analysis and Processing	KZ	2					
Time series analysis, tr	Time series analysis, trends, mutual dependency, stationarity. Correlation function and covariance function. Algorithms of correlation function estimation. Impact of removing trends to							
autocorrelation function	. Periodogram - relationship between corellogram and periodogram. Frequency spectrum, spectrum of random signals. Linea	ar frequency filteri	ng. AR, ARMA,					
and MA processes. Spectral analysis. FFT algorithm. Non-parametric methods of the frequency spectrum estimation. Positives and negatives of the specteal analysis. Repeated								
measurements and analysis of their properties. AR a ARMA model parameter identification. Prediction. Bivariance analysis of time series - cross-correlation and cross-covariance and								
their estimation, Bispec	trum.		1					

F7ABBMTB Microprocessors in Biomedicine KZ 2

The aim is to explain the principles and building blocks of a microprocessor system, the structure of a microprocessor, the connection of basic peripherals, the programming model of a microcomputer system in the form of a practically oriented explanation and demonstration tasks. Provide a basic overview of ATMega and ARM Cortex M architectures with practical

a microcomputer system in the form of a practically oriented explanation and demonstration tasks. Provide a basic overview of ATMega and ARM Cortex M architectures with practical examples of their programming with examples of use in biomedicine. Prerequisites and co-requisites: basic knowledge of digital technology and signal processing, basics of ISO C. Output knowledge, skills, abilities and competencies: The student is familiar with the selection and design of microprocessor system solutions for use in biomedicine. It manages the configuration and program control of these building blocks of the microprocessor system: digital inputs and outputs, A / D and D / A converters, serial and parallel communication, counters and timers, interrupt controller. Understands the basics of communication of microcomputers with the environment: interfaces for LCD displays, keyboards, RS232, Ethernet, WIFI, Bluetooth, XBee and mobile 3G / 4G communication, GPS / GLONAS localization.

F7ABBTA Technical Audiology KZ 2

The aim of the course is to give students a basic overview of audiology, i.e. basic knowledge of biology, medicine and technology in relation to normal and impaired hearing, and all this in an interrelated context with emphasis on technical aspects. Motivation to work in clinical practice in audiology is also an integral part of this goal, workplace. Course entry requirements: These requirements are expressed as prerequisites and a detailed breakdown of the requirements is as follows: - nervous system - organisation and function of the CNS, internal environment of the CNS (blood-brain barrier, cerebrospinal formation, transport and function), neuroglia, motor nervous system, spinal cord (structure, reflexes), - nervous system - motor system, brainstem (structure, reflexes), cerebellum (structure, reflexes), basal ganglia (structure, reflexes), cerebral cortex (structure, reslexes), physiology of movement control, - sensory nervous system - receptors, skin sensation, movement and position perception, vision, hearing, taste, smell, pain, autonomic nervous system, brain stem, hypothalamus, peripheral compartments: sympathetic and parasympathetic, - waves, types of waves, successive waves, interference, standing waves, sound, - types of signals, basic signal operations, signal decomposition, - harmonic analysis, Fourier transform for continuous and discrete signals, DFT, FFT, - convolution, - technical and biological systems, systems and their description, linear and non-linear system, - external description of continuous and discrete linear system - differential/differential equations, transfer functions, frequency characteristics distribution of zeros and poles, time characteristics, - coupling of systems, feedback loops, - Characteristics of basic biosignals EEG, ECG, EOG, EP, EMG, artefacts, origin, sources, diagnostic applications, frequency range and bands, - Biological data acquisition and preprocessing, basic computer conversion chain, A/D converters, problems signal sampling and quantization, Nyquist theorem, conversion errors, signal conditioning, aliasing, filtering, trends, sensing options. Output knowledge, skills, abilities and competences: Students will acquire a basic understanding of acoustics, measurement and diagnosis of auditory functions, including technical principles, instrumentation and software, and hearing aids and replacements. The students will be able to orient themselves. They will be able to learn about these issues, learn about other areas of medical instrumentation and methods used in clinical practice, as well as motivated and ready to enter the field of audiology upon graduation and to add to this knowledge and advanced skills within the framework of the so-called certified course, which, according to Act 96/2004 Coll., allows for the acquisition of the so-called "certificate of audiology". Special professional competence Technical audiologist after graduation, i.e. after obtaining the so-called professional competence Biomedical technician under the Act.

F7ABBZOD Image Data Processing

Z

| 2

Continuous image representation, linear 2D systems, 2D spectrum, Digital representation of images, Basic image characteristics: brightness, contrast, resolution, noise, look up tables, histogram, Discrete Fourier transform, discrete cosine transform, image enhancement, geometric operations, image filtering, morphological operations, image restoration, image segmentation, basic principles of image compression.

Code of the group: F7ABB PV 6S 20

Name of the group: Biomedical Technology compulsory optional course

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 6)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)

Credits in the group: 2 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
F7ABBAZC	Algorithms for Biosignals Processing in the C Language Pavel Smr ka	KZ	2	1P+1C	L	S
F7ABBEMP	Electromagnetic Fields of Living Organisms Jan Vrba, Ond ej Fišer Ond ej Fišer Jan Vrba (Gar.)	KZ	2	1P+1L	L	S
F7ABBRBL	Robotics in Medicine	KZ	2	1P+1C	L	S

Characteristics of the courses of this group of Study Plan: Code=F7ABB PV 6S 20 Name=Biomedical Technology compulsory optional course

F7ABBAZC Algorithms for Biosignals Processing in the C Language

The principle and implementation of the most used algorithms for biosignal processing and their specific functional (and time and memory efficient) implementation in C and C ++ will be explained in the form of a practically oriented interpretation and demonstration tasks. Graduates will be acquainted with specific solutions to basic algorithmic problems in biosignal processing: with segmentation, analysis in the time and frequency domain, with the design of linear digital filters (FIR and IIR) and with the visualization of results. Prerequisites and co-requisites: basic knowledge of systems and signal processing, basics of ISO C. Output knowledge, skills, abilities and competences: The student is familiar with algorithms for preprocessing and intelligent segmentation of biological time series in C and C ++, eg: FFT algorithm, SFFT and wavelet transforms, algorithm for calculating autocorrelation and cross-correlation functions, convolution, etc. Can implement in C language the floating time window method for feature extraction and basic algorithms for the design and implementation of digital FIR and IIR filters. Understands and can implement in C language the basic ways of visualization of biological data and the results of their processing.

F7ABBEMP Electromagnetic Fields of Living Organisms

Static and quasi-static electric and magnetic fields, electromagnetic fields. Electrical and magnetic properties of biological tissues. Electrical, magnetic and electromagnetic stimulation in medicine. Anatomical and physiological bases of bioelectromagnetism. Bioelectric sources and conductive environment. Integral relations of electrodynamics of bioelectric fields, electrodynamic aspects of mathematical modeling of electrocardiography and electroencephalography. Topographic concept of bioelectrical and biomagnetic measurements. Methods and techniques of measurement. Human-robotic limb replacement interface.

F7ABBRBL Robotics in Medicine KZ 2

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
F7ABBA3A	English Language IIIA (part 1)	KZ	2

The aim of the course is to increase students' language competence in academic English and professional vocabulary, along with common communication skills. Students should be able to work actively with academic text, understand and be able to use basic terminology and be aware of the different stylistic levels of English and the associated syntactic and lexical devices.

F7ABBAF1 Anatomy and Physiology I. Anatomy and physiology II. Anatomy and physiology III. Anatomy and physiology II. Anatomy and physiology II. Anatomy and physiology II. Anatomy and physiology II. Anatomy and physiology III. Anatomy and physiol	E7ARRA3R			
Anatomy and Physiology I. Anatomy and Physiology II. F7ABBALP Anatomy and physiology II. Anatomy and Physiology	ITADDASD		KZ	2
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F7ABBBLS Biological Signals Z,ZK 4	F7ABBBI S			4
The subject deals with origins and description of the most important electric and non-electric biological signals. The principles of generation, recording and basic properties 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,	in all the signals. T	The studied signals involve native and evoked biosignals, including biological signals of the heart, brain, muscles, nervous system, at	iditory signals, visu	ual system,
signals from the gastro-intestinal system etc. Advanced methods of digital biosignal processing, spectrum analysis, modern methods of artificial intelligence, features extraction, automatic classification, graphic presentation of results. Adaptive segmentation, artificial neural networks for signal processing.	signals from the gas		, features extractio	n, automatic
F7ABBBOZP Safety Regulations and Standards in Electrical Engineering Z 1	F7ABBBOZP		7	1
Basic safety regulations, training and examinations from the sections of the regulation No. 50/1978 Coll. and instructions concerning the laboratory experiments based on the electrical				he electrical
devices. Factors determining electrical shock injury. Symbols and labeling in electrotechnology - safety colors importance, safety geometrical shape importance, examples of the safety	devices. Factors de	termining electrical shock injury. Symbols and labeling in electrotechnology - safety colors importance, safety geometrical shape importance,	rtance, examples	of the safety
legends, examples of the safety tables, graphical signs on the electrical devices, letter conductor labeling, AC nominal voltages, maximum values of the available current, short circuit	-			
and overloading protection, safety of the electrical devices - safety classes, periodical inspection and check of the electrical devices and hand tools, important norms, first aid in cases of electrical shock. Relationship of the law and safety regulations. Risk analysis in the field of electrotechnology. Special qualification in electrotechnology - regulation No. 50/1978 Coll				
Validity based on the electrotechnology qualification and directive "B". Lasers safety regulations.	of electrical shock.		regulation No. 3	0, 1370 0011.
F7ABBP Bachelor Thesis Z 6	F7ABBBP	Bachelor Thesis	Z	6
Individual student projects at the end of bachelor studies. Topics are selected during the 5th term from a list. Bachelor thesis is defended at the end of the examination period. Bachelo	-		-	
thesis defence is a part of the state exam. Bachelor thesis can be written and defended either Czech or English. Students are supervised by a tutor during the above mentioned process				
F7ABBCHM Chemistry Z,ZK 4 Introduction to chemistry, categorization and properties of substances, chemical bonds, chemical reactions, elements in periodic table, organic chemistry fundamentals, natural		ı	•	
substances, polymers, analytical methods - instrumental analysis, chemical calculations, chemical equations	minouuciion io t		non y runuambilidis	s, natural
F7ABBDIZ Detectors of Ionizing Radiation KZ 2				
Types of gas filled detectors, DC mode of IC, pulse mode of IC, proportional counters, pulse shape of proportional counter, neutron detection and spectrometry by means of nuclear		Detectors of Ionizing Radiation	KZ	2
reactions, principle of Geiger-Mueller counters, corona counter, preliminary of the scintillation detectors, exploitation of organic (solid and/or liquid) scintillators, Cerenkov detector,	F7ABBDIZ Types of gas filled	detectors, DC mode of IC, pulse mode of IC, proportional counters, pulse shape of proportional counter, neutron detection and spec	trometry by means	of nuclear
semiconductor detectors, Li compensated Ge detectors and HPGe detectors as photon detector.	F7ABBDIZ Types of gas filled	detectors, DC mode of IC, pulse mode of IC, proportional counters, pulse shape of proportional counter, neutron detection and specile of Geiger-Mueller counters, corona counter, preliminary of the scintillation detectors, exploitation of organic (solid and/or liquid) sci	trometry by means	of nuclear

F7ABBEBI Ethics in Biomedical Engineering ZK An overview of basic ethical concepts and theories in the context of applied ethics with respect to the professional orientation, maintenance, and development of humanities in technically oriented students. Prerequisites and co-requisites: Knowledge of humanities in the scope of secondary school studies (basics of philosophy, history, psychology). Acquired knowledge, skills, abilities, and competencies: Knowledge of basic concepts and controversial topics in theoretical and applied ethics, the ability to critically think, discuss, argue and defend their own views in ethical dilemma situations, developing the ability to work with literature, enhance empathy skills. F7ABBELF Electrophysiology Aim/objectives: to introduce students to the theory of electrical phenomena at the cell, organ and organism level, to the possibilities of measuring and using these manifestations. A sub-objective is to enable students to experimentally verify the knowledge. This course builds on Anatomy and Physiology I and II and requires a basic knowledge of the structure (anatomy) and function (physiology) of the following systems (excitable tissues): nervous, musculoskeletal, circulatory (especially the heart). The course deals with the problems of excitable tissues (nervous, The course deals with the physiology of nervous tissue, muscle and glandular tissue and provides knowledge of the physiology of electrical processes at different levels: cell, tissue, organ, organism. F7ABBEM **Electrical Measurements** Z,ZK Measuring of electric values, principles, using, and parameters. Analogue measuring converters. Electromechanical measuring devices. Current and potential measuring. Frequency and shift phase measuring. Electric work and electric power measuring: direct current, single-phase and three-phase current. Electrical resistance and impedance measuring. Magnetic measuring. Analogue scope. Digitalization, digital signal processing, signal reconstruction. Electronic measuring devices: multimeter, digital scope. Optoelectronic measuring device. F7ABBEMP Electromagnetic Fields of Living Organisms Static and quasi-static electric and magnetic fields, electromagnetic fields, Electrical and magnetic properties of biological tissues, Electrical, magnetic and electromagnetic stimulation in medicine. Anatomical and physiological bases of bioelectromagnetism. Bioelectric sources and conductive environment. Integral relations of electrodynamics of bioelectric fields, electrodynamic aspects of mathematical modeling of electrocardiography and electroencephalography. Topographic concept of bioelectrical and biomagnetic measurements. Methods and techniques of measurement. Human-robotic limb replacement interface. F7ABBEO **Electronic Circuits** The course provides a basic orientation in the principles of electronic circuits used in electronic laboratory and medical devices. It provides a prerequisite for the skilled operation of analogue and digital instrumentation, technology. Course entry requirements; Successful completion of Theoretical Electrical Engineering, Exit Knowledge, Skills, Abilities and Competencies: Students will become familiar with functional electronic blocks that are used in the design of laboratory and medical instruments. The course will prepare them to competently assess the basic properties and parameters of electronic devices. F7ABBESP Management of Health Care Technology Z.ZK 2 F7ABBEZP **Economics of Health Services** 2 ΚZ Basic category of health care facility economics (hospitals, public and private health care facility) as: facility effectiveness, costs and income, financial management in health care, health care marketing etc. Specifics of health care facilities. Integral view of functioning of health care companies view on health care "company". Development of knowledge and skills in the field of financial management tools. F7ABBFCH Z,ZK Physical Chemistry Physical and chemical properties of substances. Basic calculations. Principles and behavior of systems of gases and liquids. Chemical bonds. Properties of solvents. Electrolytes. Dissociation of substances. Phase equilibria, multiface systems. Behavior and properties of vapors, evaporation. Electrochemical potential, electrodes. Electrodes of first and second kind. Referent and indication electrodes, electrodes for EKG, EEG, EMG etc. Redox potential. Inert electrodes. Membranes - types, properties and applications. Osmotic pressure. Ion selective electrodes. Acidity and basicity of solutions, pH. pH measurement. Stability of materials, corrosion. Passivation and self-passivation. Electrolysis and conductivity of solutions and its measurements. Polarography. Further methods of analysis of gases and solutions in BME (Biomedical Engineering.) Optical absorption. Spectrophotometry. Fluorescence and phosphorescence. Sensors for measuring of pH, pO2, pCO2, and SaO2 working on the basis of fibre optic cables and absorption or fluorescence. Advanced analytical devices. Mass spectroscopy, nuclear magnetic resonance, flame spectroscopy. Thermodynamics of reaction systems, basic calculations F7ABBFVP Multivariable Calculus ΚZ 2 F7ABBFY1 Physics I. Z,ZK Course Physics 1 is used to repeat and expand the basic knowledge of physics in the field of classical mechanics, thermals and optics, which is needed for further study at FBME CTU. Students will gain theoretical knowledge, the ability to solve numerical problems and practical skills associated with working in laboratories F7ABBFY2 Physics II. Z,ZK 6 The course Physics 2 follows the course Physics 1 and expands the acquired knowledge in the field of electromagnetism and the basics of atomic and nuclear physics and condensed matter physics. **F7ABBHE** Hygiene and Epidemiology Students should learn theoretical basics of Epidemiology and Hygiene disciplines in depth covered by lecture topics. As result of this subject, student should be familiar with targets and working methods used in all disciplines of infectious and non-infectious epidemiology, environmental epidemiology and in solving of priorities and problems of Public Health Protection. Outcoming knowledge, skills, abilities and competences: Knowledge of basic methods used in preventive medical disciplines and legislation. F7ABBISZ Information Systems in Health Care Lectures are oriented on medical informatics definition and basic characteristic of the different specialized areas. The relations between IS and health care structure, financing and controlling are analyzed as well. Some basic information technology, HW and SW tools are described in relation to IS design. A special attention is paid to medical data coding and interpretation, data and communication standards. Different types and features of clinical and hospital IS, decision support systems and regional health care IS are analyzed and discussed. Methodology of IS development, implementation and support are presented as well. **F7ABBITP** Integral Calculus The subject is an introduction to integral calculus and integral transforms. Integral calculus: anti-derivative, indefinite integral, properties and methods of integration (integration by parts and by substitution, partial fractions), definite integral, properties, Newton-Leibnitz fundamental theorem, simple applications of both indefinite and definite integrals, improper integral, solving differential equations (ODEs) (1st order ODEs with separable variables, linear 1st order homogenous as well as non-homogenous ODEs, 2nd order linear homogenous and non-homogenous ODEs with constant coefficients), intro to multiple integrals, particularly double integral and applications. Integral transforms: Laplace transform and inverse Laplace transform and their application for solving nth order linear ODEs with constant coefficients. F7ABBKT Communication Technology 2 The aim of the course is to teach the student to understand the basic principles of the function of personal computers, their peripherals and communication interfaces. They will be able to configure the network interface and configure and connect a peripheral type of a standard medical devices equipped with a wired or wireless interface. Conventional Imaging Systems Electromagnetic radiation spectrum and relationship to the modalities of medical diagnostic imaging systems. Fundamentals of imaging theory. Application of 2D FT. Transmission properties of imaging systems. Optical imaging systems including microscopic. Television imaging systems (including video endoscopic imaging systems). Basic digital image pre-processing methods. Infrared imaging systems (thermal imaging/IR imaging systems). X-ray imaging systems. Gamma imaging systems. Lectures and especially the laboratory exercises provide students with an overview of the principles of image formation in medicine for conventional imaging systems and methods. There are described methods for image data sensing, digitization and subsequent processing and principles of function and properties of sensing image devices in context, which is especially relevant from the interdisciplinary point of view of the whole course and study specialization. Knowledge, skills and competences: The student is able to explain the basic physical principle of the given modalities and knows its layout including the principle of image formation. The student is able to assess, on the basis of standard definition of technical parameters that imaging system meets the

physician requirements for selected modality. Such knowledge is a prerequisite to the correct process technology selection and application of the modalities as well as the minimum necessary to ensure the required quality of the resulting image data. F7ABBLAD Linear Algebra and Differential Calculus Z.ZK 6 The course is introduction to differential calculus and linear algebra. Differential calculus - sets of numbers, sequences of real numbers, real functions (function properties, limits, continuity and derivative of a function investigation of function behavior), Taylor's formula, real number series. Linear algebra - vector spaces, matrices and determinants, systems of linear algebraic equations (solvability and solution), eigenvalues and eigenvectors of matrices, applications. F7ABBLPZ1 Medical Devices and Equipment I. (Diagnostic Devices) 7 7K Medical devices categories. Electrical safety of medical devices. Biopotentials amplifiers. Electrocardiographs, electromyographs and electroencephalographs. Dilution methods of blood flow and cardiac output measurement. Blood pressure measurement. Cardiac frequency measurement. Phonocardiography. Pulse oximetry. Medical monitors. Electrostimulation and electrosurgery medical devices. Therapeutic medical devices. Implantable medical devices. Telemetry. Medical devices for audiology. F7ABBLPZ2 Medical Devices and Equipment II. (Therapeutical Devices) 2 Medical devices categories. The electrical safety of therapeutical medical devices. Artificial ventilation, introduction. Conventional ventilation. High-frequency ventilation. Extracorporeal membrane oxygenation. Hemodialysis. Drug infusion pumps (volumetric, syringe). Artificial cardiac pacemaker. Defibrillators (external, implantable). Cochlear implant. Electrosurgery units. Therapeutic ultrasound. Electro-therapy. Magneto-therapy. F7ABBLT Clinical Laboratory Instrumentation Clinical laboratory instrumentation introduces principles of bioanalytical methods used in clinical diagnostics. Emphasis is put on optical methods (UV-VIS spectrophotometry, IR spectroscopy, AAS, AES, fluorimetry), NMR and X-ray analysis, electrochemical and electromigration methods (ion electrodes, biosensors, electrophoresis, isoelectric focusing), imunoassays and genetic methods (ELISA, PCR) as well as on chromatography and mass spectrometry. Contribution of lab automation to clinical diagnostics will be also discussed. During the laboratory course students will be introduced into the basics of work in bioanalytical laboratory and lab data processing. F7ABBMAT Marketing of Medical Technology ΚZ 2 Marketing fundamentals, products management, basic knowledge concerning export activities in the field of marketing and commercial health care technology. Practical cases are presented including health care technology companies from the Czech Republic. Discussion and analysis of the real products are included in the exercises F7ABBMAZ Management and Admininistration in Health Care Getting to know the structure of the health sector and financing models Health. Zoom administrative management issues various types of medical workplaces, their necessary interconnection. Orientation in the specific features of health facilities and European systems of health care workplaces. F7ABBMDT Microwave Diagnostics and Therapy K7 2 Interaction of the EM field with biological tissues and its use in diagnostics and therapy. Numerical methods suitable for modeling these interactions. Basics of microwave imaging (MWI). Perspective application of microwave techniques in medical diagnostics: non-invasive monitoring of blood glucose concentration, microwave detection and classification of cerebral vascular events and early detection of breast cancer. Therapeutic systems and applicators for microwave and RF local and regional hyperthermia. Planning treatment. Design and testing of applicators. F7ABBMEC Mechanics Z.ZK Students will get acquainted with the following areas of mechanics: General physical equations, Newton's laws, statics and dynamics. Force and moment effect - decomposition, replacement. Equilibrium of a force system in a plane and space - equation of equilibrium, systems into equilibrium. Reactions on statically determined systems - motion restrictions, spatial and planar constraints, solution of reactions. Static moment, center of gravity and center of area. Spatial moment of inertia - kinetic energy of rotational motion, product moment, momentum, law of conservation of momentum. Second moment of area - product moment, polar moment, Mohr circle, main moments of inertia, ellipse of inertia. Internal static effects - beam, system of plates, course of internal static effects, kinematic method, statically indeterminate problems. Mechanical properties of materials - tests of mechanical properties, stresses and deformations, Hooke's law. Stress and strain - uniaxial and biaxial stress state, simple bending, bending curve, torsional stress, cross-section design, thin-walled cross-sections, combined stress, nonlinear models. Buckling strength - critical load, stability of members, calculation of cross section. Tests of hardness, adhesion, toughness, tribological. Physical Phenomena Modeling in COMSOL MULTIPHYSICS F7ABBMFJ Numerical simulations are increasingly being used to develop new and optimize existing products and devices. Numerical simulations can greatly reduce the number of prototypes needed and thus significantly accelerate and reduce development costs. Another sector where numerical simulations are used is a sector where it is difficult to verify ongoing physical processes (eg, heating the biological tissue under electrodes for direct brain simulation). Last but not least, based on numerical simulations, we can plan treatment where, based on knowledge of material properties, we can define the amount of power delivered to the device (eg radiofrequency ablation in oncology or cardiac surgery). Computer modeling involves the creation of geometry, setting of material properties and boundary conditions and, last but not least, the choice of differential equations, the method of discretization of the computing area and the processing of results. The accuracy of the results obtained, the length of calculations and the computational power requirements are very dependent on the numerical model setting. The lectures cover the most common problems in electrical engineering, thermics, mechanics, chemistry, acoustics and fluid dynamics. The acquired knowledge will be tested by the students when designing individual parts of devices and devices. F7ABBMS Z.ZK Modelling and Simulation Basic concepts. Aims and consequences of modeling and simulation. The methodology of modeling and simulation. Inverse problem. Proposal for a new, respectively additional experiment. Compartmental models. Physiological models. Pharmacokinetics. Continuous and discrete models of population dynamics. Epidemiological models. Veneral disease models. F7ABBMT Medical Terminology Ζ 1 Attendants are made acquainted with particular terms flowing from latin but also greek expressions during their lectures. Students are continuously informed about terms of whole diagnosis and therapeutical procedures. Education is combined with continuous knowlegde check up through the use of tests. Microprocessors in Biomedicine The aim is to explain the principles and building blocks of a microprocessor system, the structure of a microprocessor, the connection of basic peripherals, the programming model of a microcomputer system in the form of a practically oriented explanation and demonstration tasks. Provide a basic overview of ATMega and ARM Cortex M architectures with practical examples of their programming with examples of use in biomedicine. Prerequisites and co-requisites: basic knowledge of digital technology and signal processing, basics of ISO C. Output knowledge, skills, abilities and competencies: The student is familiar with the selection and design of microprocessor system solutions for use in biomedicine. It manages the configuration and program control of these building blocks of the microprocessor system: digital inputs and outputs, A / D and D / A converters, serial and parallel communication, counters and timers, interrupt controller. Understands the basics of communication of microcomputers with the environment: interfaces for LCD displays, keyboards, RS232, Ethernet, WIFI, Bluetooth, XBee and mobile 3G / 4G communication, GPS / GLONAS localization. F7ABBMVP Research Methodology ΚZ 2 The course introduces students to the basic methods of research work and the requirements for scientific communication. The course also introduces students to the principles of writing and presenting of bachelor's thesis. **Project Proposal and Management** F7ABBNMP K7 2 As part of the lectures, students will become familiar with topics such as project management (PM) according to IPMA, the certification process, project, program, portfolio, phases, and the project life cycle, as well as project initiation. They will learn about the feasibility study, project initiation, project identification document, and logical framework. Other topics include an introduction to project planning, scheduling, risk and risk analysis, project implementation, behavioral competencies in PM, project closure, and evaluation. Students will also gain practical insights from a hospital environment. During the exercises, students will master the following concepts and topics and develop relevant outputs: teamwork, feasibility study, identification document, logical framework, WBS (Work Breakdown Structure a hierarchical structure of tasks or activities), scheduling, risk analysis, project implementation, and a final test. As part of this course, students have the opportunity to obtain the IPMA Level D certification, which is intended for aspiring project managers, project coordinators, and team members. The certification is valid for five years.

F7ABBOIZ	Protection Against Ionizing Radiation	ZK	2
	urse is to give students an overview of the issues of protection against ionizing radiation and dosimetry in general and in a specialize	ı d medical workplad	ce. Student
	ties of basic types of ionizing radiation, sources of ionizing radiation, interaction of gamma radiation with matter, interaction of charge	-	-
	passage through the matter, units used in dosimetry and radiation protection, operational units for working and environment monitorin	•	
	elding of simple sources. Special attention is paid to the exposure control of workers, residents and patients. In course students will give		-
•	osage limits. Entry requirements of the course: Structure of matter, basic types of nuclear transformations. Properties of basic types o Interaction of gamma radiation with matter, interaction of charged particles with matter, passage of photon and electron beams throug	•	
	nowledge, skills, abilities and competences: Units used in dosimetry and radiation protection. Principles and goals of radiation protection		_
•	ionizing radiation and protection against internal contamination. Dose limitation system, ionizing radiation in legislation of Czech Repu		-
· ·	healthcare.	· ·	
F7ABBPMS	Probability and Mathematical Statistics	Z,ZK	4
Objectives: to fam	iliarize students with the basic principles of the theory of probability and mathematical statistics. Pre-requisites and entry requirement	s of the course: Kr	owledge of
mathematics (li	near algebra, differential and integral calculus) in the range of F7PBBLAD and F7PBBITP courses taught in the first year of study. Kno	owledge, skills, abi	lities and
•	e student is acquainted with the probabilistic model, basic definitions of Kolmogorov theory of probability and inductive statistics. The student is acquainted with the probabilistic model, basic definitions of Kolmogorov theory of probability and inductive statistics. The student is acquainted with the probabilistic model, basic definitions of Kolmogorov theory of probability and inductive statistics. The student is acquainted with the probabilistic model, basic definitions of Kolmogorov theory of probability and inductive statistics.		
to practical probler	ms that arise in other areas of professional work and can explain them sufficiently (e.g. doctors). The student is familiar with the basic	methods of inducti	ve statistics
EZADDDNIK	and can choose a suitable method for standard statistical problems.	V7	4
F7ABBPNK	ı	KZ	functional
· · · · · · · · · · · · · · · · · · ·	actically oriented course is to acquaint students with the design process of the measuring part of the device, ie basic problem analysi lesign, selection of suitable components and their values with emphasis on working with catalog sheets and application recommendat		
	d board design. printed circuit board, its mounting, soldering and revitalization. During the course, students will implement a functional		
	ic thermometer, which will consist of two functional units - analog part for temperature measurement and signal conditioning (equippe		_
display element wi	th diode bargraph (equipped with SMT components). For both products, students will implement the design of the diagram and PCB in	the CAD environm	ent EAGLE.
	nalog part of the device, an application for digitizing data from the analog device using NI-DAQ cards and a cheap solution with the help of		nplemented.
	The last part will be a service intervention in the device (monitor of vital functions) with emphasis on safe handling and measurement of	of test points.	ı
F7ABBPP	First Aid	KZ	2
_	a brief overview of the main principles and procedures of providing emergency first aid with special attention to the procedures for fail		
	ening situations. The subject also includes situations of mass casualty of victims in crisis situations and emergencies, including the ph		
F7ABBPPM1		KZ	1
The aim of the co	purse is to acquaint students with the Matlab environment and language. Students will learn how to create functions and scripts in Ma about data structures and work with data and their vizualization. The course is followed by the course Programming in Matlat		y wiii learn
F7ABBPPM2		KZ	2
	the students will consolidate and widen their previous knowledge with the Matlab environment, programming language and with basic	l	1
-	n course Programming in Matlab I. The students will learn how to create functions and scripts in Matlab, how to manipulate and visual		-
	the basic toolboxes. As well the students will learn to create basic user interfaces.		
F7ABBPPP	Programming Tools	KZ	2
Introduction to so	ftware tools on MS Windows platform and GNU/Linux platform. Short introduction of several software tools (MS Word, Excel, LateX, F	owerpoint) and pr	ogramming
	languages (Python, R, Java, CSS, bash) .		1
F7ABBPPS	Patient and Device Simulators and Testers	Z,ZK	2
	ment simulators and testers. Basic principles of implementation, connections with other disciplines. Detailed description and impleme		
,	gn and implementation of patient and instrument simulator sub-blocks. Examples of circuit implementations of simulators and testers. E Ind procedures in manikin control, basic concepts and principles of anesthesiology. Other types of simulators and phantoms. Possibilitie	,	
	stration. Connection of the simulator with other medical equipment. Simulators and testers. Implementation of an established simulatic		
. radiida. domen	creation of new scenarios. Collaboration between HPS and anaesthesia machine.	m ocomano, ocoma	
F7ABBPSL	Psychology	KZ	2
	hodology and methods of psychology. Mental activities and psychic processes, psychology of personality, objects of psychology and the	eir formation and d	evelopment.
Modern psycholog	y; its concept and theory, psychic processes and stages. Psychological interpretation of personality. Application of knowledge in medic	al situations. Relat	ion between
	nedical doctors, technicians and patients, technicians and nurses. Communication as a tool for good cooperation amongst people and		
expression and	communication skills. Use of elocution and gestures in personal expression. Verbal and nonverbal communication. Dialogue; types of	dialogue, question	ns during
EZA DODE!	dialogue. Model situations. Communication process as part of economics - components, tools and functions.	1/7	
F7ABBPTI	Principles and Practice in Tissue Engineering	KZ	2
F7ABBRBL	Robotics in Medicine	KZ	2
F7ABBROP	Guided Practical Training	Z	2
	students with the organization and provision of professional internships at the clinical workplace. Provision of contractual documents	•	
	d professional practice). The ROP will then enable the acquired practical skills and habits to be applied in the key subjects of the 3rd y current technical level of hospital equipment; an overview of the organization of the work of biomedical technicians and engineers; car		
OVERVIEW OF THE C	ensure the safe operation of medical equipment. He can communicate with technicians, but also medical staff. He is able to work in		Cilicino to
F7ABBSBP	Bachelor Thesis Seminar	Z	1
	aim of the course is to accentuate the realized outcomes of the projects solved in the 4th, 5th and 6th semesters of the Biomedical To		1
	e aim of the course is also to prepare students for the defense of their bachelor thesis infront of the final state examination committee.		_
Prerequisite F7PBI	BMVP Exit Knowledge, Skills, Abilities and Competencies: Students are fully aware of the requirements for the requirements of profession	al reports and com	munications,
they are proficien	t in the orientation in the professional literature. The students are able to understand the literature and literature on a given topic, appl	y scientific researc	h methods
	to specific assignments. They present their proposed solutions and results, are able to interpret the results.		
F7ABBSEL	Power Engineering	Z,ZK	5
•	electronics, power supplies, including electrochemical sources, rectifiers, stabilizers, the most commonly used types of motors, basics	-	
electrical systems	s and connecting appliances with a focus on medical use. Emphasis is placed primarily on the physical nature of the problem and its u be verified on practical examples and in the laboratory.	muerstanding. KNO	wieuge Will
F7ABBSJ	Scripting Languages	KZ	2
	rse is to understand the topic of scripting languages and their applications, to understand their advantages and disadvantages and their		ı
	its will become familiar with regular expressions and tools for word processing. The course focuses on the scripting languages within the scripting languages with the scripting languages		-
-	the scripting languages Python.		

F7ABBSM Sensors in Medicine Z,ZK

This subject provides information about basic electronic devices - sensors, describes their operation principle, basic circuit configuration and application. The stress is aid mainly on clarifying of basic principles and practical utilization. Integral part of this course is basic information about sensors of non-electric quantities and their read-out circuits eq. strain related sensors (force, pressure, torque, vibration, displacement, acceleration etc.) magnetic field sensors, temperature sensors, chemical sensors, optical sensors and biosensors. The stress is aid on miniaturization, integration

F7ABBSPR1 Semestral Project I. K7

The topic of the semester project (SPR1) must be in the field of biomedical engineering and must be related to the study field of the same name Biomedical Technician. The topics are available for the relevant academic year in the database projects.fbmi.cvut.cz Note: It is not possible to implement economic-managerial topics, topics based mainly on the creation of research, clean programming, topics purely in the field of biology, etc. The application must always be part of the work in accordance with the focus of the field. The topic must always be related to technology (medical devices, or the scope of work of a Biomedical Technician in clinical practice)! Entries that do not fall into the above areas will not be approved.

Semestral Project II. F7ABBSPR2

The main idea is to start work on a project which can be improved in time and finish as a Bachelor thesis. In the course will be discussed topic as basic communication and presentation skills, including teamwork and project management. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing a commented bibliographic search. The student solves topic (project) from the selection of the PROJECTS database - http://projects.fbmi.cvut.cz During the term, there are dedicated 2 hours every week for work under teacher supervising.

F7ABBSPT Equipment for Anaesthesiology and Resuscitation Z.ZK

The main objective of the course is to introduce students to the basic equipment of intensive care units (ICU) and anesthesiology and resuscitation departments of hospitals. These are devices to support vital functions, especially lung ventilation, as well as patient monitors, anesthesia machines and their parts and other equipment. Another objective of the course is to integrate knowledge and skills of students from the fields of science (especially physics, chemistry and physiology) and engineering (modeling, circuit theory, pneumatic elements, etc.) in the analysis of clinical technology and in the design and implementation of functional technical systems.

Technical Audiology

The aim of the course is to give students a basic overview of audiology, i.e. basic knowledge of biology, medicine and technology in relation to normal and impaired hearing, and all this in an interrelated context with emphasis on technical aspects. Motivation to work in clinical practice in audiology is also an integral part of this goal. workplace. Course entry requirements: These requirements are expressed as prerequisites and a detailed breakdown of the requirements is as follows: - nervous system - organisation and function of the CNS, internal environment of the CNS (blood-brain barrier, cerebrospinal formation, transport and function), neuroglia, motor nervous system, spinal cord (structure, reflexes), - nervous system - motor system, brainstem (structure, reflexes), cerebellum (structure, reflexes), basal ganglia (structure, reflexes), cerebral cortex (structure, rexlexes), physiology of movement control, - sensory nervous system - receptors, skin sensation, movement and position perception, vision, hearing, taste, smell, pain, autonomic nervous system, brain stem, hypothalamus, peripheral compartments: sympathetic and parasympathetic, - waves, types of waves, successive waves, interference, standing waves, sound, - types of signals, basic signal operations, signal decomposition, - harmonic analysis, Fourier transform for continuous and discrete signals, DFT, FFT, - convolution, - technical and biological systems, systems and their description, linear and non-linear system, - external description of continuous and discrete linear system - differential/differential equations, transfer functions, frequency characteristics, distribution of zeros and poles, time characteristics, - coupling of systems, feedback loops, - Characteristics of basic biosignals EEG, ECG, EOG, EP, EMG, artefacts, origin, sources, diagnostic applications, frequency range and bands, - Biological data acquisition and preprocessing, basic computer conversion chain, A/D converters, problems signal sampling and quantization, Nyquist theorem, conversion errors, signal conditioning, aliasing, filtering, trends, sensing options. Output knowledge, skills, abilities and competences: Students will acquire a basic understanding of acoustics, measurement and diagnosis of auditory functions, including technical principles. instrumentation and software, and hearing aids and replacements. The students will be able to orient themselves. They will be able to learn about these issues, learn about other areas of medical instrumentation and methods used in clinical practice, as well as motivated and ready to enter the field of audiology upon graduation and to add to this knowledge and advanced skills within the framework of the so-called certified course, which, according to Act 96/2004 Coll., allows for the acquisition of the so-called "certificate of audiology". Special professional competence Technical audiologist after graduation, i.e. after obtaining the so-called professional competence Biomedical technician under the Act.

Theory of Electrical Engineering

Electric current, DC and AC currents. Electrical curcuits including R, L, C. Power of electric current, thermal effect of electric current. Distribution of electrical energy. Connection of the electrical systems. Input resistance and impedance, idle voltage, inner resistance and impedance of the source, mutual loading of the source and electrical appliance, impedance matching. Properties of circuits in time and frequency domain. Transient action in DC circuits, frequency characteristics of the L/C circuit. Electrical current in semiconductor, type of the conductivity, creation of the semiconductor crossing, properties in the forward and reverse direction. Bipolar transistor - transistor effect, basic principle in elementary circuit. Unipolar transistor. Unipolar transistors with complementary vodivosti (CMOS). Electromagnetic effects (induction, magnetization, force effect). Electromagnetic wave, spreading, interference, electromagnetic compatibility. Soft and hard magnetic materials. Transformers construction and parameters. Magnetic recording and reproduction of signals. Electromotors principles.

F7ABBTZS Tomographical Imaging Systems Z.ZK

CT systems (basic principle, schematic arrangement system, basic physical principle, developmental generations, basic principles of reconstruction). Imaging systems magnetic resonance. PET and SPECT principle. Specialized imaging systems (hybride). Ultrasound imaging systems. Doppler systems. Subject and especially laboratory exercises provide students with an insight into the principles of creating image data used in medicine, the principle of methods their scanning, digitization and subsequent processing, on the principle of function and properties of scanning image means in context, which is important especially in terms of interdisciplinarity of the subject and the field as a whole

F7ABBUSS Introduction to Signals and Systems Z,ZK 4 To introduce students to basics of theory of signals and systems. To explain main principles on applications from biology and medicine. To become acquainted with basic mutual

relations in computer laboratories by means of MATLAB.

F7ABBZLN Legislation in Health Care and Technical Standards

Aims / aims: The aim of the course Legislation in Health Care and Technical Standards is to teach students the basic requirements and regulatory obligations in healthcare, especially in the field of medical devices. During the course, students will learn the basics of legislation process, as well as regulation related to the medical devices, lso with legislative regulations in the field of clinical trials and the operation of medical devices. Furthermore, students will learn the legal context of providing health care. The aim is to acquaint students with the rights and obligations arising from current legislation relating to health care issues. The emphasis is not on memorizing of the text of legal regulations, but on acquainting students with the main points and ideas contained in the laws, regulations and standards of the Czech Republic and EU directives in the field of healthcare. Prerequisites and co-requisites: To successfully complete the course, students should know the basics of the principles of medical devices due to the practical application of legislation in this area. Output knowledge, skills, abilities and competences: After completing the course, the student should have a comprehensive overview of health legislation. He should be able to orientate himself in a given problem related to legislation without any problems and he should know where he can find individual details related to legal issues in health care.

Image Data Processing

Continuous image representation, linear 2D systems, 2D spectrum, Digital representation of images, Basic image characteristics: brightness, contrast, resolution, noise, look up tables, histogram, Discrete Fourier transform, discrete cosine transform, image enhancement, geometric operations, image filtering, morphological operations, image restoration, image segmentation, basic principles of image compression.

Fundamentals of Pathology

The main goal of the course is represented by continuous enlargement of anatomical, physiological and multi-disciplinary consequences in human health and disease. At the very beginning of the course the fundamentals of cell structure disorders and metabolic paths disturbances are provided to understand pathology of organ systems and complexity of disease origin and causes. The course provides a wide overview of morphological and functional conditions in pathology. The knowledge is then simply transformable to clinical and technical disciplines used in examination and health monitoring of the patients. The Course Requirements: The enrolment to the course is contingent on successful finishing of the course Anytomy and Physiology II. Release and Results: The students obtain basic outline of pathological processes in the human body. Their skills comprise definition of disease, comprehension and description of pathological changes in organs and body structure. The theoretical basis of the course is oriented to use in technical branches of biomedical engineering.

For updated information see http://bilakniha.cvut.cz/en/FF.html Generated: day 2025-04-17, time 06:34.