

Study plan

Name of study plan: Computer Science, Presented in English, Version 2012

Faculty/Institute/Others:

Department: Department of Theoretical Computer Science

Branch of study guaranteed by the department: Computer Science

Garantor of the study branch: doc. Ing. Jan Janoušek, Ph.D.

Program of study: Informatics

Type of study: Bachelor full-time

Required credits: 177

Elective courses credits: 3

Sum of credits in the plan: 180

Note on the plan:

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 121

The role of the block: PP

Code of the group: BIE-PP.2

Name of the group: Compulsory Courses of Study Program Informatics, Presented in English

Requirement credits in the group: In this group you have to gain 117 credits

Requirement courses in the group: In this group you have to complete at least 20 courses

Credits in the group: 117

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
BIE-AAG	Automata and Grammars Jan Trávníček, Jan Holub, Jan Janoušek Radomír Polách Jan Holub (Gar.)	Z,ZK	6	2+2	Z	PP
BIE-BAP	Bachelor Theses Miroslav Balík Miroslav Balík (Gar.)	Z	14	0+0	L,Z	PP
BIE-PSI	Computer Networks	Z,ZK	5	2+2	L	PP
BIE-SAP	Computer Structures and Architectures	Z,ZK	6	2+3	L	PP
BIE-DBS	Database Systems Michal Valenta, Josef Pavlíček Miroslav Balík Michal Valenta (Gar.)	Z,ZK	6	2+3	Z,L	PP
BIE-CAO	Digital and Analog Circuits Kateřina Hyniová Miroslav Balík Kateřina Hyniová (Gar.)	Z,ZK	5	2+2	Z	PP
BIE-TED	Electronic Documentation Design Ondřej Guth	KZ	5	2+2	L	PP
BIE-ZMA	Elements of Calculus Antonella Marchesiello Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	6	3+2	Z	PP
BIE-ZDM	Elements of Discrete Mathematics Josef Kolář Miroslav Balík Josef Kolář (Gar.)	Z,ZK	5	2+2	Z	PP
BIE-UOS	Introduction to Operating System UNIX Jan Žďárek	KZ	5	2+2	Z	PP
BIE-PAI	Law and Informatics Zdeněk Kučera Miroslav Balík Zdeněk Kučera (Gar.)	ZK	3	2+0	Z	PP
BIE-LIN	Linear Algebra	Z,ZK	7	4+2	L	PP
BIE-MLO	Mathematical Logic Kateřina Trlifajová Kateřina Trlifajová (Gar.)	Z,ZK	5	2+1	Z	PP
BIE-OSY	Operating Systems	Z,ZK	5	2+1	L	PP
BIE-PST	Probability and Statistics Petr Novák Rudolf Bohumil Blažek (Gar.)	Z,ZK	5	2+2	Z	PP
BIE-PA1	Programming and Algorithmics 1 Jan Trávníček, Miroslav Balík, Ladislav Vagner, Josef Vogel, Ondřej Guth Jan Trávníček Ladislav Vagner (Gar.)	Z,ZK	6	2+2+2	Z	PP
BIE-PA2	Programming and Algorithmics 2 Jan Trávníček	Z,ZK	7	2+2	L	PP
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR) Dana Vyníkarová Dana Vyníkarová (Gar.)	KZ	5	2+1	Z	PP

BIE-BEZ	Security	Z,ZK	6	2+2	L	PP
BIE-SI1.2	Software Engineering I <i>Zdeněk Rybola Zdeněk Rybola Zdeněk Rybola (Gar.)</i>	Z,ZK	5	2+1	Z,L	PP

Characteristics of the courses of this group of Study Plan: Code=BIE-PP.2 Name=Compulsory Courses of Study Program Informatics, Presented in English

BIE-AAG	Automata and Grammars	Z,ZK	6
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits.			
BIE-BAP	Bachelor Theses	Z	14
BIE-PSI	Computer Networks	Z,ZK	5
Students understand the basic common techniques, protocols, technologies, and algorithms necessary to communicate in computer networks focusing primarily the 2nd to 4th layer of the ISO OSI model. They also get a basic understanding of communication media, security, and network administration. Students will be able to write a simple network application and configure a simple network.			
BIE-SAP	Computer Structures and Architectures	Z,ZK	6
Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools.			
BIE-DBS	Database Systems	Z,ZK	6
Students are introduced to the database engine architecture and typical user roles. They are briefly introduced to various database models. They learn to design small databases (including integrity constraints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with the SQL language, as well as with its theoretical foundation the relational database model. They learn the principles of normalizing a relational database schema. They understand the fundamental concepts of transaction processing, controlling parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduced to special ways of storing data in relational databases with respect to speed of access to large quantities of data. This introductory-level module does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.			
BIE-CAO	Digital and Analog Circuits	Z,ZK	5
Students get the fundamental understanding of technologies underlying electronic digital systems. They understand the basic theoretical models and principles of functionality of transistors, gates, circuits, and conductors. They are able to design simple circuits and evaluate circuit parameters. They understand the differences between analog and digital modes of electronic devices.			
BIE-TED	Electronic Documentation Design	KZ	5
Students are able to create electronic documentation, namely technical reports. They learn alternatives of WYSIWYG editors and are able to produce well-formed technical reports using configurable tools appropriate for ICT professionals. They learn the documentation of software projects, including basics of UML and documentation of source code.			
BIE-ZMA	Elements of Calculus	Z,ZK	6
Students acquire knowledge and understanding of the fundamentals of classical calculus so that they are able to apply mathematical way of thinking and reasoning and are able to use basic proof techniques. They get skills to practically handle functions of one variable in solving the problems in informatics. They understand the links between the integrals and sums of sequences. They are able to estimate lower or upper bounds of values of real functions and to handle simple asymptotic expressions.			
BIE-ZDM	Elements of Discrete Mathematics	Z,ZK	5
Students get both a mathematical sound background, but also practical calculation skills in the area of combinatorics, value estimation and formula approximation, and tools for solving recurrent equations.			
BIE-UOS	Introduction to Operating System UNIX	KZ	5
Students become advanced and knowledgeable users of common operating systems: UNIX, Linux, or MS Windows. They understand the fundamental principles of the operating systems (file systems, processes and threads, access rights, memory management, network interfaces). They gain the knowledge of advanced users, with hands-on experience of the shell, basic commands, and filters.			
BIE-PAI	Law and Informatics	ZK	3
Students have knowledge of fundamental protection of intangible property, overview of contractual aspects of copyright. They are able to design an appropriate contract-based copyright protection and do research and verification of the outputs concerning trademarks, patents, industrial design rights. They are able to participate actively in the proceedings to register intangible property. They have a good overview of the Czech Republic legislation as well as the EU legislation.			
BIE-LIN	Linear Algebra	Z,ZK	7
Students understand the theoretical foundation of algebra and mathematical principles of linear models of systems around us, where the dependencies among components are only linear. They know the basic methods for operating with polynomials and linear spaces. They are able to perform matrix operations and solve systems of linear equations. They can apply these mathematical principles to solving problems in 2D or 3D analytic geometry. They understand error-detecting and error-correcting codes.			
BIE-MLO	Mathematical Logic	Z,ZK	5
An introduction to predicate logic, the standard language and deductive system of mathematics and computer science.			
BIE-OSY	Operating Systems	Z,ZK	5
Students understand the classical theory of operating systems (OS) in addition to the knowledge gained in the BI-UOS module. They get a solid knowledge of OS kernels, processes and threads implementations. They understand the problems of race conditions and principles and algorithms for critical sections, thread scheduling, resource allocation, deadlocks. They understand the techniques of managing virtual memory, principles and architectures of disks and disk arrays, file systems and peripheral devices. They gain basic knowledge necessary for developing system applications or for system administration. They are able to design and implement simple multithreaded applications.			
BIE-PST	Probability and Statistics	Z,ZK	5
Students are introduced to elements of probability thinking, ability of the synthesis both prior and posterior information and use to work with random variables. They will be able to apply correctly basic models of the distribution of random variables and to solve applied probability problems in the area of informatics and computer science. Using statistical inference methods, they master methods of statistical inference to estimate unknown population parameters on the basis of sample. They get acquainted with basic methods of the determination of possible statistical dependence of two or more random variables.			
BIE-PA1	Programming and Algorithmics 1	Z,ZK	6
Students learn to construct algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn the basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.			
BIE-PA2	Programming and Algorithmics 2	Z,ZK	7
Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, set, table). They can implement linked structures. They learn these skills using the programming language C++. Although this is not a module of programming in C++, students are introduced to all C++ features needed to achieve the main objective (e.g., operator overloading, templates).			
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR)	KZ	5
This subject is aimed to the professional communication and writing of the scientific texts (bachelor's and diploma thesis). Students will learn to create and prepare interactive presentations and presenting before an audience. Students will also learn to write technical reports and scientific texts.			

BIE-BEZ	Security	Z,ZK	6
Students understand the mathematical fundamentals of cryptography and have an overview of current cryptographic algorithms and applications: symmetric and asymmetric cryptosystems, and hash functions. They also learn the fundamentals of secure programming and IT security, the fundamentals of designing and using modern cryptosystems for computer systems. They are able to properly and securely use cryptographic primitives and systems that are based on these primitives. Students are introduced to legal aspects of information security, security standards, social engineering, and basic principles of security management.			
BIE-SI1.2	Software Engineering I	Z,ZK	5
Students learn the methods of analysis and design of large software systems, which are typically designed and implemented in teams. Students will get acquainted with CASE tools using a visual modeling language UML for modeling and solving software-related problems. Students will get an overview of object-oriented analysis, design, architecture, validation, verification, and testing processes. The knowledge obtained in the lectures is practiced on a team project. If enrolled for the BIE-SP1 course running in parallel (only summer semester), the students can work on a single more complex project and they are classified to both courses for a single project. This course does not teach the students programming, nor any particular technology, framework or programming language. The students are required to have some knowledge of these to apply them on their team project.			

Code of the group: BIE-EPDSK

Name of the group: Business Economics

Requirement credits in the group: In this group you have to gain at least 4 credits (at most 5)

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 4

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-EPD	Business Economics	KZ	4	2+2	L	PP
BIE-EPD.2	Business Economics	KZ	5	2+2	L	PP
BIE-EKP	Enterprise Economics	Z,ZK	5	2+2	Z	PP

Characteristics of the courses of this group of Study Plan: Code=BIE-EPDSK Name=Business Economics

BIE-EPD	Business Economics	KZ	4
Students get common knowledge of business economics. They understand the goals and functions of a business, the business environment, and the business lifecycle. They understand the relationships among profit, production volume, price and costs. They have an overview of applicable taxes. They know the fundamentals of financial mathematics and investment decision making. They can draft a business plan. They understand management functions, corporate processes and corporate governance.			
BIE-EPD.2	Business Economics	KZ	5
This course is aimed to fundamental problems of business economy. The course makes students familiar with a life cycle of business, specifically with fields: enterprise foundation, enterprise putting into state economic environment (CR), management of property and capital structure, business transaction records keeping during an accounting period, a relation between business production and costs, evaluation of enterprise financial health and business rehabilitation or termination.			
BIE-EKP	Enterprise Economics	Z,ZK	5
Students get common knowledge of business economics. They understand the goals and functions of a business, the business environment, and the business lifecycle. They understand the relationships among profit, production volume, price and costs. They have an overview of applicable taxes. They know the fundamentals of financial mathematics and investment decision making. They can draft and interpret a business plan. They understand management functions, corporate processes and corporate governance.			

Name of the block: Compulsory courses of the specialization

Minimal number of credits of the block: 50

The role of the block: PO

Code of the group: BIE-PO-TI.2

Name of the group: Compulsory Courses of Bachelor Branch Computer Science, Presented in English

Requirement credits in the group: In this group you have to gain 30 credits

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 30

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-APS	Architectures of Computer Systems <i>Róbert Lórencz, Tomáš Zahradnický, Jiří Buček Tomáš Zahradnický Róbert Lórencz (Gar.)</i>	Z,ZK	6	2+2	Z	PO
BIE-VZD	Data Mining <i>Marcel Jiřina Pavel Kordík Pavel Kordík (Gar.)</i>	Z,ZK	4	2+2	Z,L	PO
BIE-EFA	Efficient Algorithms <i>Jiřina Scholtzová Jiřina Scholtzová Pavel Tvrdlík (Gar.)</i>	Z,ZK	5	2+2	Z	PO
BIE-EIA	Efficient Implementation of Algorithms <i>Ivan Šimeček Ivan Šimeček Ivan Šimeček (Gar.)</i>	Z,ZK	5	2+1	Z	PO
BIE-GRA	Graph Algorithms and Complexity Theory <i>Miroslav Balík</i>	Z,ZK	5	2+2	L	PO

BIE-PJP	Programming Languages and Compilers <i>Jan Trávníček, Radomír Polách, Jan Janoušek Radomír Polách Jan Janoušek (Gar.)</i>	Z,ZK	5	2+1	L	PO
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Characteristics of the courses of this group of Study Plan: Code=BIE-PO-TI.2 Name=Compulsory Courses of Bachelor Branch Computer Science, Presented in English

BIE-APS	Architectures of Computer Systems	Z,ZK	6
Students understand computer architectures with general-purpose processors at the level of machine instructions, with emphasis on instruction pipelining and memory hierarchy. They know the main concepts of RISC and CISC architectures. They learn how modern computers work and how they are constructed. They learn about the techniques that today's processors use to increase program execution speed. They are able to optimize their programs to fully exploit the processor. They get an idea about the principles of modern trends in computer architectures and how will they affect software. They also understand the architectures of vector processors, their use in today's microprocessors. They understand the principles and architectures of shared-memory multiprocessor systems and the issues of memory consistency.			
BIE-VZD	Data Mining	Z,ZK	4
Students are introduced to the basic methods of discovering knowledge in data. In particular, they learn the basic techniques of data preprocessing, multidimensional data visualization, statistical techniques of data transformation, and fundamental principles of knowledge discovery methods. Students will be aware of the relationships between model bias and variance and will know the fundamentals of assessing model quality. Data mining software is extensively used in the module. Students will be able to apply basic data mining tools to common problems (classification, regression, clustering).			
BIE-EFA	Efficient Algorithms	Z,ZK	5
Students get an overview of efficient algorithms and data structures for solving classical algorithmic problems, such as searching and sorting, on dynamically changing data sets. Students are able to design and implement such algorithms, to use methods for analysing their computational and memory complexity. They understand the sorting algorithms with $O(n \log n)$ time complexity, special sorting algorithms with linear complexity, algorithms for associative and address searching. They are able to use the efficient dynamic data structures, such as hash tables, search trees, balanced search trees, heaps, B-trees, and others. They are able to work with recursive algorithms and dynamic programming.			
BIE-EIA	Efficient Implementation of Algorithms	Z,ZK	5
Students learn to combine their programming skills (ability to design efficient algorithms) and HW knowledge (utilization of all available features of a particular processor and memory architecture). Students learn the basics of code tuning and optimization.			
BIE-GRA	Graph Algorithms and Complexity Theory	Z,ZK	5
Students get an overview of typical usages of graph models in computing. They learn algorithmic methods of solving graph problems. They understand algorithms for the key application domains of graph theory (flows in networks, heuristic search, approximation of complex problems). Students get basic competence in computer science background: they understand Turing machine models and issues of NP-completeness and NP-hardness.			
BIE-PJP	Programming Languages and Compilers	Z,ZK	5
Students master basic methods of implementation of common high-level programming languages. They get experience with the design and implementation of individual compiler parts for a simple programming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has a certain syntax into a target form and write a compiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but extends to all other programs for parsing and processing text in a language defined by a LL(1) grammar.			

Code of the group: BIE-OST

Name of the group: Miscellaneous Compulsory Courses of Bachelor Branches, Presented in English

Requirement credits in the group: In this group you have to gain 20 credits

Requirement courses in the group: In this group you have to complete at least 5 courses

Credits in the group: 20

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-TED	Electronic Documentation Design <i>Ondřej Guth</i>	KZ	5	2+2	L	PO
BIE-EC	English External Certificate <i>Miroslav Balík</i>	Z	2	0+0	L	PO
BIE-UOS	Introduction to Operating System UNIX <i>Jan Žďárek</i>	KZ	5	2+2	Z	PO
BIE-PAI	Law and Informatics <i>Zdeněk Kučera Miroslav Balík Zdeněk Kučera (Gar.)</i>	ZK	3	2+0	Z	PO
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR) <i>Dana Vyníkarová Dana Vyníkarová (Gar.)</i>	KZ	5	2+1	Z	PO

Characteristics of the courses of this group of Study Plan: Code=BIE-OST Name=Miscellaneous Compulsory Courses of Bachelor Branches, Presented in English

BIE-TED	Electronic Documentation Design	KZ	5
Students are able to create electronic documentation, namely technical reports. They learn alternatives of WYSIWYG editors and are able to produce well-formed technical reports using configurable tools appropriate for ICT professionals. They learn the documentation of software projects, including basics of UML and documentation of source code.			
BIE-UOS	Introduction to Operating System UNIX	KZ	5
Students become advanced and knowledgeable users of common operating systems: UNIX, Linux, or MS Windows. They understand the fundamental principles of the operating systems (file systems, processes and threads, access rights, memory management, network interfaces). They gain the knowledge of advanced users, with hands-on experience of the shell, basic commands, and filters.			
BIE-PAI	Law and Informatics	ZK	3
Students have knowledge of fundamental protection of intangible property, overview of contractual aspects of copyright. They are able to design an appropriate contract-based copyright protection and do research and verification of the outputs concerning trademarks, patents, industrial design rights. They are able to participate actively in the proceedings to register intangible property. They have a good overview of the Czech Republic legislation as well as the EU legislation.			

BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR) This subject is aimed to the professional communication and writing of the scientific texts (bachelor's and diploma thesis). Students will learn to create and prepare interactive presentations and presenting before an audience. Students will also learn to write technical reports and scientific texts.	KZ	5
BIE-EC	English External Certificate	Z	2

Name of the block: Compulsory elective economic-management courses

Minimal number of credits of the block: 4

The role of the block: VE

Code of the group: BIE-PV-EM

Name of the group: Compulsory Elective Economics, and Management Courses, Presented in English

Requirement credits in the group: In this group you have to gain at least 4 credits (at most 12)

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

Credits in the group: 4

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) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-FIP	Accounting and Corporate Finance <i>Miroslav Balík</i>	Z,ZK	5	2+2	Z	VE
BIE-FTR	Financial Markets <i>Pavla Vozárová Pavla Vozárová Pavla Vozárová (Gar.)</i>	Z,ZK	4	2+2	Z	VE
BIE-MIK	Fundamentals of Microeconomics <i>Pavla Vozárová</i>	Z,ZK	4	2+2	L	VE
BIE-TIS	Information Systems Design <i>Miroslav Balík</i>	Z,ZK	5	2+1	Z	VE
BIE-PRP	Law and Business <i>Miroslav Balík</i>	Z,ZK	4	2+1	L	VE

Characteristics of the courses of this group of Study Plan: Code=BIE-PV-EM Name=Compulsory Elective Economics, and Management Courses, Presented in English

BIE-FIP	Accounting and Corporate Finance Students understand the principles and have practical skills in corporate finance. They have a grasp of accounting principles and understand the concepts of assets and liabilities, costs, revenues and profit. They know the structure of financial statements and know how to analyze them. They are able to evaluate investments and understand the effect of inflation and taxes on investment decisions.	Z,ZK	5
BIE-FTR	Financial Markets Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field.	Z,ZK	4
BIE-MIK	Fundamentals of Microeconomics This is an introductory course of microeconomics designed for students without previous economic background. It describes different market regimes and ways how firm can react to consumer demand, competitor strategies, government intervention, uncertainty and information asymmetry. All concepts are illustrated on real life examples.	Z,ZK	4
BIE-TIS	Information Systems Design Students will learn various ways and methods of design and implementation of information systems. They will gain overview in different kinds of ISs, appropriate technologies, and practical areas of their deployment. Students will also be able to consider customers' requirements on the IS and choose proper technologies for their implementation.	Z,ZK	5
BIE-PRP	Law and Business Students understand the basic issues when engaging in business activities in the CR and in the EU. Students learn to establish companies, gain necessary business permits, conclude commercial or civil contracts. Students also get acquainted with the principles of antitrust regulation and learn to resolve disputes in the area of business, labour, or civil relationships in courts.	Z,ZK	4

Name of the block: Compulsory elective humanities courses

Minimal number of credits of the block: 2

The role of the block: VH

Code of the group: BIE-PV-HU

Name of the group: Compulsory Elective Bachelor Social Courses, Presented in English

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

Credits in the group: 2

Note on the group:

Faculty guarantees the availability of these modules.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BI-HMI	History of Mathematics and Informatics	Z,ZK	3	2+1	L	VH
FIE-HTE	History of Technology and Economics	ZK	2	2+0	Z,L	VH
AE0B16FI1	Philosophy I <i>Peter Zamarovský Peter Zamarovský Peter Zamarovský (Gar.)</i>	KZ	4	2+2s	Z,L	VH

Characteristics of the courses of this group of Study Plan: Code=BIE-PV-HU Name=Compulsory Elective Bachelor Social Courses, Presented in English

BI-HMI	History of Mathematics and Informatics	Z,ZK	3
FIE-HTE	History of Technology and Economics	ZK	2
The course introduces the scientific disciplines of history and technology , economic and social history of the Czech lands and Czechoslovakia in comparison with the development of the European region 19 to 21 century.			
AE0B16FI1	Philosophy I	KZ	4
We deal with the most important persons, schools and ideas of ancient philosophy. We are concerned especially on transdisciplinary nature of philosophy and connection of old philosophical thoughts with recent problems of science, technology, economics and politics.			

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: BIE-V

Name of the group: Elective Courses of Bachelor Study Program Informatics, Presented in English

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group: Besides the Modules listed here as Elective, You can enroll in any Module that offers the Program BIE for Your Study Form, which you have'nt enrolled in as a Compulsory or Compulsory Optional Module.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-FIP	Accounting and Corporate Finance <i>Miroslav Balík</i>	Z,ZK	5	2+2	Z	v
BIE-APS	Architectures of Computer Systems <i>Róbert Lórencz, Tomáš Zahradnický, Jiří Buček Tomáš Zahradnický Róbert Lórencz (Gar.)</i>	Z,ZK	6	2+2	Z	v
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4	2+2	L	v
BIE-AAG	Automata and Grammars <i>Jan Trávníček, Jan Holub, Jan Janoušek Radomír Polách Jan Holub (Gar.)</i>	Z,ZK	6	2+2	Z	v
BIE-BAP	Bachelor Theses <i>Miroslav Balík Miroslav Balík (Gar.)</i>	Z	14	0+0	L,Z	v
BIE-ZRS	Basics of Systems Control <i>Kateřina Hyniová</i>	Z,ZK	4	2+2	L	v
BIE-PGR	Computer Graphics <i>Miroslav Balík</i>	Z,ZK	6	2+2	Z	v
BIE-PSI	Computer Networks	Z,ZK	5	2+2	L	v
BIE-SAP	Computer Structures and Architectures	Z,ZK	6	2+3	L	v
BIE-JPO	Computer Units <i>Jiří Douša Miroslav Balík Alois Pluháček (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-VZD	Data Mining <i>Marcel Jiřina Pavel Kordík Pavel Kordík (Gar.)</i>	Z,ZK	4	2+2	Z,L	v
BIE-DBS	Database Systems <i>Michal Valenta, Josef Pavlíček Miroslav Balík Michal Valenta (Gar.)</i>	Z,ZK	6	2+3	Z,L	v
BIE-CAO	Digital and Analog Circuits <i>Kateřina Hyniová Miroslav Balík Kateřina Hyniová (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-EFA	Efficient Algorithms <i>Jiřina Scholtzová Jiřina Scholtzová Pavel Tvrdík (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-EIA	Efficient Implementation of Algorithms <i>Ivan Šimeček Ivan Šimeček Ivan Šimeček (Gar.)</i>	Z,ZK	5	2+1	Z	v
BIE-TED	Electronic Documentation Design <i>Ondřej Guth</i>	KZ	5	2+2	L	v
BIE-ZMA	Elements of Calculus <i>Antonella Marchesiello Tomáš Kalvoda Tomáš Kalvoda (Gar.)</i>	Z,ZK	6	3+2	Z	v

BIE-ZDM	Elements of Discrete Mathematics <i>Josef Kolář Miroslav Balík Josef Kolář (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-VES	Embedded Systems <i>Miroslav Skrbek Miroslav Balík Miroslav Skrbek (Gar.)</i>	Z,ZK	5	2+2	L	v
BIE-EC	English External Certificate <i>Miroslav Balík</i>	Z	2	0+0	L	v
BIE-GRA	Graph Algorithms and Complexity Theory <i>Miroslav Balík</i>	Z,ZK	5	2+2	L	v
BIE-TIS	Information Systems Design <i>Miroslav Balík</i>	Z,ZK	5	2+1	Z	v
BIE-IMA	Introduction to Mathematics <i>Martin Malachov Karel Klouda Karel Klouda (Gar.)</i>	Z	4	0+3	Z	v
BIE-UOS	Introduction to Operating System UNIX <i>Jan Žďárek</i>	KZ	5	2+2	Z	v
BIE-ZSI	Introduction to Software Engineering	Z,ZK	5	2+1	Z	v
BIE-ZWU	Introduction to Web and User Interfaces	Z,ZK	4	2+2	L	v
BIE-PRP	Law and Business <i>Miroslav Balík</i>	Z,ZK	4	2+1	L	v
BIE-PAI	Law and Informatics <i>Zdeněk Kučera Miroslav Balík Zdeněk Kučera (Gar.)</i>	ZK	3	2+0	Z	v
BIE-LIN	Linear Algebra	Z,ZK	7	4+2	L	v
BIE-MLO	Mathematical Logic <i>Kateřina Trlifajová Kateřina Trlifajová (Gar.)</i>	Z,ZK	5	2+1	Z	v
BIE-MGA	Multimedia and Graphics Applications <i>Miroslav Balík</i>	Z,ZK	5	2+2	Z	v
BIE-ADS	Network Administration <i>Viktor Černý, Jiří Smítka Viktor Černý Jiří Smítka (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-OMO	Object Modelling <i>Martin Podloucký, Robert Pergl Robert Pergl Robert Pergl (Gar.)</i>	Z,ZK	5	2+2	Z	v
BI-OOP	Object-Oriented Programming <i>Robert Pergl</i>	Z,ZK	4	2+2	Z	v
BIE-OSY	Operating Systems	Z,ZK	5	2+1	L	v
BIE-PNO	Practical Digital Design <i>Martin Novotný Miroslav Balík Martin Novotný (Gar.)</i>	KZ	5	2+2	Z	v
BIE-PST	Probability and Statistics <i>Petr Novák Rudolf Bohumil Blažek (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-PHP.1	Programing in PHP <i>Tomáš Kadlec Tomáš Kadlec Tomáš Kadlec (Gar.)</i>	KZ	4	0+3	Z	v
BIE-PA1	Programming and Algorithmics 1 <i>Jan Trávníček, Miroslav Balík, Ladislav Vagner, Josef Vogel, Ondřej Guth Jan Trávníček Ladislav Vagner (Gar.)</i>	Z,ZK	6	2+2+2	Z	v
BIE-PA2	Programming and Algorithmics 2 <i>Jan Trávníček</i>	Z,ZK	7	2+2	L	v
BIE-PJV	Programming in Java <i>Jiří Daněček Miroslav Balík Jiří Daněček (Gar.)</i>	Z,ZK	4	2+2	Z	v
BIE-PS2	Programming in shell 2 <i>Jan Žďárek Jan Žďárek (Gar.)</i>	Z,ZK	4	2+2	L	v
BIE-PJP	Programming Languages and Compilers <i>Jan Trávníček, Radomír Polách, Jan Janoušek Radomír Polách Jan Janoušek (Gar.)</i>	Z,ZK	5	2+1	L	v
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR) <i>Dana Vyníkarová Dana Vyníkarová (Gar.)</i>	KZ	5	2+1	Z	v
BIE-SRC	Real-time Systems <i>Miroslav Balík</i>	KZ	4	2+2	L	v
BIE-SKJ	Scripting Languages	Z,ZK	4	2+1	L	v
BIE-VWM	Searching Web and Multimedia Databases <i>Miroslav Balík</i>	Z,ZK	5	2+1	L	v
BIE-BEZ	Security	Z,ZK	6	2+2	L	v
BIE-SI2	Software Engineering 2 <i>Miroslav Balík</i>	Z,ZK	5	2+0	Z	v
BIE-SP1	Team Software Project 1 <i>Zdeněk Rybola</i>	KZ	4	0+2	Z	v
BIE-SP2	Team Software Project 2 <i>Zdeněk Rybola, Stanislav Kuzněcov Stanislav Kuzněcov Zdeněk Rybola (Gar.)</i>	KZ	6	0+0	Z	v
BI-TS1	Theoretical Seminar I <i>Ondřej Suchý, Tomáš Valla Jan Janoušek</i>	Z	4	0+2	Z	v
BI-TS2	Theoretical Seminar II <i>Tomáš Valla</i>	Z	4	0+2	L	v
BI-TS3	Theoretical Seminar III <i>Ondřej Suchý, Tomáš Valla Jan Janoušek Ondřej Suchý (Gar.)</i>	Z	4	0+2	Z	v
BI-TS4	Theoretical Seminar IV <i>Jan Janoušek</i>	Z	4	0+2	L	v

BIE-ADU.1	Unix Administration <i>Jan Žďárek Jan Žďárek Jan Žďárek (Gar.)</i>	Z,ZK	5	2+2	L	v
BIE-ADU	Unix Internals and Administration <i>Jan Žďárek</i>	Z,ZK	6	2+2	L	v
BIE-TUR	User Interface Design <i>Tomáš Zahradnický</i>	Z,ZK	4	2+2	L	v
BIE-AWD	Web and Database Server Administration	Z,ZK	4	2+2	L	v
BIE-WMM	Web and Multimedia <i>Tomáš Kadlec</i>	Z,ZK	5	2+1	Z	v
BIE-TWA	Web Application Design	Z,ZK	5	2+2	L	v
BIE-ADW	Windows Administration <i>Jiří Kašpar, Miroslav Prágl Miroslav Prágl Miroslav Prágl (Gar.)</i>	Z,ZK	5	2+1	Z	v
BIE-3DT.1	3D Printing	KZ	4	0+3	L	v

Characteristics of the courses of this group of Study Plan: Code=BIE-V Name=Elective Courses of Bachelor Study Program Informatics, Presented in English

BIE-AAG	Automata and Grammars	Z,ZK	6
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits.			
BIE-BAP	Bachelor Theses	Z	14
BIE-PSI	Computer Networks	Z,ZK	5
Students understand the basic common techniques, protocols, technologies, and algorithms necessary to communicate in computer networks focusing primarily the 2nd to 4th layer of the ISO OSI model. They also get a basic understanding of communication media, security, and network administration. Students will be able to write a simple network application and configure a simple network.			
BIE-SAP	Computer Structures and Architectures	Z,ZK	6
Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools.			
BIE-DBS	Database Systems	Z,ZK	6
Students are introduced to the database engine architecture and typical user roles. They are briefly introduced to various database models. They learn to design small databases (including integrity constraints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with the SQL language, as well as with its theoretical foundation the relational database model. They learn the principles of normalizing a relational database schema. They understand the fundamental concepts of transaction processing, controlling parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduced to special ways of storing data in relational databases with respect to speed of access to large quantities of data. This introductory-level module does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.			
BIE-CAO	Digital and Analog Circuits	Z,ZK	5
Students get the fundamental understanding of technologies underlying electronic digital systems. They understand the basic theoretical models and principles of functionality of transistors, gates, circuits, and conductors. They are able to design simple circuits and evaluate circuit parameters. They understand the differences between analog and digital modes of electronic devices.			
BIE-TED	Electronic Documentation Design	KZ	5
Students are able to create electronic documentation, namely technical reports. They learn alternatives of WYSIWYG editors and are able to produce well-formed technical reports using configurable tools appropriate for ICT professionals. They learn the documentation of software projects, including basics of UML and documentation of source code.			
BIE-ZMA	Elements of Calculus	Z,ZK	6
Students acquire knowledge and understanding of the fundamentals of classical calculus so that they are able to apply mathematical way of thinking and reasoning and are able to use basic proof techniques. They get skills to practically handle functions of one variable in solving the problems in informatics. They understand the links between the integrals and sums of sequences. They are able to estimate lower or upper bounds of values of real functions and to handle simple asymptotic expressions.			
BIE-ZDM	Elements of Discrete Mathematics	Z,ZK	5
Students get both a mathematical sound background, but also practical calculation skills in the area of combinatorics, value estimation and formula approximation, and tools for solving recurrent equations.			
BIE-UOS	Introduction to Operating System UNIX	KZ	5
Students become advanced and knowledgeable users of common operating systems: UNIX, Linux, or MS Windows. They understand the fundamental principles of the operating systems (file systems, processes and threads, access rights, memory management, network interfaces). They gain the knowledge of advanced users, with hands-on experience of the shell, basic commands, and filters.			
BIE-PAI	Law and Informatics	ZK	3
Students have knowledge of fundamental protection of intangible property, overview of contractual aspects of copyright. They are able to design an appropriate contract-based copyright protection and do research and verification of the outputs concerning trademarks, patents, industrial design rights. They are able to participate actively in the proceedings to register intangible property. They have a good overview of the Czech Republic legislation as well as the EU legislation.			
BIE-LIN	Linear Algebra	Z,ZK	7
Students understand the theoretical foundation of algebra and mathematical principles of linear models of systems around us, where the dependencies among components are only linear. They know the basic methods for operating with polynomials and linear spaces. They are able to perform matrix operations and solve systems of linear equations. They can apply these mathematical principles to solving problems in 2D or 3D analytic geometry. They understand error-detecting and error-correcting codes.			
BIE-MLO	Mathematical Logic	Z,ZK	5
An introduction to predicate logic, the standard language and deductive system of mathematics and computer science.			
BIE-OSY	Operating Systems	Z,ZK	5
Students understand the classical theory of operating systems (OS) in addition to the knowledge gained in the BI-UOS module. They get a solid knowledge of OS kernels, processes and threads implementations. They understand the problems of race conditions and principles and algorithms for critical sections, thread scheduling, resource allocation, deadlocks. They understand the techniques of managing virtual memory, principles and architectures of disks and disk arrays, file systems and peripheral devices. They gain basic knowledge necessary for developing system applications or for system administration. They are able to design and implement simple multithreaded applications.			

BIE-PST	Probability and Statistics	Z,ZK	5
Students are introduced to elements of probability thinking, ability of the synthesis both prior and posterior information and use to work with random variables. They will be able to apply correctly basic models of the distribution of random variables and to solve applied probability problems in the area of informatics and computer science. Using statistical inference methods, they master methods of statistical inference to estimate unknown population parameters on the basis of sample. They get acquainted with basic methods of the determination of possible statistical dependence of two or more random variables.			
BIE-PA1	Programming and Algorithmics 1	Z,ZK	6
Students learn to construct algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn the basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.			
BIE-PA2	Programming and Algorithmics 2	Z,ZK	7
Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, set, table). They can implement linked structures. They learn these skills using the programming language C++. Although this is not a module of programming in C++, students are introduced to all C++ features needed to achieve the main objective (e.g., operator overloading, templates).			
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR)	KZ	5
This subject is aimed to the professional communication and writing of the scientific texts (bachelor's and diploma thesis). Students will learn to create and prepare interactive presentations and presenting before an audience. Students will also learn to write technical reports and scientific texts.			
BIE-BEZ	Security	Z,ZK	6
Students understand the mathematical fundamentals of cryptography and have an overview of current cryptographic algorithms and applications: symmetric and asymmetric cryptosystems, and hash functions. They also learn the fundamentals of secure programming and IT security, the fundamentals of designing and using modern cryptosystems for computer systems. They are able to properly and securely use cryptographic primitives and systems that are based on these primitives. Students are introduced to legal aspects of information security, security standards, social engineering, and basic principles of security management.			
BIE-APS	Architectures of Computer Systems	Z,ZK	6
Students understand computer architectures with general-purpose processors at the level of machine instructions, with emphasis on instruction pipelining and memory hierarchy. They know the main concepts of RISC and CISC architectures. They learn how modern computers work and how they are constructed. They learn about the techniques that today's processors use to increase program execution speed. They are able to optimize their programs to fully exploit the processor. They get an idea about the principles of modern trends in computer architectures and how will they affect software. They also understand the architectures of vector processors, their use in today's microprocessors. They understand the principles and architectures of shared-memory multiprocessor systems and the issues of memory consistency.			
BIE-VZD	Data Mining	Z,ZK	4
Students are introduced to the basic methods of discovering knowledge in data. In particular, they learn the basic techniques of data preprocessing, multidimensional data visualization, statistical techniques of data transformation, and fundamental principles of knowledge discovery methods. Students will be aware of the relationships between model bias and variance and will know the fundamentals of assessing model quality. Data mining software is extensively used in the module. Students will be able to apply basic data mining tools to common problems (classification, regression, clustering).			
BIE-EFA	Efficient Algorithms	Z,ZK	5
Students get an overview of efficient algorithms and data structures for solving classical algorithmic problems, such as searching and sorting, on dynamically changing data sets. Students are able to design and implement such algorithms, to use methods for analysing their computational and memory complexity. They understand the sorting algorithms with $O(n \log n)$ time complexity, special sorting algorithms with linear complexity, algorithms for associative and address searching. They are able to use the efficient dynamic data structures, such as hash tables, search trees, balanced search trees, heaps, B-trees, and others. They are able to work with recursive algorithms and dynamic programming.			
BIE-EIA	Efficient Implementation of Algorithms	Z,ZK	5
Students learn to combine their programming skills (ability to design efficient algorithms) and HW knowledge (utilization of all available features of a particular processor and memory architecture). Students learn the basics of code tuning and optimization.			
BIE-GRA	Graph Algorithms and Complexity Theory	Z,ZK	5
Students get an overview of typical usages of graph models in computing. They learn algorithmic methods of solving graph problems. They understand algorithms for the key application domains of graph theory (flows in networks, heuristic search, approximation of complex problems). Students get basic competence in computer science background: they understand Turing machine models and issues of NP-completeness and NP-hardness.			
BIE-PJP	Programming Languages and Compilers	Z,ZK	5
Students master basic methods of implementation of common high-level programming languages. They get experience with the design and implementation of individual compiler parts for a simple programming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has a certain syntax into a target form and write a compiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but extends to all other programs for parsing and processing text in a language defined by a LL(1) grammar.			
BIE-EC	English External Certificate	Z	2
BIE-FIP	Accounting and Corporate Finance	Z,ZK	5
Students understand the principles and have practical skills in corporate finance. They have a grasp of accounting principles and understand the concepts of assets and liabilities, costs, revenues and profit. They know the structure of financial statements and know how to analyze them. They are able to evaluate investments and understand the effect of inflation and taxes on investment decisions.			
BIE-TiS	Information Systems Design	Z,ZK	5
Students will learn various ways and methods of design and implementation of information systems. They will gain overview in different kinds of ISs, appropriate technologies, and practical areas of their deployment. Students will also be able to consider customers' requirements on the IS and choose proper technologies for their implementation.			
BIE-PRP	Law and Business	Z,ZK	4
Students understand the basic issues when engaging in business activities in the CR and in the EU. Students learn to establish companies, gain necessary business permits, conclude commercial or civil contracts. Students also get acquainted with the principles of antitrust regulation and learn to resolve disputes in the area of business, labour, or civil relationships in courts.			
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.			
BIE-ZRS	Basics of Systems Control	Z,ZK	4
Optional subject Basics of System Control is designed for anyone interested in applied computer science in bachelor studies. A brief introduction to the field of automatic control will be definitely evaluated by our graduates in the industrial practice. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems. We will teach you description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD and fuzzy controllers. This is a survey course in which students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. The themes of lectures are accompanied by a number of useful examples and practical industrial implementations.			

BIE-PGR	Computer Graphics	Z,ZK	6
Students are able to program a simple interactive 3D graphical application like a computer game or scientific visualisation, to design the scene, add textures imitating geometric details and materials (like wall surface, wood, sky), and set up the lighting. At the same time, they understand the fundamental principles and terms used in computer graphics, such as graphical pipeline, geometric transformations, or lighting model. They gain knowledge allowing orientation in computer graphics, and representing solid fundamentals for their professional development, e.g. for GPU programming and animations. They get used to techniques utilised in geometric modelling, modelling of curves and surfaces, and scientific visualisation.			
BIE-JPO	Computer Units	Z,ZK	5
Students know the internal structure and organization of computer or processor components and their interfacing with the environment. They understand the organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM). They know the organization of an arithmetic unit. They learn the design methodology for control units and controllers, as well as basic principles of communication with peripheral devices and buses. They understand the architecture of a bus system.			
BIE-VES	Embedded Systems	Z,ZK	5
Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.			
BIE-IMA	Introduction to Mathematics	Z	4
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.			
BIE-ZSI	Introduction to Software Engineering	Z,ZK	5
Students learn to understand formalized descriptions of analytic and design models in UML. To a limited extent, they take part in creating such models in seminars, where they work on small team projects. Students should be able to discuss the models with other members of a software development team. This experience and skills enable the students to participate in such teams as members.			
BIE-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
The course focuses on correct web design. It addresses technical aspects as well as correct user interface design.			
BIE-MGA	Multimedia and Graphics Applications	Z,ZK	5
Students gain practical experience with applications for raster and vector 2D/3D graphics and DTP. They learn basic methods of creating and editing computer graphics. Students also learn the theoretical fundamentals of computer graphics. During the semester, students work on various parts of a complex project involving 2D/3D graphics and DTP.			
BIE-ADS	Network Administration	Z,ZK	5
Students acquire basic skills needed to administrate computer networks and to ensure their security. They understand and are able to practically use Ethernet technology, VLAN, authorisation, security architecture of computer networks, routing protocols and backbone routing mechanisms, directory and naming services and addressing, administration of networking equipment, secure client connections and secure data transfer, flow control mechanisms, and service availability monitoring.			
BIE-OMO	Object Modelling	Z,ZK	5
Students will practically master conceptual modelling of business structures, they will learn fundamentals of OntoUML notation and methodology. Students will learn fundamentals of pure object-oriented paradigm, i.e. terms object, method, message, class, class instance, composition, inheritance, collections. Students will learn to transform a conceptual model to object-oriented implementation model and they will learn fundamentals of pure object-oriented implementation in Smalltalk and pure object database. Students will learn to formulate rules and queries upon the object database.			
BI-OOP	Object-Oriented Programming	Z,ZK	4
Students will learn the pure object-oriented paradigm, being a tool for effective implementation of quality, evolvable business software systems. They will understand fundamentals and they will learn how to apply it for solving typical implementation tasks. Students will learn syntax and programming fundamentals of a pure OO open-source technology Pharo. Various other modern programming languages utilising the OO concepts will be introduced in the subject, as well.			
BIE-PNO	Practical Digital Design	KZ	5
Students get an overview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the basics of the VHDL language, and implementation technologies FPGA and ASIC.			
BIE-PHP.1	Programing in PHP	KZ	4
Main goal of the course is an introduction to PHP - language and technology. Students will learn also best practices and will use tool that eases development in PHP. The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register for this course in their 3rd semester of study.			
BIE-PJV	Programming in Java	Z,ZK	4
The course Programming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java language the fundamental library will also be presented. There are especially file, net, data structures, database and concurrent library.			
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, pros and cons. In addition, they gain a deeper insight into Bourne Again shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: Prior knowledge of topics from Programming in Shell 1 module is a prerequisite. Namely basic Bourne shell usage, as well as orientation in user filesystem tools (cp, ln, mkdir, rm...) and some experience with data filtering (cut, tr, sort, uniq...). Even though it is possible to attend the classes without this knowledge, it may be difficult to follow the lectures and to complete all required tasks to pass this module without them.			
BIE-SRC	Real-time Systems	KZ	4
Students obtain the basic knowledge in the Real-Time (RT) theory and in the design methods for RT systems including the dependability issues. Thereticla knowledges from lectures will be experimentally verified on the practical labs of the Department of Digital Design. This subject is mainly based on embedded R-T systems, therefore the first used design kits are the same as in BI-VES subject.			
BIE-SKJ	Scripting Languages	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, pros and cons. In addition, they gain a deeper insight into UNIX shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: Prior knowledge of topics from Programming in Shell 1 module is a prerequisite. Namely basic Bourne shell usage, as well as orientation in user filesystem tools (cp, ln, mkdir, rm...) and some experience with data filtering (cut, tr, sort, uniq...). Even though it is possible to attend the classes without this knowledge, it may be difficult to follow the lectures and to complete all required tasks to pass this module without them.			
BIE-VWM	Searching Web and Multimedia Databases	Z,ZK	5
Students gain basic knowledge concerning retrieval techniques on the web, where the web environment is viewed as a large distributed and heterogenous data repository. In particular, the students will understand the techniques for retrieving text and hypertext documents (the web pages). Moreover, they will be aware of similarity retrieval methods focused on heterogenous multimedia databases (unstructured data collections, respectively).			
BIE-SI2	Software Engineering 2	Z,ZK	5
Students will learn to work methodically with respect to software development methodic, especially Unified Process methodic and Unified Modeling Language (UML). They will understand the functions of individual roles in a typical software team, as well as get a practical experience with them in the concurrent BIE-SP2 module. Students will also get an idea about software testing and measuring software quality. This knowledge will get extended with a practical experience thanks to the concurrently running BIE-SP2 module.			

BIE-SP1	Team Software Project 1	KZ	4
In this course, students work on a complex team project applying all the knowledge obtained in the BIE-SI1.2 course. There are no lectures and no seminars/tutorials in this course. This course is to be enrolled in parallel with BIE-SI1.2 course.			
BIE-SP2	Team Software Project 2	KZ	6
Students gain hands-on experience with the iterative development process while working on a large-scale software project. The first iteration is the result of the BEI-SP1 course project. However, this time, the functionality, testing and documenting of the system being developed will be emphasized. Students will work in teams of 4-6 people. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) with regard to the formal as well as material aspects of their solution. The BEI-SI2 course that runs concurrently will provide the students with supporting knowledge, especially in the area of teamwork, testing and quality assurance of the software product.			
BI-TS1	Theoretical Seminar I	Z	4
BI-TS2	Theoretical Seminar II	Z	4
BI-TS3	Theoretical Seminar III	Z	4
BI-TS4	Theoretical Seminar IV	Z	4
BIE-ADU.1	Unix Administration	Z,ZK	5
BIE-ADU	Unix Internals and Administration	Z,ZK	6
Students learn the internals of the UNIX operating system and the administration of its basic subsystems, and get practical skills on real-world examples. They understand the differences between the user and administrator roles. They understand theoretically and know practically system monitoring, analysis and tuning tools; file systems implementation and administration; disk subsystems; processes; memory; network services; shared file systems; naming services; remote access; system boot.			
BIE-TUR	User Interface Design	Z,ZK	4
Students have a basic overview of the methods for designing and testing common user interfaces. They have experience to solve the problems where software and other products do not communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of the methods that bring users into the development process to ensure optimal communication with a user.			
BIE-AWD	Web and Database Server Administration	Z,ZK	4
Students are introduced to the administration of database and web servers and services. Students will be able to install, configure, maintain, test and backup complex systems of database and web services. To provide a balanced overview, students will be introduced to three different database engines: Oracle as a representative of a large commercial system; PostgreSQL as a representative of a complex and advanced open-source, community-developed software; MySQL as the most common database engine to use with the Apache web server.			
BIE-WMM	Web and Multimedia	Z,ZK	5
Students learn to use the presentation and user interaction side of web technologies. They understand the principles of proper HTML, CSS, and JavaScript design. They learn the basics of PHP scripting and connecting a web application with a database. They are introduced to the techniques of processing multimedia that can be used on the web, such as raster graphics, video, and 3D graphics.			
BIE-TWA	Web Application Design	Z,ZK	5
Students are able to design and implement a complete web application (both the client side and the server side). Students learn to design and implement application with secured access, and are able to use technologies for effective and efficient client-server communication.			
BIE-ADW	Windows Administration	Z,ZK	5
Students understand the architecture and internals of the Windows OS and acquire the skills to administer it. They are able to use system management mechanisms, standard administration and security tools, memory and filesystem management tools. Students understand the network layer and the implementation of network and security services. Students know the methods of user administration, advanced ActiveDirectory administration, system migration, deployment, backup. They are able to troubleshoot problems and administer Windows in heterogeneous environments.			
BIE-3DT.1	3D Printing	KZ	4
Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.			

Code of the group: BIE-V-PRO_MG

Name of the group: Elective Courses, Suitable for those who intend to apply for Master's program at FIT, in English

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group: Modules in this group are recommended for students who intend to enroll to master program at FIT.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
BIE-EFA	Efficient Algorithms <i>Jiřina Scholtzov Jiřina Scholtzov Pavel Tvrk (Gar.)</i>	Z,ZK	5	2+2	Z	v
BIE-GRA	Graph Algorithms and Complexity Theory <i>Miroslav Balk</i>	Z,ZK	5	2+2	L	v

Characteristics of the courses of this group of Study Plan: Code=BIE-V-PRO_MG Name=Elective Courses, Suitable for those who intend to apply for Master's program at FIT, in English

BIE-EFA	Efficient Algorithms	Z,ZK	5
Students get an overview of efficient algorithms and data structures for solving classical algorithmic problems, such as searching and sorting, on dynamically changing data sets. Students are able to design and implement such algorithms, to use methods for analysing their computational and memory complexity. They understand the sorting algorithms with $O(n \log n)$ time complexity, special sorting algorithms with linear complexity, algorithms for associative and address searching. They are able to use the efficient dynamic data structures, such as hash tables, search trees, balanced search trees, heaps, B-trees, and others. They are able to work with recursive algorithms and dynamic programming.			
BIE-GRA	Graph Algorithms and Complexity Theory	Z,ZK	5
Students get an overview of typical usages of graph models in computing. They learn algorithmic methods of solving graph problems. They understand algorithms for the key application domains of graph theory (flows in networks, heuristic search, approximation of complex problems). Students get basic competence in computer science background: they understand Turing machine models and issues of NP-completeness and NP-hardness.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
AE0B16FI1	Philosophy I We deal with the most important persons, schools and ideas of ancient philosophy. We are concerned especially on transdisciplinary nature of philosophy and connection of old philosophical thoughts with recent problems of science, technology, economics and politics.	KZ	4
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
BI-OOP	Object-Oriented Programming Students will learn the pure object-oriented paradigm, being a tool for effective implementation of quality, evolvable business software systems. They will understand fundamentals and they will learn how to apply it for solving typical implementation tasks. Students will learn syntax and programming fundamentals of a pure OO open-source technology Pharo. Various other modern programming languages utilising the OO concepts will be introduced in the subject, as well.	Z,ZK	4
BI-TS1	Theoretical Seminar I	Z	4
BI-TS2	Theoretical Seminar II	Z	4
BI-TS3	Theoretical Seminar III	Z	4
BI-TS4	Theoretical Seminar IV	Z	4
BIE-3DT.1	3D Printing Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.	KZ	4
BIE-AAG	Automata and Grammars Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits.	Z,ZK	6
BIE-ADS	Network Administration Students acquire basic skills needed to administrate computer networks and to ensure their security. They understand and are able to practically use Ethernet technology, VLAN, authorisation, security architecture of computer networks, routing protocols and backbone routing mechanisms, directory and naming services and addressing, administration of networking equipment, secure client connections and secure data transfer, flow control mechanisms, and service availability monitoring.	Z,ZK	5
BIE-ADU	Unix Internals and Administration Students learn the internals of the UNIX operating system and the administration of its basic subsystems, and get practical skills on real-world examples. They understand the differences between the user and administrator roles. They understand theoretically and know practically system monitoring, analysis and tuning tools; file systems implementation and administration; disk subsystems; processes; memory; network services; shared file systems; naming services; remote access; system boot.	Z,ZK	6
BIE-ADU.1	Unix Administration	Z,ZK	5
BIE-ADW	Windows Administration Students understand the architecture and internals of the Windows OS and acquire the skills to administer it. They are able to use system management mechanisms, standard administration and security tools, memory and filesystem management tools. Students understand the network layer and the implementation of network and security services. Students know the methods of user administration, advanced ActiveDirectory administration, system migration, deployment, backup. They are able to troubleshoot problems and administer Windows in heterogeneous environments.	Z,ZK	5
BIE-APS	Architectures of Computer Systems Students understand computer architectures with general-purpose processors at the level of machine instructions, with emphasis on instruction pipelining and memory hierarchy. They know the main concepts of RISC and CISC architectures. They learn how modern computers work and how they are constructed. They learn about the techniques that today's processors use to increase program execution speed. They are able to optimize their programs to fully exploit the processor. They get an idea about the principles of modern trends in computer architectures and how will they affect software. They also understand the architectures of vector processors, their use in today's microprocessors. They understand the principles and architectures of shared-memory multiprocessor systems and the issues of memory consistency.	Z,ZK	6
BIE-AWD	Web and Database Server Administration Students are introduced to the administration of database and web servers and services. Students will be able to install, configure, maintain, test and backup complex systems of database and web services. To provide a balanced overview, students will be introduced to three different database engines: Oracle as a representative of a large commercial system; PostgreSQL as a representative of a complex and advanced open-source, community-developed software; MySQL as the most common database engine to use with the Apache web server.	Z,ZK	4
BIE-BAP	Bachelor Theses	Z	14
BIE-BEZ	Security Students understand the mathematical fundamentals of cryptography and have an overview of current cryptographic algorithms and applications: symmetric and asymmetric cryptosystems, and hash functions. They also learn the fundamentals of secure programming and IT security, the fundamentals of designing and using modern cryptosystems for computer systems. They are able to properly and securely use cryptographic primitives and systems that are based on these primitives. Students are introduced to legal aspects of information security, security standards, social engineering, and basic principles of security management.	Z,ZK	6
BIE-CAO	Digital and Analog Circuits Students get the fundamental understanding of technologies underlying electronic digital systems. They understand the basic theoretical models and principles of functionality of transistors, gates, circuits, and conductors. They are able to design simple circuits and evaluate circuit parameters. They understand the differences between analog and digital modes of electronic devices.	Z,ZK	5
BIE-DBS	Database Systems Students are introduced to the database engine architecture and typical user roles. They are briefly introduced to various database models. They learn to design small databases (including integrity constraints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with the SQL language, as well as with its theoretical foundation the relational database model. They learn the principles of normalizing a relational database schema. They understand the fundamental concepts of transaction processing, controlling parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduced to special ways of storing data in relational databases with respect to speed of access to large quantities of data. This introductory-level module does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.	Z,ZK	6
BIE-EC	English External Certificate	Z	2

BIE-EFA	Efficient Algorithms Students get an overview of efficient algorithms and data structures for solving classical algorithmic problems, such as searching and sorting, on dynamically changing data sets. Students are able to design and implement such algorithms, to use methods for analysing their computational and memory complexity. They understand the sorting algorithms with $O(n \log n)$ time complexity, special sorting algorithms with linear complexity, algorithms for associative and address searching. They are able to use the efficient dynamic data structures, such as hash tables, search trees, balanced search trees, heaps, B-trees, and others. They are able to work with recursive algorithms and dynamic programming.	Z,ZK	5
BIE-EIA	Efficient Implementation of Algorithms Students learn to combine their programming skills (ability to design efficient algorithms) and HW knowledge (utilization of all available features of a particular processor and memory architecture). Students learn the basics of code tuning and optimization.	Z,ZK	5
BIE-EKP	Enterprise Economics Students get common knowledge of business economics. They understand the goals and functions of a business, the business environment, and the business lifecycle. They understand the relationships among profit, production volume, price and costs. They have an overview of applicable taxes. They know the fundamentals of financial mathematics and investment decision making. They can draft and interpret a business plan. They understand management functions, corporate processes and corporate governance.	Z,ZK	5
BIE-EPD	Business Economics Students get common knowledge of business economics. They understand the goals and functions of a business, the business environment, and the business lifecycle. They understand the relationships among profit, production volume, price and costs. They have an overview of applicable taxes. They know the fundamentals of financial mathematics and investment decision making. They can draft a business plan. They understand management functions, corporate processes and corporate governance.	KZ	4
BIE-EPD.2	Business Economics This course is aimed to fundamental problems of business economy. The course makes students familiar with a life cycle of business, specifically with fields: enterprise foundation, enterprise putting into state economic environment (CR), management of property and capital structure, business transaction records keeping during an accounting period, a relation between business production and costs, evaluation of enterprise financial health and business rehabilitation or termination.	KZ	5
BIE-FIP	Accounting and Corporate Finance Students understand the principles and have practical skills in corporate finance. They have a grasp of accounting principles and understand the concepts of assets and liabilities, costs, revenues and profit. They know the structure of financial statements and know how to analyze them. They are able to evaluate investments and understand the effect of inflation and taxes on investment decisions.	Z,ZK	5
BIE-FTR	Financial Markets Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field.	Z,ZK	4
BIE-GRA	Graph Algorithms and Complexity Theory Students get an overview of typical usages of graph models in computing. They learn algorithmic methods of solving graph problems. They understand algorithms for the key application domains of graph theory (flows in networks, heuristic search, approximation of complex problems). Students get basic competence in computer science background: they understand Turing machine models and issues of NP-completeness and NP-hardness.	Z,ZK	5
BIE-IMA	Introduction to Mathematics Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.	Z	4
BIE-JPO	Computer Units Students know the internal structure and organization of computer or processor components and their interfacing with the environment. They understand the organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM). They know the organization of an arithmetic unit. They learn the design methodology for control units and controllers, as well as basic principles of communication with peripheral devices and buses. They understand the architecture of a bus system.	Z,ZK	5
BIE-LIN	Linear Algebra Students understand the theoretical foundation of algebra and mathematical principles of linear models of systems around us, where the dependencies among components are only linear. They know the basic methods for operating with polynomials and linear spaces. They are able to perform matrix operations and solve systems of linear equations. They can apply these mathematical principles to solving problems in 2D or 3D analytic geometry. They understand error-detecting and error-correcting codes.	Z,ZK	7
BIE-MGA	Multimedia and Graphics Applications Students gain practical experience with applications for raster and vector 2D/3D graphics and DTP. They learn basic methods of creating and editing computer graphics. Students also learn the theoretical fundamentals of computer graphics. During the semester, students work on various parts of a complex project involving 2D/3D graphics and DTP.	Z,ZK	5
BIE-MIK	Fundamentals of Microeconomics This is an introductory course of microeconomics designed for students without previous economic background. It describes different market regimes and ways how firm can react to consumer demand, competitor strategies, government intervention, uncertainty and information asymmetry. All concepts are illustrated on real life examples.	Z,ZK	4
BIE-MLO	Mathematical Logic An introduction to predicate logic, the standard language and deductive system of mathematics and computer science.	Z,ZK	5
BIE-OMO	Object Modelling Students will practically master conceptual modelling of business structures, they will learn fundamentals of OntoUML notation and methodology. Students will learn fundamentals of pure object-oriented paradigm, i.e. terms object, method, message, class, class instance, composition, inheritance, collections. Students will learn to transform a conceptual model to object-oriented implementation model and they will learn fundamentals of pure object-oriented implementation in Smalltalk and pure object database. Students will learn to formulate rules and queries upon the object database.	Z,ZK	5
BIE-OSY	Operating Systems Students understand the classical theory of operating systems (OS) in addition to the knowledge gained in the BI-UOS module. They get a solid knowledge of OS kernels, processes and threads implementations. They understand the problems of race conditions and principles and algorithms for critical sections, thread scheduling, resource allocation, deadlocks. They understand the techniques of managing virtual memory, principles and architectures of disks and disk arrays, file systems and peripheral devices. They gain basic knowledge necessary for developing system applications or for system administration. They are able to design and implement simple multithreaded applications.	Z,ZK	5
BIE-PA1	Programming and Algorithmics 1 Students learn to construct algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn the basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.	Z,ZK	6
BIE-PA2	Programming and Algorithmics 2 Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, set, table). They can implement linked structures. They learn these skills using the programming language C++. Although this is not a module of programming in C++, students are introduced to all C++ features needed to achieve the main objective (e.g., operator overloading, templates).	Z,ZK	7

BIE-PAI	Law and Informatics	ZK	3
Students have knowledge of fundamental protection of intangible property, overview of contractual aspects of copyright. They are able to design an appropriate contract-based copyright protection and do research and verification of the outputs concerning trademarks, patents, industrial design rights. They are able to participate actively in the proceedings to register intangible property. They have a good overview of the Czech Republic legislation as well as the EU legislation.			
BIE-PGR	Computer Graphics	Z,ZK	6
Students are able to program a simple interactive 3D graphical application like a computer game or scientific visualisation, to design the scene, add textures imitating geometric details and materials (like wall surface, wood, sky), and set up the lighting. At the same time, they understand the fundamental principles and terms used in computer graphics, such as graphical pipeline, geometric transformations, or lighting model. They gain knowledge allowing orientation in computer graphics, and representing solid fundamentals for their professional development, e.g. for GPU programming and animations. They get used to techniques utilised in geometric modelling, modelling of curves and surfaces, and scientific visualisation.			
BIE-PHP.1	Programing in PHP	KZ	4
Main goal of the course is an introduction to PHP - language and technology. Students will learn also best practices and will use tool that eases development in PHP. The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register for this course in their 3rd semester of study.			
BIE-PJP	Programming Languages and Compilers	Z,ZK	5
Students master basic methods of implementation of common high-level programming languages. They get experience with the design and implementation of individual compiler parts for a simple programming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has a certain syntax into a target form and write a compiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but extends to all other programs for parsing and processing text in a language defined by a LL(1) grammar.			
BIE-PJV	Programming in Java	Z,ZK	4
The course Programming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java language the fundamental library will also be presented. There are especially file, net, data structures, database and concurrent library.			
BIE-PNO	Practical Digital Design	KZ	5
Students get an overview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the basics of the VHDL language, and implementation technologies FPGA and ASIC.			
BIE-PPR	Project, Presentation and Rhetorics (BIE-PPR)	KZ	5
This subject is aimed to the professional communication and writing of the scientific texts (bachelor's and diploma thesis). Students will learn to create and prepare interactive presentations and presenting before an audience. Students will also learn to write technical reports and scientific texts.			
BIE-PRP	Law and Business	Z,ZK	4
Students understand the basic issues when engaging in business activities in the CR and in the EU. Students learn to establish companies, gain necessary business permits, conclude commercial or civil contracts. Students also get acquainted with the principles of antitrust regulation and learn to resolve disputes in the area of business, labour, or civil relationships in courts.			
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, pros and cons. In addition, they gain a deeper insight into Bourne Again shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: Prior knowledge of topics from Programming in Shell 1 module is a prerequisite. Namely basic Bourne shell usage, as well as orientation in user filesystem tools (cp, ln, mkdir, rm...) and some experience with data filtering (cut, tr, sort, uniq...). Even though it is possible to attend the classes without this knowledge, it may be difficult to follow the lectures and to complete all required tasks to pass this module without them.			
BIE-PSI	Computer Networks	Z,ZK	5
Students understand the basic common techniques, protocols, technologies, and algorithms necessary to communicate in computer networks focusing primarily the 2nd to 4th layer of the ISO OSI model. They also get a basic understanding of communication media, security, and network administration. Students will be able to write a simple network application and configure a simple network.			
BIE-PST	Probability and Statistics	Z,ZK	5
Students are introduced to elements of probability thinking, ability of the synthesis both prior and posterior information and use to work with random variables. They will be able to apply correctly basic models of the distribution of random variables and to solve applied probability problems in the area of informatics and computer science. Using statistical inference methods, they master methods of statistical inference to estimate unknown population parameters on the basis of sample. They get acquainted with basic methods of the determination of possible statistical dependence of two or more random variables.			
BIE-SAP	Computer Structures and Architectures	Z,ZK	6
Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools.			
BIE-SI1.2	Software Engineering I	Z,ZK	5
Students learn the methods of analysis and design of large software systems, which are typically designed and implemented in teams. Students will get acquainted with CASE tools using a visual modeling language UML for modeling and solving software-related problems. Students will get an overview of object-oriented analysis, design, architecture, validation, verification, and testing processes. The knowledge obtained in the lectures is practiced on a team project. If enrolled for the BIE-SP1 course running in parallel (only summer semester), the students can work on a single more complex project and they are classified to both courses for a single project. This course does not teach the students programming, nor any particular technology, framework or programming language. The students are required to have some knowledge of these to apply them on their team project.			
BIE-SI2	Software Engineering 2	Z,ZK	5
Students will learn to work methodically with respect to software development methodic, especially Unified Process methodic and Unified Modeling Language (UML). They will understand the functions of individual roles in a typical software team, as well as get a practical experience with them in the concurrent BIE-SP2 module. Students will also get an idea about software testing and measuring software quality. This knowledge will get extended with a practical experience thanks to the concurrently running BIE-SP2 module.			
BIE-SKJ	Scripting Languages	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, pros and cons. In addition, they gain a deeper insight into UNIX shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: Prior knowledge of topics from Programming in Shell 1 module is a prerequisite. Namely basic Bourne shell usage, as well as orientation in user filesystem tools (cp, ln, mkdir, rm...) and some experience with data filtering (cut, tr, sort, uniq...). Even though it is possible to attend the classes without this knowledge, it may be difficult to follow the lectures and to complete all required tasks to pass this module without them.			
BIE-SP1	Team Software Project 1	KZ	4
In this course, students work on a complex team project applying all the knowledge obtained in the BIE-SI1.2 course. There are no lectures and no seminars/tutorials in this course. This course is to be enrolled in parallel with BIE-SI1.2 course.			
BIE-SP2	Team Software Project 2	KZ	6
Students gain hands-on experience with the iterative development process while working on a large-scale software project. The first iteration is the result of the BEI-SP1 course project. However, this time, the functionality, testing and documenting of the system being developed will be emphasized. Students will work in teams of 4-6 people. The teacher, in the role of			

the team and project leader, regularly consults with the team (at the seminars) with regard to the formal as well as material aspects of their solution. The BEI-SI2 course that runs concurrently will provide the students with supporting knowledge, especially in the area of teamwork, testing and quality assurance of the software product.			
BIE-SRC	Real-time Systems	KZ	4
Students obtain the basic knowledge in the Real-Time (RT) theory and in the design methods for RT systems including the dependability issues. Thoretical knowledges from lectures will be experimentally verified on the practical labs of the Department of Digital Design. This subject is mainly based on embedded R-T systems, therefore the first used design kits are the same as in BI-VES subject.			
BIE-TED	Electronic Documentation Design	KZ	5
Students are able to create electronic documentation, namely technical reports. They learn alternatives of WYSIWYG editors and are able to produce well-formed technical reports using configurable tools appropriate for ICT professionals. They learn the documentation of software projects, including basics of UML and documentation of source code.			
BIE-TIS	Information Systems Design	Z,ZK	5
Students will learn various ways and methods of design and implementation of information systems. They will gain overview in different kinds of ISs, appropriate technologies, and practical areas of their deployment. Students will also be able to consider customers' requirements on the IS and choose proper technologies for their implementation.			
BIE-TUR	User Interface Design	Z,ZK	4
Students have a basic overview of the methods for designing and testing common user interfaces. They have experience to solve the problems where software and other products do not communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of the methods that bring users into the development process to ensure optimal communication with a user.			
BIE-TWA	Web Application Design	Z,ZK	5
Students are able to design and implement a complete web application (both the client side and the server side). Students learn to design and implement application with secured access, and are able to use technologies for effective and efficient client-server communication.			
BIE-UOS	Introduction to Operating System UNIX	KZ	5
Students become advanced and knowledgeable users of common operating systems: UNIX, Linux, or MS Windows. They understand the fundamental principles of the operating systems (file systems, processes and threads, access rights, memory management, network interfaces). They gain the knowledge of advanced users, with hands-on experience of the shell, basic commands, and filters.			
BIE-VES	Embedded Systems	Z,ZK	5
Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.			
BIE-VWM	Searching Web and Multimedia Databases	Z,ZK	5
Students gain basic knowledge concerning retrieval techniques on the web, where the web environment is viewed as a large distributed and heterogenous data repository. In particular, the students will understand the techniques for retrieving text and hypertext documents (the web pages). Moreover, they will be aware of similarity retrieval methods focused on heterogenous multimedia databases (unstructured data collections, respectively).			
BIE-VZD	Data Mining	Z,ZK	4
Students are introduced to the basic methods of discovering knowledge in data. In particular, they learn the basic techniques of data preprocessing, multidimensional data visualization, statistical techniques of data transformation, and fundamental principles of knowledge discovery methods. Students will be aware of the relationships between model bias and variance and will know the fundamentals of assessing model quality. Data mining software is extensively used in the module. Students will be able to apply basic data mining tools to common problems (classification, regression, clustering).			
BIE-WMM	Web and Multimedia	Z,ZK	5
Students learn to use the presentation and user interaction side of web technologies. They understand the principles of proper HTML, CSS, and JavaScript design. They learn the basics of PHP scripting and connecting a web application with a database. They are introduced to the techniques of processing multimedia that can be used on the web, such as raster graphics, video, and 3D graphics.			
BIE-ZDM	Elements of Discrete Mathematics	Z,ZK	5
Students get both a mathematical sound background, but also practical calculation skills in the area of combinatorics, value estimation and formula approximation, and tools for solving recurrent equations.			
BIE-ZMA	Elements of Calculus	Z,ZK	6
Students acquire knowledge and understanding of the fundamentals of classical calculus so that they are able to apply mathematical way of thinking and reasoning and are able to use basic proof techniques. They get skills to practically handle functions of one variable in solving the problems in informatics. They understand the links between the integrals and sums of sequences. They are able to estimate lower or upper bounds of values of real functions and to handle simple asymptotic expressions.			
BIE-ZRS	Basics of Systems Control	Z,ZK	4
Optional subject Basics of System Control is designed for anyone interested in applied computer science in bachelor studies. A brief introduction to the field of automatic control will be definitely evaluated by our graduates in the industrial practice. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems. We will teach you description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD and fuzzy controllers. This is a survey course in which students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. The themes of lectures are accompanied by a number of useful examples and practical industrial implementations.			
BIE-ZSI	Introduction to Software Engineering	Z,ZK	5
Students learn to understand formalized descriptions of analytic and design models in UML. To a limited extent, they take part in creating such models in seminars, where they work on small team projects. Students should be able to discuss the models with other members of a software development team. This experience and skills enable the students to participate in such teams as members.			
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.			
BIE-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
The course focuses on correct web design. It addresses technical aspects as well as correct user interface design.			
FIE-HTE	History of Technology and Economics	ZK	2
The course introduces the scientific disciplines of history and technology, economic and social history of the Czech lands and Czechoslovakia in comparison with the development of the European region 19 to 21 century.			

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

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