Study plan

Name of study plan: Bachelor branch Knowledge Engineering, in Czech, 2018-2020

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: 157
Elective courses credits: 23
Sum of credits in the plan: 180
Note on the plan: Tato verze studijního plánu je určena pro ročník, který byl přijat ke studiu v akademickém roce 2018/2019 do prezenční formy studia bakalářského programu.

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: BI-PP.2015
Name of the group: Compulsory Courses of Bachelor Study Program Informatics, Presented in Czech, 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: Povinný předmět BI-SI1 se studentům bez oboru nezapisuje automaticky. Zapíší si jej individuálně podle pokynů z katedry Softwarového inženýrství.

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
BI-AG1	**Algorithms and Graphs 1** ***Dušan Knop***	Z,ZK	6	2P+2C	Z	PP
BI-AAG	**Automata and Grammars** ***Jan Janoušek***	Z,ZK	6	2P+2C	Z	PP
BI-BAP	**Bachelor Thesis** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	14		L,Z	PP
BI-BPR	**Bachelor project** *Zdeněk Muzikář* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	2		Z,L	PP
BI-BEZ	**Security** ***Jiří Dostál***	Z,ZK	6	2P+2C	L	PP
BI-CAO	**Digital and Analog Circuits** ***Martin Kohlík***	Z,ZK	5	2P+2C	Z	PP
BI-DBS	**Database Systems** ***Jiří Hunka***	Z,ZK	6	2P+2R+1L	Z,L	PP
BI-DPR	**Document., Presentation, Rhetorics** *Alena Libánská, Ondřej Guth, Petra Pavlíčková, Dana Vynikarová* ***Ondřej Guth*** *Dana Vynikarová (Gar.)*	KZ	4	2P+2C	Z,L	PP
BI-LIN	**Linear Algebra** *Daniel Dombek* ***Daniel Dombek*** *Daniel Dombek (Gar.)*	Z,ZK	7	4P+2C	L	PP
BI-MLO	**Mathematical Logic** *Kateřina Trlifajová* ***Kateřina Trlifajová*** *Kateřina Trlifajová (Gar.)*	Z,ZK	5	2P+1C	Z	PP
BI-OSY	**Operating Systems** ***Ladislav Vagner***	Z,ZK	5	2P+1R+1L	L	PP
BI-PSI	**Computer Networks** ***Jan Fesl***	Z,ZK	5	2P+1R+1C	L	PP
BI-PST	**Probability and Statistics** ***Petr Novák***	Z,ZK	5	2P+1R+1C	Z	PP
BI-PA1	**Programming and Algorithmics 1** ***Ladislav Vagner***	Z,ZK	6	2P+2R+2C	Z	PP
BI-PA2	**Programming and Algorithmics 2** ***Ladislav Vagner***	Z,ZK	7	2P+1R+2C	L	PP

BI-PS1	**Programming in Shell 1** ***Zdeněk Muzikář***	KZ	5	2P+2C	Z	PP
BI-SI1.2	**Software Engineering I** *Jiří Mlejnek, Zdeněk Rybola* ***Zdeněk Rybola*** *Jiří Mlejnek (Gar.)*	Z,ZK	5	2P+1C	Z,L	PP
BI-SAP	**Computer Structure and Architecture** ***Hana Kubátová***	Z,ZK	6	2P+1R+2C	L	PP
BI-ZDM	**Elements of Discrete Mathematics** *Jiřina Scholtzová, Jan Legerský* ***Jiřina Scholtzová*** *Josef Kolář (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BI-ZMA	**Elements of Calculus** *Ivo Petr* ***Ivo Petr*** *Tomáš Kalvoda (Gar.)*	Z,ZK	6	3P+2C	Z	PP

Characteristics of the courses of this group of Study Plan: Code=BI-PP.2015 Name=Compulsory Courses of Bachelor Study Program Informatics, Presented in Czech, Version 2015

BI-AG1	Algorithms and Graphs 1	Z,ZK	6

The course covers the basics of efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It links and partially develops the knowledge from the course BI-DML.21, in which students acquire the knowledge and skills in combinatorics necessary for evaluating the time and space complexity of algorithms. The course also follows up knowledge from BI-MA1.21, the practical usage of asymptotic mathematics, in particular, the asymptotic notation.

BI-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.

BI-BAP	Bachelor Thesis	Z	14
BI-BPR	Bachelor project	Z	2
BI-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 use properly and securely cryptographic primitives and systems that are based on these primitives.

BI-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.

BI-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 course does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.

BI-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.

BI-LIN	Linear Algebra	Z,ZK	7

The course is taught in Czech. 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 matrices 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 the error-detecting and error-correcting codes.

BI-MLO	Mathematical Logic	Z,ZK	5

The course seminary is taught in Czech.

BI-OSY	Operating Systems	Z,ZK	5

Students understand the classical theory of operating systems (OS) in addition to the knowledge gained in the module "Programming in Shell 1". They get a solid knowledge of OS kernels, processes and threads implementations. They understand the problems of race conditions, thread scheduling, resource allocation and deadlocks, the techniques of the management of virtual memory, principles and architectures of disks, RAID and file systems. They are able to design and implement simple multithreaded applications.

BI-PSI	Computer Networks	Z,ZK	5

Students understand the basic common techniques, protocols, technologies, and algorithms necessary to communicate in computer networks. The topics are primarily focused on 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.

BI-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.

BI-PA1	Programming and Algorithmics 1	Z,ZK	6

Students gain the ability to formulate 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 to analyse simple cases of algorithm complexity. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.

BI-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 with all C++ features needed to achieve the main objective (operator overloading, templates).

BI-PS1	Programming in Shell 1	KZ	5

Students become knowledgeable users of common Unix-like operating systems. 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 to process various text data.

BI-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. They get practical skill thanks to applying hands-on analysis and design of a large-scale software project that is to be developed within the concurrent BI-SP1 module. They get skill to use CASE tools and UML for modelling and solving software-related problems. They get overview of object-oriented analysis, design, architecture, validation, verification, and testing processes.			
BI-SAP	Computer Structure and Architecture	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. The subject teaches basic knowledge of digital computer construction principles, how a computer performs its operations, what is machine code, and what are its connections to higher programming languages.			
BI-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, tools for solving recurrent equations, and basics of graph theory.			
BI-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.			

Name of the block: Compulsory courses of the specialization
Minimal number of credits of the block: 29
The role of the block: PO

Code of the group: BI-PO-ZI.2018
Name of the group: Compulsory Courses of Bachelor Branch Knowledge Engineering, in Czech, Version 2018
Requirement credits in the group: In this group you have to gain 29 credits
Requirement courses in the group: In this group you have to complete 7 courses
Credits in the group: 29
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**
BI-BIG	**DB Technologies for Big Data** *Josef Gattermayer, Jan Matoušek, Monika Borkovcová* ***Jan Matoušek*** *Monika Borkovcová (Gar.)*	KZ	4	2P+2C	Z	PO
BI-PAI	**Law and Informatics** ***Zdeněk Kučera***	ZK	3	2P	Z	PO
BI-PJV	**Programming in Java** *Miroslav Balík, Jan Blizničenko, Jiří Borský, Jan Zimolka* ***Miroslav Balík*** *Miroslav Balík (Gar.)*	Z,ZK	4	2P+2C	Z,L	PO
BI-VWM	**Searching the Web and Multimedia Databases** ***Tomáš Skopal***	Z,ZK	5	2P+1C	L	PO
BI-VZD	**Data Mining** *Alexander Kovalenko, Karel Klouda, Ondřej Tichý, Daniel Vašata* ***Daniel Vašata*** *Pavel Kordík (Gar.)*	Z,ZK	4	2P+2C	L,Z	PO
BI-ZUM	**Artificial Intelligence Fundamentals** *Pavel Surynek* ***Pavel Surynek*** *Pavel Surynek (Gar.)*	Z,ZK	4	2P+2C	L	PO
BI-ZNS	**Knowledge-based Systems** *Marcel Jiřina* ***Marcel Jiřina*** *Marcel Jiřina (Gar.)*	Z,ZK	5	2P+2C	Z	PO

Characteristics of the courses of this group of Study Plan: Code=BI-PO-ZI.2018 Name=Compulsory Courses of Bachelor Branch Knowledge Engineering, in Czech, Version 2018

BI-BIG	DB Technologies for Big Data	KZ	4
This course is presented in Czech.			
BI-PAI	Law and Informatics	ZK	3
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-PJV	Programming in Java	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-VWM	Searching the Web and Multimedia Databases	Z,ZK	5
Students get basic overview about search techniques in the web environment that is interpreted as a very large distributed and heterogeneous storage of documents. In particular, students acquire information about search techniques in text and hypertext documents (the web pages themselves) and about feature extraction from web pages. They get detailed knowledge of similarity search in multimedia databases (generally in collections of unstructured data). They also learn techniques for programming web search engines for the mentioned data types (documents).			
BI-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).			

BI-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.			
BI-ZNS	Knowledge-based Systems	Z,ZK	5
Students will become familiar with the systems based on knowledge (knowledge-based systems), which are systems that usetechniques of artificial intelligence to solve problems that require human judgment, learning and reasoning from findingsand actions. The course introduces students to the philosophy and architecture of knowledge-based systems to support decision-makingand planning. The course assumes knowledge of set theory, probability theory, artificial neural networks, and evolutionary algorithms.			

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

Code of the group: BI-PP-EM.2015
Name of the group: Compulsory Economics and Management Bachelor Courses, in Czech, 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: Povinný předmět BI-EMP se studentům bez oboru nezapisuje automaticky. Zapíší si jej individuálně podle pokynů z katedry Softwarového inženýrství.

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
BI-EMP	**Economics and Management Principles** *David Buchtela, Petra Pavlíčková **David Buchtela** David Buchtela (Gar.)*	KZ	4	2P+2C	Z,L	PE

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

BI-EMP	Economics 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 economic-management courses
Minimal number of credits of the block: 4
The role of the block: VE

Code of the group: BI-PV-EM.2015
Name of the group: Compulsory Elective Economical Courses of Bc. Program Informatics, Presented in Czech, Ver. 2015
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)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BI-DAN	**Taxes for non-Economists** *Savina Finardi, Tereza Jiříková **Tereza Jiříková** Savina Finardi (Gar.)*	Z,ZK	4	2P+2C	Z	VE
FI-VEZ	**economic-managerial course from a study abroad** ***Miroslav Balík***	Z	4	0+0	Z,L	VE
BI-FTR.1	**Financial Markets** ***Pavla Vozárová***	Z,ZK	5	2P+2C	L	VE
BI-MEK	**Macroeconomic Context of Domestic and World Economy** *Ivo Straka **Ivo Straka** Ivo Straka (Gar.)*	Z,ZK	4	2P+2C	Z	VE
BI-PRP	**Law and business** *Zdeněk Kučera, Martin Samek **Martin Samek** Zdeněk Kučera (Gar.)*	Z,ZK	4	2P+1R	L	VE
BI-PRR	**Project management** ***David Pešek***	KZ	4	2P+2C	Z	VE
BI-SEP	**World Economy and Business** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	Z,ZK	4	2P+2C	L	VE
BI-MIK	**Fundamentals of Microeconomics** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	Z,ZK	4	2P+2C	L	VE

Characteristics of the courses of this group of Study Plan: Code=BI-PV-EM.2015 Name=Compulsory Elective Economical Courses of Bc. Program Informatics, Presented in Czech, Ver. 2015

BI-DAN	Taxes for non-Economists	Z,ZK	4
Taxes, including social insurance contributions, are obligatory payments paid by people or institutions to public budgets. This is the way how a significant portion of GDP is redistributed. This course concerns who pays which taxes or who bears the tax burden. The course introduces students to the tax theory and policy fundamentals and shows how they affect taxation of income, consumption, and wealth. The course provides practical information on calculations of tax liabilities of both citizens and institutions as well as information about important taxpayers´ formal duties towards public administration.			
FI-VEZ	economic-managerial course from a study abroad	Z	4
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.			
BI-FTR.1	Financial Markets	Z,ZK	5
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-MEK	Macroeconomic Context of Domestic and World Economy	Z,ZK	4
This course is presented in Czech.			
BI-PRP	Law and business	Z,ZK	4
This course is presented in Czech.			
BI-PRR	Project management	KZ	4
This course is presented in Czech.			
BI-SEP	World Economy and Business	Z,ZK	4
This course is presented in Czech. 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.			
BI-MIK	Fundamentals of Microeconomics	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			

Name of the block: Povinná zkouška z angličtiny
Minimal number of credits of the block: 2
The role of the block: PJ

Code of the group: BI-ZKA
Name of the group: English Language, Internal Certifica
Requirement credits in the group: In this group you have to gain at least 2 credits (at most 4)
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 2
Note on the group: Ze skupiny je nutné absolvovat jeden ze dvou předmětů, představujících interní zkoušku z angličtiny. -- Předmět BI-ANG si zapisují studenti, kteří absolvovali přípravné kurzy z angličtiny a mají zápočet z předmětu BI-A2L. -- Předmět BI--ANG1 si zapisují studenti, kteří se na zkoušku připravovali samostatně. Tito studenti musí před vlastní zkouškou absolvovat zápočtovou písemku.

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
BI-ANG1	**English Language Examination without Preparatory Courses** *Kateřina Valentová* ***Kateřina Valentová*** *Kateřina Valentová (Gar.)*	Z,ZK	2		L	PJ
BIE-EEC	**English language external certificate** *Zdeněk Muzikář* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	4		L	PJ
BI-ANG	**English Language, Internal Certificate** *Kateřina Valentová* ***Kateřina Valentová*** *Kateřina Valentová (Gar.)*	ZK	2		Z,L	PJ

Characteristics of the courses of this group of Study Plan: Code=BI-ZKA Name=English Language, Internal Certifica

BI-ANG1	English Language Examination without Preparatory Courses	Z,ZK	2
BIE-EEC	English language external certificate	Z	4
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding the B2 level of the Common European Framework of Reference for Languages.			
BI-ANG	English Language, Internal Certificate	ZK	2
Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG			

Name of the block: Povinná tělesná výchova, sportovní kurzy
Minimal number of credits of the block: 0
The role of the block: PT

Code of the group: BI-PT.2015
Name of the group: Compulsory Physical Education of Bachelor Program Informatics, in Czech, Version 2015
Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 2 courses
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
TV1	**Physical Education**	Z	0	0+2	Z	PT
TVV	**Physical education**	Z	0	0+2	Z,L	PT
TVV0	**Physical education**	Z	0	0+2	Z,L	PT
TV2	**Physical Education**	Z	0	0+2	L	PT
TVKLV	**Physical Education Course**	Z	0	7dní	L	PT
TVKZV	**Physical Education Course**	Z	0	7dní	Z	PT

Characteristics of the courses of this group of Study Plan: Code=BI-PT.2015 Name=Compulsory Physical Education of Bachelor Program Informatics, in Czech, Version 2015

TV1	Physical Education	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0
TV2	Physical Education	Z	0
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0

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: BI-PV-HU.2015
Name of the group: Compulsory Elective Humanity Courses of Bachelor Study Program Informatics, in Czech, Version 2015
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)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
FI-FIL	**Philosophy** *Peter Zamarovský **Peter Zamarovský** Peter Zamarovský (Gar.)*	ZK	2	2P	Z,L	VH
BI-HMI	**History of Mathematics and Informatics** *Alena Šolcová **Alena Šolcová** Alena Šolcová (Gar.)*	Z,ZK	3	2P+1C	L	VH
FI-HTE	**History of Technology and Economics** *Jan Mikeš, Marcela Efmertová **Jan Mikeš** Jan Mikeš (Gar.)*	ZK	2	2+0	Z,L	VH
FI-HPZ	**Humanities subject from a study abroad** ***Miroslav Balík***	Z	3	0+0	Z,L	VH
FI-MPL	**Managerial Psychology** ***Jan Fiala***	ZK	2	2+0	Z,L	VH
BI-EHD	**Introduction to European Economic History** *Tomáš Evan **Tomáš Evan** Tomáš Evan (Gar.)*	Z,ZK	3	2P+1C	Z,L	VH
FI-KSA	**Cultural and Social Anthropology** ***Jakub Šenovský***	ZK	2	2P	L,Z	VH
BI-KSA	**Cultural and Social Anthropology** *Alena Libánská, Tomáš Houdek, Jakub Šenovský **Jakub Šenovský** Alena Libánská (Gar.)*	ZK	2	2P	Z,L	VH
FI-ULI	**Introduction to Linguistics for Computer** ***Václav Cvrček***	ZK	2	2P	L	VH
FI-GNO	**Introduction to Gnoseology** ***Ivo Janoušek***	ZK	2	2+0	L	VH

Characteristics of the courses of this group of Study Plan: Code=BI-PV-HU.2015 Name=Compulsory Elective Humanity Courses of Bachelor Study Program Informatics, in Czech, Version 2015

FI-FIL	Philosophy	ZK	2
see A0B16			
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
This course is presented in Czech.			

FI-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 .			
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.			
FI-MPL	Managerial Psychology	ZK	2
BI-EHD	Introduction to European Economic History	Z,ZK	3
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
FI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is an interesting alternative to other humanities, taught at FIT.			
BI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is presented in Czech.			
FI-ULI	Introduction to Linguistics for Computer	ZK	2
This course is presented in Czech.			
FI-GNO	Introduction to Gnoseology	ZK	2
Předmět studenty uvádí do teorie poznání, systémovým pohledem nahlíží na pole kultury, na vztahy a rozdíly mezi přírodními a humánními obory, vědou a uměním. Rozborem dějin modernismu a myšlenkových proudů 20. století jsou ukázány proměny paradigmat a převrat k postmodernismu, analýzou paralelismů ve vědě a umění odhaleny mechanismy tvůrčích procesů. V návaznosti na teorii přírodních jazyků a sémiotiky je vedena diskuze i o kognitivních procesech, v historickém přehledu nastíněna hlediska estetického vnímání. Samostatnou kapitolou jsou modely spojitých přírodních soustav a systémů, v závěru přednášek je pozornost věnována filozofii vědy a otázkám udržitelného rozvoje. Předmět přednáší a garantuje Ing. Ivo Janoušek CSc.			

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: BI-ZI-VO.2017
Name of the group: Elective Vocational Courses for a Bachelor Branch BI-ZI, Version 2017
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: Všechny povinné předměty oborů a zaměření s výjimkou tohoto oboru

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
BI-ADU.1	**Unix Administration** ***Zdeněk Muzikář***	Z,ZK	5	2P+2C	L	v
BI-ADW.1	**Windows Administration** *Jiří Kašpar, Miroslav Prágl* ***Miroslav Prágl*** *Miroslav Prágl (Gar.)*	Z,ZK	4	2P+1C	Z	v
BI-AG2	**Algorithms and Graphs 2** ***Ondřej Suchý***	Z,ZK	5	2P+2C	L	v
BI-APS.1	**Architectures of Computer Systems** ***Pavel Tvrdík***	Z,ZK	5	2P+2C	Z	v
BI-BEK	**Secure Code** ***Róbert Lórencz***	Z,ZK	5	2P+2C	L	v
BI-HWB	**Hardware Security** *Jiří Buček, Filip Kodýtek, Róbert Lórencz* ***Jiří Buček*** *Róbert Lórencz (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-JPO	**Computer Units** ***Alois Pluháček***	Z,ZK	5	2P+2C	Z	v
BI-KOM	**Conceptual Modelling** *Marek Suchánek, Robert Pergl* ***Robert Pergl*** *Robert Pergl (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-MGA	**Multimedia and Graphics Applications** ***Jiří Chludil***	Z,ZK	5	2P+2C	Z	v
BI-OOP	**Object-Oriented Programming** *Filip Křikava* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	4	2P+2C	Z	v
BI-PGR.1	**Computer graphics programming**	Z,ZK	5	2P+2C	L	v
BI-PNO	**Practical Digital Design** *Martin Novotný* ***Martin Novotný*** *Martin Novotný (Gar.)*	KZ	5	2P+2C	Z	v
BI-PRP	**Law and business** *Zdeněk Kučera, Martin Samek* ***Martin Samek*** *Zdeněk Kučera (Gar.)*	Z,ZK	4	2P+1R	L	v
BI-PJP	**Programming Languages and Compilers** ***Jan Janoušek***	Z,ZK	5	2P+1C	L	v
BI-PPA	**Programming Paradigms** ***Jan Janoušek***	Z,ZK	5	2P+2R	Z	v

BI-PGA	**Programming of graphic applications** *Radek Richtr, Jiří Chludil* ***Radek Richtr*** *Radek Richtr (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-PYT	**Python Programming**	Z,ZK	4	2P+2C	L	v
BI-SI2.3	**Software Engineering 2** *Martin Hlavatý* ***Zdeněk Rybola*** *Martin Hlavatý (Gar.)*	Z,ZK	3	2P	Z	v
BI-SP1.21	**Team Software Project 1** *Radek Richtr, Marek Suchánek, Michal Valenta, Jiří Chludil, Jiří Mlejnek, Jiří Hunka, Zdeněk Rybola, Jiří Borský, Jan Matoušek, ...* ***Zdeněk Rybola*** *Jiří Mlejnek (Gar.)*	KZ	5	2C	L	v
BI-SP1	**Team Software Project 1** ***Jiří Mlejnek***	KZ	4	2C	L	v
BI-SP2	**Team Software Project 2** ***Jiří Mlejnek***	KZ	6	2C	Z	v
BI-SP2.1	**Team Software Project 2** *Marek Suchánek, Jiří Chludil, Robert Pergl, Marek Skotnica, Jiří Mlejnek, Jiří Hunka, Zdeněk Rybola, Jiří Borský* ***Jiří Mlejnek*** *Jiří Mlejnek (Gar.)*	KZ	4	2C	Z	v
BI-SSB	**System and Network Security** *Jiří Dostál* ***Jiří Dostál*** *Jiří Dostál (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-SRC	**Real-time systems** *Jaroslav Borecký, Hana Kubátová* ***Jaroslav Borecký*** *Hana Kubátová (Gar.)*	KZ	4	2P+2C	Z	v
BI-XML	**XML Technology** ***Jan Mokrý***	Z,ZK	4	2P+2C	L,Z	v
BI-TIS	**Information Systems Design** *Pavel Náplava* ***Pavel Náplava*** *Pavel Náplava (Gar.)*	Z,ZK	5	2P+1C	Z	v
BI-TUR	**User Interface Design** ***Jan Schmidt***	Z,ZK	4	2P+2C	L	v
BI-TWA.1	**Web Application Design** *Filip Glazar, David Bernhauer* ***Filip Glazar*** *David Bernhauer (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-VES	**Embedded Systems** ***Miroslav Skrbek***	Z,ZK	5	2P+2C	L	v
BI-ZRS	**Basics of System Control** ***Kateřina Hyniová***	Z,ZK	4	2P+2C	Z	v

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

BI-PRP	Law and business	Z,ZK	4
This course is presented in Czech.			
BI-ADU.1	Unix Administration	Z,ZK	5
Students will learn the internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will understand the differences between user and administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file systems, disk subsystems, processes, memory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge from the lectures on specific examples from practice.			
BI-ADW.1	Windows Administration	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-AG2	Algorithms and Graphs 2	Z,ZK	5
This course, presented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course BI-AG1. It further delves into advances data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version of the course see BIE-AG2.			
BI-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.			
BI-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.			
BI-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.			
BI-JPO	Computer Units	Z,ZK	5
Students deepen their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail with the internal structure and organization of computer units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using appropriate codes for implementation of multiplication. The organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including codes for error detection and correction for parallel and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of communication of the processor with the environment and the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammed processor simulator and programmable hardware design kits (FPGA).			
BI-KOM	Conceptual Modelling	Z,ZK	5
The course is focused on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key terms in a domain, the ability to categorize and specify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological structural modeling in the OntoUML notation. Next, they learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data representation in the Internet. They also learn the foundations of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO method and the BPMN notation will be taught. The course is designed with the respect to continuation in software implementations.			

BI-MGA	Multimedia and Graphics Applications	Z,ZK	5
Students get acquainted with multimedia technologies and applications for 2D/3D bitmap and vector graphics. During the course, current tools for working with images, videos, 3D graphics and animation will be introduced. Students learn several basic techniques of creation and editing content in computer graphics, introduction to graphic formats, and compression technologies. They learn to use multimedia transmission and representation systems, including real-time multimedia processing. They understand the principle of operation and use of graphics processing cards. They gain a number of practical skills, such as vectorizing raster images, retouching photos, or creating 3D models.			
BI-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.			
BI-PGR.1	Computer graphics programming	Z,ZK	5
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 your 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.			
BI-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. Students demonstrate practical use of the design techniques in the module project sing modern, industry-standard CAD design tools.			
BI-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.			
BI-PPA	Programming Paradigms	Z,ZK	5
The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and limitations of particular approaches. Functional programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The principles are demonstrated on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstream programming languages such as C++ and Java.			
BI-PGA	Programming of graphic applications	Z,ZK	5
This course is presented in Czech only.			
BI-PYT	Python Programming	Z,ZK	4
The course is taught in Czech.			
BI-SI2.3	Software Engineering 2	Z,ZK	3
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-SP1.21	Team Software Project 1	KZ	5
Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the BIE-SWI course that runs concurrently and that teaches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software artefact will be further developed and finished in the BIE-SP2 course.			
BI-SP1	Team Software Project 1	KZ	4
Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided by the BEI-SWI course that runs concurrently and that teaches the necessary techniques and theory. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) with respect to both the formal and material aspects of the design. The resulting work will be further developed and finished in the BEI-SP2 course.			
BI-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-SP2.1	Team Software Project 2	KZ	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-SSB	System and Network Security	Z,ZK	5
This course is focused on selected areas of computer networks and computer systems in terms of cyber security			
BI-SRC	Real-time systems	KZ	4
Students obtain the basic knowledge in the Real-time 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 used design kits are the same as in BI-VES subject and FPGA.			
BI-XML	XML Technology	Z,ZK	4
Students learn to make and validate XML documents (XML Schema, Relax, Schematron) and learn standard methods of their processing (SAX, DOM). An emphasis will be given to language XPath which enables addressing of parts of XML documents and its usage in different XML technologies. Students will also learn basics of XSLT programming. XSLT and XPath programming will be based on version 2.0. Students will gain a broad overview of XML technologies.			
BI-TIS	Information Systems Design	Z,ZK	5
Students know various types of ISs and their practical implementation aspects and are able to match the needs of different market segments (customers) with applications of existing technologies (databases, programming languages, GUI etc.).			
BI-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.			
BI-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.			

BI-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.

BI-ZRS	Basics of System Control	Z,ZK	4

The course gives an introduction to the field of automatic control. 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, description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. 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.

Code of the group: BI-V-PRO_MG
Name of the group: Elective Courses, Suitable for those who intend to apply for Master's program at FIT
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: Courses 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
BI-AG2	**Algorithms and Graphs 2** ***Ondřej Suchý***	Z,ZK	5	2P+2C	L	v

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

BI-AG2	Algorithms and Graphs 2	Z,ZK	5

This course, presented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course BI-AG1. It further delves into advances data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version of the course see BIE-AG2.

Code of the group: BI-V.2017
Name of the group: Purely Elective Courses of Bachelor Programme BI, Version 2017
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group: Volitelné předměty, které nejsou povinnými v programu ani žádného oboru či zaměření

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
BI-ALO	**Algebra and Logic** *Jan Starý **Jan Starý** Jan Starý (Gar.)*	Z,ZK	4	2P+1C	L	v
BI-AVI.21	**Algorithms visually** *Luděk Kučera **Luděk Kučera** Luděk Kučera (Gar.)*	Z,ZK	4	2P+1C	L	v
BI-A2L	**English language, preparation for the B2 level exam** *Kateřina Valentová **Kateřina Valentová** Kateřina Valentová (Gar.)*	Z	2	2C	L	v
BI-APJ	**Aplication Programming in Java** ***Jiří Daněček***	Z,ZK	4	2P+1R+1C	Z	v
NI-AFP	**Applied Functional Programming** *Marek Suchánek, Robert Pergl, Daniel Němec **Robert Pergl** Robert Pergl (Gar.)*	KZ	5	2P+1C	L	v
BIE-ZUM	**Artificial Intelligence Fundamentals** *Pavel Surynek **Pavel Surynek** Pavel Surynek (Gar.)*	Z,ZK	4	2P+2C	L	v
BI-BLE	**Blender** *Lukáš Bařinka **Lukáš Bařinka** Lukáš Bařinka (Gar.)*	Z,ZK	4	2P+2C	L	v
NI-DSP	**Database Systems in Practes** *Tomáš Vichta **Tomáš Vichta** Tomáš Vichta (Gar.)*	Z,ZK	4	2P+1C	L	v
BI-STO	**Storage and Filesystems**	Z,ZK	4	2P+2C	L,Z	v
NI-DZO	**Digital Image Processing**	Z,ZK	4	2P+1C	L	v
NI-DDM	**Distributed Data Mining** ***Tomáš Borovička***	KZ	4	3C	L	v
BI-EP1	**Effective programming 1** *Martin Kačer **Martin Kačer** Martin Kačer (Gar.)*	Z	4	2P+2C	Z	v
BI-EP2	**Efficient Programming 2** *Martin Kačer **Martin Kačer** Martin Kačer (Gar.)*	KZ	4	2P+2C	L	v

BI-EJA	**Enterprise Java** *Jiří Daněček **Jiří Daněček** Jiří Daněček (Gar.)*	Z,ZK	4	2P+2C	L	v
BI-FMU	**Financial and Management Accounting** *David Buchtela **David Buchtela** David Buchtela (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-HAM	**HW accelerated network traffic monitoring** *Karel Hynek, Tomáš Čejka **Tomáš Čejka** Tomáš Čejka (Gar.)*	KZ	4	2P+1C	L	v
BI-ARD	**Interactive applications on Arduino** *Jiří Cvrček, Robert Hülle, Vojtěch Miškovský, Jan Řezníček **Robert Hülle** Robert Hülle (Gar.)*	KZ	4	3C	L	v
NI-IAM	**Internet and Multimedia** ***Jiří Melnikov***	Z,ZK	4	2P+1C	L	v
BIE-IMA2	**Introduction to Mathematics 2** ***Karel Klouda***	Z	2	1C	Z	v
BI-CS2	**C# language and data access** *Pavel Štěpán **Pavel Štěpán** Pavel Štěpán (Gar.)*	KZ	4	0P+3C	Z	v
BI-CS3	**Language C# - design of web applications** *Pavel Štěpán **Pavel Štěpán** Pavel Štěpán (Gar.)*	KZ	4	3C	Z	v
BI-SQL.1	**Language SQL, advanced** *Michal Valenta **Michal Valenta** Michal Valenta (Gar.)*	KZ	4	3C	L	v
BI-QAP	**Quantum algorithms and programming** *Tomáš Kalvoda, Ivo Petr **Ivo Petr** Ivo Petr (Gar.)*	KZ	5	1P+2C	Z	v
NI-LSM	**Statistical Modelling Lab** *Kamil Dedecius **Kamil Dedecius** Kamil Dedecius (Gar.)*	KZ	5	3C	L	v
NI-MPL	**Managerial Psychology** *Jan Fiala **Jan Fiala** Jan Fiala (Gar.)*	ZK	2	2P	Z,L	v
NI-MSI	**Mathematical Structures in Computer Science** *Jan Starý **Jan Starý** Jan Starý (Gar.)*	Z,ZK	4	2P+1C	L	v
BI-MPP.21	**Methods of interfacing peripheral devices** *Miroslav Skrbek **Miroslav Skrbek** Miroslav Skrbek (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-MIT	**Mikrotik technologies** *Jan Fesl **Jan Fesl** Jan Fesl (Gar.)*	KZ	3	1P+2C	Z	v
NI-MOP	**Modern Object-Oriented Programming in Pharo** *Marek Skotnica, Jan Blizničenko **Robert Pergl** Robert Pergl (Gar.)*	KZ	4	3C	Z	v
BI-MVT.21	**Modern Visualisation Technologies** *Jiří Chludil, Petr Pauš **Petr Pauš** Petr Pauš (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-MMP	**Multimedia team project** *Zdeňka Čechová **Zdeňka Čechová** Zdeňka Čechová (Gar.)*	KZ	4	3C	Z,L	v
NI-OLI	**Linux Drivers** *Jaroslav Borecký, Miroslav Skrbek **Jaroslav Borecký** Miroslav Skrbek (Gar.)*	Z,ZK	4	2P+2C	L	v
BI-ACM	**Programming Practices 1** *Tomáš Valla, Ondřej Suchý **Tomáš Valla** Tomáš Valla (Gar.)*	KZ	5	4C	L	v
BI-ACM2	**Programming Practices 2** *Tomáš Valla, Ondřej Suchý **Tomáš Valla** Tomáš Valla (Gar.)*	KZ	5	4C	Z	v
BI-ACM3	**Programming Practices 3** *Tomáš Valla, Ondřej Suchý **Tomáš Valla** Tomáš Valla (Gar.)*	KZ	5	4C	L	v
BI-ACM4	**Programming Practices 4** *Tomáš Valla, Ondřej Suchý **Tomáš Valla** Ondřej Suchý (Gar.)*	KZ	5	4C	Z	v
BI-AND.21	**Programming for the Android Operating System** *Jan Mottl, Jan Vepřek, Marek Kodr **Jan Mottl** Marek Kodr (Gar.)*	KZ	4	3C	L	v
BI-CS1	**Programming in C#** *Pavel Štěpán, Helena Wallenfelsová **Helena Wallenfelsová** Pavel Štěpán (Gar.)*	KZ	4	3C	L,Z	v
BI-PJV	**Programming in Java** *Miroslav Balík, Jan Blizničenko, Jiří Borský, Jan Zimolka **Miroslav Balík** Miroslav Balík (Gar.)*	Z,ZK	4	2P+2C	Z,L	v
BI-PJS.1	**JavaScript Programming** ***Oldřich Malec***	KZ	4	3C	L	v
BI-KOT	**Programing in Kotlin** *Jiří Daněček **Jiří Daněček** Jiří Daněček (Gar.)*	Z,ZK	4	2P+2C	L	v
NI-PSL	**Programming in Scala** *Jiří Daněček **Jiří Daněček** Jiří Daněček (Gar.)*	Z,ZK	4	2P+1C	Z	v
BI-PMA	**Programming in Mathematica** *Zdeněk Buk **Zdeněk Buk** Zdeněk Buk (Gar.)*	Z,ZK	4	2P+2C	Z	v
BI-PHP.1	**Programing in PHP**	KZ	4	3C	Z	v
BI-PS2	**Programming in shell 2** ***Lukáš Bařinka***	Z,ZK	4	2P+2C	L	v
NI-PDD	**Data Preprocessing** *Marcel Jiřina **Marcel Jiřina** Marcel Jiřina (Gar.)*	Z,ZK	5	2P+1C	Z	v
BI-PKM	**Introduction to mathematics** *Tomáš Kalvoda **Tomáš Kalvoda** Tomáš Kalvoda (Gar.)*	Z	4		Z	v
NI-REV	**Reverse Engineering** *Jiří Dostál, Josef Kokeš, Róbert Lórencz **Jiří Dostál** Jiří Dostál (Gar.)*	Z,ZK	5	1P+2C	Z	v
BI-SCE1	**Computer Engineering Seminar I** *Hana Kubátová **Hana Kubátová** Hana Kubátová (Gar.)*	Z	4	2C	L,Z	v
BI-SCE2	**Computer Engineering Seminar II** *Hana Kubátová **Hana Kubátová** Hana Kubátová (Gar.)*	Z	4	2C	L,Z	v

BI-ST1	**Network Technology 1** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	2C	Z	v
BI-ST2	**Network Technology 2** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	3C	L	v
BI-ST3	**Network Technology 3** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	2C	Z	v
BI-ST4	**Network Technology 4** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	2C	L	v
BI-SOJ	**Machine Oriented Languages**	Z,ZK	4	2P+2C	L	v
BI-SVZ	**Machine vision and image processing** *Lukáš Brchl, Marcel Jiřina, Jakub Novák* ***Marcel Jiřina*** *Marcel Jiřina (Gar.)*	Z,ZK	5	2P+2C	L,Z	v
NI-SYP	**Parsing and Compilers** *Jan Janoušek* ***Jan Janoušek*** *Jan Janoušek (Gar.)*	Z,ZK	5	2P+1C	Z	v
BI-GIT	**Version control system GIT** ***Petr Pulc***	KZ	2	16P	Z,L	v
TV1	**Physical Education**	Z	0	0+2	Z	v
TVV	**Physical education**	Z	0	0+2	Z,L	v
TVV0	**Physical education**	Z	0	0+2	Z,L	v
TV2	**Physical Education**	Z	0	0+2	L	v
TV2K1	**Physical Education 2**	Z	1		L	v
TVKZV	**Physical Education Course**	Z	0	7dní	Z	v
TVKLV	**Physical Education Course**	Z	0	7dní	L	v
BI-TS1	**Theoretical Seminar I** *Dušan Knop, Tomáš Valla, Ondřej Suchý* ***Tomáš Valla*** *Tomáš Valla (Gar.)*	Z	4	2C	Z	v
BI-TS2	**Theoretical Seminar II** *Tomáš Valla, Ondřej Suchý* ***Tomáš Valla*** *Ondřej Suchý (Gar.)*	Z	4	2C	L	v
BI-TS3	**Theoretical Seminar III** *Tomáš Valla, Ondřej Suchý, Ondřej Guth* ***Tomáš Valla*** *Tomáš Valla (Gar.)*	Z	4	2C	Z	v
BI-TS4	**Theoretical Seminar IV** *Tomáš Valla, Ondřej Suchý* ***Tomáš Valla*** *Tomáš Valla (Gar.)*	Z	4	2C	L	v
BI-TDA	**Test driven architecture** ***Marek Hakala***	KZ	4	2P+1C	Z,L	v
NI-TSP	**Testing and Reliability** *Petr Fišer* ***Martin Daňhel*** *Petr Fišer (Gar.)*	Z,ZK	5	2P+2C	Z	v
BI-CCN	**Compiler Construction** *Christoph Kirsch* ***Christoph Kirsch*** *Christoph Kirsch (Gar.)*	Z,ZK	5	3P	L	v
BI-TEX	**TeX and Typography** *Petr Olšák* ***Petr Olšák*** *Petr Olšák (Gar.)*	Z,ZK	4	2P+1C	L	v
BI-ULI	**Introduction to Linux** *Zdeněk Muzikář, Jan Žďárek, Dana Čermáková, Petr Zemánek* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	2	4D	Z	v
BI-OPT	**Introduction to Optical Networks** ***Pavel Tvrdík***	Z,ZK	4	2P+1C	Z	v
NI-VCC	**Virtualization and Cloud Computing** *Tomáš Vondra, Jan Fesl* ***Tomáš Vondra*** *Tomáš Vondra (Gar.)*	Z,ZK	5	2P+1C	L	v
BI-VHS	**Virtual game worlds** *Radek Richtr* ***Radek Richtr*** *Radek Richtr (Gar.)*	ZK	4	2P+2C	Z	v
BI-VR1	**Virtual reality I** *Petr Klán, Petr Pauš* ***Petr Klán*** *Petr Klán (Gar.)*	KZ	4	2P+2C	L,Z	v
BI-VR2	**Virtual reality II** *Petr Klán* ***Petr Klán*** *Petr Klán (Gar.)*	KZ	3	1P+2C	L	v
BI-VAK.21	**Selected Applications of Combinatorics** *Tomáš Valla* ***Tomáš Valla*** *Tomáš Valla (Gar.)*	Z	3	2R	L	v
BI-VMM	**Selected Mathematical Methods** *Tomáš Kalvoda* ***Tomáš Kalvoda*** *Tomáš Kalvoda (Gar.)*	Z,ZK	4	2P+2C	L	v
NI-VYC	**Computability** *Jan Starý* ***Jan Starý*** *Jan Starý (Gar.)*	Z,ZK	4	2P+2C	L	v
BI-ZS10	**Bachelor internship abroad for 10 credits** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	10		Z,L	v
BI-ZS20	**Bachelor internship abroad for 20 credits** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	20		Z,L	v
BI-ZS30	**Bachelor internship abroad for 30 credits** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	30		Z,L	v
BI-ZIVS	**Intelligent Embedded System Fundamentals** *Miroslav Skrbek* ***Miroslav Skrbek*** *Miroslav Skrbek (Gar.)*	KZ	4	1P+3C	Z	v
BI-ZPI	**Process engineering** *Robert Pergl* ***Robert Pergl*** *Robert Pergl (Gar.)*	KZ	4	1P+2C	L	v
BI-ZNF	**PHP Framework Nette - basics** ***Jiří Chludil***	KZ	3	2P+1C	L	v
BI-ZRS	**Basics of System Control** ***Kateřina Hyniová***	Z,ZK	4	2P+2C	Z	v

BI-IOS	**Fundamentals of iOS Application Development for iPhone and iPad** *Rostislav Babáček, Igor Rosocha **Martin Půlpitel** Martin Půlpitel (Gar.)*	KZ	4	2C	Z	v
BI-ZWU	**Introduction to Web and User Interfaces** *Lukáš Bařinka **Lukáš Bařinka** Jakub Klímek (Gar.)*	Z,ZK	4	2P+2C	L	v
BI-3DT.1	**3D Printing** *Miroslav Hrončok, Tomáš Sýkora **Tomáš Sýkora** Miroslav Hrončok (Gar.)*	KZ	4	3C	L	v

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

BI-PJV	Programming in Java	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
TV1	Physical Education	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0
TV2	Physical Education	Z	0
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0
BI-ZRS	Basics of System Control	Z,ZK	4
The course gives an introduction to the field of automatic control. 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, description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. 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.			
BI-ALO	Algebra and Logic	Z,ZK	4
The course extends and deepens the study of topics touched upon in the basic course in logic.			
BI-AVI.21	Algorithms visually	Z,ZK	4
The course complements other algorithm courses at FIT. It brings knowledge about particular important algorithms from different fields of the computer science that extend substantially knowledge presented in BI-AG1 and BI-AG2. A wide scope of covered subject is made possible due to using visualization bz Algovision (www.algovision.org<http://www.algovision.org>) that make understanding the principles of algorithms easy.			
BI-A2L	English language, preparation for the B2 level exam	Z	2
The content of the course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement - students are due to: -Take an active part in the language instruction. -Meet the requirements for writing assignments - Summary, Abstract, Argumentation Paper. -Succeed in both the midterm and the final term tests with the success rate set at 70%. -80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by individual teachers during the first class of the term.			
BI-APJ	Aplication Programming in Java	Z,ZK	4
This course is presented in Czech. Advanced technologies in Java.			
NI-AFP	Applied Functional Programming	KZ	5
This course is presented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice.			
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.			
BI-BLE	Blender	Z,ZK	4
The course extends knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those interested in 3D graphics and animation. It offers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphics applications) course.			
NI-DSP	Database Systems in Practes	Z,ZK	4
This course is presented in Czech.			
BI-STO	Storage and Filesystems	Z,ZK	4
The student will learn principles and current solutions of storage systems architecture. The module explains principles of data store, protection, and archiving, as so as storage scaling, load balancing and high availability.			
NI-DZO	Digital Image Processing	Z,ZK	4
This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting.			
NI-DDM	Distributed Data Mining	KZ	4
Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language.			
BI-EP1	Effective programming 1	Z	4
The course is taught in Czech.			
BI-EP2	Efficient Programming 2	KZ	4
Continuation of Efficient Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving individual problems are discussed, with the aim to choose the best one and avoid implementation errors.			
BI-EJA	Enterprise Java	Z,ZK	4
The course is on advanced technologies in the Java programming language. The focus is on technologies for development of enterprise information systems which are connected to a database and are accessed through the web interface.			

BI-FMU	Financial and Management Accounting	Z,ZK	5
The aim of the course is explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the particular accounting operations, operations in accounts and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modification of bookkeeping, description of economic operations based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of management accounting are base of Business Inteligence moduls in Business information systems.			
BI-HAM	HW accelerated network traffic monitoring	KZ	4
This course introduces students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring. The monitoring and analysis of network traffic are mandatory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as a source of information and data for analysis). The goals of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network traffic on a hardware and software level and to develop their practical abilities in this field.			
BI-ARD	Interactive applications on Arduino	KZ	4
The subject is designed for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple applications for modern programmable kits and control varied peripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded systems, i.e. to see the results not only on display of a PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefore is suitable even for Web and Software Engineering students.			
NI-IAM	Internet and Multimedia	Z,ZK	4
The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acquisition of AV signals (input), presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical use case scenarios of real-time audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effect of various components on the quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the scene up to the presentation for audience.			
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.			
BI-CS2	C# language and data access	KZ	4
The C# language and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Microsoft platform. The students will get to know objects used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current technologies such as LINQ - a set of features for querying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL (LINQ to Objects, LINQ to XML and LINQ to SQL). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects (ORM). This part of the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Model, Storage Model and Mapping (XML description).			
BI-CS3	Language C# - design of web applications	KZ	4
The students will be introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview of the development possibilities on thisplatform. They will learn to create WebAPI and to use it by client programs.			
BI-SQL.1	Language SQL, advanced	KZ	4
Module is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In particular stored program unites, triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of view of specialized database structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and possibilities of its. changes will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS and partially on PostgreSQL.			
BI-QAP	Quantum algorithms and programming	KZ	5
Course aims at giving students hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanics, on which quantum technologies are based, and algorithms showing advantages and limitations of quantum computing. During tutorials students work in open-source software development kit Qiskit, which is based on Python language. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VMM and experience with Python might be an advantage. No previous knowledge of physics is assumed.			
NI-LSM	Statistical Modelling Lab	KZ	5
The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is put on the effective use of the available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).			
NI-MPL	Managerial Psychology	ZK	2
NI-MSI	Mathematical Structures in Computer Science	Z,ZK	4
Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. Introduction to category theory.			
BI-MPP.21	Methods of interfacing peripheral devices	Z,ZK	5
The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universal serial bus (USB). The course includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USB devices, Linux and Windows drivers, simple application development, and APIs of selected devices.			
BI-MIT	Mikrotik technologies	KZ	3
The main motivation of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are commonly used by the small and middle internet service providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the metallic, optical or wireless links and how to administrate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary computer networks concepts like protocols and technologies of the data-link, network and transport layer of the OSI model.			
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium.			
BI-MVT.21	Modern Visualisation Technologies	Z,ZK	5
The goal of the course is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and augmented reality, visualization on high resolution displays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the mentioned technologies, namely fractal and procedural visualization, scientific data visualization, and 3D model scanning.			

BI-MMP	Multimedia team project	KZ	4
This course is presented in Czech.			
NI-OLI	Linux Drivers	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining powerful processors and FPGAs increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development for master's students. The course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience.			
BI-ACM	Programming Practices 1	KZ	5
This course is presented in Czech.			
BI-ACM2	Programming Practices 2	KZ	5
This course is presented in Czech.			
BI-ACM3	Programming Practices 3	KZ	5
This course is presented in Czech.			
BI-ACM4	Programming Practices 4	KZ	5
This course is presented in Czech.			
BI-AND.21	Programming for the Android Operating System	KZ	4
This course is presented in Czech.			
BI-CS1	Programming in C#	KZ	4
The goal of the course is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental construction, types of variables, operators, arrays, loops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class definition and class instancing, constructors, methods, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugging and exception processing, as well as work with files are emphasized.			
BI-PJS.1	JavaScript Programming	KZ	4
Main goal of the course is an introduction to Javascript programming. Students will learn also best practices and will use tool that eases development in Javascript. 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 4th semester of study.			
BI-KOT	Programing in Kotlin	Z,ZK	4
Kotlin is a modern, statically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of advanced language constructions. The language is fully Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of a modern, object-functional way with minimum of boiler-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages).			
NI-PSL	Programming in Scala	Z,ZK	4
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g.pattern matching and advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and libraries e.g. Play, Cassandra, Scalaz, etc.			
BI-PMA	Programming in Mathematica	Z,ZK	4
Students will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.			
BI-PHP.1	Programing in PHP	KZ	4
The course is taught in Czech.. 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.			
BI-PS2	Programming in shell 2	Z,ZK	4
Students gain a general overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into shell and some other particular scripting languages and will get practical experience with shell script programming.			
NI-PDD	Data Preprocessing	Z,ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data sources, such as images, texts, time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteristics from images or from web pages.			
BI-PKM	Introduction to mathematics	Z	4
This course is presented in Czech.			
NI-REV	Reverse Engineering	Z,ZK	5
Students will get acquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before and after the main function is called. Students will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated to reverse engineering of applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be dedicated to debuggers: how debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer malware scene. The focus of the course is on the seminars, where students will solve practically oriented tasks from the real world.			
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.			
BI-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.			
BI-ST1	Network Technology 1	Z	3
The subject is oriented to providing the students basic information and practical skills from the area of digital and IP networks. The subject is acredited under the Cisco Netacad - CCNA1 - R&S Introduction to Networks.			
BI-ST2	Network Technology 2	Z	3
This course is presented in Czech.			

BI-ST3	Network Technology 3	Z	3
Students will further enhance their knowledge acquired from previous BI-ST1 and BI-ST2 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses will get further extended in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc.			
BI-ST4	Network Technology 4	Z	3
Students will further enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses got further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely other type of network (Non Broadcast Multiple Access) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switch firmware, perform password recoveries, and emergency procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigation ways while maintaining the network running.			
BI-SOJ	Machine Oriented Languages	Z,ZK	4
Students of the course will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal use of microprocessor's features and efficient cooperation of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view linked to higher level languages. This knowledge will be used during reverse engineering, optimization, and evaluation of code security.			
BI-SVZ	Machine vision and image processing	Z,ZK	5
Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving problems of practice that the graduates may encounter.			
NI-SYP	Parsing and Compilers	Z,ZK	5
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.			
BI-GIT	Version control system GIT	KZ	2
Students will be introduced to basic principles of version control systems. These principles will be then shown on DCVS Git both theoretically and practically. In this particular system even the implementation details will be shown. Students will be challenged to use Git as users, project managers, team leaders as well as Git server administrators.			
TV2K1	Physical Education 2	Z	1
BI-TS1	Theoretical Seminar I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS2	Theoretical Seminar II	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS3	Theoretical Seminar III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS4	Theoretical Seminar IV	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TDA	Test driven architecture	KZ	4
The course is focused on practical examples of how to develop, test, and deploy software with tools like GitLab, Docker, Kubernetes, and more that are well known in the DevOps world. This course has a strong connection on courses like BI(E)-SI1 and BI(E)-SI2. The main goal of this course is to learn by examples that occur in the semester project.			
NI-TSP	Testing and Reliability	Z,ZK	5
Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits.			
BI-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.			
BI-TEX	TeX and Typography	Z,ZK	4
This course is presented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the course focuses on typographic rules.			
BI-ULI	Introduction to Linux	Z	2
Students become familiar with the basics of the Linux operating system using e-learning form. They learn to work with the command line and become familiar with basic commands and techniques of a Unix-like system. Topics can be studied first theoretically and then practically verified in a virtual machine (terminal).			
BI-OPT	Introduction to Optical Networks	Z,ZK	4
Students get basic overview of optical networking technology with the emphasis on practical utilization in Internet and in network infrastructures, on possible problems with deployment of optical network technology and on their solutions. The course will include the history of optical communications, an overview of passive components (optical fibres, multiplexors, dispersion compensators, and others), and an overview of active components (optical switches and amplifiers, high-speed coherent transmission systems). The course will also cover the most up-to-date topics presented at premium research conferences, such as ECOC or OFC. Attention will also be paid to new applications, such as the accurate time on Internet, ultrastable frequency transfer, or sensor networks. The labs will focus on real work with optical components and on measurement of their parameters. Students will solve real tasks from practice.			
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development).			

BI-VHS	Virtual game worlds	ZK	4
The course leads students to create a complex virtual world. The course is a continuation of basic graphical courses (MGA, PGR, BLE,…). This current students knowledge is furthermore complemented by the theory of game design, principles of writing dialogues and characters in order to create a functional and complex virtual world. The course can be followed by the course MI-PVR with the task of converting scenes and their dynamics into a fully virtual environment suitable for VR devices.			
BI-VR1	Virtual reality I	KZ	4
Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of virtual worlds communication. The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds. It improves computational thinking, empathy and shared social activities.			
BI-VR2	Virtual reality II	KZ	3
Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objective is to develop applications for computer science and gamification in various social metaverse and desktop engines.			
BI-VAK.21	Selected Applications of Combinatorics	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-VMM	Selected Mathematical Methods	Z,ZK	4
We start reviewing geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and its fast implementation (FFT). Further we deal with differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functions. For this purposes, we study normed linear spaces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and duality. The linear programming and the Simplex method is analyzed in more detail.			
NI-VYC	Computability	Z,ZK	4
Classical theory of recursive functions and effective computability.			
BI-ZS10	Bachelor internship abroad for 10 credits	Z	10
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			
BI-ZS20	Bachelor internship abroad for 20 credits	Z	20
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			
BI-ZS30	Bachelor internship abroad for 30 credits	Z	30
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			
BI-ZIVS	Intelligent Embedded System Fundamentals	KZ	4
Intelligent embedded system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim of the course is to teach students modern humanoid robot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to get practical experience with these technologies.			
BI-ZPI	Process engineering	KZ	4
Students will learn fundamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles of process modelling and they will learn basics of the used notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of business processes using modern CASE tools. The role of process engineering for information systems development is discussed as well as its importance in the overall context of information and business strategy of an enterprise.			
BI-ZNF	PHP Framework Nette - basics	KZ	3
Students will gain the basics of PHP framework Nette. They will learn how to practically work with MVP architecture and various libraries of this Czech popular framework. The resulting knowledge should serve for the efficient creation of a web backend in PHP language.			
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad	KZ	4
This course is presented in Czech.			
BI-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
This course is presented in Czech.			
BI-3DT.1	3D Printing	KZ	4

List of courses of this pass:

Code	Name of the course	Completion	Credits
BI-3DT.1	3D Printing	KZ	4

BI-A2L	English language, preparation for the B2 level exam	Z	2
The content of the course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement - students are due to: -Take an active part in the language instruction. -Meet the requirements for writing assignments - Summary, Abstract, Argumentation Paper. -Succeed in both the midterm and the final term tests with the success rate set at 70%. -80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by individual teachers during the first class of the term.			
BI-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.			
BI-ACM	Programming Practices 1	KZ	5
This course is presented in Czech.			
BI-ACM2	Programming Practices 2	KZ	5
This course is presented in Czech.			
BI-ACM3	Programming Practices 3	KZ	5
This course is presented in Czech.			
BI-ACM4	Programming Practices 4	KZ	5
This course is presented in Czech.			
BI-ADU.1	Unix Administration	Z,ZK	5
Students will learn the internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will understand the differences between user and administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file systems, disk subsystems, processes, memory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge from the lectures on specific examples from practice.			
BI-ADW.1	Windows Administration	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-AG1	Algorithms and Graphs 1	Z,ZK	6
The course covers the basics of efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It links and partially develops the knowledge from the course BI-DML.21, in which students acquire the knowledge and skills in combinatorics necessary for evaluating the time and space complexity of algorithms. The course also follows up knowledge from BI-MA1.21, the practical usage of asymptotic mathematics, in particular, the asymptotic notation.			
BI-AG2	Algorithms and Graphs 2	Z,ZK	5
This course, presented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course BI-AG1. It further delves into advances data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version of the course see BIE-AG2.			
BI-ALO	Algebra and Logic	Z,ZK	4
The course extends and deepens the study of topics touched upon in the basic course in logic.			
BI-AND.21	Programming for the Android Operating System	KZ	4
This course is presented in Czech.			
BI-ANG	English Language, Internal Certificate	ZK	2
Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG			
BI-ANG1	English Language Examination without Preparatory Courses	Z,ZK	2
BI-APJ	Aplication Programming in Java	Z,ZK	4
This course is presented in Czech. Advanced technologies in Java.			
BI-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.			
BI-ARD	Interactive applications on Arduino	KZ	4
The subject is designed for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple applications for modern programmable kits and control varied peripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded systems, i.e. to see the results not only on display of a PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefore is suitable even for Web and Software Engineering students.			
BI-AVI.21	Algorithms visually	Z,ZK	4
The course complements other algorithm courses at FIT. It brings knowledge about particular important algorithms from different fields of the computer science that extend substantially knowledge presented in BI-AG1 and BI-AG2. A wide scope of covered subject is made possible due to using visualization bz Algovision (www.algovision.org<http://www.algovision.org>) that make understanding the principles of algorithms easy.			
BI-BAP	Bachelor Thesis	Z	14
BI-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.			
BI-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 use properly and securely cryptographic primitives and systems that are based on these primitives.			
BI-BIG	DB Technologies for Big Data	KZ	4
This course is presented in Czech.			
BI-BLE	Blender	Z,ZK	4
The course extends knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those interested in 3D graphics and animation. It offers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphics applications) course.			
BI-BPR	Bachelor project	Z	2

BI-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.			
BI-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.			
BI-CS1	Programming in C#	KZ	4
The goal of the course is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental construction, types of variables, operators, arrays, loops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class definition and class instancing, constructors, methods, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugging and exception processing, as well as work with files are emphasized.			
BI-CS2	C# language and data access	KZ	4
The C# language and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Microsoft platform. The students will get to know objects used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current technologies such as LINQ - a set of features for querying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL (LINQ to Objects, LINQ to XML and LINQ to SQL). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects (ORM). This part of the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Model, Storage Model and Mapping (XML description).			
BI-CS3	Language C# - design of web applications	KZ	4
The students will be introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview of the development possibilities on thisplatform. They will learn to create WebAPI and to use it by client programs.			
BI-DAN	Taxes for non-Economists	Z,ZK	4
Taxes, including social insurance contributions, are obligatory payments paid by people or institutions to public budgets. This is the way how a significant portion of GDP is redistributed. This course concerns who pays which taxes or who bears the tax burden. The course introduces students to the tax theory and policy fundamentals and shows how they affect taxation of income, consumption, and wealth. The course provides practical information on calculations of tax liabilities of both citizens and institutions as well as information about important taxpayers´ formal duties towards public administration.			
BI-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 course does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.			
BI-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.			
BI-EHD	Introduction to European Economic History	Z,ZK	3
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-EJA	Enterprise Java	Z,ZK	4
The course is on advanced technologies in the Java programming language. The focus is on technologies for development of enterprise information systems which are connected to a database and are accessed through the web interface.			
BI-EMP	Economics 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.			
BI-EP1	Effective programming 1	Z	4
The course is taught in Czech.			
BI-EP2	Efficient Programming 2	KZ	4
Continuation of Efficient Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving individual problems are discussed, with the aim to choose the best one and avoid implementation errors.			
BI-FMU	Financial and Management Accounting	Z,ZK	5
The aim of the course is explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the particular accounting operations, operations in accounts and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modification of bookkeeping, description of economic operations based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of management accounting are base of Business Inteligence moduls in Business information systems.			
BI-FTR.1	Financial Markets	Z,ZK	5
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-GIT	Version control system GIT	KZ	2
Students will be introduced to basic principles of version control systems. These principles will be then shown on DCVS Git both theoretically and practically. In this particular system even the implementation details will be shown. Students will be challenged to use Git as users, project managers, team leaders as well as Git server administrators.			
BI-HAM	HW accelerated network traffic monitoring	KZ	4
This course introduces students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring. The monitoring and analysis of network traffic are mandatory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as a source of information and data for analysis). The goals of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network traffic on a hardware and software level and to develop their practical abilities in this field.			
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
This course is presented in Czech.			
BI-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.		
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad	KZ	4
	This course is presented in Czech.		
BI-JPO	Computer Units	Z,ZK	5
	Students deepen their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail with the internal structure and organization of computer units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using appropriate codes for implementation of multiplication. The organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including codes for error detection and correction for parallel and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of communication of the processor with the environment and the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammed processor simulator and programmable hardware design kits (FPGA).		
BI-KOM	Conceptual Modelling	Z,ZK	5
	The course is focused on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key terms in a domain, the ability to categorize and specify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological structural modeling in the OntoUML notation. Next, they learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data representation in the Internet. They also learn the foundations of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO method and the BPMN notation will be taught. The course is designed with the respect to continuation in software implementations.		
BI-KOT	Programing in Kotlin	Z,ZK	4
	Kotlin is a modern, statically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of advanced language constructions. The language is fully Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of a modern, object-functional way with minimum of boiler-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages).		
BI-KSA	Cultural and Social Anthropology	ZK	2
	The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is presented in Czech.		
BI-LIN	Linear Algebra	Z,ZK	7
	The course is taught in Czech. 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 matrices 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 the error-detecting and error-correcting codes.		
BI-MEK	Macroeconomic Context of Domestic and World Economy	Z,ZK	4
	This course is presented in Czech.		
BI-MGA	Multimedia and Graphics Applications	Z,ZK	5
	Students get acquainted with multimedia technologies and applications for 2D/3D bitmap and vector graphics. During the course, current tools for working with images, videos, 3D graphics and animation will be introduced. Students learn several basic techniques of creation and editing content in computer graphics, introduction to graphic formats, and compression technologies. They learn to use multimedia transmission and representation systems, including real-time multimedia processing. They understand the principle of operation and use of graphics processing cards. They gain a number of practical skills, such as vectorizing raster images, retouching photos, or creating 3D models.		
BI-MIK	Fundamentals of Microeconomics	Z,ZK	4
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).		
BI-MIT	Mikrotik technologies	KZ	3
	The main motivation of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are commonly used by the small and middle internet service providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the metallic, optical or wireless links and how to administrate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary computer networks concepts like protocols and technologies of the data-link, network and transport layer of the OSI model.		
BI-MLO	Mathematical Logic	Z,ZK	5
	The course seminary is taught in Czech.		
BI-MMP	Multimedia team project	KZ	4
	This course is presented in Czech.		
BI-MPP.21	Methods of interfacing peripheral devices	Z,ZK	5
	The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universal serial bus (USB). The course includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USB devices, Linux and Windows drivers, simple application development, and APIs of selected devices.		
BI-MVT.21	Modern Visualisation Technologies	Z,ZK	5
	The goal of the course is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and augmented reality, visualization on high resolution displays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the mentioned technologies, namely fractal and procedural visualization, scientific data visualization, and 3D model scanning.		
BI-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.		
BI-OPT	Introduction to Optical Networks	Z,ZK	4
	Students get basic overview of optical networking technology with the emphasis on practical utilization in Internet and in network infrastructures, on possible problems with deployment of optical network technology and on their solutions. The course will include the history of optical communications, an overview of passive components (optical fibres, multiplexors, dispersion compensators, and others), and an overview of active components (optical switches and amplifiers, high-speed coherent transmission systems). The course will also cover the most up-to-date topics presented at premium research conferences, such as ECOC or OFC. Attention will also be paid to new applications, such as the accurate time on Internet, ultrastable frequency transfer, or sensor networks. The labs will focus on real work with optical components and on measurement of their parameters. Students will solve real tasks from practice.		
BI-OSY	Operating Systems	Z,ZK	5
	Students understand the classical theory of operating systems (OS) in addition to the knowledge gained in the module "Programming in Shell 1". They get a solid knowledge of OS kernels, processes and threads implementations. They understand the problems of race conditions, thread scheduling, resource allocation and deadlocks, the techniques of the management of virtual memory, principles and architectures of disks, RAID and file systems. They are able to design and implement simple multithreaded applications.		

BI-PA1	Programming and Algorithmics 1	Z,ZK	6
Students gain the ability to formulate 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 to analyse simple cases of algorithm complexity. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.			
BI-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 with all C++ features needed to achieve the main objective (operator overloading, templates).			
BI-PAI	Law and Informatics	ZK	3
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-PGA	Programming of graphic applications	Z,ZK	5
This course is presented in Czech only.			
BI-PGR.1	Computer graphics programming	Z,ZK	5
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 your 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.			
BI-PHP.1	Programing in PHP	KZ	4
The course is taught in Czech.. 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.			
BI-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.			
BI-PJS.1	JavaScript Programming	KZ	4
Main goal of the course is an introduction to Javascript programming. Students will learn also best practices and will use tool that eases development in Javascript. 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 4th semester of study.			
BI-PJV	Programming in Java	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-PKM	Introduction to mathematics	Z	4
This course is presented in Czech.			
BI-PMA	Programming in Mathematica	Z,ZK	4
Students will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.			
BI-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. Students demonstrate practical use of the design techniques in the module project sing modern, industry-standard CAD design tools.			
BI-PPA	Programming Paradigms	Z,ZK	5
The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and limitations of particular approaches. Functional programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The principles are demonstrated on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstream programming languages such as C++ and Java.			
BI-PRP	Law and business	Z,ZK	4
This course is presented in Czech.			
BI-PRR	Project management	KZ	4
This course is presented in Czech.			
BI-PS1	Programming in Shell 1	KZ	5
Students become knowledgeable users of common Unix-like operating systems. 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 to process various text data.			
BI-PS2	Programming in shell 2	Z,ZK	4
Students gain a general overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into shell and some other particular scripting languages and will get practical experience with shell script programming.			
BI-PSI	Computer Networks	Z,ZK	5
Students understand the basic common techniques, protocols, technologies, and algorithms necessary to communicate in computer networks. The topics are primarily focused on 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.			
BI-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.			
BI-PYT	Python Programming	Z,ZK	4
The course is taught in Czech.			
BI-QAP	Quantum algorithms and programming	KZ	5
Course aims at giving students hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanics, on which quantum technologies are based, and algorithms showing advantages and limitations of quantum computing. During tutorials students work in open-source software development kit Qiskit, which is based			

	on Python language. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VMM and experience with Python might be an advantage. No previous knowledge of physics is assumed.		
BI-SAP	Computer Structure and Architecture	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. The subject teaches basic knowledge of digital computer construction principles, how a computer performs its operations, what is machine code, and what are its connections to higher programming languages.		
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.		
BI-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.		
BI-SEP	World Economy and Business	Z,ZK	4
	This course is presented in Czech. 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.		
BI-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. They get practical skill thanks to applying hands-on analysis and design of a large-scale software project that is to be developed within the concurrent BI-SP1 module. They get skill to use CASE tools and UML for modelling and solving software-related problems. They get overview of object-oriented analysis, design, architecture, validation, verification, and testing processes.		
BI-SI2.3	Software Engineering 2	Z,ZK	3
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).		
BI-SOJ	Machine Oriented Languages	Z,ZK	4
	Students of the course will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal use of microprocessor's features and efficient cooperation of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view linked to higher level languages. This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
BI-SP1	Team Software Project 1	KZ	4
	Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided by the BEI-SWI course that runs concurrently and that teaches the necessary techniques and theory. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) with respect to both the formal and material aspects of the design. The resulting work will be further developed and finished in the BEI-SP2 course.		
BI-SP1.21	Team Software Project 1	KZ	5
	Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the BIE-SWI course that runs concurrently and that teaches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software artefact will be further developed and finished in the BIE-SP2 course.		
BI-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-SP2.1	Team Software Project 2	KZ	4
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).		
BI-SQL.1	Language SQL, advanced	KZ	4
	Module is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In particular stored program unites, triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of view of specialized database structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and possibilities of its. changes will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS and partially on PostgreSQL.		
BI-SRC	Real-time systems	KZ	4
	Students obtain the basic knowledge in the Real-time 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 used design kits are the same as in BI-VES subject and FPGA.		
BI-SSB	System and Network Security	Z,ZK	5
	This course is focused on selected areas of computer networks and computer systems in terms of cyber security		
BI-ST1	Network Technology 1	Z	3
	The subject is oriented to providing the students basic information and practical skills from the area of digital and IP networks. The subject is acredited under the Cisco Netacad - CCNA1 - R&S Introduction to Networks.		
BI-ST2	Network Technology 2	Z	3
	This course is presented in Czech.		
BI-ST3	Network Technology 3	Z	3
	Students will further enhance their knowledge acquired from previous BI-ST1 and BI-ST2 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses will get further extended in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc.		

BI-ST4	Network Technology 4	Z	3
Students will further enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses got further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely other type of network (Non Broadcast Multiple Access) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switch firmware, perform password recoveries, and emergency procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigation ways while maintaining the network running.			
BI-STO	Storage and Filesystems	Z,ZK	4
The student will learn principles and current solutions of storage systems architecture. The module explains principles of data store, protection, and archiving, as so as storage scaling, load balancing and high availability.			
BI-SVZ	Machine vision and image processing	Z,ZK	5
Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving problems of practice that the graduates may encounter.			
BI-TDA	Test driven architecture	KZ	4
The course is focused on practical examples of how to develop, test, and deploy software with tools like GitLab, Docker, Kubernetes, and more that are well known in the DevOps world. This course has a strong connection on courses like BI(E)-SI1 and BI(E)-SI2. The main goal of this course is to learn by examples that occur in the semester project.			
BI-TEX	TeX and Typography	Z,ZK	4
This course is presented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the course focuses on typographic rules.			
BI-TIS	Information Systems Design	Z,ZK	5
Students know various types of ISs and their practical implementation aspects and are able to match the needs of different market segments (customers) with applications of existing technologies (databases, programming languages, GUI etc.).			
BI-TS1	Theoretical Seminar I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS2	Theoretical Seminar II	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS3	Theoretical Seminar III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS4	Theoretical Seminar IV	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-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.			
BI-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.			
BI-ULI	Introduction to Linux	Z	2
Students become familiar with the basics of the Linux operating system using e-learning form. They learn to work with the command line and become familiar with basic commands and techniques of a Unix-like system. Topics can be studied first theoretically and then practically verified in a virtual machine (terminal).			
BI-VAK.21	Selected Applications of Combinatorics	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-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.			
BI-VHS	Virtual game worlds	ZK	4
The course leads students to create a complex virtual world. The course is a continuation of basic graphical courses (MGA, PGR, BLE,…). This current students knowledge is furthermore complemented by the theory of game design, principles of writing dialogues and characters in order to create a functional and complex virtual world. The course can be followed by the course MI-PVR with the task of converting scenes and their dynamics into a fully virtual environment suitable for VR devices.			
BI-VMM	Selected Mathematical Methods	Z,ZK	4
We start reviewing geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and its fast implementation (FFT). Further we deal with differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functions. For this purposes, we study normed linear spaces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and duality. The linear programming and the Simplex method is analyzed in more detail.			

BI-VR1	Virtual reality I	KZ	4
Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of virtual worlds communication. The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds. It improves computational thinking, empathy and shared social activities.			
BI-VR2	Virtual reality II	KZ	3
Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objective is to develop applications for computer science and gamification in various social metaverse and desktop engines.			
BI-VWM	Searching the Web and Multimedia Databases	Z,ZK	5
Students get basic overview about search techniques in the web environment that is interpreted as a very large distributed and heterogeneous storage of documents. In particular, students acquire information about search techniques in text and hypertext documents (the web pages themselves) and about feature extraction from web pages. They get detailed knowledge of similarity search in multimedia databases (generally in collections of unstructured data). They also learn techniques for programming web search engines for the mentioned data types (documents).			
BI-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).			
BI-XML	XML Technology	Z,ZK	4
Students learn to make and validate XML documents (XML Schema, Relax, Schematron) and learn standard methods of their processing (SAX, DOM). An emphasis will be given to language XPath which enables addressing of parts of XML documents and its usage in different XML technologies. Students will also learn basics of XSLT programming. XSLT and XPath programming will be based on version 2.0. Students will gain a broad overview of XML technologies.			
BI-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, tools for solving recurrent equations, and basics of graph theory.			
BI-ZIVS	Intelligent Embedded System Fundamentals	KZ	4
Intelligent embedded system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim of the course is to teach students modern humanoid robot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to get practical experience with these technologies.			
BI-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.			
BI-ZNF	PHP Framework Nette - basics	KZ	3
Students will gain the basics of PHP framework Nette. They will learn how to practically work with MVP architecture and various libraries of this Czech popular framework. The resulting knowledge should serve for the efficient creation of a web backend in PHP language.			
BI-ZNS	Knowledge-based Systems	Z,ZK	5
Students will become familiar with the systems based on knowledge (knowledge-based systems), which are systems that usetechniques of artificial intelligence to solve problems that require human judgment, learning and reasoning from findingsand actions. The course introduces students to the philosophy and architecture of knowledge-based systems to support decision-makingand planning. The course assumes knowledge of set theory, probability theory, artificial neural networks, and evolutionary algorithms.			
BI-ZPI	Process engineering	KZ	4
Students will learn fundamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles of process modelling and they will learn basics of the used notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of business processes using modern CASE tools. The role of process engineering for information systems development is discussed as well as its importance in the overall context of information and business strategy of an enterprise.			
BI-ZRS	Basics of System Control	Z,ZK	4
The course gives an introduction to the field of automatic control. 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, description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. 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.			
BI-ZS10	Bachelor internship abroad for 10 credits	Z	10
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			
BI-ZS20	Bachelor internship abroad for 20 credits	Z	20
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			
BI-ZS30	Bachelor internship abroad for 30 credits	Z	30
Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.			

BI-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.			
BI-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
This course is presented in Czech.			
BIE-EEC	English language external certificate	Z	4
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding the B2 level of the Common European Framework of Reference for Languages.			
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-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-FIL	Philosophy	ZK	2
see A0B16			
FI-GNO	Introduction to Gnoseology	ZK	2
Předmět studenty uvádí do teorie poznání, systémovým pohledem nahlíží na pole kultury, na vztahy a rozdíly mezi přírodními a humánními obory, vědou a uměním. Rozborem dějin modernismu a myšlenkových proudů 20. století jsou ukázány proměny paradigmat a převrat k postmodernismu, analýzou paralelismů ve vědě a umění odhaleny mechanismy tvůrčích procesů. V návaznosti na teorii přírodních jazyků a sémiotiky je vedena diskuze i o kognitivních procesech, v historickém přehledu nastíněna hlediska estetického vnímání. Samostatnou kapitolou jsou modely spojitých přírodních soustav a systémů, v závěru přednášek je pozornost věnována filozofii vědy a otázkám udržitelného rozvoje. Předmět přednáší a garantuje Ing. Ivo Janoušek CSc.			
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.			
FI-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 .			
FI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is an interesting alternative to other humanities, taught at FIT.			
FI-MPL	Managerial Psychology	ZK	2
FI-ULI	Introduction to Linguistics for Computer	ZK	2
This course is presented in Czech.			
FI-VEZ	economic-managerial course from a study abroad	Z	4
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.			
NI-AFP	Applied Functional Programming	KZ	5
This course is presented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice.			
NI-DDM	Distributed Data Mining	KZ	4
Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language.			
NI-DSP	Database Systems in Practes	Z,ZK	4
This course is presented in Czech.			
NI-DZO	Digital Image Processing	Z,ZK	4
This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting.			
NI-IAM	Internet and Multimedia	Z,ZK	4
The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acquisition of AV signals (input), presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical use case scenarios of real-time audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effect of various components on the quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the scene up to the presentation for audience.			
NI-LSM	Statistical Modelling Lab	KZ	5
The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is put on the effective use of the available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).			
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In			

addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium.			
NI-MPL	Managerial Psychology	ZK	2
NI-MSI	Mathematical Structures in Computer Science	Z,ZK	4
Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. Introduction to category theory.			
NI-OLI	Linux Drivers	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining powerful processors and FPGAs increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development for master's students. The course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience.			
NI-PDD	Data Preprocessing	Z,ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data sources, such as images, texts, time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteristics from images or from web pages.			
NI-PSL	Programming in Scala	Z,ZK	4
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g.pattern matching and advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and libraries e.g. Play, Cassandra, Scalaz, etc.			
NI-REV	Reverse Engineering	Z,ZK	5
Students will get acquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before and after the main function is called. Students will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated to reverse engineering of applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be dedicated to debuggers: how debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer malware scene. The focus of the course is on the seminars, where students will solve practically oriented tasks from the real world.			
NI-SYP	Parsing and Compilers	Z,ZK	5
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.			
NI-TSP	Testing and Reliability	Z,ZK	5
Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits.			
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development).			
NI-VYC	Computability	Z,ZK	4
Classical theory of recursive functions and effective computability.			
TV1	Physical Education	Z	0
TV2	Physical Education	Z	0
TV2K1	Physical Education 2	Z	1
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0

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