Study plan

Name of study plan: Bachelor branch Security and Information Technology, in English, 2015-2020

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Informatics, valid until 2024
Type of study: Bachelor full-time
Required credits: 158
Elective courses credits: 22
Sum of credits in the plan: 180
Note on the plan: The study plan is intended for those students who have been accepted to study since the academic year 2015/2016.

Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 116
The role of the block: PP

Code of the group: BIE-PP.2015
Name of the group: Compulsory Courses od Study Program Infomatics, Presented in English, Version 2015
Requirement credits in the group: In this group you have to gain 116 credits
Requirement courses in the group: In this group you have to complete 20 courses
Credits in the group: 116
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-AG1	**Algorithms and Graphs 1** ***Dušan Knop***	Z,ZK	6	2P+2C	Z	PP
BIE-AAG	**Automata and Grammars**	Z,ZK	6	2P+2C	Z	PP
BIE-BPR	**Bachelor Project** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	2		Z,L	PP
BIE-BAP	**Bachelor Thesis** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	14		L,Z	PP
BIE-PSI	**Computer Networks**	Z,ZK	5	2P+1R+1C	L	PP
BIE-SAP	**Computer Structures and Architectures**	Z,ZK	6	2P+1R+2C	L	PP
BIE-DBS	**Database Systems**	Z,ZK	6	3L	Z,L	PP
BIE-CAO	**Digital and Analog Circuits**	Z,ZK	5	2P+2C	Z	PP
BIE-DPR	**Document., Presentation, Rhetorics** *Dana Vynikarová* ***Dana Vynikarová*** *Dana Vynikarová (Gar.)*	KZ	4		L	PP
BIE-ZMA	**Elements of Calculus** *Antonella Marchesiello* ***Tomáš Kalvoda*** *Tomáš Kalvoda (Gar.)*	Z,ZK	6	3P+2C	Z	PP
BIE-ZDM	**Elements of Discrete Mathematics** *Jiřina Scholtzová, Jan Legerský* ***Jiřina Scholtzová*** *Josef Kolář (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-LIN	**Linear Algebra** *Antonella Marchesiello* ***Antonella Marchesiello*** *Antonella Marchesiello (Gar.)*	Z,ZK	7	4P+2C	L	PP
BIE-MLO	**Mathematical Logic** *Kateřina Trlifajová* ***Kateřina Trlifajová*** *Kateřina Trlifajová (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-OSY	**Operating Systems**	Z,ZK	5	2P+1R+1L	L	PP
BIE-PST	**Probability and Statistics**	Z,ZK	5	2P+1R+1C	Z	PP
BIE-PA1	**Programming and Algorithmics 1**	Z,ZK	6	2P+2R+2C	Z	PP
BIE-PA2	**Programming and Algorithmics 2** ***Jan Trávníček***	Z,ZK	7	2P+1R+1C	L	PP
BIE-PS1	**Programming in Shell 1**	KZ	5	2P+2C	Z	PP

BIE-BEZ	**Security** ***Jiří Buček***	Z,ZK	6	2P+1R+1C	L	PP
BIE-SI1.2	**Software Engineering I** *Zdeněk Rybola* ***Zdeněk Rybola*** *Zdeněk Rybola (Gar.)*	Z,ZK	5	2P+1C	Z,L	PP

Characteristics of the courses of this group of Study Plan: Code=BIE-PP.2015 Name=Compulsory Courses od Study Program Infomatics, Presented in English, Version 2015

BIE-AG1	Algorithms and Graphs 1	Z,ZK	6

The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It is interlinked with the concurrent BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed for time and space complexity of algorithms and learn to handle practically the asymptotic mathematics.

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-BPR	Bachelor Project	Z	2

At the beginning of the semester the student will contact the supervisor of the bachelor thesis he has booked. They will discuss the partial tasks that student will perform during the semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.

BIE-BAP	Bachelor Thesis	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-DPR	Document., Presentation, Rhetorics	KZ	4

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. There is no fixed schedule for BIE-DPR. A teacher will contact you before the start of the semester.

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-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 propositional and predicate logic.

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-PS1 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

The students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods of determining the 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-PS1	Programming in Shell 1	KZ	5
Students understand the basic principles of operating systems (processes and threads, file systems, access rights, memory management, network interface) with a focus on UNIX like operating systems. In practically oriented exercises, they will learn to use shell, basic commands and filters for processing text data.			
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.			

Name of the block: Compulsory courses of the specialization
Minimal number of credits of the block: 32
The role of the block: PO

Code of the group: BIE-PO-BIT.2015
Name of the group: Compulsory Courses of Bc. Branch Security and Information Technology, in English, Version 2015
Requirement credits in the group: In this group you have to gain 32 credits
Requirement courses in the group: In this group you have to complete at least 7 courses
Credits in the group: 32
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-APS.1	**Architectures of Computer Systems**	Z,ZK	5	2P+2C	Z	PO
BIE-HWB	**Hardware Security** *Filip Kodýtek, Róbert Lórencz, Jiří Buček **Jiří Buček** Róbert Lórencz (Gar.)*	Z,ZK	5	2P+2C	Z	PO
BIE-PAI	**Law and Informatics**	ZK	3	2P	Z	PO
BIE-BEK	**Secure Code** ***Róbert Lórencz***	Z,ZK	5	2P+2C	L	PO
BIE-SSB	**System and Network Security** *Jiří Dostál **Jiří Dostál** Jiří Dostál (Gar.)*	Z,ZK	5	2P+2C	Z	PO
BIE-ADU.1	**Unix Administration**	Z,ZK	5	2P+2C	L	PO
BIE-ADW.1	**Windows Administration** *Miroslav Prágl, Jiří Kašpar **Miroslav Prágl** Miroslav Prágl (Gar.)*	Z,ZK	4	2P+1C	Z	PO

Characteristics of the courses of this group of Study Plan: Code=BIE-PO-BIT.2015 Name=Compulsory Courses of Bc. Branch Security and Information Technology, in English, Version 2015

BIE-APS.1	Architectures of Computer Systems	Z,ZK	5
Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of programs. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.			
BIE-HWB	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers.			
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-BEK	Secure Code	Z,ZK	5
The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.			
BIE-SSB	System and Network Security	Z,ZK	5
The students will understand the public key infrastructure (PKI), its strengths and weaknesses, its vulnerabilities againstattacks. The students will also understand the analysis of network protocols from the perspectives of: authentication and authorisation,key exchange, and encryption. They get an overview of the security mechanisms of operating systems (OSs), of the ways virtualization canbe used to protect OSs, and of the security mechanisms for the OS memory. The students will learn basic methods of forensic analysisof storage media and networks. The students will also understand security of the networking infrastructure and its protocols andwill be able to design and implement a secured and survivable network. Students will also get an overview of securing data in clouds,database systems, and servers.			

BIE-ADU.1	Unix Administration	Z,ZK	5
BIE-ADW.1	Windows Administration	Z,ZK	4

Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.

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.2015
Name of the group: Compulsory Elective Economics, and Management Courses, in English, Version 2015
Requirement credits in the group: In this group you have to gain at least 4 credits (at most 10)
Requirement courses in the group: In this group you have to complete at least 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)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIE-EPR	**Economic project** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	Z	1		L	VE
BIE-FTR.1	**Financial Markets** ***Pavla Vozárová***	Z,ZK	5	2P+2C	L	VE
BIE-MIK	**Fundamentals of Microeconomics** *Tomáš Evan, Pavla Vozárová **Tomáš Evan** Pavla Vozárová (Gar.)*	Z,ZK	4	2P+2C	L	VE
BIE-EHD	**Introduction to European Economic History** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	Z,ZK	3	2P+1C	L	VE

Characteristics of the courses of this group of Study Plan: Code=BIE-PV-EM.2015 Name=Compulsory Elective Economics, and Management Courses, in English, Version 2015

BIE-EPR	Economic project	Z	1

This course is an extension of the course Introduction to European Economic History (BIE-EHD). There is no fixed schedule for BIE-EPR. A teacher will contact you before the start of the semester.

BIE-FTR.1	Financial Markets	Z,ZK	5

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.

BIE-MIK	Fundamentals of Microeconomics	Z,ZK	4

This a 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.

BIE-EHD	Introduction to European Economic History	Z,ZK	3

The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover detailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lecture and discussion.

Name of the block: Povinné ekonomické
Minimal number of credits of the block: 4
The role of the block: PE

Code of the group: BIE-PP-EM.2015
Name of the group: Compulsory Economics and Management Bachelor Courses, in English, Version 2015
Requirement credits in the group: In this group you have to gain 4 credits
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)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIE-EMP	**Economic and management principles** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	KZ	4	2P+2C	Z,L	PE

Characteristics of the courses of this group of Study Plan: Code=BIE-PP-EM.2015 Name=Compulsory Economics and Management Bachelor Courses, in English, Version 2015

BIE-EMP	Economic and management principles	KZ	4

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.

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.2015
Name of the group: Compulsory Elective Bachelor Social Courses, Presented in English, Ver. 2015
Requirement credits in the group: In this group you have to gain at least 2 credits (at most 9)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)
Credits in the group: 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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIE-HMI	**History of Mathematics and Informatics** *Alena Šolcová* ***Alena Šolcová*** *Alena Šolcová (Gar.)*	Z,ZK	3	2P+1C	L	VH
FI-HPZ	**Humanities subject from a study abroad**	Z	3	0+0	Z,L	VH
BIE-EHD	**Introduction to European Economic History** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	Z,ZK	3	2P+1C	L	VH
BE0B16FI1	**Philosophy 1** *Peter Zamarovský* ***Peter Zamarovský*** *Peter Zamarovský (Gar.)*	KZ	4	2P+2S	Z,L	VH

Characteristics of the courses of this group of Study Plan: Code=BIE-PV-HU.2015 Name=Compulsory Elective Bachelor Social Courses, Presented in English, Ver. 2015

BIE-EHD	Introduction to European Economic History	Z,ZK	3

The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover detailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lecture and discussion.

BIE-HMI	History of Mathematics and Informatics	Z,ZK	3

Students will master the methods traditionally used in mathematics and related disciplines - informatics - from different periods of the development of mathematics, and will thus become acquainted with mathematical methods suitable for applications in contemporary computer science.

FI-HPZ	Humanities subject from a study abroad	Z	3

A "Humanities subject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that is required in the curriculum. The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.

BE0B16FI1	Philosophy 1	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-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)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIE-EFA	**Efficient Algorithms** ***Jiřina Scholtzová***	Z,ZK	5	2P+2C	Z	v
BIE-GRA	**Graph Algorithms and Complexity Theory** ***Josef Kolář***	Z,ZK	5	2P+2C	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.			

Code of the group: BIE-BIT-VO.2017
Name of the group: Elective Vocational Courses for Bachelor Branch BIE-BIT, Version 2017
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: Oborové předměty všech oborů včetně povinných předmětů zaměření s výjimkou oboru BIE-BIT-VO.2017

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-AG2	**Algorithms and Graphs 2** ***Ondřej Suchý***	Z,ZK	5	2P+2C	L	v
BIE-KOM	**Conceptual Modelling** *Marek Suchánek, Robert Pergl* ***Robert Pergl*** *Robert Pergl (Gar.)*	Z,ZK	5	2P+2C	Z	v
BIE-VZD	**Data Mining** *Daniel Vašata, Rodrigo Augusto Da Silva Alves* ***Daniel Vašata*** *Daniel Vašata (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-BIG	**DB Technologies for Big Data**	KZ	4	2P+2C	Z	v
BIE-TJV	**Java Technology** ***Ondřej Guth***	Z,ZK	4	2P+2C	Z	v
BIE-OOP	**Object-Oriented Programming** *Filip Křikava* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-PJP	**Programming Languages and Compilers**	Z,ZK	5	2P+1C	L	v
BIE-PPA	**Programming Paradigms**	Z,ZK	5	2P+2C	Z	v
BIE-VWM	**Searching Web and Multimedia Databases**	Z,ZK	5	2P+1C	L	v
BIE-SI2.3	**Software Engineering 2** *Michal Valenta* ***Michal Valenta*** *Michal Valenta (Gar.)*	Z,ZK	3	2P	Z	v
BIE-SP1	**Team Software Project 1** ***Zdeněk Rybola***	KZ	4	2C	Z,L	v
BIE-SP2	**Team Software Project 2**	KZ	6		Z	v
BIE-TWA.1	**Web Application Design**	Z,ZK	5	2P+2C	Z	v
BIE-XML	**XML Technology**	Z,ZK	4	2P+2C	Z	v

Characteristics of the courses of this group of Study Plan: Code=BIE-BIT-VO.2017 Name=Elective Vocational Courses for Bachelor Branch BIE-BIT, Version 2017

BIE-AG2	Algorithms and Graphs 2	Z,ZK	5
BIE-KOM	Conceptual Modelling	Z,ZK	5
The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations.			
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 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-BIG	DB Technologies for Big Data	KZ	4
Students are introduced into the field of Big Data. These are data that the standard relational databases cannot process efficientlydue to the size, and at the same time, their real-time processing can provide information that can have key importance for thecompetitiveness of a company or organization. The course is focused practically. Students learn the most important professionaltechnologies, such as Apache Cassandra, Apache Hadoop, Apache Solr, and others. The course brings to students theoreticalfoundation of algorithms used in Big data systems. In the labs, students learn to develop their own applications on topof these technologies.			
BIE-TJV	Java Technology	Z,ZK	4
The subject goal is to introduce the programming language Java. The student gains practical experiences for smaller enterprise application programming. This subject presents how to build the three and more layers enterprise systems. The student practically exercises all communication interfaces for each layers (JDBC, RestWeb services, JNDI etc.). At the course end is student able to create three layers enterprise application.			
BIE-OOP	Object-Oriented Programming	Z,ZK	4
Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handing, refactoring and design patterns.			
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-PPA	Programming Paradigms	Z,ZK	5
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-SI2.3	Software Engineering 2	Z,ZK	3
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.			
BIE-TWA.1	Web Application Design	Z,ZK	5
The basic course of web application development. Initially, the students become familiar with HTTP and its possibilities and partly with some properties of language describing the structure (HTML) and presentation of document on the Web (CSS). These skills provide the necessary basis for the development of Web applications, which will be demonstrated in modern libraries facilitate the development of Web pages applications. Server side will be demonstrated on PHP technology using frameworks Symfony 2, Doctrine 2. Developments on the client side will be demonstrated using a JavaScript language with library jQuery and possibly MV* framework AngularJS.			
BIE-XML	XML Technology	Z,ZK	4

Code of the group: BIE-V.2017
Name of the group: Purely Elective Bachelor Courses, Version 2017
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
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-ZUM	**Artificial Intelligence Fundamentals** *Pavel Surynek* ***Pavel Surynek*** *Pavel Surynek (Gar.)*	Z,ZK	4	2P+2C	L	v
BIE-ZRS	**Basics of Systems Control**	Z,ZK	4	2P+2C	L	v
BIE-CCN	**Compiler Construction** *Christoph Kirsch* ***Christoph Kirsch*** *Christoph Kirsch (Gar.)*	Z,ZK	5	3P	L	v
BIE-SCE1	**Computer Engineering Seminar I** *Miroslav Skrbek, Hana Kubátová* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z	4	2C	Z	v
BIE-SCE2	**Computer Engineering Seminar II** *Hana Kubátová* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z	4	2C	L	v
BIE-CZ0	**Czech Language for Foreigners** *Markéta Hofmannová, Ivana Vondráčková, Tomáš Houdek, Petra Korfová* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	2	4C	Z,L	v
BIE-CZ1.21	**Czech Language for Foreigners II** *Ivana Vondráčková, Petra Korfová* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	2	4C	Z,L	v
BIE-FTR.1	**Financial Markets** ***Pavla Vozárová***	Z,ZK	5	2P+2C	L	v
BIE-EHD	**Introduction to European Economic History** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	Z,ZK	3	2P+1C	L	v

BIE-IMA	**Introduction to Mathematics**	Z	4	3C	Z	v
BIE-IMA2	**Introduction to Mathematics 2**	Z	2	1C	Z	v
BIE-ST1	**Network Technology 1** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	2C	Z	v
BIE-OOP	**Object-Oriented Programming** *Filip Křikava* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-PKM	**Preparatory Mathematics** ***Jitka Rybníčková*** *Tomáš Kalvoda (Gar.)*	Z	4		Z	v
BIE-PJV	**Programming in Java** *Jan Blizničenko* ***Jan Blizničenko*** *Jan Blizničenko (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-PS2	**Programming in shell 2**	Z,ZK	4	2P+2C	L	v
BIE-PRR.21	**Project management** *David Pešek* ***David Pešek*** *David Pešek (Gar.)*	Z,ZK	5	2P+2C	Z,L	v
BIE-VAK.21	**Selected Combinatorics Applications** *Tomáš Valla, Dušan Knop, Ondřej Suchý, Šimon Schierreich, Maria Saumell Mendiola* ***Tomáš Valla*** *Tomáš Valla (Gar.)*	Z	3	2R	L	v
BI-SCE1	**Computer Engineering Seminar I** *Hana Kubátová* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z	4	2C	L,Z	v
TV2K1	**Physical Education 2**	Z	1		L,Z	v
BIE-SEP	**World Economy and Business** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-3DT.1	**3D Printing**	KZ	4	3C	L	v

Characteristics of the courses of this group of Study Plan: Code=BIE-V.2017 Name=Purely Elective Bachelor Courses, Version 2017

BIE-FTR.1	Financial Markets	Z,ZK	5

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.

BIE-EHD	Introduction to European Economic History	Z,ZK	3

The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover detailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lecture and discussion.

BIE-OOP	Object-Oriented Programming	Z,ZK	4

Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handing, refactoring and design patterns.

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-CCN	Compiler Construction	Z,ZK	5

This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.

BIE-SCE1	Computer Engineering Seminar I	Z	4

The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.

BIE-SCE2	Computer Engineering Seminar II	Z	4

The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.

BIE-CZ0	Czech Language for Foreigners	KZ	2

Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.

BIE-CZ1.21	Czech Language for Foreigners II	KZ	2

The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The course further expands the basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Republic.

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-IMA2	Introduction to Mathematics 2	Z	2
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-ST1	Network Technology 1	Z	3
The course is focused on essentials of computer networks and practice with network technologies. The course corresponds to the Cisco Netacad curriculum, CCNA1 - R&S Introduction to Networks.			
BIE-PKM	Preparatory Mathematics	Z	4
The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.			
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 APIs will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.			
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, data structures, 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: We are ready do adapt the lectures to provide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, ln, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice.			
BIE-PRR.21	Project management	Z,ZK	5
The aim of the course is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, analysis, crisis management in a project, communication, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk assessment and management, Gantt charts, resource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for students who are interested in deepening their knowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in large companies. The course is also suitable for all those who will develop software or hardware in the form of team projects.			
BIE-VAK.21	Selected Combinatorics Applications	Z	3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.			
BI-SCE1	Computer Engineering Seminar I	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.			
TV2K1	Physical Education 2	Z	1
BIE-SEP	World Economy and Business	Z,ZK	4
The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.			
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.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
BE0B16FI1	Philosophy 1	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.			
BI-SCE1	Computer Engineering Seminar I	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.			
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.			
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-ADU.1	Unix Administration	Z,ZK	5

BIE-ADW.1	Windows Administration	Z,ZK	4
Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.			
BIE-AG1	Algorithms and Graphs 1	Z,ZK	6
The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It is interlinked with the concurrent BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed for time and space complexity of algorithms and learn to handle practically the asymptotic mathematics.			
BIE-AG2	Algorithms and Graphs 2	Z,ZK	5
BIE-APS.1	Architectures of Computer Systems	Z,ZK	5
Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of programs. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.			
BIE-BAP	Bachelor Thesis	Z	14
BIE-BEK	Secure Code	Z,ZK	5
The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.			
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-BIG	DB Technologies for Big Data	KZ	4
Students are introduced into the field of Big Data. These are data that the standard relational databases cannot process efficientlydue to the size, and at the same time, their real-time processing can provide information that can have key importance for thecompetitiveness of a company or organization. The course is focused practically. Students learn the most important professionaltechnologies, such as Apache Cassandra, Apache Hadoop, Apache Solr, and others. The course brings to students theoreticalfoundation of algorithms used in Big data systems. In the labs, students learn to develop their own applications on topof these technologies.			
BIE-BPR	Bachelor Project	Z	2
At the beginning of the semester the student will contact the supervisor of the bachelor thesis he has booked. They will discuss the partial tasks that student will perform during the semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.			
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-CCN	Compiler Construction	Z,ZK	5
This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.			
BIE-CZ0	Czech Language for Foreigners	KZ	2
Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.			
BIE-CZ1.21	Czech Language for Foreigners II	KZ	2
The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The course further expands the basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Republic.			
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-DPR	Document., Presentation, Rhetorics	KZ	4
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. There is no fixed schedule for BIE-DPR. A teacher will contact you before the start of the semester.			
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-EHD	Introduction to European Economic History	Z,ZK	3
The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover detailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lecture and discussion.			
BIE-EMP	Economic and management principles	KZ	4
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-EPR	Economic project	Z	1
This course is an extension of the course Introduction to European Economic History (BIE-EHD). There is no fixed schedule for BIE-EPR. A teacher will contact you before the start of the semester.			
BIE-FTR.1	Financial Markets	Z,ZK	5
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.			
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-HMI	History of Mathematics and Informatics	Z,ZK	3
Students will master the methods traditionally used in mathematics and related disciplines - informatics - from different periods of the development of mathematics, and will thus become acquainted with mathematical methods suitable for applications in contemporary computer science.			
BIE-HWB	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers.			
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-IMA2	Introduction to Mathematics 2	Z	2
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-KOM	Conceptual Modelling	Z,ZK	5
The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations.			
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-MIK	Fundamentals of Microeconomics	Z,ZK	4
This a 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.			
BIE-MLO	Mathematical Logic	Z,ZK	5
An introduction to propositional and predicate logic.			
BIE-OOP	Object-Oriented Programming	Z,ZK	4
Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handing, refactoring and design patterns.			
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-PS1 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-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-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-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 APIs will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.			
BIE-PKM	Preparatory Mathematics	Z	4
The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.			

BIE-PPA	Programming Paradigms	Z,ZK	5
BIE-PRR.21	Project management	Z,ZK	5
The aim of the course is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, analysis, crisis management in a project, communication, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk assessment and management, Gantt charts, resource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for students who are interested in deepening their knowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in large companies. The course is also suitable for all those who will develop software or hardware in the form of team projects.			
BIE-PS1	Programming in Shell 1	KZ	5
Students understand the basic principles of operating systems (processes and threads, file systems, access rights, memory management, network interface) with a focus on UNIX like operating systems. In practically oriented exercises, they will learn to use shell, basic commands and filters for processing text data.			
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, data structures, 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: We are ready do adapt the lectures to provide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, ln, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice.			
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
The students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods of determining the 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-SCE1	Computer Engineering Seminar I	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.			
BIE-SCE2	Computer Engineering Seminar II	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.			
BIE-SEP	World Economy and Business	Z,ZK	4
The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.			
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-SI2.3	Software Engineering 2	Z,ZK	3
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.			
BIE-SSB	System and Network Security	Z,ZK	5
The students will understand the public key infrastructure (PKI), its strengths and weaknesses, its vulnerabilities againstattacks. The students will also understand the analysis of network protocols from the perspectives of: authentication and authorisation,key exchange, and encryption. They get an overview of the security mechanisms of operating systems (OSs), of the ways virtualization canbe used to protect OSs, and of the security mechanisms for the OS memory. The students will learn basic methods of forensic analysisof storage media and networks. The students will also understand security of the networking infrastructure and its protocols andwill be able to design and implement a secured and survivable network. Students will also get an overview of securing data in clouds,database systems, and servers.			
BIE-ST1	Network Technology 1	Z	3
The course is focused on essentials of computer networks and practice with network technologies. The course corresponds to the Cisco Netacad curriculum, CCNA1 - R&S Introduction to Networks.			

BIE-TJV	Java Technology	Z,ZK	4
The subject goal is to introduce the programming language Java. The student gains practical experiences for smaller enterprise application programming. This subject presents how to build the three and more layers enterprise systems. The student practically exercises all communication interfaces for each layers (JDBC, RestWeb services, JNDI etc.). At the course end is student able to create three layers enterprise application.			
BIE-TWA.1	Web Application Design	Z,ZK	5
The basic course of web application development. Initially, the students become familiar with HTTP and its possibilities and partly with some properties of language describing the structure (HTML) and presentation of document on the Web (CSS). These skills provide the necessary basis for the development of Web applications, which will be demonstrated in modern libraries facilitate the development of Web pages applications. Server side will be demonstrated on PHP technology using frameworks Symfony 2, Doctrine 2. Developments on the client side will be demonstrated using a JavaScript language with library jQuery and possibly MV* framework AngularJS.			
BIE-VAK.21	Selected Combinatorics Applications	Z	3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing 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 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-XML	XML Technology	Z,ZK	4
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-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.			
FI-HPZ	Humanities subject from a study abroad	Z	3
A "Humanities subject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that is required in the curriculum. The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.			
TV2K1	Physical Education 2	Z	1

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