

Doporu ený pr chod studijním plánem

Název pr chodu: Bachelor specialization, Information Security, 2021

Fakulta: Fakulta informa ních technologií

Katedra:

Pr chod studijním plánem: Bachelor Specialization, Information Security, 2021

Obor studia, garantovaný katedrou: Úvodní stránka

Garant oboru studia:

Program studia: Informatics

Typ studia: Bakalá ské prezen ní

Poznámka k pr chodu: In addition to purely elective courses, compulsory courses in neighboring specializations can also be enrolled here as electives. 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.

Kódování rolí p edm t a skupin p edm t :

P - povinné p edm ty programu, PO - povinné p edm ty oboru, Z - povinné p edm ty, S - povinn volitelné p edm ty, PV - povinn volitelné p edm ty, F - volitelné p edm ty odborné, V - volitelné p edm ty, T - t lovýchovné p edm ty

Kódování zp sob zakon ení predm t (KZ/Z/ZK) a zkratk semestr (Z/L):

KZ - klasifikovaný zápo et, Z - zápo et, ZK - zkouška, L - letní semestr, Z - zimní semestr

íslo semestru: 1

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garantí (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-DML.21	Discrete Mathematics and Logic Eva Pernecká, Jitka Rybní ková, Francesco Dolce Eva Pernecká Eva Pernecká (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
BIE-LA1.21	Linear Algebra 1 Marzieh Forough Karel Klouda Marzieh Forough (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
BIE-PA1.21	Programming and Algorithmics 1 Jan Trávní ek, Ladislav Vagner, Radek Hušek, Josef Vogel Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+2R+2C	Z	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 Martin Novotný, Kate ina Hyniová, Matúš Oleksák Martin Novotný Martin Novotný (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-UOS.21	Unix-like Operating Systems Jan Trdli ka, Zden k Muziká , Jakub Žitný Zden k Muziká Zden k Muziká (Gar.)	KZ	5	2P+2C	Z	PP

íslo semestru: 2

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garantí (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-PSI.21	Computer Networks Yelena Trofimova, Michal Polák, Diana Prokopisina Yelena Trofimova Yelena Trofimova (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BIE-SAP.21	Computer Structures and Architectures Petr Fišer Petr Fišer Petr Fišer (Gar.)	Z,ZK	5	2P+1R+2C	L	PP
BIE-DBS.21	Database Systems Yelena Trofimova, Josef Pavlí ek Josef Pavlí ek Josef Pavlí ek (Gar.)	Z,ZK	5	2P+2R+1L	L	PP
BIE-MA1.21	Mathematical Analysis 1 Antonella Marchesiello Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BIE-PA2.21	Programming and Algorithmics 2 Jan Trávní ek, Ladislav Vagner, Radek Hušek, Josef Vogel Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+1R+2C	L	PP
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25 BIE-ZUM,BIE-ZRS,..... (pokra ování viz seznam skupin níže)	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V

íslo semestru: 3

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejich len) Vyu uující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-AG1.21	Algorithms and Graphs 1 Tomáš Valla, Dušan Knop, Maria Saumell Mendiola Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-AAG.21	Automata and Grammars Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-MA2.21	Mathematical Analysis 2 Antonella Marchesiello Tomáš Kalvoda Antonella Marchesiello (Gar.)	Z,ZK	6	3P+2C	Z	PP
BIE-APS.21	Architectures of Computer Systems Pavel Tvrđík, Michal Štepanovský Pavel Tvrđík Pavel Tvrđík (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-UKB.21	Introduction to Cybersecurity Ivana Trummová, David Pokorný, Jan B Iohoubek, Tomáš Rabas Róbert Lórencz Jan B Iohoubek (Gar.)	Z,ZK	5	3P+1C	Z	PS
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25 BIE-ZUM,BIE-ZRS,..... (pokra ování viz seznam skupin níže)	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V

íslo semestru: 4

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejich len) Vyu uující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-KAB.21	Cryptography and Security František Ková , David Pokorný, Róbert Lórencz, Ji í Bu ek, Jaroslav K íž, Filip Kodýtek Ji í Bu ek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	L	PP
BIE-OSY.21	Operating Systems Jan Trdli ka, Pavel Tvrđík, Michal Štepanovský Pavel Tvrđík Pavel Tvrđík (Gar.)	Z,ZK	5	2P+1R+1L	L	PP
BIE-EHA.21	Ethical Hacking Tomáš Kiezler, Martin Kolárik, Ji í Dostál Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	PS
BIE-BEK.21	Secure Code Josef Kokeš Josef Kokeš Josef Kokeš (Gar.)	Z,ZK	5	2P+2C	L	PS
BIE-ADU.21	Unix Administration Zden k Muziká , Petr Zemánek Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+2C	L	PS
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25 BIE-ZUM,BIE-ZRS,..... (pokra ování viz seznam skupin níže)	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V

íslo semestru: 5

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejich len) Vyu uující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-BPR.21	Bachelor Project Zden k Muziká Zden k Muziká (Gar.)	Z	1		Z,L	PP
BIE-PST.21	Probability and Statistics Francesco Dolce Pavel Hrabák Francesco Dolce (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-ASB.21	Applied Network Security František Ková , Yelena Trofimova, Ji í Dostál Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-ZSB.21	Basics of System Security Ji í Bu ek, Simona Forn sek, Marián Svetlík Simona Forn sek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-HWB.21	Hardware Security Ji í Bu ek, Filip Kodýtek Ji í Bu ek Ji í Bu ek (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25 BIE-ZUM,BIE-ZRS,..... (pokra ování viz seznam skupin níže)	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V

íslo semestru: 6

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu učící, auto i a garantí (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-BAP.21	Bachelor Thesis Zden k Muziká Zden k Muziká (Gar.)	Z	14		L,Z	PP
BIE-TDP.21	Documentation and Presentation Dana Vynikarová Dana Vynikarová Dana Vynikarová (Gar.)	KZ	3	2P+2C	Z,L	PP
BIE-EEC	English language external certificate Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	4		L	PP
BIE-IB-PV.21	Compulsory elective Courses of the Specialization Information Security, version 2021 BIE-TAB.21,BIE-ZUM.21,..... (pokra ování viz seznam skupin níže)	Min. p edm. 1 Max. p edm. 3	Min/Max 5/15			PV
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25 BIE-ZUM,BIE-ZRS,..... (pokra ování viz seznam skupin níže)	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V

Seznam skupin p edm t tohoto pr chodu s úplným obsahem len jednotlivých skupin

Kód	Název skupiny p edm t a kódy len této skupiny p edm t (specifikace viz zde nebo níže seznam p edm t)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-IB-PV.21	Compulsory elective Courses of the Specialization Information Security, version 2021	Min. p edm. 1 Max. p edm. 3	Min/Max 5/15			PV
BIE-TAB.21	Applications of Security in Tech ...	BIE-ZUM.21	Artificial Intelligence Fundamen ...	BIE-VES	Embedded Systems	
BIE-V.2021	Purely Elective Bachelor Courses, Version 2021 till 2024/25	Min. p edm. 0 Max. p edm. 15	Min/Max 0/55			V
BIE-ZUM	Artificial Intelligence Fundamen ...	BIE-ZRS	Basics of System Control	BIE-CCN	Compiler Construction	
BIE-SCE1	Computer Engineering Seminar I	BIE-SCE2	Computer Engineering Seminar II	BIE-CZ0	Czech Language for Foreigners	
BIE-CZ1.21	Czech Language for Foreigners II	UKCJP	eština pro pokro ilé	BIE-DIF	Differential equations	
BIE-EPR	Economic project	BIE-FTR.1	Financial Markets	BIE-HAS	Human Factors in Cryptography an ...	
BIE-CSI	Introduction to Computer Science	BIE-EHD	Introduction to European Economi ...	BIE-IMA	Introduction to Mathematics	
BIE-IMA2	Introduction to Mathematics 2	BIE-ST1	Network Technology 1	BIE-OOP	Object-Oriented Programming	
BIE-PKM	Preparatory Mathematics	BIE-PJV	Programming in Java	BIE-PS2	Programming in shell 2	
BIE-PRR.21	Project management	BIE-SKJ.21	Scripting Languages	BIE-VAK.21	Selected Combinatorics Applicati ...	
BIE-VMM	Selected Mathematical Methods	BI-SCE1	Seminá po ita ového inženýrství ...	BIE-SEG	Systems Engineering	
TVV	T lesná výchova	TVV0	T lesná výchova 0	TV2K1	T lesná výchova 2	
TVKLV	T lovýchovný kurz	BIE-TUR.21	User Interface Design	BIE-VR1.21	Virtual reality I	
BIE-ADW.1	Windows Administration	BIE-SEP	World Economy and Business	BIE-3DT.1	3D Printing	

Seznam p edm t tohoto pr chodu:

Kód	Název p edm tu	Zakon ení	Kredity
BI-SCE1	Seminá po ita ového inženýrství I Seminá po ita ového inženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub jí tématy íslicového návrhu, spolehlivosti a odolnosti proti poruchám a útok m. Ke student m se v rámci p edm tu p istupuje individuáln a každý student í skupinka student eší n jaké zajímavé aktuální téma s vybraným školitelem. Sou ástí p edm tu je práce s v deckými lánky a jinou odbornou literaturou a/nebo práce v laborato ích K N. Kapacita p edm tu je omezena možnostmi u ítel seminá e. Probíraná témata jsou pro každý semestr nová.	Z	4
BIE-3DT.1	3D Printing Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.	KZ	4

BIE-AAG.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-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-BAP.21	Bachelor Thesis	Z	14
BIE-BEK.21	Secure Code	Z,ZK	5
The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.			
BIE-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
P ed m t je ur en student m, které zajímá nejen matematická a technická stránka v ci, ale i p emýšlení nad tím, jestli výsledný produkt bude použitelný pro lidi (od t ch, kte í implementují šifry po uživatele aplikací). Studenti budou moci využít nabyté v domosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projekt v kontextu kybernetické bezpe nosti zam ené na lov ka.			
BIE-HWB.21	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. Students become familiar with the operating principles of cryptographic modules, 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 methods of efficient implementations of ciphers. Students are expected to have basic knowledge of computer security and cryptography, and basic programming skills before enrolling into the course			
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-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-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 Newton's 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 Landau's 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 Taylor's 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-OOP	Object-Oriented Programming	Z,ZK	4
Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handling, refactoring and design patterns.			
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-PJV	Programming in Java	Z,ZK	4
Tento kurz je prezentován v angli tin . Existuje ale také eská varianta BI-PJV a BIK-PJV.			
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-PRR.21	Project management	Z,ZK	5
The aim of the course is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, analysis, crisis management in a project, communication, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk assessment and management, Gantt charts, resource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for students who are interested in deepening their knowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in large companies. The course is also suitable for all those who will develop software or hardware in the form of team projects.			
BIE-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 K N 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 K N 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-SKJ.21	Scripting Languages	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-ST1	Network Technology 1	Z	3
P edm t je zam en na získání základních znalosti z oblasti po íta ových sítí a praktických zkušeností se sí ovými technologiemi. P edm t odpovídá látce kurikula Cisco Netacad programu - CCNA1 - R&S Introduction to Networks.			
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-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-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-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 pohledové znalosti oboru automatického řízení budou pro naše absolventy jistě konkurenční výhodou a zhodnotí je bezesporu v praxi. Studenti získají znalosti v dynamicky se rozvíjejícím oboru s velkou budoucností. Zaměřme se zejména na řízení inženýrských a fyzikálních systémů. Poskytneme vám základní informace z oblasti zpravidla lineárních dynamických jednorozměrných systémů. Seznámíme vás s metodami vytváření popisu a modelu systémů, základní analýzou lineárních dynamických systémů a návrhem a ověřením jednoduchých zpravidla PID, PSD a fuzzy regulátorů. Pozornost je věnována rovněž snímání a akčním členům v regulačních obvodech, otázkám stability regulačních obvodů, jednorázovému a průběžnému nastavování parametrů regulátorů a některým aspektům praxe realizací spojitého a diskrétního řízení. Jednotlivá témata přednášek jsou provázána množstvím užitečných příkladů a praktických praxí realizací.			
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.			
TV2K1	T lesná výchova 2	Z	1
TVKLV	T lovýchovný kurz	Z	0
TVV	T lesná výchova	Z	0
TVV0	T lesná výchova 0	Z	0
UKCJP	eština pro pokročilé	Z,ZK	2
Kurz pokračuje eštinou pro ukrajinské studenty, kteří mají status uprchlíka. Zkouška potvrdí znalost eštiny na úrovni B2 s platností pro VUT.			

Aktualizace výše uvedených informací naleznete na adrese <http://bilakniha.cvut.cz/cs/FF.html>

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