Studijní plán

Název plánu: Bachelor Specialization, Software Engineering, 2021

Sou ást VUT (fakulta/ústav/další): Fakulta informa ních technologií

Katedra:

Obor studia, garantovaný katedrou: Úvodní stránka

Garant oboru studia.:

Program studia: Informatics Typ studia: Bakalá ské prezen ní

P edepsané kredity: 155

Kredity z volitelných p edm t: 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:

Ing. Michal Valenta, Ph.D., email: michal.valenta@fit.cvut.cz

Název bloku: Povinné p edm ty programu

Minimální po et kredit 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 skupin musíte získat 110 kredit

Podmínka p edm ty skupiny: V této skupin musíte absolvovat 21 p edm t

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 cred	dits.		,	, ,	
Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-AG1.21	Algorithms and Graphs 1 Tomáš Valla, Michal Opler, Ji ina Scholtzová, 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-BPR.21	Bachelor Project Zden k Muziká Zden k Muziká (Gar.)	Z	1		Z,L	PP
BIE-BAP.21	Bachelor Thesis Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	14		L,Z	PP
BIE-PSI.21	Computer Networks Yelena Trofimova, Michal Polák Yelena Trofimova Yelena Trofimova (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BIE-SAP.21	Computer Structures and Architectures Petr Fišer, Hana Kubátová Petr Fišer Petr Fišer (Gar.)	Z,ZK	5	2P+1R+2C	L	PP
BIE-KAB.21	Cryptography and Security Ji í Bu ek, Martin Jure ek, Filip Kodýtek, Josef Kokeš, Jaroslav K íž, Róbert Lórencz, František Ková, David Pokorný Ji í Bu ek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	L	PP
BIE-DBS.21	Database Systems Josef Pavlí ek, Otto Šleger, Martin Urbanec Josef Pavlí ek Josef Pavlí ek (Gar.)	Z,ZK	5	2P+2R+1L	L	PP
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-TDP.21	Documentation and Presentation 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	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 Antonella Marchesiello Tomáš Kalvoda Tomáš Kalvoda (Gar.)	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 Michal Štepanovský, Jan Trdli ka, Pavel Tvrdík Pavel Tvrdík Pavel Tvrdík (Gar.)	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 Trávní ek, Ladislav Vagner, Josef Vogel Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+2R+2C	Z	PP
BIE-PA2.21	Programming and Algorithmics 2 Radek Hušek, Jan Trávní ek, Ladislav Vagner, Josef Vogel Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+1R+2C	L	PP
BIE-GIT.21	SW Development Technologies Petr Pulc Petr Pulc (Gar.)	Z	3	2P	Z	PP
BIE-TZP.21	Technological Fundamentals of Computers Kate ina 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 Trdli ka, Jakub Žitný, Zden k Muziká Zden k Muziká (Gar.)	KZ	5	2P+2C	Z	PP

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

BIF-AG1.21 Algorithms and Graphs 1 Z.ZK 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** 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** 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** 14 7 BIE-PSI.21 Computer Networks 5 Z,ZK 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. Computer Structures and Architectures 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 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 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. Discrete Mathematics and Logic 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. Documentation and Presentation 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 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

7.7K

5

Students will learn the basics of probabilistic thinking, the abile 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

7 7K

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

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

ΚZ

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 p edm ty specializace

Minimální po et kredit bloku: 40

Role bloku: PS

Kód skupiny: BIE-SI-PS.21

Název skupiny: Compulsory Courses of the Specialization Software Engineering, version 2021

Podmínka kredity skupiny: V této skupin musíte získat 40 kredit

Podmínka p edm ty skupiny: V této skupin musíte absolvovat 8 p edm t

Kredity skupiny: 40 Poznámka ke skupině:

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-KOM.21	Conceptual Modelling Robert Pergl Robert Pergl (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-IDO.21	Introduction to DevOps Tomáš Vondra, Zden k Rybola, Jakub Jab rek Tomáš Vondra Zden k Rybola (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-TJV.21	Java Technology Ond ej Rozinek Ond ej Rozinek (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-OOP.21	Object-Oriented Programming Filip K ikava, Petr Máj, Filip íha Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-PPA.21	Programming Paradigms Tomáš Pecka, Petr Máj, Tomáš Jakl Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+2R	Z	PS
BIE-SWI.21	Software Engineering Stanislav Kuznetsov, Zden k Rybola, Jakub Jab rek, Ond ej Rozinek Zden k Rybola Zden k Rybola (Gar.)	Z,ZK	5	2P+1C	L	PS

BIE-SP1.21	Team Software Project 1 Stanislav Kuznetsov, Zden k Rybola, Jakub Jab rek, Ond ej Rozinek Zden k Rybola Zden k Rybola (Gar.)	KZ	5	4C	L	PS
BIE-SP2.21	Team Software Project 2 Stanislav Kuznetsov, Zden k Rybola Zden k Rybola Zden k Rybola (Gar.)	KZ	5	2C	Z	PS

Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-SI-PS.21 Název=Compulsory Courses of the Specialization Software **Engineering, version 2021**

BIE-KOM.21 Conceptual Modelling Z,ZK

The course is focused on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key terms in a domain, the ability to categorize and specify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological structural modeling in the OntoUML notation. Next, they learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data representation in the Internet. They also learn the foundations of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO method and the BPMN notation will be taught. The course is designed with the respect to continuation in software implementations.

RIF-IDO 21 Introduction to DevOps Z.ZK

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

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-OOP.21 Object-Oriented Programming

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.

Programming Paradigms

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

BIF-SWI 21 Software Engineering

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 ΚZ

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.

Team Software Project 2

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.

Název bloku: Volitelné p edm ty oboru/specializace

Minimální po et kredit bloku: 0

Role bloku: VO

Kód skupiny: BIE-SI-VO.21

Název skupiny: Elective vocational Courses of the Bachelor Specialization Computer Science, ver. 2021

Podmínka kredity skupiny: Podmínka p edm ty skupiny:

Kredity skupiny: 0

Poznámka ke skupině:

i oznanika ke ske	3pme.					
Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-SPS.21	Administration of Computer Networks and Services Libor Dostálek, Jan Kubr Pavel Tvrdík Libor Dostálek (Gar.)	Z,ZK	5	2P+2S	Z	VO
BIE-AG2	Algorithms and Graphs 2 Ond ej Suchý	Z,ZK	5	2P+2C	L	VO
BIE-TAB.21	Applications of Security in Technology Jan B Iohoubek, Ji í Dostál, Maciej Skórski, Martin Pozd na Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	VO

BIE-ASB.21	Applied Network Security Yelena Trofimova, Ji í Dostál, František Ková, Martin Šutovský Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	Z	VO
BIE-APS.1	Architectures of Computer Systems Pavel Tvrdík	Z,ZK	5	2P+2C	Z	VO
BIE-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+2C	L	VO
BIE-ZRS.21	Basics of System Control Kate ina Hyniová Kate ina Hyniová (Gar.)	Z,ZK	5	2P+2C	Z,L	VO
BIE-ZSB.21	Basics of System Security Ji í Bu ek, Simona Forn sek, Martin Šutovský, Marián Svetlík Simona Forn sek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	Z	VO
BIE-TPS.21	Computer Networks Technologies Vladimír Smotlacha, Josef Koumar 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-VES	Embedded Systems Miroslav Skrbek	Z,ZK	5	2P+2C	L	VO
BIE-EHA.21	Ethical Hacking Ji í Dostál, Andrej Šimko, Martin Kolárik Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	vo
BIE-HWB	Hardware Security Ji í Bu ek	Z,ZK	5	2P+2C	Z	vo
BIE-IOT.21	Internet of Things Pavel Tvrdík, Viktor erný, Lenka Kosková T ísková Lenka Kosková T ísková Lenka Kosková T ísková (Gar.)	Z,ZK	5	2P+2C	Z	VO
BIE-UKB.21	Introduction to Cybersecurity Jan B Iohoubek, David Pokorný, Ivana Trummová, Tomáš Rabas, Tomáš Lu ák Jan B Iohoubek Jan B Iohoubek (Gar.)	Z,ZK	5	3P+1C	Z	VO
BIE-LA2.21	Linear Algebra 2 Karel Klouda, Marzieh Forough Karel Klouda Karel Klouda (Gar.)	Z,ZK	5	2P+2C	L	VO
BIE-LOG.21	Mathematical Logic Kate ina Trlifajová Kate ina Trlifajová (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 (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-PJP	Programming Languages and Compilers Jan Janoušek	Z,ZK	5	2P+1C	L	VO
BIE-SRC.21	Real-time systems Hana Kubátová, Ji í Vysko il 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 Alexandru Moucha, Mohamed Bettaz Pavel Tvrdík Mohamed Bettaz (Gar.)	Z,ZK	5	2P+2C	L	VO
BIE-ADU.1	Unix Administration Petr Zemánek	Z,ZK	5	2P+2C	L	VO
BIE-VDC.21	Virtualization and Data Centers Ji í Kašpar Ji í Kašpar Ji í Kašpar (Gar.)	Z,ZK	5	2P+2C	L	VO
BIE-AWD.21	Web and Database Server Administration Michal Valenta, Lukáš Ba inka Lukáš Ba inka Michal Valenta (Gar.)	Z,ZK	5	2P+2C	Z	vo

Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-SI-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	s to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administr	rated under the op	perating 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	d by practical hand	ls-on experience			
with real network infrast	ructure.					
BIE-AG2	Algorithms and Graphs 2	Z,ZK	5			
BIE-TAB.21	Applications of Security in Technology	Z,ZK	5			
The goal of the course i	s to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Stu	idents get a broad	der overview of			
cybersecurity applicatio	ns 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	s to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge ga	ined in course BI-	PSI with actual			
security applications like	e the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishi	ng the course stu	dent will get			
knowledge of security a	pplications in computer networks.					
BIE-APS.1	Architectures of Computer Systems	Z,ZK	5			
Students will learn the d	construction principles of internal architecture of computers with universal processors at the level of machine instructions. Sp	ecial emphasis is	given on the			
pipelined instruction pro	pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing					

not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of programs. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.

Artificial Intelligence Fundamentals 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.21 Basics of System Control 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 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. Z.ZK Computer Networks Technologies 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 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. **Embedded Systems** 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** 7.7K 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. Hardware Security **BIF-HWB** Z.ZK 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. BIF-LA2.21 Linear Algebra 2 Z.ZK 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. BIF-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. Methods of interfacing peripheral devices 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. **Network Programming** 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 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-PJP Programming Languages and Compilers** Z.ZK 5 Students master basic methods of implementation of common high-level programming languages. They get experience with the design and implementation of individual compiler parts for a simple programming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has a certain syntax into a target form and write a compiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but extends to all other programs for parsing and processing text in a language defined by a LL(1) grammar. BIE-SRC.21 Real-time systems Z.ZK 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

Studenti se nau í posuzovat a zohled ovat bezpe nostní rizika p i návrhu svého kódu a ešení v b žné inženýrské praxi. Od teorie modelování bezpe nostních rizik p istoupí k praxi, ve které si vyzkouší b h program pod nižšími oprávn ními a jak tato oprávn ní stanovovat, protože ne každý program musí nutn b žet s administrátorským oprávn ním. Budou také prakticky demonstrována rizika spojená s p ete ením bufferu. Dále se studenti budou krátce v novat zabezpe ení dat a jak toto zabezpe ení souvisí s databázovými systémy a webem. V záv ru se budou v novat útok m typu DoS (Denial of Service) a obran proti nim.

Selected Topics in Computer Networking

Z,ZK

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-ADU.1 Unix Administration Z,ZK

Students became familiar with the internal structure of Unix-like systems, with the administration of their basic subsystems and with the principles of their protection against unauthorized use. In the seminars they will verify the information from the lectures on real life examples from practice. They will understand the differences between user and administrator roles They gain theoretical and practical knowledge of tools for tracking, analyzing, debugging and securing systems, implementing and managing file systems, disk subsystems, processes, memory, network services, shared file systems, name services, remote access, and system boot.

BIE-VDC.21 Virtualization and Data Centers Z.ZK

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.

Web and Database Server Administration

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: Povinn volitelné p edm ty

Minimální po et kredit bloku: 5

Role bloku: PV

Kód skupiny: BIE-PV-SI.21

Název skupiny: Compulsory elective Courses of the Specialization Software Engineering, version 2021

Podmínka kredity skupiny: V této skupin musíte získat alespo 5 kredit (maximáln 15)

Podmínka p edm ty skupiny: V této skupin musíte absolvovat alespo 1 p edm t (maximáln 3)

Kredity skupiny: 5 Poznámka ke skupině:

	.р					
Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-EPP.21	Economic Business Processes Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	5	2P+2C	L	PV
BIE-PAI.21	Law and Informatics Dominik Vítek Dominik Vítek Zden k Ku era (Gar.)	ZK	5	2P+2C	L	PV

Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-PV-SI.21 Název=Compulsory elective Courses of the Specialization Software Engineering, version 2021

BIE-EPP.21 Economic Business Processes

The aim of the course is to present typical processes related to the usual life cycle of a company. The course focuses mainly on the basic economic and financial aspects of business in the market environment of the Czech Republic and the basics of management. In the course, students are acquainted with the typical phases of the company's life cycle, from the establishment of the company, through the management of property and capital structure, financing of the company, determining the cost function of the company and labor costs, to evaluating the financial health of the company and its eventual rehabilitation or termination.

BIE-PAI.21 Law and Informatics

The aim of the course is to introduce students into the basic legal instruments that they will encounter in their practice. Students will gain knowledge of doing business in the Czech Republic and will be alerted to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding contracts in real and Internet environment, will know their responsibilities in working with the Internet, will be familiar with the institutes of intellectual property law, and will be able to use commercial license types and open-source licenses. Emphasis will also be put on the legal protection of data on the Internet, the registration of Internet domains and protection against their misuse. Students will also be alerted to such behaviour in the field of IT that can be classified as criminal under the Czech law. The course will also include analyses of real cases from practice.

Název bloku: Volitelné p edm ty Minimální po et kredit 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 p edm ty skupiny:

Kredity skupiny: 0

Poznámka ke skupině:

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-ZUM	Artificial Intelligence Fundamentals Pavel Surynek	Z,ZK	4	2P+2C	L	V
BIE-ZRS	Basics of System Control Kate ina Hyniová	Z,ZK	4	2P+2C	L	V
BIE-CCN	Compiler Construction Christoph Kirsch Christoph Kirsch (Gar.)	Z,ZK	5	2P+1C	L	V
BIE-SCE1	Computer Engineering Seminar I	Z	4	2C	Z	V
BIE-SCE2	Hana Kubátová, Miroslav Skrbek Hana Kubátová Hana Kubátová (Gar.) Computer Engineering Seminar II	Z	4	2C	L	V
	Hana Kubátová, Ji í Vysko il Hana Kubátová Hana Kubátová (Gar.) Czech Language for Foreigners					
BIE-CZ0	Tomáš Houdek, Markéta Hofmannová, Ivana Vondrá ková, Petra Korfová Zden k Muziká Zden k Muziká (Gar.)	KZ	2	4C	Z,L	V
BIE-CZ1.21	Czech Language for Foreigners II Tomáš Houdek, Ivana Vondrá ková, Petra Korfová Zden k Muziká Zden k Muziká (Gar.)	KZ	2	4C	Z,L	V
UKCJP	eština pro pokro ilé Tomáš Houdek, Jakub Šenovský, Jakub Šolc, Adam Vostárek Zden k Muziká Zden k Muziká (Gar.)	Z,ZK	2	2BP+2BC	Z,L	V
BIE-DIF	Differential equations Antonella Marchesiello, Ond ej Bouchala, Jan Valdman Tomáš Kalvoda Ond ej Bouchala (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-EPR	Economic project Tomáš Evan Tomáš Evan (Gar.)	Z	1		L	V
BIE-FTR.1	Financial Markets Pavla Vozárová	Z,ZK	5	2P+2C	L	V
BIE-HAS	Human Factors in Cryptography and Security Ivana Trummová Ivana Trummová Ivana Trummová (Gar.)	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	Z,ZK	3	2P+1C	L	V
FITE-EHD	Tomáš Evan Tomáš Evan (Gar.) Introduction to European Economic History	Z,ZK	3	2P+1C	L	V
BIE-IMA	Tomáš Evan Introduction to Mathematics	Z	4	3C	Z	V
BIE-IMA2	Karel Klouda Introduction to Mathematics 2	Z	2	1C	Z	V
BIE-ST1	Karel Klouda Network Technology 1	Z	3	2C	Z	V
BIE-OOP	Alexandru Moucha Alexandru Moucha (Gar.) Object-Oriented Programming	Z,ZK	4	2P+2C	Z	V
BIE-PKM	Filip K ikava Preparatory Mathematics	Z,Z1	4	21 120	Z	
	Jitka Rybní ková Tomáš Kalvoda (Gar.) Programming in Java		-	00.00		
BIE-PJV	Jan Blizni enko Jan Blizni enko Jan Blizni enko (Gar.) Programming in shell 2	Z,ZK	4	2P+2C	Z	V
BIE-PS2	Lukáš Ba inka	Z,ZK	4	2P+2C	L	V
BIE-PRR.21	Project management David Pešek David Pešek David Pešek (Gar.)	Z,ZK	5	2P+2C	Z,L	V
BIE-SKJ.21	Scripting Languages Jan Z árek, Lukáš Ba inka Lukáš Ba inka Jan Ž árek (Gar.)	Z,ZK	4	2P+2C	L	V
BIE-VAK.21	Selected Combinatorics Applications Michal Opler, Dušan Knop Michal Opler Michal Opler (Gar.)	Z	3	2R	L	V
BIE-VMM	Selected Mathematical Methods Marzieh Forough Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
BI-SCE1	Seminá po íta ového inženýrství l Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
BIE-SEG	Systems Engineering Christoph Kirsch Christoph Kirsch (Gar.)	Z	0	2C	Z	V
TVV	T lesná výchova	Z	0	0+2	Z,L	V
TVV0	T lesná výchova 0	Z	0	0+2	Z,L	V
TV2K1	T lesná výchova 2	Z	1		L,Z	V
TVKLV	T lovýchovný kurz	Z	0	7dní	L	V
BIE-TUR.21	User Interface Design Jan Schmidt Jan Schmidt Jan Schmidt (Gar.)	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 Ji í Kašpar, Miroslav Prágl Miroslav Prágl (Gar.)	Z,ZK	4	2P+1C	Z	V
FITE-SEP	World Economy and Business Tomáš Evan	Z,ZK	4	2P+2C	Z	V

BIE-SEP	World Economy and Business Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+2C	Z	V
BIE-3DT.1	3D Printing Marek Žehra	KZ	4	3C	L	V
Charakteristiky p edn 2024/25	net této skupiny studijního plánu: Kód=BIE-V.2021 Název=Pu	rely Elective	Bachelo	r Courses	s, Version	2021 till
	ificial Intelligence Fundamentals			1	,ZK	4
	e fundamental problems in the Artificial Intelligence, and the basic methods for their so stems, game theory, planning, and machine learning. Modern soft-computing methods	_	-			
be presented as well.	stems, game theory, planning, and machine learning. Modern soft-computing methods	s, including the ev	olutional y	aigoriiriis ari	u ille fleurai	HELWOIKS, WIII
•	sics of System Control			Z	,ZK	4
	ení systém je ur en pro všechny zájemce o aplikovanou informatiku v bakalá ském s					
	st konkuren ní výhodou a zhodnotí je bezesporu v pr myslové praxi. Studenti získaj ení inženýrských a fyzikálních sysém . Poskytneme vám základní informace z oblasti	-	-			
· ·	netodami vytvá ení popisu a modelu systém , základní analýzou lineárních dynamick	-		·=		- 1
PID, PSD a fuzzy regulátor .	Pozornost je v nována rovn ž sníma m a ak ním len m v regula ních obvodech, o	otázkám stability r	egula ních	obvod , jedn	orázovému a	pr b žnému
	átoru a n kterým aspekt m pr myslových realizací spojitých a íslicových regulátor .	Jednotlivá témata	a p ednášel	cjsou prováze	ena množstv	ím užite ných
p íklad a praktických pr my BIE-CCN Co	mpiler Construction			7	,ZK	5
	on compiler construction on compiler construction for bachelor students in computer science. The goal of the cl	lass is to introduc	e basic prir			
	mplementation of programming languages. Seeing and actually understanding self-cor					
	mputer Engineering Seminar I				Z	4
I -	igineering is a (s)elective course for students who want to deal with deeper topics of dig within the subject. Each student or group of students solves some interesting topic wit	-	-			
	al literature and/or work in K_N laboratories. The capacity of the subject is limited by t					
semester.		,				
!	mputer Engineering Seminar II				Z	4
•	igineering is a (s)elective course for students who want to deal with deeper topics of dig	-	-			
	within the subject. Each student or group of students solves some interesting topic wit al literature and/or work in K N laboratories. The capacity of the subject is limited by t			-		
semester.						
ļ ·	ech Language for Foreigners				KZ	2
	offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / St	tudy, Travel, Time	, Family.		V7	0
	ech Language for Foreigners II tudents of English programmes who have completed BIE-CZ0 course or have basic kr	nowledge of the C	zech langu		KZ rse further e	2 xpands the
	s the structure of the Czech language structure with regard to the practical needs of S	-	_	-		
	ština pro pokro ilé			Z	,ZK	2
	rajinské studenty, kte í mají status uprchlíka. Zkouška potvrdí znalost eštiny na úrovi	ni B2 s platnosti p	oro VUT.	7	,ZK	5
	ferential equations ational overview of differential equations, starting with basic motivation and examples of	f ODEs and progre	essing to es			-
	n existence and uniqueness establish when solutions can be guaranteed. Linear and		-			-
	by examples of non-linear models such as predator-prey and epidemiological models				-	
ļ.•	(PDEs) extends these concepts to multi-variable contexts. The course will also cover r Runge-Kutta methods, and finite element methods for both ODEs and PDEs.	iumencai metnod	S IOI SOIVIN	y ODES and I	PDES, INCIUA	ing implicit
BIE-EPR Ec	onomic project				Z	1
	of the course Introduction to European Economic History (BIE-EHD).					
	ancial Markets				,ZK	5
	eply transformed in the recent years, which led to a development of structured financi ties. The need to use and properly apply mathematical and technical tools is emphasi.		-			
	nave sufficient knowledge ICT and mathematics, and who have at the same time an ur	•			•	·
Ť	es both a description of financial markets and related economic theories, and an overv	view of mathemati	cal and sta			
	man Factors in Cryptography and Security které zajímá nejen matematická a technická stránka v ci, ale i p emýšlení nad tím, jestli	المارية معرض أرمام ماريانة	ساده مادره		,ZK	5
	tudenti budou moci využít nabyté v domosti z tohoto kurzu k návrhu, plánování a ana					
zam ené na lov ka.	, , ,		. ,			'
	oduction to Computer Science				Z	2
· · · · · · · · · · · · · · · · · · ·	on Elementary Computer Science for broad audiences: bachelor students in computer s, anybody with a background in basic math and the desire to understand the absolut					
=	computer science for students to understand, early on, what computer science is, wh	· · · · · · · · · · · · · · · · · · ·		_		
	even how, on a basic yet representative and practically relevant level. After taking the c	· -				
	about themselves such as which courses to take next and which books to follow up w	vith, ideally realizi	ng if they a	re interested	in computer	science more
than expected, or even less to BIE-EHD Into	roduction to European Economic History			7	,ZK	3
	oduction to European Economic history ection of themes from European economic history. It gives the student basic knowledge	e about forming of	the global			_
	ropean countries have been dominant actors in this process it focuses predominantly	-	-	-	-	-
•	gmentation of the Middle Ages, from the destruction of WWII to the current affairs, the	•			•	
	etailed economic history of particular European countries but rather the impact of trade onsist of a mixture of lectures and discussions.	e and the role of p	particular ev	ents, instituti	ons and orga	anizations in
motory. Class meetings will t	onoide of a mineuro of footation and discussions.					

FITE-EHD	Introduction to European Economic History	Z,ZK	3
	a selection of themes from European economic history. It gives the student basic knowledge about forming of the global econo s European countries have been dominant actors in this process it focuses predominantly on their roles in economic history.		
	e fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial	•	
· · · · · · · · · · · · · · · · · · ·	he detailed economic history of particular European countries but rather the impact of trade and the role of particular events,		
history. Class meetings	will consist of a mixture of lectures and discussions.		
BIE-IMA	Introduction to Mathematics	Z	4
	tend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they a	re able to apply th	em in particular
examples.			
BIE-IMA2	Introduction to Mathematics 2	Z	2
examples.	tend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they a	re able to apply th	em in particular
BIE-ST1	Network Technology 1	Z	3
	získání základních znalosti z oblasti po íta ových sítí a praktických zkušeností se sí ovými technologiemi. P edm t odpovíd	. – .	- 1
	kamp;S Introduction to Networks.		
BIE-OOP	Object-Oriented Programming	Z,ZK	4
Object-oriented progran	nming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together		ssing. 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 device.	elopment including	g testing, error
handing, refactoring and			
BIE-PKM	Preparatory Mathematics	Z	4
	tory Mathematics is to help students revise the most important topics of high-school mathematics.		
BIE-PJV	Programming in Java	Z,ZK	4
-	ng in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java	a language the fur	ndamental APIs
· · · · · · · · · · · · · · · · · · ·	especially data structures, files, GUI, networking, databases and concurrent APIs.	7 71/	4
BIE-PS2	Programming in shell 2 programming languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ac	Z,ZK	4
	and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmu		1
	even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp.		
	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 se	•	
techniques used in prac	tice.		
BIE-PRR.21	Project management	Z,ZK	5
	to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, an	-	-
•	argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk		-
	schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for state of the course		
· -	dge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in I e who will develop software or hardware in the form of team projects.	arge companies.	The course is
BIE-SKJ.21	Scripting Languages	Z,ZK	4
	e world of scripted programming. Together, we will unveil the power of Bourne Again shell and PERL as proven industry stand		•
	g utilities (AWK, sed), with some basic UNIX system tools, in many real-world situations like processing web feeds or logs. W		
of scripting languages a	nd introduction into their pros and cons and students get practical experience with shell script programming. We will touch al	so ROFF, PerlDoc	, and even TeX
-	how your code documentation can be implemented. And if you know UNIX system-level scripting already, we can show you a		
•	poked frequently but increase code robustness or execution efficiency. The course is led by two veteran programmers in the sc		
	ell programming, teaching developers from the IT industry in several CE countries. Jan is a skilled lecturer and developer who	ose code contribu	tes to safe and
BIE-VAK.21	f cloud service datacenters around the globe.	7	3
	Selected Combinatorics Applications duce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the	Z	-
	to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms and introduce some basic knowledge needed to design and analyze algorithms are also allows and a second and a second analyze algorithms are also allows and a second and a second analyze algorithms are also allows and a second analyze algorithms.		
	tion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical)		
will select problems to b	e solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optim	ization and more.	Students will
also try to implement so	lutions to the studied problems with a special focus on the effective use of existing tools.		
BIE-VMM	Selected Mathematical Methods	Z,ZK	4
· ·	an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then		
	ntroduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the	wavelet transform	n. We examine
	problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples.	7	4
BI-SCE1	Seminá po íta ového inženýrství l	Z Z	4 majútok m Ko
	nženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odoln edm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školitel		
	u odbornou literaturou a/nebo práce v laborato ích K. N. Kapacita p edm. tu je omezena možnostmi u itel. seminá e. Probíra		
nová.	a constitution and a constitutio	a toata jood p	o nazay 55551.
BIE-SEG	Systems Engineering	Z	0
	lass on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles		-
to understand processo	r and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking	ng the class, stud	ents are able to
	be between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what con	ncurrency is, as o	pposed to
	ocesses and threads synchronize efficiently to overcome concurrency for communication.		
TVV	T lesná výchova	Z	0
TVV0	T lesná výchova 0	Z	0
TV2K1	T lesná výchova 2	Z	1
TVKLV	T lovýchovný kurz	Z	0
BIE-TUR.21	User Interface Design	Z,ZK	5
=	verview of methods for designing and testing common user interfaces. They get experience to solve the problems where soft	· ·	
	ser optimally, since the needs and characteristics of users are not taken into account during product development. Students	gain an overview	of methods that
pring users into the devi	elopment process to ensure optimal interface for them.		

BIE-VR1.21 Virtual reality I 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 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 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. World Economy and Business Z,ZK 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. 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.

Seznam p edm t tohoto pr chodu:

udents are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions of egular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between formal languages and automata. Anowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation, and design of digital circuits. BIE-ADU.1 Unix Administration Z,ZK 5 udents became familiar with the internal structure of Unix-like systems, with the administration of their basic subsystems and with the principles of their protection against unauthorized use. In the seminars they will verify the information from the lectures on real life examples from practice. They will understand the differences between user and administrator roles. They will understand the differences between user and administrator roles. They will understand the administration against unauthorized use. In the seminars they will verify the information from the lectures on real life examples from practice. They will understand the differences between user and administrator roles. They will understand the administration against unauthorized uses. In the seminars they will verify the information from the lectures on real life examples and security to a security tools and papely advanced ActiveDirectory administration. BIE-ADW.1 Windows Administration Windows Administration Windows Administration Windows Administration Windows Administration of a computer network. BIE-AG1.21 Algorithms and Graphs 1 Algorithms and Graphs 1 Algorithms and Graphs 2 Applie	Kód	Název p edm tu	Zakon ení	Kredity
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BIE-AAG.21 Automata and Grammars	BIE-3DT.1	3D Printing	KZ	4
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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 the concurrent BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed for time and space complexity of algorithms and learn to handle practically the asymptotic mathematics. BIE-AG2 Algorithms and Graphs 2 Z,ZK 5 BIE-APS.1 Architectures of Computer Systems Z,ZK 5 Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing to only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of programs. The course further elaborates the principles and architectures of shared memory multiprocessors and multicore systems and the memory coherence and consistency in such systems. BIE-ASB.21 Applied Network Security he 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 udents 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		heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.		
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			. ,	
ekteré si vyzkouší b h program pod nižšími oprávn ními a jak tato oprávn ní stanovovat, protože ne každý program musí nutn b žet s administrátorským oprávn ním. Budou také		·		

prakticky demonstrována rizika spojená s p ete ením bufferu. Dále se studenti budou krátce v novat zabezpe ení dat a jak toto zabezpe ení souvisí s databázovými systémy a webem.

V záv ru se budou v novat útok m typu DoS (Denial of Service) a obran 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 s	tudent will perform	during the			
DIE OON	semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.	7.71				
BIE-CCN	Compiler Construction uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles	Z,ZK	5 udents to			
	and the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching					
BIE-CSI	Introduction to Computer Science	Z	2			
	ory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fi	elds but interested				
-	ool students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The g					
•	rinciples of computer science for students to understand, early on, what computer science is, why things such as high-level program / are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer no					
	questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interest					
	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, Tim					
BIE-CZ1.21	Czech Language for Foreigners II	KZ	2			
	ended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The cocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the		pands the			
BIE-DBS.21	Database Systems	Z,ZK	5			
	ainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (1 ' 1	-			
	model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theorem					
model. They will ge	et acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction pro	-	l of parallel			
BIE-DIF	user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database r		5			
	Differential equations as a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential s	Z,ZK plution methods like	-			
•	theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered wi					
	rsis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world application	· · · · · · · · · · · · · · · · · · ·				
partial differential	equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs	and PDEs, includi	ng implicit			
BIE-DML.21	and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs. Discrete Mathematics and Logic	Z,ZK	5			
	positive wathermatics and Logic cquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts fro		-			
=	paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course	=				
	combinatorics and number theory, with emphasis on modular arithmetics.					
BIE-EEC	English language external certificate se can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in Engli	ch comparable to o	4			
THE BIL-LOC COUR	the B2 level of the Common European Framework of Reference for Languages.	on comparable to o	rexceeding			
BIE-EHA.21	Ethical Hacking	Z,ZK	5			
	ourse is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vuln					
exploitation in con	nputer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is vulnerabilities testing and the following process of penetration test documentation.	on hands-on expe	rience with			
BIE-EHD	Introduction to European Economic History	Z,ZK	3			
	ces a selection of themes from European economic history. It gives the student basic knowledge about forming of the global economy					
	ods. As European countries have been dominant actors in this process it focuses predominantly on their roles in economic history. Fro					
•	re to the fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial in					
course does not c	over the detailed economic history of particular European countries but rather the impact of trade and the role of particular events, in history. Class meetings will consist of a mixture of lectures and discussions.	stitutions and orgar	nizations in			
BIE-EPP.21	Economic Business Processes	Z,ZK	5			
	irse is to present typical processes related to the usual life cycle of a company. The course focuses mainly on the basic economic and					
	ronment of the Czech Republic and the basics of management. In the course, students are acquainted with the typical phases of the					
establishment of th	ne company, through the management of property and capital structure, financing of the company, determining the cost function of the evaluating the financial health of the company and its eventual rehabilitation or termination.	e company and lab	or costs, to			
BIE-EPR	Economic project	Z	1			
DIL-LI IX	This course is an extension of the course Introduction to European Economic History (BIE-EHD).	_	'			
BIE-FTR.1	Financial Markets	Z,ZK	5			
	has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view or					
-	rket activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activition ools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of fin	=	-			
	se thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistic					
BIE-GIT.21	SW Development Technologies	Z	3			
This course is aim	ed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students t		on manager			
DIE IIAO	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 tudent m, které zajímá nejen matematická a technická stránka v ci, ale i p emýšlení nad tím, jestli výsledný produkt bude použitelný pro	Z,ZK	5 mplementují			
=	aplikací). Studenti budou moci využít nabyté v domosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projekt v konte	·				
	zam ené na lov ka.					
BIE-HWB	Hardware Security	Z,ZK	5			
	s with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar wit					
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	٠, ٠				
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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 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 BIF-IMA2 Introduction to Mathematics 2 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 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). Computer Units Z,ZK 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. BIF-KAB.21 Cryptography and Security Z,ZK 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.21 Conceptual Modelling The course is focused on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key terms in a domain, the ability to categorize and specify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological structural modeling in the OntoUML notation. Next, they learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data representation in the Internet. They also learn the foundations of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO method and the BPMN notation will be taught. The course is designed with the respect to continuation in software implementations. 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. BIF-LA2.21 Linear Algebra 2 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 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. Mathematical Analysis 2 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-MPP.21 Methods of interfacing peripheral devices 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 Object-Oriented Programming Z,ZK Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handing, refactoring and design patterns. BIE-OOP.21 Object-Oriented Programming Z,ZK 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
	construct algorithms for solving basic problems and write them in the C language. They master data types (simple, pointers, structure esented in C language. They understand the principle of recursion and basics of algorithm complexity analysis. They know fundamen		
and functions pr	sorting, and manipulating linked lists and trees.	iai aigoritiiris ioi si	earching,
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, que	eue, enlargeable ari	ray, list, set,
table). They lear	rn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e	e.g., template progr	amming,
DIE DALO4	copying/moving of objects, operator overloading, inheritance, polymorphism).	71/	
BIE-PAI.21	Law and Informatics urse is to introduce students into the basic legal instruments that they will encounter in their practice. Students will gain knowledge of	ZK	5 the Czech
	ill be alerted to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding co	-	
environment, will k	know their responsibilities in working with the Internet, will be familiar with the institutes of intellectual property law, and will be able to	use commercial lic	ense types
	icenses. Emphasis will also be put on the legal protection of data on the Internet, the registration of Internet domains and protection a	-	
BIE-PJP	rted to such behaviour in the field of IT that can be classified as criminal under the Czech law. The course will also include analyses of Programming Languages and Compilers	Z,ZK	5
_	asic methods of implementation of common high-level programming languages. They get experience with the design and implementat	, , , , , , , , , , , , , , , , , , ,	-
	amming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has		
form and write a co	ompiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but	extends to all other	er programs
DIE DIV	for parsing and processing text in a language defined by a LL(1) grammar.	7 71/	
BIE-PJV	Programming in Java Imming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java la	Z,ZK	4 nental APIs
The course i rogia	will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.	riguage the fandan	nentar / trib
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 ov	verview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the and implementation technologies FPGA and ASIC.	basics of the VHDL	_ language,
BIE-PPA.21	Programming Paradigms	Z,ZK	5
	s with basic paradigms of high-level programming languages, including their basic execution models, benefits, and limitations of partic		
	digm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The		
on lambda calculu	is and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstr such as C++ and Java.	eam programming	languages
BIE-PRR.21	Project management	Z,ZK	5
	purse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, anal		_
	cation, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk as	sessment and mar	nagement,
	ource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for st		
	nowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in lar		
deepening their k	cnowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in lar also suitable for all those who will develop software or hardware in the form of team projects.	ge companies. The	course is
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BIE-SEP World Economy and Business Z,ZK 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** 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 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 ΚZ 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 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 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 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 Ζ 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 odpovída látce kurikula Cisco Netacad programu - CCNA1 - R&S Introduction to Networks. Software Engineering 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. **Documentation and Presentation** BIF-TDP21 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. Java Technology 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 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 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 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.

SIE-UVD.2.1 The course area on the medium services and the production of the produc		1/7
systems for computers and their revolves and clusters. The most popular OS study, Android, has a unix bernef. Students give overwine of basic properties of this OS family, such as provision to utilize powerful system took that are available to usen, but an allocation to usen, but are allocated to any about to using the universe of the provision of the provision of the provision to usen, but are available to usen, but are allocated to any about to using the universe propriety of the provision of	BIE-UOS.21 Unix-like Operating Systems	KZ 5
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The counters aims to introduce students in an accessable form to violuse branches of theoretical computer science and commitmations, in contrast to the basic counters, we approach the lasses from applications to theory. Together we will be called problems are subject problems and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will be called problems are subject problems and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will be control to a solid problems of the problems of the problems of the problems of the problems from various areas of (not only theoretical) informatics. Areas from which we will be control to be subject to be subject to the subject problems and easily the problems of t		
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	Kurz pokro ilé eštiny pro ukrajinské studenty, kte í mají status uprchlíka. Zkouška potvrdí znalost eštiny na úrovní B2 s platností p	oro VUT.	

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