Studijní plán

Název plánu: Bachelor Specialization, Computer Science, 2021

Součást ČVUT (fakulta/ústav/další): Fakulta informačních technologií
Katedra:
Obor studia, garantovaný katedrou: Úvodní stránka
Garant oboru studia.:
Program studia: Informatics
Typ studia: Bakalářské prezenční
Předepsané kredity: 155
Kredity z volitelných předmětů: 25
Kredity v rámci plánu celkem: 180
Poznámka k plánu: This version of the study plan is intended for students who have been enrolled for study from the academic year 2021/2022 into the full-time form of study of the bachelor's program. . Guarantor: doc. Ing. Jan Janousek, Ph.D., email: jan.janousek@fit.cvut.cz

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Název bloku: Povinné předměty programu
Minimální počet kreditů bloku: 110
Role bloku: PP

Kód skupiny: BIE-PP.21
Název skupiny: Compulsory Courses of Bachelor Study Program Informatics, version 2021
Podmínka kredity skupiny: V této skupině musíte získat 110 kreditů
Podmínka předměty skupiny: V této skupině musíte absolvovat 21 předmětů
Kredity skupiny: 110
Poznámka ke skupině: If you plan to profile yourself in the specialization Information Security, Computer Networks and Internet, Computer Systems and Virtualization, or Software Engineering, enroll in the course BIE-PSI.21 in your 2nd semester of study. If you plan to profile yourself in the specialization Computer Engineering, or Computer Science, enroll in the course BI-PSI.21 in your 4th semester of study. - On the basis of the certificate of knowledge of English at the B2 level, which is stated in the conditions for admission to study, you can have the subject BIE-EEC recognized for 4 credits.

Kód	Název předmětu / Název skupiny předmětů *(u skupiny předmětů seznam kódů jejích členů)* *Vyučující,* ***autoři*** *a garanti (gar.)*	Zakončení	Kredity	Rozsah	Semestr	Role
BIE-AG1.21	**Algorithms and Graphs 1** *Jan Volec, Radek Hušek, Michal Opler, Jiřina Scholtzová, Dušan Knop, Maria Saumell Mendiola, Ondřej Suchý, Tomáš Valla* ***Dušan Knop*** *Dušan Knop (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-AAG.21	**Automata and Grammars** *David Beowulf Bradley-Williams, Tomáš Pecka, Jan Holub* ***Jan Holub*** *Jan Holub (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-BPR.21	**Bachelor Project** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	1		Z,L	PP
BIE-BAP.21	**Bachelor Thesis** *Zdeněk Muzikář* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	14		L,Z	PP
BIE-PSI.21	**Computer Networks** ***Yelena Trofimova***	Z,ZK	5	2P+1R+1C	L	PP
BIE-SAP.21	**Computer Structures and Architectures** ***Petr Fišer***	Z,ZK	5	2P+1R+2C	L	PP
BIE-KAB.21	**Cryptography and Security** ***Jiří Buček***	Z,ZK	5	2P+2C	L	PP
BIE-DBS.21	**Database Systems** ***Michal Valenta***	Z,ZK	5	2P+2R+1L	L	PP
BIE-DML.21	**Discrete Mathematics and Logic** *Eva Pernecká, Jitka Rybníčková, Francesco Dolce* ***Eva Pernecká*** *Eva Pernecká (Gar.)*	Z,ZK	5	2P+1R+1C	Z	PP
BIE-TDP.21	**Documentation and Presentation** *Tomáš Nováček, Dana Vynikarová* ***Tomáš Nováček*** *Tomáš Nováček (Gar.)*	KZ	3	2P+2C	Z,L	PP
BIE-EEC	**English language external certificate** ***Zdeněk Muzikář***	Z	4	2D	L	PP
BIE-LA1.21	**Linear Algebra 1** *Marzieh Forough* ***Karel Klouda*** *Marzieh Forough (Gar.)*	Z,ZK	5	2P+1R+1C	Z	PP

BIE-MA1.21	**Mathematical Analysis 1** ***Tomáš Kalvoda***	Z,ZK	5	2P+1R+1C	L	PP
BIE-MA2.21	**Mathematical Analysis 2** *Antonella Marchesiello* ***Tomáš Kalvoda*** *Antonella Marchesiello (Gar.)*	Z,ZK	6	3P+2C	Z	PP
BIE-OSY.21	**Operating Systems** ***Pavel Tvrdík***	Z,ZK	5	2P+1R+1L	L	PP
BIE-PST.21	**Probability and Statistics** *Francesco Dolce* ***Pavel Hrabák*** *Francesco Dolce (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-PA1.21	**Programming and Algorithmics 1** *Radek Hušek, Jan Trávníček, Ladislav Vagner* ***Jan Trávníček*** *Jan Trávníček (Gar.)*	Z,ZK	7	2P+2R+2C	Z	PP
BIE-PA2.21	**Programming and Algorithmics 2** ***Jan Trávníček***	Z,ZK	7	2P+1R+2C	L	PP
BIE-GIT.21	**SW Development Technologies** *Petr Pulc* ***Petr Pulc*** *Petr Pulc (Gar.)*	Z	3	2P	Z	PP
BIE-TZP.21	**Technological Fundamentals of Computers** *Kateřina Hyniová, Martin Novotný, Matúš Olekšák* ***Martin Novotný*** *Martin Novotný (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BIE-UOS.21	**Unix-like Operating Systems** *Jan Trdlička, Jakub Žitný, Zdeněk Muzikář, Petr Zemánek* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	5	2P+2C	Z	PP

Charakteristiky předmětů této skupiny studijního plánu: Kód=BIE-PP.21 Název=Compulsory Courses of Bachelor Study Program Informatics, version 2021

BIE-AG1.21	Algorithms and Graphs 1	Z,ZK	5

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

BIE-AAG.21	Automata and Grammars	Z,ZK	5

Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits.

BIE-BPR.21	Bachelor Project	Z	1

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

BIE-BAP.21	Bachelor Thesis	Z	14
BIE-PSI.21	Computer Networks	Z,ZK	5

The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS.

BIE-SAP.21	Computer Structures and Architectures	Z,ZK	5

Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools.

BIE-KAB.21	Cryptography and Security	Z,ZK	5

Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis. Students are expected to be competent programmers in C/C++ (on a small scale). Basic Python knowledge is an advantage.

BIE-DBS.21	Database Systems	Z,ZK	5

Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (including integrity constraints) using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoretical basis - relational database model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction processing and control of parallel user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database models.

BIE-DML.21	Discrete Mathematics and Logic	Z,ZK	5

Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from set theory will be explained. Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course also lays down the basics of combinatorics and number theory, with emphasis on modular arithmetics.

BIE-TDP.21	Documentation and Presentation	KZ	3

The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.

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-LA1.21	Linear Algebra 1	Z,ZK	5

We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science.

BIE-MA1.21	Mathematical Analysis 1	Z,ZK	5

We begin the course by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers. Then we study real sequences and real functions of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions. This theoretical foundation is then applied to root-finding problems (iterative method of bisection and Newtons method), construction of cubic interpolation (spline), and formulation and solution of simple optimization problems (i.e., the issue of finding extrema of functions). The course is closed with the Landaus asymptotic notation and methods of mathematical description of complexity of algorithms.

BIE-MA2.21	Mathematical Analysis 2	Z,ZK	6

The course completes the theme of analysis of real functions of a real variable initiated in BIE-MA1 by introducing the Riemann integral. Students will learn how to integrate by parts and use the substitution method.The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylors theorem to the computation of elementary functions with a prescribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, and its analysis using the Master theorem. Finally, we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and Hessian matrix, we study the analytical method of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integration of multivariate functions.

BIE-OSY.21	Operating Systems	Z,ZK	5

In this course that is a follow-up of the Unix-like operating systems course students deepen their knowledge in areas of OS kernels, process and thread implementations, race conditions, critical regions, thread scheduling, shared resource allocation and deadlocks, management of virtual memory and data storages, file systems, OS monitoring. They are able to design and implement simple multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS Windows.

BIE-PST.21	Probability and Statistics	Z,ZK	5

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 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 for testing statistical hypotheses and determining the statistical dependence of two or more random variables.

BIE-PA1.21	Programming and Algorithmics 1	Z,ZK	7

Students learn to construct algorithms for solving basic problems and write them in the C language. They master data types (simple, pointers, structured), expressions, statements, and functions presented in C language. They understand the principle of recursion and basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating linked lists and trees.

BIE-PA2.21	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, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism).

BIE-GIT.21	SW Development Technologies	Z	3

This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use.

BIE-TZP.21	Technological Fundamentals of Computers	Z,ZK	5

Students get acquainted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer structures look like at the lowest level. They are introduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to reduce the consumption; what the limits to the maximum operating frequency are and how to raise them; why a computer bus needs to be terminated, what happens if it is not; how a computer power supply looks like (in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica.

BIE-UOS.21	Unix-like Operating Systems	KZ	5

Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell.

Název bloku: Povinné předměty specializace
Minimální počet kreditů bloku: 40
Role bloku: PS

Kód skupiny: BIE-TI-PS.21
Název skupiny: Compulsory Courses of the Bachelor Specialisation Computer Science, version 2021
Podmínka kredity skupiny: V této skupině musíte získat 40 kreditů
Podmínka předměty skupiny: V této skupině musíte absolvovat 8 předmětů
Kredity skupiny: 40
Poznámka ke skupině:

Kód	Název předmětu / Název skupiny předmětů *(u skupiny předmětů seznam kódů jejích členů)* *Vyučující,* ***autoři*** *a garanti (gar.)*	Zakončení	Kredity	Rozsah	Semestr	Role
BIE-AG2.21	**Algorithms and Graphs 2** ***Ondřej Suchý***	Z,ZK	5	2P+2C	L	PS
BIE-APS.21	**Architectures of Computer Systems** *Michal Štepanovský, Pavel Tvrdík* ***Pavel Tvrdík*** *Pavel Tvrdík (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BIE-ZUM.21	**Artificial Intelligence Fundamentals** ***Pavel Surynek***	Z,ZK	5	2P+2C	L	PS
BIE-LA2.21	**Linear Algebra 2** ***Karel Klouda***	Z,ZK	5	2P+2C	L	PS
BIE-LOG.21	**Mathematical Logic** *Kateřina Trlifajová* ***Kateřina Trlifajová*** *Kateřina Trlifajová (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BIE-OOP.21	**Object-Oriented Programming** *Filip Křikava, Petr Máj, Filip Říha* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BIE-PJP.21	**Programming Languages and Compilers** ***Jan Janoušek***	Z,ZK	5	2P+1C	L	PS
BIE-PPA.21	**Programming Paradigms** *Tomáš Pecka, Petr Máj, Tomáš Jakl* ***Jan Janoušek*** *Jan Janoušek (Gar.)*	Z,ZK	5	2P+2R	Z	PS

Charakteristiky předmětů této skupiny studijního plánu: Kód=BIE-TI-PS.21 Název=Compulsory Courses of the Bachelor Specialisation Computer Science, version 2021

BIE-AG2.21	Algorithms and Graphs 2	Z,ZK	5
The course presents the basic algorithms and concepts of graph theory building on the introduction exposed in the compulsory course BIE-AG1.21. It also covers advanced data structures and amortized analysis. It also includes a very light introduction into approximation algorithms.			
BIE-APS.21	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 the program. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.			
BIE-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5
Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.			
BIE-LA2.21	Linear Algebra 2	Z,ZK	5
Students will broaden their knowledge gained in the BIE-LA1 introductory course, where only vectors in the form of n-tuples of numbers were considered. Here we will introduce vector spaces in a general abstract form. The notions of a scalar product and a linear map will enable to demonstrate the profound link between linear algebra, geometry, and computer graphics. The other main topic will be numerical linear algebra, in particular problems with solving systems of linear equations on computers. The issues of numerical linear algebra will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be presented.			
BIE-LOG.21	Mathematical Logic	Z,ZK	5
The course focuses on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability, logical equivalence, and the logical consequence of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are explained. This relates to the P vs. NP problem and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and their models. The syntactic approach to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness theorems is explained.			
BIE-OOP.21	Object-Oriented Programming	Z,ZK	5
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 students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.			
BIE-PJP.21	Programming Languages and Compilers	Z,ZK	5
Students learn basic compiling methods of programming languages. They are introduced to intermediate representations used in current compilers GNU and LLVM. They learn to create a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification. The compiler can translate not only a programming language but any text in a language generated by a given LL input grammar.			
BIE-PPA.21	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.			

Název bloku: Volitelné předměty oboru/specializace
Minimální počet kreditů bloku: 0
Role bloku: VO

Kód skupiny: BIE-TI-VO.21
Název skupiny: Elective vocational Courses of the Bachelor Specialization Computer Science, ver. 2021
Podmínka kredity skupiny:
Podmínka předměty skupiny:
Kredity skupiny: 0
Poznámka ke skupině:

Kód	Název předmětu / Název skupiny předmětů *(u skupiny předmětů seznam kódů jejích členů)* *Vyučující,* ***autoři*** *a garanti (gar.)*	Zakončení	Kredity	Rozsah	Semestr	Role
BIE-SPS.21	**Administration of Computer Networks and Services** *Jan Kubr, Ondřej Slavík* ***Pavel Tvrdík*** *Jan Kubr (Gar.)*	Z,ZK	5	2P+2S	Z	VO
BIE-TAB.21	**Applications of Security in Technology** ***Jiří Dostál***	Z,ZK	5	2P+2C	L	VO
BIE-ASB.21	**Applied Network Security** *Jiří Dostál, Sinan Yucebas, Gramoz Cubreli* ***Jiří Dostál*** *Jiří Dostál (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-ZRS.21	**Basics of System Control** ***Kateřina Hyniová***	Z,ZK	5	2P+2C	Z,L	VO
BIE-ZSB.21	**Basics of System Security** *Jiří Buček, Simona Fornůsek, Marián Svetlík, Martin Šutovský* ***Simona Fornůsek*** *Simona Fornůsek (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-TPS.21	**Computer Networks Technologies** *Vladimír Smotlacha, Josef Koumar, David Verner* ***Vladimír Smotlacha*** *Vladimír Smotlacha (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-JPO	**Computer Units** ***Pavel Kubalík***	Z,ZK	5	2P+2C	Z	VO
BIE-KOM	**Conceptual Modelling** ***Robert Pergl***	Z,ZK	5	2P+2C	Z	VO
BIE-VES	**Embedded Systems** ***Miroslav Skrbek***	Z,ZK	5	2P+2C	L	VO

BIE-EHA.21	**Ethical Hacking** ***Jiří Dostál***	Z,ZK	5	2P+2C	L	VO
BIE-HWB	**Hardware Security** ***Jiří Buček***	Z,ZK	5	2P+2C	Z	VO
BIE-IOT.21	**Internet of Things** *Viktor Černý, Lenka Kosková Třísková* ***Lenka Kosková Třísková*** *Lenka Kosková Třísková (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-UKB.21	**Introduction to Cybersecurity** *Jan Bělohoubek, Jakub Tetera, David Pokorný, Ivana Singr, Tomáš Luňák, Tomáš Rabas* ***Jan Bělohoubek*** *Jan Bělohoubek (Gar.)*	Z,ZK	5	3P+1C	Z	VO
BIE-IDO.21	**Introduction to DevOps** *Jakub Jabůrek, Zdeněk Rybola, Tomáš Vondra* ***Tomáš Vondra*** *Zdeněk Rybola (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-TJV.21	**Java Technology** *Stanislav Kuznetsov, Ondřej Rozinek* ***Ondřej Rozinek*** *Ondřej Rozinek (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-MPP.21	**Methods of interfacing peripheral devices** *Miroslav Skrbek* ***Miroslav Skrbek*** *Miroslav Skrbek (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-SIP.21	**Network Programming** *Jan Fesl* ***Jan Fesl*** *Jan Fesl (Gar.)*	Z	5	2P+2C	Z	VO
BIE-PNO	**Practical Digital Design** *Martin Novotný* ***Martin Novotný*** *Martin Novotný (Gar.)*	KZ	5	2P+2C	Z	VO
BIE-SRC.21	**Real-time systems** *Hana Kubátová, Jiří Vyskočil* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z,ZK	5	2P+2C	Z	VO
BIE-BEK	**Secure Code** ***Róbert Lórencz***	Z,ZK	5	2P+2C	L	VO
BIE-VPS.21	**Selected Topics in Computer Networking** ***Pavel Tvrdík***	Z,ZK	5	2P+2C	L	VO
BIE-SWI.21	**Software Engineering** ***Zdeněk Rybola***	Z,ZK	5	2P+1C	L	VO
BIE-SP1.21	**Team Software Project 1** ***Zdeněk Rybola***	KZ	5	4C	L	VO
BIE-SP2.21	**Team Software Project 2** *Jakub Jabůrek, Stanislav Kuznetsov, Zdeněk Rybola, Michal Valenta, Ondřej Rozinek, Adéla Svítková* ***Stanislav Kuznetsov*** *Zdeněk Rybola (Gar.)*	KZ	5	2C	Z	VO
BIE-ADU.21	**Unix Administration** ***Petr Zemánek***	Z,ZK	5	2P+2C	L	VO
BIE-VDC.21	**Virtualization and Data Centers** ***Jiří Kašpar***	Z,ZK	5	2P+2C	L	VO
BIE-AWD.21	**Web and Database Server Administration** *Lukáš Bařinka, Michal Valenta* ***Lukáš Bařinka*** *Michal Valenta (Gar.)*	Z,ZK	5	2P+2C	Z	VO

Charakteristiky předmětů této skupiny studijního plánu: Kód=BIE-TI-VO.21 Název=Elective vocational Courses of the Bachelor Specialization Computer Science, ver. 2021

BIE-SPS.21	Administration of Computer Networks and Services	Z,ZK	5

The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure.

BIE-TAB.21	Applications of Security in Technology	Z,ZK	5

The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.

BIE-ASB.21	Applied Network Security	Z,ZK	5

The aim of the course is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gained in course BI-PSI with actual security applications like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing the course student will get knowledge of security applications in computer networks.

BIE-ZRS.21	Basics of System Control	Z,ZK	5

The course gives an introduction to the field of automatic control. It focuses particularly on the control of engineering and physical systems. It covers basic knowledge of the feedback control of linear dynamical single-input-single-output systems. Students will learn the methods of creating descriptions of system models, basic linear dynamic systems analysis, and design and verification of simple feedback PID, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability of control systems, single and continuous adjustment of the controller parameters, and certain aspects of the industrial implementations of continuous and digital controllers.

BIE-ZSB.21	Basics of System Security	Z,ZK	5

The goal of the course is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forensic analysis and related topics such as malware analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of modern operating systems security, as well as skills needed for independent work in the area of operating system security incident analysis.

BIE-TPS.21	Computer Networks Technologies	Z,ZK	5

The course introduces students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the physical layer with the overlap to the link layer. The lectures provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies will be demonstrated and with the most important ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks, Ethernet, modern wireless networks, always with focus on high-speed networks.

BIE-JPO	Computer Units	Z,ZK	5

Students are acquainted with the internal structure and organization of computer units and their interfacing with the environment. They also learn the organization of various memory types (main memory, LIFO, FIFO and CAM), design methodology of control units and basic principles of bus communication. Students get skills needed for computer engineers.

BIE-KOM	Conceptual Modelling	Z,ZK	5
The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations.			
BIE-VES	Embedded Systems	Z,ZK	5
Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.			
BIE-EHA.21	Ethical Hacking	Z,ZK	5
The goal of the course is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vulnerabilities, and their possible exploitation in computer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is on hands-on experience with vulnerabilities testing and the following process of penetration test documentation.			
BIE-HWB	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers.			
BIE-IOT.21	Internet of Things	Z,ZK	5
The course focuses on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an overview of sensors and actuators, wireless communication technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architectures for different application areas. Within the computer labs, students will gain practical experience with developing simple IoT systems using common development environments (hardware - ARM, ESP, STM; software - Arduino, Raspberry Pi OS).			
BIE-UKB.21	Introduction to Cybersecurity	Z,ZK	5
The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.			
BIE-IDO.21	Introduction to DevOps	Z,ZK	5
The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice.			
BIE-TJV.21	Java Technology	Z,ZK	5
The aim of the course is to provide knowledge and skills needed for the development of smaller and larger information systems. Students will get acquainted with general theoretical concepts and will be able to apply these concepts using libraries and tools from the ecosystem of the Java programming language. After completing the course students will be able to participate in the development of software systems on the Java platform. Students are assumed to be acquainted with the following topics (they are used and not taught in this course): Java language syntax, SQL, git version control system, Docker, continuous integration.			
BIE-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.			
BIE-SIP.21	Network Programming	Z	5
The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment.			
BIE-PNO	Practical Digital Design	KZ	5
Students get an overview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the basics of the VHDL language, and implementation technologies FPGA and ASIC.			
BIE-SRC.21	Real-time systems	Z,ZK	5
Students obtain the basic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issues. Theoretical knowledge from lectures will be experimentally verified in department specialized labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab are the same as in the BIE-VES course and FPGAs..			
BIE-BEK	Secure Code	Z,ZK	5
Studenti se naučí posuzovat a zohledňovat bezpečnostní rizika při návrhu svého kódu a řešení v běžné inženýrské praxi. Od teorie modelování bezpečnostních rizik přistoupí k praxi, ve které si vyzkouší běh programů pod nižšími oprávněními a jak tato oprávnění stanovovat, protože ne každý program musí nutně běžet s administrátorským oprávněním. Budou také prakticky demonstrována rizika spojená s přetečením bufferu. Dále se studenti budou krátce věnovat zabezpečení dat a jak toto zabezpečení souvisí s databázovými systémy a webem. V závěru se budou věnovat útokům typu DoS (Denial of Service) a obraně proti nim.			
BIE-VPS.21	Selected Topics in Computer Networking	Z,ZK	5
The course builds upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technologies used in modern computer networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical experience with real network devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security.			
BIE-SWI.21	Software Engineering	Z,ZK	5
Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development.			
BIE-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.			

BIE-SP2.21	Team Software Project 2	KZ	5
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 BIE-SP1 course project. However, in this follow-up, the functionality, testing, and documentation of the software 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) the formal as well as material aspects of their solution.			
BIE-ADU.21	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.			
BIE-VDC.21	Virtualization and Data Centers	Z,ZK	5
The aim of the course is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses.			
BIE-AWD.21	Web and Database Server Administration	Z,ZK	5
Students will get acquainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and backup complex database and web service systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an example of a web server.			

Název bloku: Povinně volitelné předměty
Minimální počet kreditů bloku: 5
Role bloku: PV

Kód skupiny: BIE-PV-TI.21
Název skupiny: Compulsory elective Courses of the Specialization Computer Science, version 2021
Podmínka kredity skupiny: V této skupině musíte získat alespoň 5 kreditů (maximálně 10)
Podmínka předměty skupiny: V této skupině musíte absolvovat alespoň 1 předmět (maximálně 2)
Kredity skupiny: 5
Poznámka ke skupině:

Kód	Název předmětu / Název skupiny předmětů *(u skupiny předmětů seznam kódů jejích členů)* *Vyučující,* ***autoři*** *a garanti (gar.)*	Zakončení	Kredity	Rozsah	Semestr	Role
BIE-ML1.21	**Machine Learning 1** *Alexander Kovalenko, Ondřej Tichý, Daniel Vašata, Rodrigo Augusto Da Silva Alves* ***Daniel Vašata*** *Daniel Vašata (Gar.)*	Z,ZK	5	2P+2C	Z	PV
BIE-SWI.21	**Software Engineering** ***Zdeněk Rybola***	Z,ZK	5	2P+1C	L	PV

Charakteristiky předmětů této skupiny studijního plánu: Kód=BIE-PV-TI.21 Název=Compulsory elective Courses of the Specialization Computer Science, version 2021

BIE-SWI.21	Software Engineering	Z,ZK	5
Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development.			
BIE-ML1.21	Machine Learning 1	Z,ZK	5
The goal of this course is to introduce students to the basic methods of machine learning. They get theoretical understanding and practical working knowledge of regression and classification models in the supervised learning scenario and clustering models in the unsupervised scenario. Students will be aware of the relationships between model bias and variance, and know the fundamentals of assessing model quality. Moreover, they learn the basic techniques of data preprocessing and multidimensional data visualization. In practical demonstrations, pandas and scikit libraries in Python will be used.			

Název bloku: Volitelné předměty
Minimální počet kreditů bloku: 0
Role bloku: V

Kód skupiny: BIE-V.2021
Název skupiny: Purely Elective Bachelor Courses, Version 2021 till 2024/25
Podmínka kredity skupiny:
Podmínka předměty skupiny:
Kredity skupiny: 0
Poznámka ke skupině:

Kód	Název předmětu / Název skupiny předmětů *(u skupiny předmětů seznam kódů jejích členů)* *Vyučující,* ***autoři*** *a garanti (gar.)*	Zakončení	Kredity	Rozsah	Semestr	Role
BIE-ZUM	**Artificial Intelligence Fundamentals** ***Pavel Surynek***	Z,ZK	4	2P+2C	L	V

BIE-ZRS	**Basics of System Control** ***Kateřina Hyniová***	Z,ZK	4	2P+2C	L	v
FIT-BIP	**Blended Intensive Programme** ***Zdeněk Muzikář***	Z	3		Z,L	v
BIE-CCN	**Compiler Construction** ***Christoph Kirsch***	Z,ZK	5	2P+1C	L	v
BIE-SCE1	**Computer Engineering Seminar I** ***Hana Kubátová***	Z	4	2C	Z	v
BIE-SCE2	**Computer Engineering Seminar II** ***Hana Kubátová***	Z	4	2C	L	v
BIE-CZ0	**Czech Language for Foreigners** *Tomáš Houdek, Markéta Hofmannová* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	2	4C	Z,L	v
BIE-CZ1.21	**Czech Language for Foreigners II** *Tomáš Houdek, Markéta Hofmannová* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	2	4C	Z,L	v
UKCJP	**Čeština pro pokročilé** *Tomáš Houdek, Jakub Šenovský, Jakub Šolc, Adam Vostárek* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z,ZK	2	2BP+2BC	Z,L	v
BIE-DIF	**Differential equations** ***Tomáš Kalvoda***	Z,ZK	5	2P+2C	L	v
BIE-EPR	**Economic project** ***Tomáš Evan***	Z	1		L	v
BIE-FTR.1	**Financial Markets** ***Pavla Vozárová***	Z,ZK	5	2P+2C	L	v
FITE-GIA	**Global issues and artificial intelligence** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	ZK	4	2P+1C	Z,L	v
FITE-GRI	**Grid Computing** *André Sopczak, Petr Fiedler* ***André Sopczak*** *André Sopczak (Gar.)*	Z,ZK	5	2P+1C	Z	v
BIE-HAS	**Human Factors in Cryptography and Security** ***Ivana Singr***	Z,ZK	5	2P+1C	Z	v
BIE-CSI	**Introduction to Computer Science** *Christoph Kirsch* ***Christoph Kirsch*** *Christoph Kirsch (Gar.)*	Z	2	2C	Z	v
BIE-EHD	**Introduction to European Economic History** ***Tomáš Evan***	Z,ZK	3	2P+1C	L	v
FITE-EHD	**Introduction to European Economic History** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	Z,ZK	3	2P+1C	L	v
BIE-IMA	**Introduction to Mathematics** ***Karel Klouda***	Z	4	3C	Z	v
BIE-IMA2	**Introduction to Mathematics 2** ***Karel Klouda***	Z	2	1C	Z	v
BIE-ST1	**Network Technology 1** ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z	3	2C	Z	v
BIE-PKM	**Preparatory Mathematics** ***Jitka Rybníčková*** *Tomáš Kalvoda (Gar.)*	Z	4		Z	v
BIE-PJV	**Programming in Java** *Jan Blizničenko* ***Jan Blizničenko*** *Jan Blizničenko (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-PS2	**Programming in shell 2** ***Lukáš Bařinka***	Z,ZK	4	2P+2C	L	v
FIT-ACM1	**Programovací praktika 1** ***Tomáš Valla*** *Tomáš Valla (Gar.)*	KZ	5	4C	L	v
FIT-ACM2	**Programovací praktika 2** ***Tomáš Valla***	KZ	5	4C	Z	v
FIT-ACM3	**Programovací praktika 3** ***Tomáš Valla*** *Tomáš Valla (Gar.)*	KZ	5	4C	L	v
FIT-ACM4	**Programovací praktika 4** ***Ondřej Suchý***	KZ	5	4C	Z	v
FIT-ACM5	**Programovací praktika 5** ***Ondřej Suchý***	KZ	5	4C	L	v
FIT-ACM6	**Programovací praktika 6** ***Ondřej Suchý***	KZ	5	4C	L	v
BIE-PRR.21	**Project management** *David Pešek, Tomáš Šubrt* ***David Pešek*** *Tomáš Šubrt (Gar.)*	Z,ZK	5	2P+2C	Z,L	v
BIE-SKJ.21	**Scripting Languages** ***Lukáš Bařinka***	Z,ZK	4	2P+2C	L	v
BIE-VAK.21	**Selected Combinatorics Applications** ***Michal Opler***	Z	3	2R	L	v
BIE-VMM	**Selected Mathematical Methods** ***Tomáš Kalvoda***	Z,ZK	4	2P+2C	L	v
BI-SCE1	**Seminář počítačového inženýrství I** *Hana Kubátová* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z	4	2C	L,Z	v
BIE-SEG	**Systems Engineering** *Christoph Kirsch* ***Christoph Kirsch*** *Christoph Kirsch (Gar.)*	Z	0	2C	Z	v
TVV	**Tělesná výchova**	Z	0	0+2	Z,L	v
TVV0	**Tělesná výchova 0**	Z	0	0+2	Z,L	v

TV2K1	**Tělesná výchova 2**	Z	1		L,Z	v
TVKLV	**Tělovýchovný kurz**	Z	0	7dní	L	v
BIE-TUR.21	**User Interface Design** ***Jan Schmidt***	Z,ZK	5	2P+2C	L	v
BIE-VR1.21	**Virtual reality I** *Petr Klán* ***Petr Klán*** *Petr Klán (Gar.)*	KZ	4	2P+2C	L,Z	v
BIE-ADW.1	**Windows Administration** *Miroslav Prágl* ***Miroslav Prágl*** *Miroslav Prágl (Gar.)*	Z,ZK	4	2P+1C	Z	v
FITE-SEP	**World Economy and Business** *Tomáš Evan* ***Tomáš Evan*** *Tomáš Evan (Gar.)*	Z,ZK	4	2P+2C	Z	v
BIE-SEP	**World Economy and Business** ***Tomáš Evan***	Z,ZK	4	2P+2C	Z	v
BIE-3DT.1	**3D Printing** ***Marek Žehra***	KZ	4	3C	L	v

Charakteristiky předmětů této skupiny studijního plánu: Kód=BIE-V.2021 Název=Purely Elective Bachelor Courses, Version 2021 till 2024/25

BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4

Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.

BIE-ZRS	Basics of System Control	Z,ZK	4

Volitelný předmět základy řízení systémů je určen pro všechny zájemce o aplikovanou informatiku v bakalářském studiu. Alespoň přehledové znalosti oboru automatického řízení budou pro naše absolventy jistě konkurenční výhodou a zhodnotí je bezesporu v průmyslové praxi. Studenti získají znalosti v dynamicky se rozvíjejícím oboru s velkou budoucností. Zaměříme se zejména na řízení inženýrských a fyzikálních sysémů. Poskytneme vám základní informace z oblasti zpětnovazebního řízení lineárních dynamických jednorozměrových systémů. Seznámíme vás s metodami vytváření popisu a modelu systémů, základní analýzou lineárních dynamických systémů a návrhem a ověřením jednoduchých zpětnovazebních PID, PSD a fuzzy regulátorů. Pozornost je věnována rovněž snímačům a akčním členům v regulačních obvodech, otázkám stability regulačních obvodů, jednorázovému a průběžnému nastavování parametrů regulátoru a některým aspektům průmyslových realizací spojitých a číslicových regulátorů. Jednotlivá témata přednášek jsou provázena množstvím užitečných příkladů a praktických průmyslových realizací.

FIT-BIP	Blended Intensive Programme	Z	3

Blended Intensive Program: krátkodobý výjezd přes program Erasmus+

BIE-CCN	Compiler Construction	Z,ZK	5

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

BIE-SCE1	Computer Engineering Seminar I	Z	4

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

BIE-SCE2	Computer Engineering Seminar II	Z	4

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

BIE-CZ0	Czech Language for Foreigners	KZ	2

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

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

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

UKCJP	Čeština pro pokročilé	Z,ZK	2

Kurz pokročilé češtiny pro ukrajinské studenty, kteří mají status uprchlíka. Zkouška potvrdí znalost češtiny na úrovní B2 s platností pro ČVUT.

BIE-DIF	Differential equations	Z,ZK	5

This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.

BIE-EPR	Economic project	Z	1

This course is an extension of the course Introduction to European Economic History (BIE-EHD).

BIE-FTR.1	Financial Markets	Z,ZK	5

Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field.

FITE-GIA	Global issues and artificial intelligence	ZK	4

Tento kurz se zabývá transformativní rolí umělé inteligence (AI) při řešení a formování nejnaléhavějších globálních výzev 21. století. Studenti budou kriticky analyzovat AI jednak jako mocný nástroj napomáhající řešit složité problémy (jako je optimalizace zdrojů, šíření zbraní a zdravotní péče), jednak jako zdroj nových systémových rizik souvisejících s etikou či geopolitickými posuny moci. Semináře přispívají k prohloubení znalostí formou diskusí vycházejících z individuální četby a interpretace zdrojů.

FITE-GRI	Grid Computing	Z,ZK	5

Grid computing and gain knowledge about the world-wide network and computing infrastructure.

BIE-HAS	Human Factors in Cryptography and Security	Z,ZK	5
Předmět je určen studentům, které zajímá nejen matematická a technická stránka věci, ale i přemýšlení nad tím, jestli výsledný produkt bude použitelný pro lidi (od těch, kteří implementují šifry po uživatele aplikací). Studenti budou moci využít nabyté vědomosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projektů v kontextu kybernetické bezpečnosti zaměřené na člověka.			
BIE-CSI	Introduction to Computer Science	Z	2
This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before.			
BIE-EHD	Introduction to European Economic History	Z,ZK	3
The course introduces a selection of themes from European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key historical periods. As European countries have been dominant actors in this process it focuses predominantly on their roles in economic history. From the large economic area of the Roman Empire to the fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover the detailed economic history of particular European countries but rather the impact of trade and the role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lectures and discussions.			
FITE-EHD	Introduction to European Economic History	Z,ZK	3
The course introduces a selection of themes from European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key historical periods. As European countries have been dominant actors in this process it focuses predominantly on their roles in economic history. From the large economic area of the Roman Empire to the fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover the detailed economic history of particular European countries but rather the impact of trade and the role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lectures and discussions.			
BIE-IMA	Introduction to Mathematics	Z	4
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.			
BIE-IMA2	Introduction to Mathematics 2	Z	2
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.			
BIE-ST1	Network Technology 1	Z	3
Předmět je zaměřen na získání základních znalosti z oblasti počítačových sítí a praktických zkušeností se síťovými technologiemi. Předmět odpovída látce kurikula Cisco Netacad programu - CCNA1 - R&S Introduction to Networks.			
BIE-PKM	Preparatory Mathematics	Z	4
The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.			
BIE-PJV	Programming in Java	Z,ZK	4
The course Programming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java language the fundamental APIs will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.			
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into Bourne Again shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: We are ready do adapt the lectures to provide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, ln, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice.			
FIT-ACM1	Programovací praktika 1	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM2	Programovací praktika 2	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM3	Programovací praktika 3	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM4	Programovací praktika 4	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM5	Programovací praktika 5	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM6	Programovací praktika 6	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
BIE-PRR.21	Project management	Z,ZK	5
BIE-SKJ.21	Scripting Languages	Z,ZK	4
Join us on a tour into the world of scripted programming. Together, we will unveil the power of Bourne Again shell and PERL as proven industry standards, as well as a couple of other standard text processing utilities (AWK, sed), with some basic UNIX system tools, in many real-world situations like processing web feeds or logs. We will provide a general overview of scripting languages and introduction into their pros and cons and students get practical experience with shell script programming. We will touch also ROFF, PerlDoc, and even TeX to get some insight into how your code documentation can be implemented. And if you know UNIX system-level scripting already, we can show you advanced programming techniques and tricks that get overlooked frequently but increase code robustness or execution efficiency. The course is led by two veteran programmers in the scripting world. Lukáš is a renowned lecturer in advanced shell programming, teaching developers from the IT industry in several CE countries. Jan is a skilled lecturer and developer whose code contributes to safe and streamline operations of cloud service datacenters around the globe.			
BIE-VAK.21	Selected Combinatorics Applications	Z	3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.			

BIE-VMM	Selected Mathematical Methods	Z,ZK	4
The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples.			
BI-SCE1	Seminář počítačového inženýrství I	Z	4
Seminář počítačového inženýrství je výběrový předmět pro studenty, kteří se chtějí zabývat hlouběji tématy číslicového návrhu, spolehlivosti a odolnosti proti poruchám a útokům. Ke studentům se v rámci předmětu přistupuje individuálně a každý student či skupinka studentů řeší nějaké zajímavé aktuální téma s vybraným školitelem. Součástí předmětu je práce s vědeckými články a jinou odbornou literaturou a/nebo práce v laboratořích KČN. Kapacita předmětu je omezena možnostmi učitelů semináře. Probíraná témata jsou pro každý semestr nová.			
BIE-SEG	Systems Engineering	Z	0
This is an introductory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of operating systems for students to understand processor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking the class, students are able to understand the difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what concurrency is, as opposed to parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication.			
TVV	Tělesná výchova	Z	0
TVV0	Tělesná výchova 0	Z	0
TV2K1	Tělesná výchova 2	Z	1
TVKLV	Tělovýchovný kurz	Z	0
BIE-TUR.21	User Interface Design	Z,ZK	5
Students gain a basic overview of methods for designing and testing common user interfaces. They get 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 methods that bring users into the development process to ensure optimal interface for them.			
BIE-VR1.21	Virtual reality I	KZ	4
Introduction to Virtual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The course focuses on the ways of creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social activities.			
BIE-ADW.1	Windows Administration	Z,ZK	4
Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.			
FITE-SEP	World Economy and Business	Z,ZK	4
The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the 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 knowledge in the form of discussions based on individual readings.			
BIE-SEP	World Economy and Business	Z,ZK	4
The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the 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 knowledge in the form of discussions based on individual readings.			
BIE-3DT.1	3D Printing	KZ	4
Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.			

Seznam předmětů tohoto průchodu:

Kód	Název předmětu	Zakončení	Kredity
BI-SCE1	Seminář počítačového inženýrství I	Z	4
Seminář počítačového inženýrství je výběrový předmět pro studenty, kteří se chtějí zabývat hlouběji tématy číslicového návrhu, spolehlivosti a odolnosti proti poruchám a útokům. Ke studentům se v rámci předmětu přistupuje individuálně a každý student či skupinka studentů řeší nějaké zajímavé aktuální téma s vybraným školitelem. Součástí předmětu je práce s vědeckými články a jinou odbornou literaturou a/nebo práce v laboratořích KČN. Kapacita předmětu je omezena možnostmi učitelů semináře. Probíraná témata jsou pro každý semestr nová.			
BIE-3DT.1	3D Printing	KZ	4
Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.			
BIE-AAG.21	Automata and Grammars	Z,ZK	5
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits.			
BIE-ADU.21	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.			
BIE-ADW.1	Windows Administration	Z,ZK	4
Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.			

BIE-AG1.21	Algorithms and Graphs 1	Z,ZK	5
The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It is interlinked with the concurrent BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed for time and space complexity of algorithms and learn to handle practically the asymptotic mathematics.			
BIE-AG2.21	Algorithms and Graphs 2	Z,ZK	5
The course presents the basic algorithms and concepts of graph theory building on the introduction exposed in the compulsory course BIE-AG1.21. It also covers advanced data structures and amortized analysis. It also includes a very light introduction into approximation algorithms.			
BIE-APS.21	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 the program. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.			
BIE-ASB.21	Applied Network Security	Z,ZK	5
The aim of the course is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gained in course BI-PSI with actual security applications like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing the course student will get knowledge of security applications in computer networks.			
BIE-AWD.21	Web and Database Server Administration	Z,ZK	5
Students will get acquainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and backup complex database and web service systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an example of a web server.			
BIE-BAP.21	Bachelor Thesis	Z	14
BIE-BEK	Secure Code	Z,ZK	5
Studenti se naučí posuzovat a zohledňovat bezpečnostní rizika při návrhu svého kódu a řešení v běžné inženýrské praxi. Od teorie modelování bezpečnostních rizik přistoupí k praxi, ve které si vyzkouší běh programů pod nižšími oprávněními a jak tato oprávnění stanovovat, protože ne každý program musí nutně běžet s administrátorským oprávněním. Budou také prakticky demonstrována rizika spojená s přetečením bufferu. Dále se studenti budou krátce věnovat zabezpečení dat a jak toto zabezpečení souvisí s databázovými systémy a webem. V závěru se budou věnovat útokům typu DoS (Denial of Service) a obraně proti nim.			
BIE-BPR.21	Bachelor Project	Z	1
At the beginning of the semester the student will contact the supervisor of the bachelor thesis he has booked. They will discuss the partial tasks that student will perform during the semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.			
BIE-CCN	Compiler Construction	Z,ZK	5
This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.			
BIE-CSI	Introduction to Computer Science	Z	2
This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before.			
BIE-CZ0	Czech Language for Foreigners	KZ	2
Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.			
BIE-CZ1.21	Czech Language for Foreigners II	KZ	2
The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The course further expands the basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Republic.			
BIE-DBS.21	Database Systems	Z,ZK	5
Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (including integrity constraints) using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoretical basis - relational database model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction processing and control of parallel user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database models.			
BIE-DIF	Differential equations	Z,ZK	5
This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.			
BIE-DML.21	Discrete Mathematics and Logic	Z,ZK	5
Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from set theory will be explained. Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course also lays down the basics of combinatorics and number theory, with emphasis on modular arithmetics.			
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-EHA.21	Ethical Hacking	Z,ZK	5
The goal of the course is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vulnerabilities, and their possible exploitation in computer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is on hands-on experience with vulnerabilities testing and the following process of penetration test documentation.			
BIE-EHD	Introduction to European Economic History	Z,ZK	3
The course introduces a selection of themes from European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key historical periods. As European countries have been dominant actors in this process it focuses predominantly on their roles in economic history. From the large economic area of the Roman Empire to the fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover the detailed economic history of particular European countries but rather the impact of trade and the role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lectures and discussions.			

BIE-EPR	Economic project	Z	1
This course is an extension of the course Introduction to European Economic History (BIE-EHD).			
BIE-FTR.1	Financial Markets	Z,ZK	5
Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field.			
BIE-GIT.21	SW Development Technologies	Z	3
This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use.			
BIE-HAS	Human Factors in Cryptography and Security	Z,ZK	5
Předmět je určen studentům, které zajímá nejen matematická a technická stránka věci, ale i přemýšlení nad tím, jestli výsledný produkt bude použitelný pro lidi (od těch, kteří implementují šifry po uživatele aplikací). Studenti budou moci využít nabyté vědomosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projektů v kontextu kybernetické bezpečnosti zaměřené na člověka.			
BIE-HWB	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers.			
BIE-IDO.21	Introduction to DevOps	Z,ZK	5
The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice.			
BIE-IMA	Introduction to Mathematics	Z	4
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.			
BIE-IMA2	Introduction to Mathematics 2	Z	2
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.			
BIE-IOT.21	Internet of Things	Z,ZK	5
The course focuses on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an overview of sensors and actuators, wireless communication technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architectures for different application areas. Within the computer labs, students will gain practical experience with developing simple IoT systems using common development environments (hardware - ARM, ESP, STM; software - Arduino, Raspberry Pi OS).			
BIE-JPO	Computer Units	Z,ZK	5
Students are acquainted with the internal structure and organization of computer units and their interfacing with the environment. They also learn the organization of various memory types (main memory, LIFO, FIFO and CAM), design methodology of control units and basic principles of bus communication. Students get skills needed for computer engineers.			
BIE-KAB.21	Cryptography and Security	Z,ZK	5
Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis. Students are expected to be competent programmers in C/C++ (on a small scale). Basic Python knowledge is an advantage.			
BIE-KOM	Conceptual Modelling	Z,ZK	5
The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations.			
BIE-LA1.21	Linear Algebra 1	Z,ZK	5
We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science.			
BIE-LA2.21	Linear Algebra 2	Z,ZK	5
Students will broaden their knowledge gained in the BIE-LA1 introductory course, where only vectors in the form of n-tuples of numbers were considered. Here we will introduce vector spaces in a general abstract form. The notions of a scalar product and a linear map will enable to demonstrate the profound link between linear algebra, geometry, and computer graphics. The other main topic will be numerical linear algebra, in particular problems with solving systems of linear equations on computers. The issues of numerical linear algebra will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be presented.			
BIE-LOG.21	Mathematical Logic	Z,ZK	5
The course focuses on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability, logical equivalence, and the logical consequence of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are explained. This relates to the P vs. NP problem and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and their models. The syntactic approach to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness theorems is explained.			
BIE-MA1.21	Mathematical Analysis 1	Z,ZK	5
We begin the course by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers. Then we study real sequences and real functions of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions. This theoretical foundation is then applied to root-finding problems (iterative method of bisection and Newtons method), construction of cubic interpolation (spline), and formulation and solution of simple optimization problems (i.e., the issue of finding extrema of functions). The course is closed with the Landaus asymptotic notation and methods of mathematical description of complexity of algorithms.			
BIE-MA2.21	Mathematical Analysis 2	Z,ZK	6
The course completes the theme of analysis of real functions of a real variable initiated in BIE-MA1 by introducing the Riemann integral. Students will learn how to integrate by parts and use the substitution method.The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylors theorem to the computation of elementary			

functions with a prescribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, and its analysis using the Master theorem. Finally, we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and Hessian matrix, we study the analytical method of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integration of multivariate functions.

BIE-ML1.21	Machine Learning 1	Z,ZK	5

The goal of this course is to introduce students to the basic methods of machine learning. They get theoretical understanding and practical working knowledge of regression and classification models in the supervised learning scenario and clustering models in the unsupervised scenario. Students will be aware of the relationships between model bias and variance, and know the fundamentals of assessing model quality. Moreover, they learn the basic techniques of data preprocessing and multidimensional data visualization. In practical demonstrations, pandas and scikit libraries in Python will be used.

BIE-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.

BIE-OOP.21	Object-Oriented Programming	Z,ZK	5

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 students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.

BIE-OSY.21	Operating Systems	Z,ZK	5

In this course that is a follow-up of the Unix-like operating systems course students deepen their knowledge in areas of OS kernels, process and thread implementations, race conditions, critical regions, thread scheduling, shared resource allocation and deadlocks, management of virtual memory and data storages, file systems, OS monitoring. They are able to design and implement simple multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS Windows.

BIE-PA1.21	Programming and Algorithmics 1	Z,ZK	7

Students learn to construct algorithms for solving basic problems and write them in the C language. They master data types (simple, pointers, structured), expressions, statements, and functions presented in C language. They understand the principle of recursion and basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating linked lists and trees.

BIE-PA2.21	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, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism).

BIE-PJP.21	Programming Languages and Compilers	Z,ZK	5

Students learn basic compiling methods of programming languages. They are introduced to intermediate representations used in current compilers GNU and LLVM. They learn to create a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification. The compiler can translate not only a programming language but any text in a language generated by a given LL input grammar.

BIE-PJV	Programming in Java	Z,ZK	4

The course Programming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java language the fundamental APIs will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.

BIE-PKM	Preparatory Mathematics	Z	4

The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.

BIE-PNO	Practical Digital Design	KZ	5

Students get an overview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the basics of the VHDL language, and implementation technologies FPGA and ASIC.

BIE-PPA.21	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.

BIE-PRR.21	Project management	Z,ZK	5
BIE-PS2	Programming in shell 2	Z,ZK	4

Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into Bourne Again shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: We are ready do adapt the lectures to provide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, ln, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice.

BIE-PSI.21	Computer Networks	Z,ZK	5

The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS.

BIE-PST.21	Probability and Statistics	Z,ZK	5

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 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 for testing statistical hypotheses and determining the statistical dependence of two or more random variables.

BIE-SAP.21	Computer Structures and Architectures	Z,ZK	5

Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools.

BIE-SCE1	Computer Engineering Seminar I	Z	4

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

BIE-SCE2	Computer Engineering Seminar II	Z	4

The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific

	articles and other professional literature and/or work in KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.		
BIE-SEG	Systems Engineering	Z	0
	This is an introductory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of operating systems for students to understand processor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking the class, students are able to understand the difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what concurrency is, as opposed to parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication.		
BIE-SEP	World Economy and Business	Z,ZK	4
	The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the 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 knowledge in the form of discussions based on individual readings.		
BIE-SIP.21	Network Programming	Z	5
	The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment.		
BIE-SKJ.21	Scripting Languages	Z,ZK	4
	Join us on a tour into the world of scripted programming. Together, we will unveil the power of Bourne Again shell and PERL as proven industry standards, as well as a couple of other standard text processing utilities (AWK, sed), with some basic UNIX system tools, in many real-world situations like processing web feeds or logs. We will provide a general overview of scripting languages and introduction into their pros and cons and students get practical experience with shell script programming. We will touch also ROFF, PerlDoc, and even TeX to get some insight into how your code documentation can be implemented. And if you know UNIX system-level scripting already, we can show you advanced programming techniques and tricks that get overlooked frequently but increase code robustness or execution efficiency. The course is led by two veteran programmers in the scripting world. Lukáš is a renowned lecturer in advanced shell programming, teaching developers from the IT industry in several CE countries. Jan is a skilled lecturer and developer whose code contributes to safe and streamline operations of cloud service datacenters around the globe.		
BIE-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.		
BIE-SP2.21	Team Software Project 2	KZ	5
	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 BIE-SP1 course project. However, in this follow-up, the functionality, testing, and documentation of the software 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) the formal as well as material aspects of their solution.		
BIE-SPS.21	Administration of Computer Networks and Services	Z,ZK	5
	The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure.		
BIE-SRC.21	Real-time systems	Z,ZK	5
	Students obtain the basic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issues. Theoretical knowledge from lectures will be experimentally verified in department specialized labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab are the same as in the BIE-VES course and FPGAs..		
BIE-ST1	Network Technology 1	Z	3
	Předmět je zaměřen na získání základních znalosti z oblasti počítačových sítí a praktických zkušeností se síťovými technologiemi. Předmět odpovída látce kurikula Cisco Netacad programu - CCNA1 - R&S Introduction to Networks.		
BIE-SWI.21	Software Engineering	Z,ZK	5
	Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development.		
BIE-TAB.21	Applications of Security in Technology	Z,ZK	5
	The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.		
BIE-TDP.21	Documentation and Presentation	KZ	3
	The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.		
BIE-TJV.21	Java Technology	Z,ZK	5
	The aim of the course is to provide knowledge and skills needed for the development of smaller and larger information systems. Students will get acquainted with general theoretical concepts and will be able to apply these concepts using libraries and tools from the ecosystem of the Java programming language. After completing the course students will be able to participate in the development of software systems on the Java platform. Students are assumed to be acquainted with the following topics (they are used and not taught in this course): Java language syntax, SQL, git version control system, Docker, continuous integration.		
BIE-TPS.21	Computer Networks Technologies	Z,ZK	5
	The course introduces students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the physical layer with the overlap to the link layer. The lectures provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies will be demonstrated and with the most important ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks, Ethernet, modern wireless networks, always with focus on high-speed networks.		
BIE-TUR.21	User Interface Design	Z,ZK	5
	Students gain a basic overview of methods for designing and testing common user interfaces. They get 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 methods that bring users into the development process to ensure optimal interface for them.		

BIE-TZP.21	Technological Fundamentals of Computers	Z,ZK	5
Students get acquainted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer structures look like at the lowest level. They are introduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to reduce the consumption; what the limits to the maximum operating frequency are and how to raise them; why a computer bus needs to be terminated, what happens if it is not; how a computer power supply looks like (in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica.			
BIE-UKB.21	Introduction to Cybersecurity	Z,ZK	5
The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.			
BIE-UOS.21	Unix-like Operating Systems	KZ	5
Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell.			
BIE-VAK.21	Selected Combinatorics Applications	Z	3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.			
BIE-VDC.21	Virtualization and Data Centers	Z,ZK	5
The aim of the course is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses.			
BIE-VES	Embedded Systems	Z,ZK	5
Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.			
BIE-VMM	Selected Mathematical Methods	Z,ZK	4
The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples.			
BIE-VPS.21	Selected Topics in Computer Networking	Z,ZK	5
The course builds upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technologies used in modern computer networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical experience with real network devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security.			
BIE-VR1.21	Virtual reality I	KZ	4
Introduction to Virtual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The course focuses on the ways of creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social activities.			
BIE-ZRS	Basics of System Control	Z,ZK	4
Volitelný předmět základy řízení systémů je určen pro všechny zájemce o aplikovanou informatiku v bakalářském studiu. Alespoň přehledové znalosti oboru automatického řízení budou pro naše absolventy jistě konkurenční výhodou a zhodnotí je bezesporu v průmyslové praxi. Studenti získají znalosti v dynamicky se rozvíjejícím oboru s velkou budoucností. Zaměříme se zejména na řízení inženýrských a fyzikálních sysémů. Poskytneme vám základní informace z oblasti zpětnovazebního řízení lineárních dynamických jednorozměrových systémů. Seznámíme vás s metodami vytváření popisu a modelu systémů, základní analýzou lineárních dynamických systémů a návrhem a ověřením jednoduchých zpětnovazebních PID, PSD a fuzzy regulátorů. Pozornost je věnována rovněž snímačům a akčním členům v regulačních obvodech, otázkám stability regulačních obvodů, jednorázovému a průběžnému nastavování parametrů regulátoru a některým aspektům průmyslových realizací spojitých a číslicových regulátorů. Jednotlivá témata přednášek jsou provázena množstvím užitečných příkladů a praktických průmyslových realizací.			
BIE-ZRS.21	Basics of System Control	Z,ZK	5
The course gives an introduction to the field of automatic control. It focuses particularly on the control of engineering and physical systems. It covers basic knowledge of the feedback control of linear dynamical single-input-single-output systems. Students will learn the methods of creating descriptions of system models, basic linear dynamic systems analysis, and design and verification of simple feedback PID, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability of control systems, single and continuous adjustment of the controller parameters, and certain aspects of the industrial implementations of continuous and digital controllers.			
BIE-ZSB.21	Basics of System Security	Z,ZK	5
The goal of the course is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forensic analysis and related topics such as malware analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of modern operating systems security, as well as skills needed for independent work in the area of operating system security incident analysis.			
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.			
BIE-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5
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.			
FIT-ACM1	Programovací praktika 1	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM2	Programovací praktika 2	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM3	Programovací praktika 3	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			
FIT-ACM4	Programovací praktika 4	KZ	5
Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.			

FIT-ACM5	Programovací praktika 5	KZ	5
	Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.		
FIT-ACM6	Programovací praktika 6	KZ	5
	Tento výběrový kurz má za cíl připravit ty nejlepší studenty na reprezentaci fakulty v rámci mezinárodních ACM soutěží.		
FIT-BIP	Blended Intensive Programme	Z	3
	Blended Intensive Program: krátkodobý výjezd přes program Erasmus+		
FITE-EHD	Introduction to European Economic History	Z,ZK	3
	The course introduces a selection of themes from European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key historical periods. As European countries have been dominant actors in this process it focuses predominantly on their roles in economic history. From the large economic area of the Roman Empire to the fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover the detailed economic history of particular European countries but rather the impact of trade and the role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lectures and discussions.		
FITE-GIA	Global issues and artificial intelligence	ZK	4
	Tento kurz se zabývá transformativní rolí umělé inteligence (AI) při řešení a formování nejnaléhavějších globálních výzev 21. století. Studenti budou kriticky analyzovat AI jednak jako mocný nástroj napomáhající řešit složité problémy (jako je optimalizace zdrojů, šíření zbraní a zdravotní péče), jednak jako zdroj nových systémových rizik souvisejících s etikou či geopolitickými posuny moci. Semináře přispívají k prohloubení znalostí formou diskusí vycházejících z individuální četby a interpretace zdrojů.		
FITE-GRI	Grid Computing	Z,ZK	5
	Grid computing and gain knowledge about the world-wide network and computing infrastructure.		
FITE-SEP	World Economy and Business	Z,ZK	4
	The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the 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 knowledge in the form of discussions based on individual readings.		
TV2K1	Tělesná výchova 2	Z	1
TVKLV	Tělovýchovný kurz	Z	0
TVV	Tělesná výchova	Z	0
TVV0	Tělesná výchova 0	Z	0
UKCJP	Čeština pro pokročilé	Z,ZK	2
	Kurz pokročilé češtiny pro ukrajinské studenty, kteří mají status uprchlíka. Zkouška potvrdí znalost češtiny na úrovní B2 s platností pro ČVUT.		

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