Study plan

Name of study plan: Biomedical Informatics - full-time study

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Biomedical and Clinical 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: 162
The role of the block: Z

Code of the group: 17PBI POV
Name of the group: Biomedical Informatics compulsory course 13
Requirement credits in the group: In this group you have to gain 162 credits
Requirement courses in the group: In this group you have to complete 44 courses
Credits in the group: 162
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
17PBIALP	**Algoritmic and Programming Theory**	Z,ZK	5	2P+2C	Z	z
17PBIJA3	**English III.**	KZ	4	4C	Z	z
17PBIBP	**Bachelor Thesis** Zoltán Szabó, Ond ej Klempí **Zoltán Szabó** Zoltán Szabó (Gar.)	Z	8	8L	L	z
17BOZP	**Occupational Safety and Health, Fire Protection and First Aid** Petr Kudrna **Petr Kudrna** Petr Kudrna (Gar.)	Z	0	1P	Z	z
17PBIBPD	**Safety of Data Transmission and Processing**	Z,ZK	2	2P+1C	Z	z
17PBIBIF	**Bioinformatics** Ond ej Klempí	KZ	4	2P+1C	Z	z
17PBIBS	**Biomedical Statistics**	Z,ZK	5	2P+2C	L	z
17PBIDDS	**Data and Data Structures**	Z,ZK	5	2P+2L	L	z
17PBIDBS	**Database Systems**	Z,ZK	3	1P+1C	Z	z
17PBIDTA	**Desktop Application of MS Office** Zoltán Szabó	KZ	3	1P+1C	Z	z
17PBIEHT	**eHealth and Telemedicine**	Z,ZK	5	2P+2C	L	z
17PBIEUI	**Expert Systems and Artificial Intelligence for Medicine**	Z,ZK	3	2P+1C	Z	z
17PBIIPZ	**Implementation and Support of IS in Health Care**	Z,ZK	3	1P+1C	Z	z
17PBIIT	**Information Technologies**	Z,ZK	3	2P	Z	z
17PBIITP	**Integral Calculus**	Z,ZK	5	2P+2C	L	z
17PBILDT	**Laboratory Diagnostics and Technology**	Z,ZK	4	1P+1L	L	z
17PBILTR	**Medical Terminology**	Z	1	1P	Z	z
17PBILAD	**Linear Algebra and Differential Calculus**	Z,ZK	5	2P+2C	Z	z
17PBILOG	**Logics**	Z,ZK	4	2P+2L	Z	z
17PBIMTL	**Matlab**	KZ	3	2C	L	z
17PBIVZP	**Methods of Healthcare Reporting**	KZ	2	1P	L	z
17PBIMS	**Modelling & Simulation**	Z,ZK	5	2P+2C	L	z
17PBINIS	**Hospital Information Systems**	Z,ZK	5	2P+2C	Z	z

17PBIPJC	**C++ and C# Programming**	Z,ZK	3	1P+2C	Z	z
17PBIOPS	**Operating Systems**	KZ	3	2P	L	z
17PBIDPS	**Computer Network**	Z,ZK	5	2P+2C	L	z
17PBIPPZ	**Programming Tools**	KZ	3	2L	Z	z
17PBIPAB	**Computer Security and Legal Aspects of IT**	KZ	4	1P+1C	L	z
17PBIRBL	**Robotics in Medicine**	KZ	2	1P+1L	L	z
17PBISPR	**Term Project** *Zoltán Szabó*	KZ	5	4S	Z	z
17PBITZT	**Theory and Practice of Journalistic Writing**	Z,ZK	5	2P+2C	L	z
17PBITWA	**Web Application Development**	KZ	3	2C	L	z
17PBITPR	**Team Project**	KZ	6	4S	L	z
17PBIUSS	**Introduction to Systems and Signals**	Z,ZK	5	2P+2C	Z	z
17PBIVAA	**Multi-tier Application Architecture in Biomedicine**	KZ	3	1P+2S	Z	z
17PBIKO1	**Principles of Clinical Branches I**	Z,ZK	3	2P	Z	z
17PBIKO2	**Principles of Clinical Branches II**	Z,ZK	2	2P	L	z
17PBIPM1	**Fundamentals of Preclinical Medicine I**	Z,ZK	3	2P	Z	z
17PBIPM2	**Fundamentals of Preclinical Medicine II**	Z,ZK	3	2P	L	z
17PBITM1	**Fundamentals of Theoretical Medicine I**	Z,ZK	3	2P	Z	z
17PBITM2	**Fundamentals of Theoretical Medicine II**	Z,ZK	3	2P	L	z
17PBIZEL	**The Basic Use of E-learning**	Z,ZK	3	1P+1C	Z	z
17PBIZIZ	**Information Sources in Health Care**	Z,ZK	3	1P+1C	L	z
17PBIZOD	**Image Data Processing** *Zoltán Szabó*	Z,ZK	5	2P+2L	Z	z

Characteristics of the courses of this group of Study Plan: Code=17PBI POV Name=Biomedical Informatics compulsory course 13

17PBIALP	Algoritmic and Programming Theory	Z,ZK	5

Algorithm, data structures. Identifiers, data types. assignment statement, conditional statement, cycles. Arithmetical and logical operations. Digital representation of numbers, numeration systems. Introduction to structured programming in C language - building and structure of simple programs, creating of the user functions, user input and output, file management, memory management. Practical overview of programming techniques and basic algorithms in C language. Recursive and iterative methods, measuring algorithm quality. Abstract data-types, data sorting and searching, implementation of basic numerical algorithms. Introduction to biomedical data processing - programmers view. Introduction to software engineering.

17PBIJA3	English III.	KZ	4

The aim of the subject is to extend the wordstock of students in the field of biomedical engineering and its terminology. The subject is primarily focused on the development of communicative and speaking skills.

17PBIBP	Bachelor Thesis	Z	8

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. Bachelor 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.

17BOZP	Occupational Safety and Health, Fire Protection and First Aid	Z	0

17PBIBPD	Safety of Data Transmission and Processing	Z,ZK	2

The orientation of this course is focused to the essential mathematical theory and presents contemporary algorithms and applications of cryptography. Both symmetrical and asymmetrical cryptographic systems are mentioned. The course also contains a primer of quantum cryptography and cryptonalysis.

17PBIBIF	Bioinformatics	KZ	4

Laboratories around the world produce massive amount of new nucleotide and protein sequences, gene expression profiles, 3-D structures and other data of biological character. To illustrate this fact, the number of known nucleotide sequences grew 100 times in just over five years. The database of 3-D structures expanded by 20 % in the same year and more than 3000 organisms have been or are sequenced at the moment. With an ever-increasing amount of data available, grows even the significance of bioinformatics. Bioinformatics collects, archives and most importantly analyses and attempt to find a meaning and useful information in this explosively growing sea of data. Bioinformatics is one of the most dynamically developing areas of biomedical research and basic knowledge of bioinformatics methods becomes quickly indispensable for anyone with a serious interest in doing biomedical research. The aim of this course is to introduce students with basic, but also modern promising bioinformatics methods. These methods will be shown and explained in lectures and later used in a series of practicals. These "hands-on" practicals are designed to show how to take an advantage of bioinformatics in every day life in a laboratory. The practicals were tested for a long time and successfully on students of the Uppsala University, Sweden. This course is suitable for the second- or higher year students of biology or chemistry who want to specialize within the biomedical field of research. A basic knowledge of structure of biomacromolecules (nucleic acids, proteins) is an advantage ut it is not required to have it.

17PBIBS	Biomedical Statistics	Z,ZK	5

Introduction into probability theory and mathematical statistics. Classical, geometrical and Kolmogorov definitions of probability. Random variables, their distributions, characteristics, transformations. Population and sample. Parameter estimators. Statistical tests.

17PBIDDS	Data and Data Structures	Z,ZK	5

A survey of basic data structures and their application. A specification of abstract data types (ADT). Specification and implementation of ADT: list, stack, queue, set, array, look-up table, graph, binary tree. Dynamic data structures and operations with them (effective searching, sorting, storing of data structures etc.). Representation of the data structures, strategies for choice of proper data structure.

17PBIDBS	Database Systems	Z,ZK	3

Database function principles, methodology of relational data model design and object data model. Database systems implementation using of SQL92 and script language PHP inside relational database MYSQL. Database systems implementation using of SQL92 and script language VB inside postrelational database CACHE. Transition data processing. Architecture of client-server and distributed database systems. Both principles relational and postreational will practice and show. Database CACHE includes both principles. It is database service for NIS.

Code	Course	Exam	Credits
17PBIDTA	Desktop Application of MS Office	KZ	3

MS Outlook - operating, use as 'Personal Information Manager' and use as email client, set up and management of accounts, Exchange server client, working with language 'Microsoft Visual Basic for Application (VBA)', COM model; MS Word - basic of typography, advanced format using styles, basic DTP, wholesale correspondence, creating XML documents, XSLT - Extensible Stylesheet Language Transformations, multi users document edit, macros creating; MS Excel - cell and sheet format, working with functions and equations, data analysis, macros creating and interactive aplications; MS Access - relation database and database in MS Access, creating new database and tables, data searching and sorting, relations betwen tables, using 'Data Access Pages (DAP)', database security; MS Project - Project establishing, tasks, resources, duration monitoring, task revision, project server; MS PowerPoint - making presentations, working with the text and objects, graphics and multimedia, automatic, interactive and web presentations, makros; MS FrontPage, MS Publisher, MS Visios - familiarizing with functionality and effective usage; mutual integration of applications MS Office package

Code	Course	Exam	Credits
17PBIEHT	eHealth and Telemedicine	Z,ZK	5

Tele-medical applications - WHO definition, history of telemedicine, relations to development of ICT. Health care organization. Communication in health care. Electronic health record as a basis for telemedicine, hospital information systems, legal issues. Information technology as support of shared and distributed health care. Data security and standardization in health care. Image information processing. Networks and Internet in health care.

Code	Course	Exam	Credits
17PBIEUI	Expert Systems and Artificial Intelligence for Medicine	Z,ZK	3

The course is aimed at providing theoretically deeper knowledge in the area of Expert systems and artificial intelligence in medicine.

Code	Course	Exam	Credits
17PBIIPZ	Implementation and Support of IS in Health Care	Z,ZK	3

Course presents basic information about specific processes of implementation and support of large Information Systems in health care area. Implementation of health care IS process is based on large project management theory description, implementation methodology standards and their application. The best practice and experience in area of large Information System implementation are documented as well. The description of the implementation process starts by decomposition of the Information System to specific modules and its implementation requirements. Implementation team structure and roles of implementation team members are discussed and described as well as time table of the implementation process including necessary documents contented and structure. Logical part of the course is costs calculation, implementation process planning methodology and risks description and management. The second part of the course is oriented on the large Information System and its users support. The course presents the typical Support contract structure, specification of vendor and customer duties and rights, classification of user's requirements, response procedures and time of vendor's call center and product specialists. Students will be informed about internal processes of required services handling on customer and support services vendor side.

Code	Course	Exam	Credits
17PBIIT	Information Technologies	Z,ZK	3

Computer history, structure of computers, motherboard, processors, memody, graphical card, computer buses, BIOS, I/O devices, server, desktop, notebook, pocket PC, data storage, mobile devices, memory card, OS, tasks and memory management, printers scanner, multimedial devices, mass data storage, multitasking, multiprocessoring, set of instruction, assembler, programming languages, power test, network, LAN, WAN, interner, TCP/IP, HTTP, FTP etc., client-server, gate, router, using IT in medicine and telemedicine.

Code	Course	Exam	Credits
17PBIITP	Integral Calculus	Z,ZK	5

The subject is an introduction to integral calculus and integral transforms. Integral calculus: primitive function, 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.

Code	Course	Exam	Credits
17PBILDT	Laboratory Diagnostics and Technology	Z,ZK	4

Laboratory Diagnostics and Technology introduces the principles of bioanalytical methods used in clinical diagnostics. Emphasis is put on the data types produced by these methods as well on the tools for their analysis. During the tutorials students will be introduced into the basic principles of computer data managing and processing.

Code	Course	Exam	Credits
17PBILTR	Medical Terminology	Z	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.

Code	Course	Exam	Credits
17PBILAD	Linear Algebra and Differential Calculus	Z,ZK	5

The course is an introduction into linear algebra and calculus of one variable. Linear algebra part consists of: systems of linear equations and their solutions, Gauss elimination, matrices, rank of a matrix, operations with matrices, inverse matrix, determinant and its calculation, eigenvalues and eigenvectors of matrices. Differential calculus consists of: sequences and their limits. Functions of one real variable, their limits, continuousness, derivatives. Local and absolute extremes of a function of one variable, investigations of functions. Taylor-polynome.

Code	Course	Exam	Credits
17PBILOG	Logics	Z,ZK	4

Logic system, logic circuit, logic function. Bool's algebra. Representation (models) of logic functions: expression/formula, table, cube, map, logical and functional schema, graph. Combinatorial and sequential logic nets. Huffman's schema. Minimization of expressions for combinatorial logical nets with one and more outputs. Normalized expressions, disjunctive and conjunctive forms. Minimization based on operations of Bool's algebra in expressions, in a unit cube, in a truth table (Quin-McCluskey's method), in a logic map - Karnaugh's maps. Combinatorial logical terms, circuits and blocks. Synthesis of combinatorial logic circuits NOT, AND, OR, NAND, NOR. Synthesis of combinatorial logic circuits with limited number of inputs. Modeling of sequential behavior. Finite automata: Mealy and Moore automata. Memory circuits. Analysis and synthesis of synchronized sequential nets. Asynchronous sequential logic nets. Predicate logic (PL): language, terms, formula, substitution and basic syntactic terms, semantics: structures for predicate logic, evaluation, evaluation of terms and formulas. Axiomatic system of PL: axioms, inference rules, concept of a proof, reasoning theorem.

Code	Course	Exam	Credits
17PBIMTL	Matlab	KZ	3

Basic description of MATLAB environment. Numerical formats. Variables and matrices. Complex numbers. Rounding numbers. Basic instructions. Matrices operations. Visualization. Simulink (basic description, exercise formulation, parameters entry). Conditional and cyclical instructions. Script creation, functions, debugging. Continuous and discrete processes. Symbolical solutions. Graphical user interface creation. Applications in MATLAB.

Code	Course	Exam	Credits
17PBIVZP	Methods of Healthcare Reporting	KZ	2

Get familiar with basic principles of a general system for health care coverage. System of health care coverage in the Czech Republic. Legislation on health care coverage in the Czech Republic. Means of regulation of health care coverage. Methods for health care reporting. IT systems supporting health care reporting. Performance coverage, lump-sum payments, capitalization payments, payments for diagnosis. Cost record and coverage of especially high-priced items. Prescription of pharmaceuticals and medical devices, and their coverage. Means of data transfer to health insurance companies. Auditing health care coverage; inspectors in health insurance companies. Health insurance companies in the Czech Republic. System of regressive refunds. Health documentation.

Code	Course	Exam	Credits
17PBIMS	Modelling & Simulation	Z,ZK	5

Modelling and simulation - fundamentals. Compartmental models. Models of population dynamics - single species population, interacting population, continuous models, discrete models. Models with age distribution. Epidemic models - model of SIR structure, criss-cross models, models of venereal diseases.

17PBINIS	Hospital Information Systems	Z,ZK	5

Definition of hospital episodes, organization and workflow of hospital care. Data items and structuring electronic patient record. The structure of patient-oriented databases, monitoring and correction of incompleteness. Record of medical information and data, display and prints of medical records and information. Patient admission, transfer and discharge module. The structure of electronic medical record forms. Medical order and record of drug and infusion therapy. Electronic patient record, registration physiological condition of the patient and nursing care. Checking the quality of care, standardization and accreditation of providers of hospital care. Protocols of patient care. Orders, findings and neutral services, structure, format of order status monitoring. Structured patient record and its interpretation. Intensive care and resuscitation. Resuscitation record. Calculation of physiological liquid, ions and energy balance and classification of severity of patient condition. Surgical care, surgery planning, traffic management of operating rooms. Anesthesiology and operational protocol. Postoperative care. Outpatient episode, outpatient patient record and outpatient information subsystems. Laboratory information systems, LIS database, communication and quality control. Integration of the laboratory complement. Radiology IS, specific workflow, planning, testing, generation, transmission and archiving of digital image information (PACS). One-dimensional and multi-dimensional medical data coding systems (ICD-10, SNOP, SNOMED ,..). Data standards for transmission and storage of information and data (HL7, DaSta CR, DICOM ,..). Accounting of health care, performance-related systems, DRG, controlling of clinical departments.

17PBIPJC	C++ and C# Programming	Z,ZK	3

Object oriented programming. Variables, strings. Classes (methods, parameters, constructors, polymorphism, virtual methods, inheritance). Arrays. GUI, Windows Forms, WPF. Genericity, lists, dictionary. Errors and exceptions. Input-output operations.Files, streams - read, write. XML. Databases and Entity Framework.

17PBIOPS	Operating Systems	KZ	3

17PBIDPS	Computer Network	Z,ZK	5

Lectures are oriented to techniques required for safe and efficient communication in networks bases on telecommunication, local area and wireless technologies. Structures of network messages and methods of their usage in distributed applications and distributed algorithms are presented in several lectures. The aim of exercises is to try some of mechanisms and to obtain an experience with frequently utilized programming techniques.

17PBIPPZ	Programming Tools	KZ	3

Introduction to modern software resources in MS Windows and GNU/Linux environment - office applications, basic visualisation of experimental data, graphical presentation, Internet communication. Data formats, compatibility. Selected parts of the course are compatible with the ECDL (European Computer Driving Licence) knowldege sylabus .

17PBIPAB	Computer Security and Legal Aspects of IT	KZ	4

Legal problems of IT and e health are discussed.

17PBIRBL	Robotics in Medicine	KZ	2

Principles of robotics in medicine and laboratory technics what kind of task is solving, synthesis of kinematics according to the task processed by robot - operational (surgical room), handling (laboratory), kinematics a dynamics of robot arm - computing methodology, verification of obtained models in Matlab environment, sensors and drives used by robots applicable in medicine, possible robot control paradigms - according human (operator) task.

17PBISPR	Term Project	KZ	5

Basic communication and presentation skills. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing a commented bibliographic search.

17PBITZT	Theory and Practice of Journalistic Writing	Z,ZK	5

Aim of the subject is to learn about theory and practice of journalism. Students will be introduced into problematic of mass communication, types of media and their specifications, basics of journalism and internet as instrument of communication.

17PBITWA	Web Application Development	KZ	3

Client-server communication and HTTP protocol, web development applications standards (HTML, XHTML, XML, CSS, javascript), web developing languages, database systems, web server, modern approaches in web application development, developing tools, design web application and realization, web hypermedial systems, e-learning systems on web, design of medical informational web systems.

17PBITPR	Team Project	KZ	6

Basic communication and presentation skills, including team work, team heading 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.

17PBIUSS	Introduction to Systems and Signals	Z,ZK	5

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.

17PBIVAA	Multi-tier Application Architecture in Biomedicine	KZ	3

Students will get acquainted with the design and usage of the client-server software architecture namely in biomedicine applications.

17PBIKO1	Principles of Clinical Branches I	Z,ZK	3

The student is acquainted with principles of problems of particular most important clinical branches, with most important features of diseases and possibilities of their treatment. Emphasize is put on diseases principally participating in the mortality in the Czech Republic or occurring most frequently.

17PBIKO2	Principles of Clinical Branches II	Z,ZK	2

The student is acquainted with principles of problems of particular clinical disciplines, with most important features of diseases and possibilities of their treatment. Emphasize is put on diseases principally affecting the mortality in the Czech Republic and those, in which non-pharmacological prevention is possible and effective. The conclusion of the block is aimed at principles of the medical management.

17PBIPM1	Fundamentals of Preclinical Medicine I	Z,ZK	3

Multibranch subject. Student became familiar with basics necessary to understand basic pathological processes and changes in human body. This knowledge will be added with essential knowledge from laboratory branches.

17PBIPM2	Fundamentals of Preclinical Medicine II	Z,ZK	3

Student will get familiar with basic terms from pharmacology, hygiene, epidemiology, immunology and ethics.

17PBITM1	Fundamentals of Theoretical Medicine I	Z,ZK	3

17PBITM2	Fundamentals of Theoretical Medicine II	Z,ZK	3

Basic information about particular physiological processes, influence of physics strengths on human organism, physical treatment methods, physiological background of effect of particular methods.

17PBIZEL	The Basic Use of E-learning	Z,ZK	3

The aim of the study subject entitled "The Basic Use of e-learning" is to provide students with basic knowledge in the field of e-learning and to develop the students' capacity to design and create e-learning materials and courses as a result of acquired knowledge. Furthermore, students will learn how to study the specialized literature and how to communicate in this field. Subject: The basics of e-learning will provide the students with the knowledge of history and present situation of e-learning, the students will acquire knowledge of the pedagogical aspects of e-learning, of LMS systems and other tools for creating of e-learning materials and of possibilities for assessing the quality of e-learning. Emphasis will be placed on acquiring of practical skills for creating e-learning materials and e-learning courses.

17PBIZIZ	Information Sources in Health Care	Z,ZK	3
Bibliographic resources: primary information resources, structure of the professional communication, secondary information resources, bibliographic databases. Medical databases and registries: image and pharmacological databases, national medical registries - purpose, legislation, data entry, accessibility of outputs, forms of data mining. Internet resources: types of the Internet resources in health care, Internet search services, strategy and tactics of the Internet search. Evaluated information resources: Evidence Based Medicine, The Cochrane collaboration, EBM databases, interpretation of meta-analysis, recommended guidelines. Quality of bibliographic information: Impact factor, SCI database, the accuracy, completeness and effectiveness of information search in databases Quality of Internet information: visit rate, citation, criteria for quality web presentations, international evaluation standards. Information resources for the public: credibility evaluation of resources, sociological aspects of information optimality, interactive resources of communication				
17PBIZOD	Image Data Processing	Z,ZK	5
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.				

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 18
The role of the block: S

Code of the group: 17PBI PV 1S
Name of the group: Biomedical Informatics compulsory optional course 1st semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 6)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 2)
Credits in the group: 3
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
17PBIFY1	**Physics I.**	KZ	3	2P	Z	s
17PBISM	**Mathematical Seminars**	KZ	3	2S	Z	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 1S Name=Biomedical Informatics compulsory optional course 1st semester 13

17PBIFY1	Physics I.	KZ	3
Physics I course will allow students to acquire and strengthen knowledge in these branches of physics: mechanics, thermodynamics and solid state physics. Through the course we also touch the limits of the classical Physics.				
17PBISM	Mathematical Seminars	KZ	3

Code of the group: 17PBI PV 2S
Name of the group: Biomedical Informatics compulsory optional course 2nd semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 12)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 4)
Credits in the group: 3
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
17PBIAZI	**Applied Informatics in Health Care**	KZ	3	1P+1C	L	s
17PBIFY2	**Physics II.**	KZ	3	2P	L	s
17PBIMVP	**Research Methodology**	KZ	3	1P+1C	L	s
17PBINMP	**Project Proposal and Management**	KZ	3	1P+1C	L	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 2S Name=Biomedical Informatics compulsory optional course 2nd semester 13

17PBIAZI	Applied Informatics in Health Care	KZ	3
The subject contains the basic areas of medicine, which are presented on the internet by the medium of medical-related web pages. Information sharing via internet in discussion forums and electronic conferences for fields like pharmacy or stomatology is also discussed.				
17PBIFY2	Physics II.	KZ	3
The Physics II course introduces fundamentals and applications of electromagnetic fields. The covered topics include electromagnetic interaction, electric field, magnetic field, electromagnetic field, Maxwell's equations, electromagnetic radiation, fundamentals of quantum physics, atomic nucleus and elementary particles, and interaction of radiation with matter.				
17PBIMVP	Research Methodology	KZ	3
Methodical starting points of research. Methods and technology of research. Logic of scientific research. Theoretical starting points of research. Scientific information as a fool for everyday work. Structure of scientific information, possibility for their acquisition, methods of processing and application in practice. Description of principles for searching for scientific information. Description of specific systems, namely from health service. Final report.				

17PBINMP	Project Proposal and Management		KZ	3

How to apply for a grant project. Types of grant projects. Stages of proposal of the project. Specific requierements of projects. Documentation of the projects. Management, ordering and coordination of the project. Curriculum vitae. Planing and controlling of project realization. Presentation of the project. Team management in project.Sample application.

Code of the group: 17PBI PV 3S
Name of the group: Biomedical Informatics compulsory optional course 3rd semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 9)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)
Credits in the group: 3
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
17PBILOD	**Medical and Nursing Documentation**	KZ	3	2P	Z	s
17PBIMZB	**Biosignal Measuring & Processing in Real Time**	KZ	3	1P+1L	Z	s
17PBITEL	**Theory of Electrical Engineering**	KZ	3	2P	Z	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 3S Name=Biomedical Informatics compulsory optional course 3rd semester 13

17PBILOD	Medical and Nursing Documentation		KZ	3

The course are focused on basic principles and concepts of medical and nursing documentation. The topic for this course is the main structure of the ambulatory check-ups, the structure of the records of patient hospitalization, the emphasis will be given to the specific clinical departements, such as oncology, internal medicine, traumatology, surgery etc. The seminar also provides an introduction to main code classification systems (scores) specific to individual disciplines - TNM, FIGO, Child - Pugh, Karnofsky, Ishak, etc. In the last lessons the students learn the fundamentals of nursing documentation and the basic standards of nursing care.

17PBIMZB	Biosignal Measuring & Processing in Real Time		KZ	3

Real-time, latency, interrupts. Design of the measuring chain - input circuits, bus structure of the digital part, signal processing unit (microcontrolers, signal processors, single chip industrial computers, personal computers). Operating system Windows and real time, serious real-time operating systems. Multitasking and preemption, priority of processes, multithreading. Algorithms of real-time biosignal processing.

17PBITEL	Theory of Electrical Engineering		KZ	3

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 of conductance (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.

Code of the group: 17PBI PV 4S
Name of the group: Biomedical Informatics compulsory optional course 4th semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 12)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 4)
Credits in the group: 3
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
17PBIFY3	**Physics III.**	KZ	3	1P+1C	L	s
17PBIJV	**Java**	KZ	3	2C	L	s
17PBIPPT	**Advanced Programming Techniques**	KZ	3	2C	L	s
17PBIPPP	**Programming Tools (Advanced)**	KZ	3	2L	L	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 4S Name=Biomedical Informatics compulsory optional course 4th semester 13

17PBIFY3	Physics III.		KZ	3

The course extends the previous courses Physics I. and Physics II. In this set of courses the main emphasis is placed on the understanding of priciples and the ability to solve standard physical examples. In Physics III. course we study waves, optics and lasers. We concentrate on practical examples and experiments.

17PBIJV	Java		KZ	3

The subject is focused on understanding students with object-oriented programming language Java. Builds on the knowledge gained in the course of programming in c #. In the framework of exercises will be discussed the description of integrated environment, the structure of the programme and debugging and testing tasks, the commands of a programming language, design methodology algorithms, basic control structures, data types, memory management, design and the use of classes, the treatment of exceptions, introduction to user interfaces, technologies for creating the presentation layer of a program.

17PBIPPT	Advanced Programming Techniques		KZ	3

17PBIPPP	Programming Tools (Advanced)	KZ	3
Introduction to software tools on MS Windows platform and GNU/Linux platform. Problem of portability of data-files, standardized exchange formats - HTML, XML, PDF, ODF, PNG etc. Introduction to administartion and configuration of MS Windows and GNU/Linux, programming of scripts, connectivity and comaptibility of major operating systems. Multiplatform applications - WWW browsers, e-mail clients, Office toolboxes, Graphical and CAD programs.			

Code of the group: 17PBI PV 5S
Name of the group: Biomedical Informatics compulsory optional course 5th semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 15)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 5)
Credits in the group: 3
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
17PBIIAB	**Information Analysis of Biological Systems & Signals**	KZ	3	1P+1C	Z	s
17PBIITH	**IT for Handicapped People**	KZ	3	1P+1L	Z	s
17PBILPZ	**Medical Devices & Equipment** *Petr Kudrna*	KZ	3	2P	Z	s
17PBIMTB	**Microprocessors in Medicine**	KZ	3	1P+1L	Z	s
17PBIZS	**Imaging Systems**	KZ	3	2P	Z	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 5S Name=Biomedical Informatics compulsory optional course 5th semester 13

17PBIIAB	Information Analysis of Biological Systems & Signals	KZ	3
Information entropy, applications. Average mutual information. Continuous and discrete communication channel. Relationship of information and thermodynamic entropy. Principle of maximal entropy. Biosystem organization, models and system identification. Introduction of statistical decision making, testing of statistical hypothesis, Bayessian approach.			
17PBIITH	IT for Handicapped People	KZ	3
17PBILPZ	Medical Devices & Equipment	KZ	3
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 oxymetry. Medical monitors. Electrostimulation and electrosurgery medical devices. Therapeutic medical devices. Implantable medical devices. Telemetry. Medical devices for audiology.			
17PBIMTB	Microprocessors in Medicine	KZ	3
Introduction to embedded microprocessor systems in medicine, principles and structure of microcontrolers, logical circuits. Interconnection with common peripheral devices: AD and DA converters, serial communication, WIFI, Bluetooth a GPRS communication. Examples of embedded systems on architectures 8051, AVR, PIC and ARM. Introduction to multiplatform software development fo embedded systems.			
17PBIZS	Imaging Systems	KZ	3
Electromagnetic radiation and relationship to the medical imaging systems. Imaging theory fundamentals. 2D Fourier transform and related applications. Transfer properties of imaging systems. Optical imaging systems. Television (TV) imaging systems (including videoendoscopy and capsule imaging). Fundamentals of image processing. Imaging systems using infrared radiotion (termovision systems). X-ray imaging systems. X-ray TV medical imaging systems. Nuclear medical imaging systems. Ultrasound medical imaging systems Doppler systems. Computed tomography (basic idea, schematic system arrangement, basic physical principle, development generation, basic principles of reconstruction) Magnetic resonance imaging. Positron emission tomography (PET) and Single photon emission computed tomography (SPECT) Specialized medical imaging systems. Lectures and laboratory exercises offer to students view on the medical image data formation, on the sensing and scanning principles, on the digitization and processing, on the functional principle and image sensing devices as well. There are very important mutual relationships, which are important from the point of view of subject and study branch interdisciplinarity.			

Code of the group: 17PBI PV 6S
Name of the group: Biomedical Informatics compulsory optional course 6th semester 13
Requirement credits in the group: In this group you have to gain at least 3 credits (at most 12)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 4)
Credits in the group: 3
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
17PBIEZP	**Economics of Health Services**	KZ	3	1P+1S	L	s
17PBIGZS	**Biosignals Genesis and Processing**	KZ	3	1P+1L	L	s
17PBISRK	**Quality Management Systems**	KZ	3	1P+1S	L	s
17PBIZLN	**Legislation in Health Care and Technical Standarts**	KZ	3	1P+1S	L	s

Characteristics of the courses of this group of Study Plan: Code=17PBI PV 6S Name=Biomedical Informatics compulsory optional course 6th semester 13

17PBIEZP	Economics of Health Services	KZ	3

Introduction to Economics of medical facilities, main terms. Investments in healthcare - economic balance. Investment planning and management, interconnection between maintenance and investments, contracts. Costs incurred by legislation and mere operation of the technology. Return on investments, risk analysis. Commodity knowledge of consumables and spare parts. Prices of medical devices consumables and tools.

17PBIGZS	Biosignals Genesis and Processing	KZ	3

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, 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.

17PBISRK	Quality Management Systems	KZ	3

Quality. Quality management. Relevant norms. Quality of the hospital processes and systems. Improvement and reengineering of the processes. Euromodel TQM. Health care quality management. Driving and of realization processes of the health care facilities, map of the processes and subprocesses. Project of the integrated management of the health care facility. Possibilities of application of TQM within the health care facility. Relevant HW and SW.

17PBIZLN	Legislation in Health Care and Technical Standarts	KZ	3

Public health law. Law No. 96/2004 and applicable regulations.EU Directives. Legal technical product requirements. National government decrees. Institutional requirements for publication of technical norms. Technical norms in health care. Nuclear law. Procedures concerning introduction of medical devices. Clinical testing. Functional position of the testing rooms. Legislation concerning GMP, GLP and GCP.

List of courses of this pass:

Code	Name of the course	Completion	Credits
17BOZP	Occupational Safety and Health, Fire Protection and First Aid	Z	0
17PBIALP	Algoritmic and Programming Theory	Z,ZK	5

Algorithm, data structures. Identifiers, data types. assignment statement, conditional statement, cycles. Arithmetical and logical operations. Digital representation of numbers, numeration systems. Introduction to structured programming in C language - building and structure of simple programs, creating of the user functions, user input and output, file management, memory management. Practical overview of programming techniques and basic algorithms in C language. Recursive and iterative methods, measuring algorithm quality. Abstract data-types, data sorting and searching, implementation of basic numerical algorithms. Introduction to biomedical data processing - programmers view. Introduction to software engineering.

17PBIAZI	Applied Informatics in Health Care	KZ	3

The subject contains the basic areas of medicine, which are presented on the internet by the medium of medical-related web pages. Information sharing via internet in discussion forums and electronic conferences for fields like pharmacy or stomatology is also discussed.

17PBIBIF	Bioinformatics	KZ	4

Laboratories around the world produce massive amount of new nucleotide and protein sequences, gene expression profiles, 3-D structures and other data of biological character. To illustrate this fact, the number of known nucleotide sequences grew 100 times in just over five years. The database of 3-D structures expanded by 20 % in the same year and more than 3000 organisms have been or are sequenced at the moment. With an ever-increasing amount of data available, grows even the significance of bioinformatics. Bioinformatics collects, archives and most importantly analyses and attempt to find a meaning and useful information in this explosively growing sea of data. Bioinformatics is one of the most dynamically developing areas of biomedical research and basic knowledge of bioinformatics methods becomes quickly indispensable for anyone with a serious interest in doing biomedical research. The aim of this course is to introduce students with basic, but also modern promising bioinformatics methods. These methods will be shown and explained in lectures and later used in a series of practicals. These "hands-on" practicals are designed to show how to take an advantage of bioinformatics in every day life in a laboratory. The practicals were tested for a long time and successfully on students of the Uppsala University, Sweden. This course is suitable for the second- or higher year students of biology or chemistry who want to specialize within the biomedical field of research. A basic knowledge of structure of biomacromolecules (nucleic acids, proteins) is an advantage ut it is not required to have it.

17PBIBP	Bachelor Thesis	Z	8

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. Bachelor 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.

17PBIBPD	Safety of Data Transmission and Processing	Z,ZK	2

The orientation of this course is focused to the essential mathematical theory and presents contemporary algorithms and applications of cryptography. Both symmetrical and asymmetrical cryptographic systems are mentioned. The course also contains a primer of quantum cryptography and cryptonalysis.

17PBIBS	Biomedical Statistics	Z,ZK	5

Introduction into probability theory and mathematical statistics. Classical, geometrical and Kolmogorov definitions of probability. Random variables, their distributions, characteristics, transformations. Population and sample. Parameter estimators. Statistical tests.

17PBIDBS	Database Systems	Z,ZK	3

Database function principles, methodology of relational data model design and object data model. Database systems implementation using of SQL92 and script language PHP inside relational database MYSQL. Database systems implementation using of SQL92 and script language VB inside postrelational database CACHE. Transition data processing. Architecture of client-server and distributed database systems. Both principles relational and postreational will practice and show. Database CACHE includes both principles. It is database service for NIS.

17PBIDDS	Data and Data Structures	Z,ZK	5

A survey of basic data structures and their application. A specification of abstract data types (ADT). Specification and implementation of ADT: list, stack, queue, set, array, look-up table, graph, binary tree. Dynamic data structures and operations with them (effective searching, sorting, storing of data structures etc.). Representation of the data structures, strategies for choice of proper data structure.

17PBIDPS	Computer Network	Z,ZK	5

Lectures are oriented to techniques required for safe and efficient communication in networks bases on telecommunication, local area and wireless technologies. Structures of network messages and methods of their usage in distributed applications and distributed algorithms are presented in several lectures. The aim of exercises is to try some of mechanisms and to obtain an experience with frequently utilized programming techniques.

17PBIDTA	Desktop Application of MS Office	KZ	3

MS Outlook - operating, use as 'Personal Information Manager' and use as email client, set up and management of accounts, Exchange server client, working with language 'Microsoft Visual Basic for Application (VBA)', COM model; MS Word - basic of typography, advanced format using styles, basic DTP, wholesale correspondence, creating XML documents, XSLT - Extensible Stylesheet Language Transformations, multi users document edit, macros creating; MS Excel - cell and sheet format, working with functions and equations, data analysis, macros creating and interactive aplications; MS Access - relation database and database in MS Access, creating new database and tables, data searching and sorting, relations between

tables, using 'Data Access Pages (DAP)', database security; MS Project - Project establishing, tasks, resources, duration monitoring, task revision, project server; MS PowerPoint - making presentations, working with the text and objects, graphics and multimedia, automatic, interactive and web presentations, makros; MS FrontPage, MS Publisher, MS Visios - familiarizing with functionality and effective usage; mutual integration of applications MS Office package			
17PBIEHT	eHealth and Telemedicine	Z,ZK	5
Tele-medical applications - WHO definition, history of telemedicine, relations to development of ICT. Health care organization. Communication in health care. Electronic health record as a basis for telemedicine, hospital information systems, legal issues. Information technology as support of shared and distributed health care. Data security and standardization in health care. Image information processing. Networks and Internet in health care.			
17PBIEUI	Expert Systems and Artificial Intelligence for Medicine	Z,ZK	3
The course is aimed at providing theoretically deeper knowledge in the area of Expert systems and artificial intelligence in medicine.			
17PBIEZP	Economics of Health Services	KZ	3
Introduction to Economics of medical facilities, main terms. Investments in healthcare - economic balance. Investment planning and management, interconnection between maintenance and investments, contracts. Costs incurred by legislation and mere operation of the technology. Return on investments, risk analysis. Commodity knowledge of consumables and spare parts. Prices of medical devices consumables and tools.			
17PBIFY1	Physics I.	KZ	3
Physics I course will allow students to acquire and strengthen knowledge in these branches of physics: mechanics, thermodynamics and solid state physics. Through the course we also touch the limits of the classical Physics.			
17PBIFY2	Physics II.	KZ	3
The Physics II course introduces fundamentals and applications of electromagnetic fields. The covered topics include electromagnetic interaction, electric field, magnetic field, electromagnetic field, Maxwell's equations, electromagnetic radiation, fundamentals of quantum physics, atomic nucleus and elementary particles, and interaction of radiation with matter.			
17PBIFY3	Physics III.	KZ	3
The course extends the previous courses Physics I. and Physics II. In this set of courses the main emphasis is placed on the understanding of principles and the ability to solve standard physical examples. In Physics III. course we study waves, optics and lasers. We concentrate on practical examples and experiments.			
17PBIGZS	Biosignals Genesis and Processing	KZ	3
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, 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 procesing.			
17PBIIAB	Information Analysis of Biological Systems & Signals	KZ	3
Information entropy, applications. Average mutual information. Continuous and discrete communication channel. Relationship of information and thermodynamic entropy. Principle of maximal entropy. Biosystem organization, models and system identification. Introduction of statistical decision making, testing of statistical hypothesis, Bayessian approach.			
17PBIIPZ	Implementation and Support of IS in Health Care	Z,ZK	3
Course presents basic information about specific processes of implementation and support of large Information Systems in health care area. Implementation of health care IS process is based on large project management theory description, implementation methodology standards and their application. The best practice and experience in area of large Information System implementation are documented as well. The description of the implementation process starts by decomposition of the Information System to specific modules and its implementation requirements. Implementation team structure and roles of implementation team members are discussed and described as well as time table of the implementation process including necessary documents contented and structure. Logical part of the course is costs calculation, implementation process planning methodology and risks description and management. The second part of the course is oriented on the large Information System and its users support. The course presents the typical Support contract structure, specification of vendor and customer duties and rights, classification of user's requirements, response procedures and time of vendor's call center and product specialists. Students will be informed about internal processes of required services handling on customer and support services vendor side.			
17PBIIT	Information Technologies	Z,ZK	3
Computer history, structure of computers, motherboard, processors, memody, graphical card, computer buses, BIOS, I/O devices, server, desktop, notebook, pocket PC, data storage, mobile devices, memory card, OS, tasks and memory management, printers scanner, multimedial devices, mass data storage, multitasking, multiprocessoring, set of instruction, assembler, programming languages, power test, network, LAN, WAN, interner, TCP/IP, HTTP, FTP etc., client-server, gate, router, using IT in medicine and telemedicine.			
17PBIITH	IT for Handicapped People	KZ	3
17PBIITP	Integral Calculus	Z,ZK	5
The subject is an introduction to integral calculus and integral transforms. Integral calculus: primitive function, 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.			
17PBIJA3	English III.	KZ	4
The aim of the subject is to extend the wordstock of students in the field of biomedical engineering and its terminology. The subject is primarily focused on the development of communicative and speaking skills.			
17PBIJV	Java	KZ	3
The subject is focused on understanding students with object-oriented programming language Java. Builds on the knowledge gained in the course of programming in c #. In the framework of exercises will be discussed the description of integrated environment, the structure of the programme and debugging and testing tasks, the commands of a programming language, design methodology algorithms, basic control structures, data types, memory management, design and the use of classes, the treatment of exceptions, introduction to user interfaces, technologies for creating the presentation layer of a program.			
17PBIKO1	Principles of Clinical Branches I	Z,ZK	3
The student is acquainted with principles of problems of particular most important clinical branches, with most important features of diseases and possibilities of their treatment. Emphasize is put on diseases principally participating in the mortality in the Czech Republic or occurring most frequently.			
17PBIKO2	Principles of Clinical Branches II	Z,ZK	2
The student is acquainted with principles of problems of particular clinical disciplines, with most important features of diseases and possibilities of their treatment. Emphasize is put on diseases principally affecting the mortality in the Czech Republic and those, in which non-pharmacological prevention is possible and effective. The conclusion of the block is aimed at principles of the medical management.			
17PBILAD	Linear Algebra and Differential Calculus	Z,ZK	5
The course is an introduction into linear algebra and calculus of one variable. Linear algebra part consists of: systems of linear equations and their solutions, Gauss elimination, matrices, rank of a matrix, operations with matrices, inverse matrix, determinant and its calculation, eigenvalues and eigenvectors of matrices. Differential calculus consists of: sequences and their limits. Functions of one real variable, their limits, continuousness, derivatives. Local and absolute extremes of a function of one variable, investigations of functions. Taylor-polynome.			

Code	Course	Type	Credits
17PBILDT	Laboratory Diagnostics and Technology	Z,ZK	4
Laboratory Diagnostics and Technology introduces the principles of bioanalytical methods used in clinical diagnostics. Emphasis is put on the data types produced by these methods as well on the tools for their analysis. During the tutorials students will be introduced into the basic principles of computer data managing and processing.			
17PBILOD	Medical and Nursing Documentation	KZ	3
The course are focused on basic principles and concepts of medical and nursing documentation. The topic for this course is the main structure of the ambulatory check-ups, the structure of the records of patient hospitalization, the emphasis will be given to the specific clinical departements, such as oncology, internal medicine, traumatology, surgery etc. The seminar also provides an introduction to main code classification systems (scores) specific to individual disciplines - TNM, FIGO, Child - Pugh, Karnofsky, Ishak, etc. In the last lessons the students learn the fundamentals of nursing documentation and the basic standards of nursing care.			
17PBILOG	Logics	Z,ZK	4
Logic system, logic circuit, logic function. Bool's algebra. Representation (models) of logic functions: expression/formula, table, cube, map, logical and functional schema, graph. Combinatorial and sequential logic nets. Huffman's schema. Minimization of expressions for combinatorial logical nets with one and more outputs. Normalized expressions, disjunctive and conjunctive forms. Minimization based on operations of Bool's algebra in expressions, in a unit cube, in a truth table (Quin-McCluskey's method), in a logic map - Karnaugh's maps. Combinatorial logical terms, circuits and blocks. Synthesis of combinatorial logic circuits NOT, AND, OR, NAND, NOR. Synthesis of combinatorial logic circuits with limited number of inputs. Modeling of sequential behavior. Finite automata: Mealy and Moore automata. Memory circuits. Analysis and synthesis of synchronized sequential nets. Asynchronous sequential logic nets. Predicate logic (PL): language, terms, formula, substitution and basic syntactic terms, semantics: structures for predicate logic, evaluation, evaluation of terms and formulas. Axiomatic system of PL: axioms, inference rules, concept of a proof, reasoning theorem.			
17PBILPZ	Medical Devices & Equipment	KZ	3
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 oxymetry. Medical monitors. Electrostimulation and electrosurgery medical devices. Therapeutic medical devices. Implantable medical devices. Telemetry. Medical devices for audiology.			
17PBILTR	Medical Terminology	Z	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.			
17PBIMS	Modelling & Simulation	Z,ZK	5
Modelling and simulation - fundamentals. Compartmental models. Models of population dynamics - single species population, interacting population, continuous models, discrete models. Models with age distribution. Epidemic models - model of SIR structure, criss-cross models, models of venereal diseases.			
17PBIMTB	Microprocessors in Medicine	KZ	3
Introduction to embedded microprocessor systems in medicine, principles and structure of microcontrolers, logical circuits. Interconnection with common peripheral devices: AD and DA converters, serial communication, WIFI, Bluetooth a GPRS communication. Examples of embedded systems on architectures 8051, AVR, PIC and ARM. Introduction to multiplatform software development fo embedded systems.			
17PBIMTL	Matlab	KZ	3
Basic description of MATLAB environment. Numerical formats. Variables and matrices. Complex numbers. Rounding numbers. Basic instructions. Matrices operations. Visualization. Simulink (basic description, exercise formulation, parameters entry). Conditional and cyclical instructions. Script creation, functions, debugging. Continuous and discrete processes. Symbolical solutions. Graphical user interface creation. Applications in MATLAB.			
17PBIMVP	Research Methodology	KZ	3
Methodical starting points of research. Methods and technology of research. Logic of scientific research. Theoretical starting points of research. Scientific information as a fool for everyday work. Structure of scientific information, possibility for their acquisition, methods of processing and application in practice. Description of principles for searching for scientific information. Description of specific systems, namely from health service. Final report.			
17PBIMZB	Biosignal Measuring & Processing in Real Time	KZ	3
Real-time, latency, interrupts. Design of the measuring chain - input circuits, bus structure of the digital part, signal processing unit (microcontrolers, signal processors, single chip industrial computers, personal computers). Operating system Windows and real time, serious real-time operating systems. Multitasking and preemption, priority of processes, multithreading. Algorithms of real-time biosignal processing.			
17PBINIS	Hospital Information Systems	Z,ZK	5
Definition of hospital episodes, organization and workflow of hospital care. Data items and structuring electronic patient record. The structure of patient-oriented databases, monitoring and correction of incompleteness. Record of medical information and data, display and prints of medical records and information. Patient admission, transfer and discharge module. The structure of electronic medical record forms. Medical order and record of drug and infusion therapy. Electronic patient record, registration physiological condition of the patient and nursing care. Checking the quality of care, standardization and accreditation of providers of hospital care. Protocols of patient care. Orders, findings and neutral services, structure, format of order status monitoring. Structured patient record and its interpretation. Intensive care and resuscitation. Resuscitation record. Calculation of physiological liquid, ions and energy balance and classification of severity of patient condition. Surgical care, surgery planning, traffic management of operating rooms. Anesthesiology and operational protocol. Postoperative care. Outpatient episode, outpatient patient record and outpatient information subsystems. Laboratory information systems, LIS database, communication and quality control. Integration of the laboratory complement. Radiology IS, specific workflow, planning, testing, generation, transmission and archiving of digital image information (PACS). One-dimensional and multi-dimensional medical data coding systems (ICD-10, SNOP, SNOMED ,..). Data standards for transmission and storage of information and data (HL7, DaSta CR, DICOM ,..). Accounting of health care, performance-related systems, DRG, controlling of clinical departments.			
17PBINMP	Project Proposal and Management	KZ	3
How to apply for a grant project. Types of grant projects. Stages of proposal of the project. Specific requierements of projects. Documentation of the projects. Management, ordering and coordination of the project. Curriculum vitae. Planing and controlling of project realization. Presentation of the project. Team management in project.Sample application.			
17PBIOPS	Operating Systems	KZ	3
17PBIPAB	Computer Security and Legal Aspects of IT	KZ	4
Legal problems of IT and e health are discussed.			
17PBIPJC	C++ and C# Programming	Z,ZK	3
Object oriented programming. Variables, strings. Classes (methods, parameters, constructors, polymorphism, virtual methods, inheritance). Arrays. GUI, Windows Forms, WPF. Genericity, lists, dictionary. Errors and exceptions. Input-output operations.Files, streams - read, write. XML. Databases and Entity Framework.			
17PBIPM1	Fundamentals of Preclinical Medicine I	Z,ZK	3
Multibranch subject. Student became familiar with basics necessary to understand basic pathological processes and changes in human body. This knowledge will be added with essential knowledge from laboratory branches.			
17PBIPM2	Fundamentals of Preclinical Medicine II	Z,ZK	3
Student will get familiar with basic terms from pharmacology, hygiene, epidemiology, immunology and ethics.			
17PBIPPP	Programming Tools (Advanced)	KZ	3
Introduction to software tools on MS Windows platform and GNU/Linux platform. Problem of portability of data-files, standardized exchange formats - HTML, XML, PDF, ODF, PNG etc. Introduction to administartion and configuration of MS Windows and GNU/Linux, programming of scripts, connectivity and comaptibility of major operating systems. Multiplatform applications - WWW browsers, e-mail clients, Office toolboxes, Graphical and CAD programs.			
17PBIPPT	Advanced Programming Techniques	KZ	3

Code	Name		Exam	Credits
17PBIPPZ	Programming Tools		KZ	3
Introduction to modern software resources in MS Windows and GNU/Linux environment - office applications, basic visualisation of experimental data, graphical presentation, Internet communication. Data formats, compatibility. Selected parts of the course are compatible with the ECDL (European Computer Driving Licence) knowldege sylabus .				
17PBIRBL	Robotics in Medicine		KZ	2
Principles of robotics in medicine and laboratory technics what kind of task is solving, synthesis of kinematics according to the task processed by robot - operational (surgical room), handling (laboratory), kinematics a dynamics of robot arm - computing methodology, verification of obtained models in Matlab environment, sensors and drives used by robots applicable in medicine, possible robot control paradigms - according human (operator) task.				
17PBISM	Mathematical Seminars		KZ	3
17PBISPR	Term Project		KZ	5
Basic communication and presentation skills. Creation of presentations and written texts. Typography rules. Types, purpose and requirements of technical presentations and technical texts. Writing a commented bibliographic search.				
17PBISRK	Quality Management Systems		KZ	3
Quality. Quality management. Relevant norms. Quality of the hospital processes and systems. Improvement and reengineering of the processes. Euromodel TQM. Health care quality management. Driving and of realization processes of the health care facilities, map of the processes and subprocesses. Project of the integrated management of the health care facility. Possibilities of application of TQM within the health care facility. Relevant HW and SW.				
17PBITEL	Theory of Electrical Engineering		KZ	3
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 of conductance (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.				
17PBITM1	Fundamentals of Theoretical Medicine I		Z,ZK	3
17PBITM2	Fundamentals of Theoretical Medicine II		Z,ZK	3
Basic information about particular physiological processes, influence of physics strengths on human organism, physical treatment methods, physiological background of effect of particular methods.				
17PBITPR	Team Project		KZ	6
Basic communication and presentation skills, including team work, team heading 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.				
17PBITWA	Web Application Development		KZ	3
Client-server communication and HTTP protocol, web development applications standards (HTML, XHTML, XML, CSS, javascript), web developing languages, database systems, web server, modern approaches in web application development, developing tools, design web application and realization, web hypermedial systems, e-learning systems on web, design of medical informational web systems.				
17PBITZT	Theory and Practice of Journalistic Writing		Z,ZK	5
Aim of the subject is to learn about theory and practice of journalism. Students will be introduced into problematic of mass communication, types of media and their specifications, basics of journalism and internet as instrument of communication.				
17PBIUSS	Introduction to Systems and Signals		Z,ZK	5
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.				
17PBIVAA	Multi-tier Application Architecture in Biomedicine		KZ	3
Students will get acquainted with the design and usage of the client-server software architecture namely in biomedicine applications.				
17PBIVZP	Methods of Healthcare Reporting		KZ	2
Get familiar with basic principles of a general system for health care coverage. System of health care coverage in the Czech Republic. Legislation on health care coverage in the Czech Republic. Means of regulation of health care coverage. Methods for health care reporting. IT systems supporting health care reporting. Performance coverage, lump-sum payments, capitalization payments, payments for diagnosis. Cost record and coverage of especially high-priced items. Prescription of pharmaceuticals and medical devices, and their coverage. Means of data transfer to health insurance companies. Auditing health care coverage; inspectors in health insurance companies. Health insurance companies in the Czech Republic. System of regressive refunds. Health documentation.				
17PBIZEL	The Basic Use of E-learning		Z,ZK	3
The aim of the study subject entitled "The Basic Use of e-learning" is to provide students with basic knowledge in the field of e-learning and to develop the students' capacity to design and create e-learning materials and courses as a result of acquired knowledge. Furthermore, students will learn how to study the specialized literature and how to communicate in this field. Subject: The basics of e-learning will provide the students with the knowledge of history and present situation of e-learning, the students will acquire knowledge of the pedagogical aspects of e-learning, of LMS systems and other tools for creating of e-learning materials and of possibilities for assessing the quality of e-learning. Emphasis will be placed on acquiring of practical skills for creating e-learning materials and e-learning courses.				
17PBIZIZ	Information Sources in Health Care		Z,ZK	3
Bibliographic resources: primary information resources, structure of the professional communication, secondary information resources, bibliographic databases. Medical databases and registries: image and pharmacological databases, national medical registries - purpose, legislation, data entry, accessibility of outputs, forms of data mining. Internet resources: types of the Internet resources in health care, Internet search services, strategy and tactics of the Internet search. Evaluated information resources: Evidence Based Medicine, The Cochrane collaboration, EBM databases, interpretation of meta-analysis, recommended guidelines. Quality of bibliographic information: Impact factor, SCI database, the accuracy, completeness and effectiveness of information search in databases Quality of Internet information: visit rate, citation, criteria for quality web presentations, international evaluation standards. Information resources for the public: credibility evaluation of resources, sociological aspects of information optimality, interactive resources of communication				
17PBIZLN	Legislation in Health Care and Technical Standarts		KZ	3
Public health law. Law No. 96/2004 and applicable regulations.EU Directives. Legal technical product requirements. National government decrees. Institutional requirements for publication of technical norms. Technical norms in health care. Nuclear law. Procedures concerning introduction of medical devices. Clinical testing. Functional position of the testing rooms. Legislation concerning GMP, GLP and GCP.				
17PBIZOD	Image Data Processing		Z,ZK	5
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.				
17PBIZS	Imaging Systems		KZ	3
Electromagnetic radiation and relationship to the medical imaging systems. Imaging theory fundamentals. 2D Fourier transform and related applications. Transfer properties of imaging systems. Optical imaging systems. Television (TV) imaging systems (including videoendoscopy and capsule imaging). Fundamentals of image processing. Imaging systems using				

infrared radiotion (termovision systems). X-ray imaging systems. X-ray TV medical imaging systems. Nuclear medical imaging systems. Ultrasound medical imaging systems Doppler systems. Computed tomography (basic idea, schematic system arrangement, basic physical principle, development generation, basic principles of reconstruction) Magnetic resonance imaging. Positron emission tomography (PET) and Single photon emission computed tomography (SPECT) Specialized medical imaging systems. Lectures and laboratory exercises offer to students view on the medical image data formation, on the sensing and scanning principles, on the digitization and processing, on the functional principle and image sensing devices as well. There are very important mutual relationships, which are important from the point of view of subject and study branch interdisciplinarity.

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