Study plan

Name of study plan: Bachelor Specialization, Information Security, 2021

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch: Program of study: Informatics Type of study: Bachelor full-time

Required credits: 155
Elective courses credits: 25
Sum of credits in the plan: 180

Note on the plan: 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:

prof. Ing. Róbert Lórencz, CSc., Email: robert.lorenz@fit.cvut.cz

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 110

The role of the block: PP

Code of the group: BIE-PP.21

Name of the group: Compulsory Courses of Bachelor Study Program Informatics, version 2021

Requirement credits in the group: In this group you have to gain 110 credits

Requirement courses in the group: In this group you have to complete 21 courses

Credits in the group: 110

Note on the group: If you plan to profile yourself in the specialization Information Security, Computer Networks and Internet,
Computer Systems and Virtualization, or Software Engineering, enroll in the course BIE-PSI.21 in your 2nd
semester of study. If you plan to profile yourself in the specialization Computer Engineering, or Computer
Science, enroll in the course BI-PSI.21 in your 4th semester of study. - On the basis of the certificate of
knowledge of English at the B2 level, which is stated in the conditions for admission to study, you can have

the subject BIE-EEC recognized for 4 credits.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-AG1.21	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 (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 (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, Ivana Trummová, 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 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

Characteristics of the courses of this group of Study Plan: Code=BIE-PP.21 Name=Compulsory Courses of Bachelor Study Program Informatics, version 2021

BIE-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. **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** 7 14 BIE-PSI.21 Computer Networks Z,ZK 5 The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS. BIE-SAP.21 Computer Structures and Architectures Z.ZK 5 Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools. BIE-KAB.21 Cryptography and Security Z.ZK 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. Z,ZKBIE-DBS.21 **Database Systems** 5 Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (including integrity constraints) using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoretical basis - relational database model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction processing and control of parallel user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database models. 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. BIE-TDP.21 **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. English language external certificate BIF-FFC 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. Z,ZK BIF-LA1.21 Linear Algebra 1 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 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.

Operating Systems

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.

Probability and Statistics

Students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods for testing statistical hypotheses and determining

BIF-PA1 21 Programming and Algorithmics 1 Z,ZK

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

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).

SW Development Technologies

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.

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

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.

Name of the block: Compulsory courses in the specialization

Minimal number of credits of the block: 40

The role of the block: PS

Code of the group: BIE-IB-PS.21

Name of the group: Compulsory Courses of Specialization Information Security, version 2021

Requirement credits in the group: In this group you have to gain 40 credits

Requirement courses in the group: In this group you have to complete 8 courses

Credits in the group: 40

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-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	PS
BIE-APS.21	Architectures of Computer Systems Michal Štepanovský, Pavel Tvrdík Pavel Tvrdík Pavel Tvrdík (Gar.)	Z,ZK	5	2P+2C	Z	PS
BIE-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	PS
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	PS
BIE-HWB.21	Hardware Security Ji í Bu ek, Filip Kodýtek Ji í Bu ek Ji í Bu ek (Gar.)	Z,ZK	5	2P+2C	Z	PS

BIE-UKB.21	Introduction to Cybersecurity Jan B Iohoubek, Ivana Trummová, David Pokorný, Tomáš Rabas, Tomáš Lu ák Jan B Iohoubek Jan B Iohoubek (Gar.)	Z,ZK	5	3P+1C	Z	PS
BIE-BEK.21	Secure Code Josef Kokeš Josef Kokeš (Gar.)	Z,ZK	5	2P+2C	L	PS
BIE-ADU.21	Unix Administration Zden k Muziká . Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+2C	L	PS

Characteristics of the courses of this group of Study Plan: Code=BIE-IB-PS.21 Name=Compulsory Courses of Specialization Information Security, version 2021

BIE-ASB.21 Applied Network Security

Z,ZK

5

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

BIE-APS.21 Architectures of Computer Systems

Z,ZK

Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of the program. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.

BIE-ZSB.21 Basics of System Security

Z,ZK

5

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

BIE-EHA.21 Ethical Hacking

7*V*

5

The goal of the course is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vulnerabilities, and their possible exploitation in computer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is on hands-on experience with vulnerabilities testing and the following process of penetration test documentation.

BIE-HWB.21 Hardware Security

'.7K

5

The course deals with hardware resources used to ensure security of computer systems including embedded ones. Students become familiar with the operating principles of cryptographic modules, security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand methods of efficient implementations of ciphers. Students are expected to have basic knowledge of computer security and cryptography, and basic programming skills before enrolling into the course.

BIE-UKB.21 Introduction to Cybersecurity

Z.ZK

5

The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.

BIE-BEK.21 Secure Code

Z,ZK

5

The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.

BIE-ADU.21 Unix Administration

Z.ZK

5

Students will learn the internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will understand the differences between user and administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file systems, disk subsystems, processes, memory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge from the lectures on specific examples from practice.

Name of the block: Elective vocational courses in the branch/specialization

Minimal number of credits of the block: 0

The role of the block: VO

Code of the group: BIE-IB-VO.21

Name of the group: Elective vocational Courses of the Bachelor Specialization Information Security, 2021

Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-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-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek 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-TPS.21	Computer Networks Technologies Vladimír Smotlacha, Josef Koumar Vladimír Smotlacha Vladimír Smotlacha	Z.ZK	5	2P+2C	Z	VO
	(Gar.)				_	
BIE-JPO	Computer Units Pavel Kubalík	Z,ZK	5	2P+2C	Z	VO
BIE-KOM	Conceptual Modelling Robert Pergl	Z,ZK	5	2P+2C	Z	VO
BIE-VES	Embedded Systems Miroslav Skrbek	Z,ZK	5	2P+2C	L	VO
BIE-IOT.21	Internet of Things Pavel Tvrdík, Viktor erný, Lenka Kosková Tísková Lenka Kosková Tísková Lenka Kosková Tísková (Gar.)	Z,ZK	5	2P+2C	Z	VO
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	VO
BIE-TJV.21	Java Technology Ond ej Rozinek Ond ej Rozinek (Gar.)	Z,ZK	5	2P+2C	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-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	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-PPA	Programming Paradigms Petr Máj	Z,ZK	5	2P+2C	Z	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-VPS.21	Selected Topics in Computer Networking Alexandru Moucha, Mohamed Bettaz Pavel Tvrdík Mohamed Bettaz (Gar.)	Z,ZK	5	2P+2C	L	VO
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	VO
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	VO
BIE-SP2.21	Team Software Project 2 Stanislav Kuznetsov, Zden k Rybola Zden k Rybola Zden k Rybola (Gar.)	KZ	5	2C	Z	VO
BIE-VDC.21	Virtualization and Data Centers Jií Kašpar Jií 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

Characteristics of the courses of this group of Study Plan: Code=BIE-IB-VO.21 Name=Elective vocational Courses of the Bachelor Specialization Information Security, 2021

Specialization Info	ormation Security, 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	e course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained	by practical hand	ls-on experience
with real network infrast	ructure.		
BIE-AG2	Algorithms and Graphs 2	Z,ZK	5
BIE-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5
Students are introduced	to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the clas	ssical tasks from the	ne areas of state
space search, multi-age	ent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algori	thms and the neur	ral networks, will
be presented as well.			
BIE-ZRS.21	Basics of System Control	Z,ZK	5
The course gives an int	oduction 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 dynami	cal single-input-single-output systems. Students will learn the methods of creating descriptions of system models, basic linea	ar dynamic system	ns analysis, and
design and verification of	of simple feedback PID, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of	stability of control	l systems, single
and continuous adjustm	ent of the controller parameters, and certain aspects of the industrial implementations of continuous and digital controllers.		
BIE-TPS.21	Computer Networks Technologies	Z,ZK	5
The course introduces s	students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the phys	ical layer with the	overlap to the
link layer. The lectures p	provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies	nologies will be de	monstrated and
with the most important	ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks, Eth	ernet, modern wir	reless networks,
always with focus on high	gh-speed networks.		
BIE-JPO	Computer Units	Z,ZK	5
Students know the inter	nal structure and organization of computer or processor components and their interfacing with the environment. They unders	tand the organiza	tion of main

memory and other internal memories (addressable, LIFO, FIFO and CAM). They know the organization of an arithmetic unit. They learn the design methodology for control units and

controllers, as well as basic principles of communication with peripheral devices and buses. They understand the architecture of a bus system.

BIE-KOM Conceptual Modelling The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations. 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. BIF-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-IDO.21 Z.ZK Introduction to DevOps 5 The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice. BIE-TJV.21 Java Technology 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-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. 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 BIE-SIP.21 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-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. Practical Digital Design 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-PPA Programming Paradigms** Z.ZK 5 Real-time systems BIF-SRC 21 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. BIF-VPS 21 Selected Topics in Computer Networking 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. 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.

Team Software Project 1

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 ΚZ

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-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.

BIE-AWD.21 Web and Database Server Administration Z,ZK

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.

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 5

The role of the block: PV

Code of the group: BIE-IB-PV.21

Name of the group: Compulsory elective Courses of the Specialization Information Security, version 2021

Requirement credits in the group: In this group you have to gain at least 5 credits (at most 15)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)

Credits in the group: 5 Note on the group:

	·					
Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-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	PV
BIE-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+2C	L	PV
BIE-VES.21	Embedded Systems Miroslav, Skrbek, Miroslav, Skrbek (Gar.)	Z,ZK	5	2P+2C	L	PV

Characteristics of the courses of this group of Study Plan: Code=BIE-IB-PV.21 Name=Compulsory elective Courses of the Specialization Information Security, version 2021

BIF-ZUM.21 Artificial Intelligence Fundamentals Z,ZK 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-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. **Embedded Systems** Z,ZK

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.

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: BIE-V.2021

Name of the group: Purely Elective Bachelor Courses, Version 2021 till 2024/25

Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0 Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members)	Completion	Credits	Scope	Semester	Role
DIE ZUM	Tutors, authors and guarantors (gar.) Artificial Intelligence Fundamentals	7 71/	4	20.20		
BIE-ZUM	Pavel Surynek	Z,ZK	4	2P+2C	L	V
BIE-ZRS	Basics of Systems 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 Hana Kubátová, Miroslav Skrbek Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	Z	V
BIE-SCE2	Computer Engineering Seminar II Hana Kubátová, Ji í Vysko il Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L	V
BIE-CZ0	Czech Language for Foreigners 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	Czech language for advanced 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 (Gar.)	Z,ZK	5	2P+1C	Z	V
BIE-CSI	Introduction to Computer Science Christoph Kirsch Christoph Kirsch (Gar.)	Z	2	2C	Z	V
BIE-EHD	Introduction to European Economic History Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	3	2P+1C	L	V
FITE-EHD	Introduction to European Economic History Tomáš Evan	Z,ZK	3	2P+1C	L	V
BIE-IMA	Introduction to Mathematics Karel Klouda	Z	4	3C	Z	V
BIE-IMA2	Introduction to Mathematics 2 Karel Klouda	Z	2	1C	Z	V
BIE-ST1	Network Technology 1 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BIE-OOP	Object-Oriented Programming Filip K ikava	Z,ZK	4	2P+2C	Z	V
BIE-PKM	Preparatory Mathematics Jitka Rybní ková Tomáš Kalvoda (Gar.)	Z	4		Z	V
BIE-PJV	Programming in Java Jan Blizni enko Jan Blizni enko (Gar.)	Z,ZK	4	2P+2C	Z	V
BIE-PS2	Programming in shell 2 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 Ż 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	Computer Engineering Seminar I 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	Physical education	Z	0	0+2	Z,L	V
TVV0	Physical education	Z	0	0+2	Z,L	V
TV2K1	Physical Education 2	Z	1		L,Z	V
TVKLV	Physical Education Course	Z	0	7dní	L	V
BIE-TUR.21	User Interface Design Jan Schmidt Jan Schmidt (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-VR1.21	Virtual reality I Petr Klán Petr Klán (Gar.) Windows A desiration	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

	World Economy and Pusiness			T T		1
TE-SEP	World Economy and Business Tomáš Evan	Z,ZK	4	2P+2C	Z	V
E-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+2C	Z	V
E-3DT.1	3D Printing Marek Žehra	KZ	4	3C	L	V
2024/25	the courses of this group of Study Plan: Code=BIE-V.2)21 Name=Purely Elect	ive Bach			sion 2021
	Artificial Intelligence Fundamentals			Z,		4
	to the fundamental problems in the Artificial Intelligence, and the basic methent systems, game theory, planning, and machine learning. Modern soft-compared to the compared to the following systems are the following the following systems.					
	Basics of Systems Control			Z,2		4
definitely evaluated b	of System Control is designed for anyone interested in applied computer so by our graduates in the industrial practice. Students will gain knowledge in the and physical systems. We will provide basic information from the feedback co	is rapidly evolving field of great t	future. We w	vill focus our a	ttention par	rticularly on
	nd physical systems. We will provide basic information from the reedback co near dynamic systems analysis and design verification, simple PID feedback		-	=	-	
	escription of the system model, the basic linear dynamic systems analysis an	•	-			
-	and actuators in control loops, issues of stability in control systems, single a					-
·	n of continuous and digital controllers and PLC control. The themes of lecture	es are accompanied by a numb	er of useful	examples and	l practical i	ndustrial
plementations.	Compiler Construction			7.	71/	F
	Compiler Construction lass on compiler construction for bachelor students in computer science. The	e goal of the class is to introduc	e hasic nrin	ciples of comp		5 idents to
	and implementation of programming languages. Seeing and actually underst					adents to
E-SCE1	Computer Engineering Seminar I				7	4
	er Engineering is a (s)elective course for students who want to deal with deep	er topics of digital design, reliab	ility and resi	-		acks. Studer
approached individu	ally within the subject. Each student or group of students solves some interest	sting topic with the selected sur	pervisor. Pa	rt of the subje	ct is work v	vith scientifi
•	ssional literature and/or work in K N laboratories. The capacity of the subject	is limited by the possibilities of	the semina	r teachers. The	e topics are	e new for ea
mester.						
	Computer Engineering Seminar II			1	<u> </u>	4
•	er Engineering is a (s)elective course for students who want to deal with deep		•			
* *	ially within the subject. Each student or group of students solves some interesting and for work in K. N. Inherentarion. The constitute of the public	- ·	-	· -		
ticles and other profes emester.	ssional literature and/or work in K N laboratories. The capacity of the subjec	is limited by the possibilities of	tne semina	r teachers. The	e topics are	e new for ea
	Czech Language for Foreigners			K	7	2
	ners offers the basic topics of conversation: Introductions, Orientation, Shop	ping, Work / Study, Travel, Time	. Family.	"	_	2
IE-CZ1.21	Czech Language for Foreigners II		,	K	7	2
-	for Students of English programmes who have completed BIE-CZ0 course of	r have basic knowledge of the C	Czech langu			_
	arifies the structure of the Czech language structure with regard to the pract					•
KCJP	Czech language for advanced			Z,2	ZK	2
	urse for Ukrainian students with refugee status. The exam will confirm knowle	edge of Czech at B2 level with v	alidity for C		'	
IE-DIF	Differential equations			Z,2	ZK	5
is course provides a fo	oundational overview of differential equations, starting with basic motivation a	nd examples of ODEs and progre	essing to es	sential solution	n methods l	ike separati
,	ms on existence and uniqueness establish when solutions can be guarantee	,				
	owed by examples of non-linear models such as predator-prey and epidemic	•			•	
· ·	ions (PDEs) extends these concepts to multi-variable contexts. The course v		s for solving	ODEs and Pl	JES, INClud	ling implicit
<u> </u>	ods, Runge-Kutta methods, and finite element methods for both ODEs and P	JES.		<u> </u>	7	
	Economic project sion of the course Introduction to European Economic History (BIE-EHD). The	are is no fived schodule for DIC	EDD 4400		Z	1
e semester.	non of the course introduction to European Economic History (BIE-EHD). If	ere is no fixed schedule for bie-	-EPR. A lea	cher will conta	ct you beit	ne me start
	Financial Marketa			7	71/	5
	Financial Markets on deeply transformed in the recent years, which led to a development of str	uctured financial products, a new	w point of vi	Z,Z		
	activities. The need to use and properly apply mathematical and technical to	· ·	•			
	1 1 3 113			,	,	U
balization of market a	who have sufficient knowledge ICT and mathematics, and who have at the sa	and an overview of mathemati	ical and stat			
balization of market a m technical schools v	who have sufficient knowledge ICT and mathematics, and who have at the signifier globes both a description of financial markets and related economic theories	, and an overview or mathemati	icai anu stat	istical tools us	ed in this f	ield.
obalization of market a m technical schools v arkets course thus en		, and an overview of mathemati	icai ariu stat	istical tools us		ield. 5
obalization of market a om technical schools w arkets course thus end E-HAS	globes both a description of financial markets and related economic theories	•		Z,2	ZK	5
obalization of market a m technical schools warkets course thus end E-HAS is course is for studer	globes both a description of financial markets and related economic theories Human Factors in Cryptography and Security	aking products usable - for users		Z,2	ZK	5
obalization of market a orm technical schools we rekets course thus engue. E-HAS is course is for studer their gained knowle	globes both a description of financial markets and related economic theories Human Factors in Cryptography and Security Its interested not only in technical scope of computer science, but also in markets.	aking products usable - for users		Z,Z velopers. Stud	ZK	5
obalization of market as me technical schools warkets course thus engarkets course thus engarkets course is for studer e their gained knowle.	globes both a description of financial markets and related economic theories. Human Factors in Cryptography and Security nts interested not only in technical scope of computer science, but also in madge to design, plan and analyse their own projects in the context of human-	aking products usable - for users centered security.	s and for de	Z,2	ZK ents of this	5 course car
balization of market a m technical schools v irkets course thus end E-HAS is course is for studer be their gained knowle E-CSI is is an introductory cl ence, high-school stu	globes both a description of financial markets and related economic theories. Human Factors in Cryptography and Security Ints interested not only in technical scope of computer science, but also in madge to design, plan and analyse their own projects in the context of human-Introduction to Computer Science lass on Elementary Computer Science for broad audiences: bachelor student idents, anybody with a background in basic math and the desire to understa	aking products usable - for users centered security. ts in computer science, students nd the absolute basics of compu	s and for de	velopers. Stud	ents of this ut intereste ne class is	5 course can 2 ed in computo introduce
balization of market a m technical schools v arkets course thus eng E-HAS is course is for studer e their gained knowle E-CSI is is an introductory cl ence, high-school stu d relate basic principl	Blobes both a description of financial markets and related economic theories. Human Factors in Cryptography and Security has interested not only in technical scope of computer science, but also in madge to design, plan and analyse their own projects in the context of human-Introduction to Computer Science lass on Elementary Computer Science for broad audiences: bachelor student idents, anybody with a background in basic math and the desire to understate es of computer science for students to understand, early on, what computer	aking products usable - for users centered security. Its in computer science, students and the absolute basics of compuscience is, why things such as its content of the second compuscience is the second content of the s	s and for de s majoring ir uter science high-level p	velopers. Stud	ZK ents of this Z ut intereste ne class is nguages a	5 course car 2 ed in computo introduce nd tools are
balization of market a m technical schools v irkets course thus end E-HAS is course is for studer e their gained knowled E-CSI is is an introductory clence, high-school studer d relate basic principle the the way they are, a	Human Factors in Cryptography and Security Into interested not only in technical scope of computer science, but also in madge to design, plan and analyse their own projects in the context of human-Introduction to Computer Science Iass on Elementary Computer Science for broad audiences: bachelor student idents, anybody with a background in basic math and the desire to understates of computer science for students to understand, early on, what computer and even how, on a basic yet representative and practically relevant level. Af	aking products usable - for users centered security. Its in computer science, students and the absolute basics of compuscience is, why things such as ter taking the class, students are	s and for de s majoring ir uter science high-level pr e able to an:	velopers. Stud velopers. Stud o other fields b The goal of the trogramming late swer not just be	ZK ents of this ut intereste ne class is nguages a asic comp	5 course can 2 ed in compute to introduce and tools are uter science.
obalization of market a com technical schools v arkets course thus eng IE-HAS is course is for studer be their gained knowled IE-CSI is is an introductory clience, high-school studer id relate basic principlone the way they are, a	Human Factors in Cryptography and Security Into interested not only in technical scope of computer science, but also in madge to design, plan and analyse their own projects in the context of human-control of of	aking products usable - for users centered security. Its in computer science, students and the absolute basics of compuscience is, why things such as ter taking the class, students are	s and for de s majoring ir uter science high-level pr e able to an:	velopers. Stud velopers. Stud o other fields b The goal of the trogramming late swer not just be	ZK ents of this ut intereste ne class is nguages a asic comp	5 course can 2 ed in compute to introduce and tools are uter science.

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

Introduction to European Economic History

meetings will consist of a mixture of lecture and discussion.

Z,ZK

FITE-EHD	Introduction to European Economic History	Z,ZK	3
	a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global e	, ,	
• •	tory. As European countries have been dominant actors in this process it focuses predominantly on their roles in the econom	-	-
	to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial inst economic history of particular European countries but rather the impact of trade and role of particular events, institutions and		
	a mixture of lecture and discussion.	organizations in	riistory. Class
BIE-IMA	Introduction to Mathematics	Z	4
	tend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they a		
examples.		,	·
BIE-IMA2	Introduction to Mathematics 2	Z	2
Students refresh and ex	ttend 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-ST1	Network Technology 1	Z	3
	on essentials of computer networks and practice with network technologies. The course corresponds to the Cisco Netacad cu	rriculum, CCNA1	- R&S
Introduction to Networks			
BIE-OOP	Object-Oriented Programming	_ Z,ZK	4
	nming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate togeth		-
handing, refactoring and	of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software devi	elopment including	g testing, error
BIE-PKM	Preparatory Mathematics	Z	4
	tory Mathematics is to help students revise the most important topics of high-school mathematics.	2	7
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		•
_	especially data structures, files, GUI, networking, databases and concurrent APIs.	33	
BIE-PS2	Programming in shell 2	Z,ZK	4
	overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ac		a deeper insight
into Bourne Again shell	and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmu	s students: We are	ready do adapt
the lectures to provide e	even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp,	ln, mkdir, rm) ar	nd useful basic
	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	election of advance	ed scripting
techniques used in prac			
BIE-PRR.21	Project management	Z,ZK	5
	s 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 sidge 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		
	and introduction into their pros and cons and students get practical experience with shell script programming. We will touch al	-	
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 are	dvanced program	ming techniques
_	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 contribut	tes to safe and
•	f cloud service datacenters around the globe.		
BIE-VAK.21	Selected Combinatorics Applications	Z	3
	oduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to th to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some base.		
• • • • • • • • • • • • • • • • • • • •	tion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) i		
	be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optim		
•	olutions 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	, ,	eries and their
properties. Further, we i	ntroduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the	wavelet transform	n. We examine
the linear programming	problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples.		
BI-SCE1	Computer Engineering Seminar I	Z	4
•	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance		
	ually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of t		
•	ssional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar tead	chers. The topics a	are new for each
semester.	Cystoma Enginessing	7	
BIE-SEG	Systems Engineering	Z	0
-	class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles r and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taki		
	be between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what co	-	
	ocesses and threads synchronize efficiently to overcome concurrency for communication.	-, -, 0	
TVV	Physical education	Z	0
TVV0	Physical education	Z	0
TV2K1	Physical Education 2	Z	1
TVKLV	Physical Education Course	Z	0
BIE-TUR.21	User Interface Design	Z,ZK	5
	USET INTETFACE DESIGN 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		
	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 Z,ZK World Economy and Business The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite. **BIE-SEP** World Economy and Business Z,ZK The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite. BIE-3DT.1 3D Printing Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.

List of courses of this pass:

Code	Name of the course	Completion	Credits
BI-SCE1	Computer Engineering Seminar I	Z	4
The Seminar of Co	mputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to	failures and attacl	ks. Student
	dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other p	professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	s. The topics are n	ew for eac
·	semester.	·	
BIE-3DT.1	3D Printing	KZ	4
	design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects,		ng and prin
	in 3D.		5 - 1
BIE-AAG.21	Automata and Grammars	Z,ZK	5
_	uced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite a		_
	ars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between for		
	red through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation,		
BIE-ADU.21	Unix Administration	Z,ZK	5
	he internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They	,	_
	administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights,		
	ory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the kno	•	•
•	specific examples from practice.	· ·	
BIE-ADW.1	Windows Administration	Z.ZK	4
Students unders	tand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the	standard administr	ation and
security tools a	nd apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting	methods and adm	inistrate
	heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.		
BIE-AG1.21	Algorithms and Graphs 1	Z,ZK	5
The course covers	s the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computir	ng 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 a	algorithms and lea	rn to hand
	practically the asymptotic mathematics.		
BIE-AG2	Algorithms and Graphs 2	Z,ZK	5
BIE-APS.21	Architectures of Computer Systems	Z,ZK	5
Students will lear	n the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Spec	ial emphasis is giv	en on the
pipelined instruction	n processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the princ	ciples of instruction	processir
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 mo	del of the
program. The cours	se further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coher	rence and consiste	ency in suc
	systems.		
BIE-ASB.21	Applied Network Security	Z,ZK	5
	irse is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gaine	d in course BI-PSI	with actua
The aim of the cou	ons like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing	g the course stude	nt will get
	knowledge of security applications in computer networks.		
security applicati	knowledge of security applications in computer networks.		5
	Web and Database Server Administration	Z,ZK	J
security application BIE-AWD.21 Students will get ac	Web and Database Server Administration equainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and because the configure of the configure of the configuration of database and web servers and services.	packup complex da	itabase ar
security application BIE-AWD.21 Students will get accommoder web servers	Web and Database Server Administration equainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and be ince systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an exam	packup complex da ple of a web serve	atabase ar er.
security application BIE-AWD.21 Students will get ac	Web and Database Server Administration equainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and because the configure of the configure of the configuration of database and web servers and services.	packup complex da uple of a web serve Z	itabase ar
security application BIE-AWD.21 Students will get accommoder web servers	Web and Database Server Administration equainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and be ince systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an exam	packup complex da ple of a web serve	atabase ar er.

administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the		
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 semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.		
BIE-CCN Compiler Construction This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles	Z,ZK	5
understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching	-	
BIE-CSI Introduction to Computer Science	Z	2
This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fit		
science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The grand relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programmer.		
done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer no		
questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interest	sted in computer sc	ience more
than expected, or even less than before. BIE-CZ0 Czech Language for Foreigners	KZ	2
Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Tim BIE-CZ1.21 Czech Language for Foreigners II	e, Family.	2
The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The		
basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the	Czech Republic.	
BIE-DBS.21 Database Systems	Z,ZK	5
Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoret		
model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction pro		
user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database n		
BIE-DIF Differential equations	Z,ZK	5
This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential so of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered wi		
polynomial analysis, 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, including	ng implicit
and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs. BIE-DML.21 Discrete Mathematics and Logic	Z,ZK	5
Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts fro		-
Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The cours	se also lays down th	ne basics of
combinatorics and number theory, with emphasis on modular arithmetics. BIE-EEC English language external certificate	Z	4
	_	
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in Engli	sh comparable to o	r exceeding
the B2 level of the Common European Framework of Reference for Languages.		
the B2 level of the Common European Framework of Reference for Languages. BIE-EHA.21 Ethical Hacking	Z,ZK	5
the B2 level of the Common European Framework of Reference for Languages. BIE-EHA.21 Ethical Hacking The goal of the course is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vuln	Z,ZK erabilities, and their	5 r possible
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	n introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquaintuused in practice.	ea with modern tec	hnologies
DIE IMA		Z	4
BIE-IMA	Introduction to Mathematics Indicate to Mathematics Introduction to Mathematics Introduction to Mathematics Indicate Ind		-
Students refresh a	examples.	ible to apply them if	i particulai
BIE-IMA2	Introduction to Mathematics 2	Z	2
	Introduction to Mathematics 2 and their properties. Students understand basic mathematical principles and they are a	1	
Ciddonio idileoli d	examples.	оо арріу шеш І	, particulai
BIE-IOT.21	Internet of Things	Z,ZK	5
	s on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an over		
	ication technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architect		
	computer labs, students will gain practical experience with developing simple IoT systems using common development environments		
	software - Arduino, Raspberry Pi OS).		
BIE-JPO	Computer Units	Z,ZK	5
Students know t	he internal structure and organization of computer or processor components and their interfacing with the environment. They understa	and the organization	n of main
memory and othe	r internal memories (addressable, LIFO, FIFO and CAM). They know the organization of an arithmetic unit. They learn the design met	hodology for contro	l units and
	controllers, as well as basic principles of communication with peripheral devices and buses. They understand the architecture of a buse	us system.	
BIE-KAB.21	Cryptography and Security	Z,ZK	5
Students will un	derstand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to	use cryptographic	keys and
	tems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in appl		
will gain practical	skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of	of cryptanalysis. Stu	idents are
	expected to be competent programmers in C/C++ (on a small scale). Basic Python knowledge is an advantage.		
BIE-KOM	Conceptual Modelling	Z,ZK	5
	s on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability and the distributions of the students will be a second and the distributions of the students will be a second and the students will be a second as a second and the students will be a second as a second and the students will be a second as a second	-	
	ategorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will lead to complex systems of social reality, especially enterprises and institutions. Students will also leave to express the rules and limitations of suggestions reality using the OCL leave age. Students		•
	ng in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students		
Enterprise Engine	ering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEM also designed with regard to the continuity of software implementations.	io inetriodology. In	e course is
BIE-LA1.21		Z,ZK	5
	Linear Algebra 1 students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field		
	e fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimina	· · · · · · · · · · · · · · · · · · ·	
	with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenv	•	-
	matrix. We will also demonstrate some applications of these concepts in computer science.		
BIE-LA2.21	Linear Algebra 2	Z.ZK	5
	den their knowledge gained in the BIE-LA1 introductory course, where only vectors in the form of n-tuples of numbers were considered	· ' I	_
spaces in a gen	eral abstract form. The notions of a scalar product and a linear map will enable to demonstrate the profound link between linear algeb	ra, geometry, and c	omputer
graphics. The oth	er main topic will be numerical linear algebra, in particular problems with solving systems of linear equations on computers. The issue		
	or main topic will be numerical algebra, in particular problems with conving dyctoms of linear equations on computers. The locate	s of numerical lines	ar algebra
	will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be pre-		ar algebra
BIE-LOG.21			ar algebra 5
The course focuse	will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be pre Mathematical Logic es on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability	esented. Z,ZK y, logical equivalence	5 ce, and the
The course focuse logical consequen	will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be pre Mathematical Logic es on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability ce of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are expressed in the satisfiability of formulas.	esented. Z,ZK y, logical equivalence explained. This relat	5 ce, and the es to the P
The course focuse logical consequen vs. NP problem	will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be pre Mathematical Logic es on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability ce of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and	zented. Z,ZK y, logical equivalence explained. This relate their models. The second	5 ce, and the res to the P
The course focuse logical consequen vs. NP problem approace	will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be pre Mathematical Logic so on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability of of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and the to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness the	zented. Z,ZK y, logical equivalence explained. This relate their models. The seconds is explained.	5 ce, and the res to the P syntactic
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BIE-PA1.21 Programming and Algorithmics 1 Z,ZK Students learn to construct algorithms for solving basic problems and write them in the C language. They master data types (simple, pointers, structured), expressions, statements, and functions presented in C language. They understand the principle of recursion and basics of algorithm complexity analysis. They know fundamental algorithms for searching, sorting, and manipulating linked lists and trees. BIE-PA2.21 Programming and Algorithmics 2 Z,ZK Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism). BIE-PJP Programming Languages and Compilers Z,ZK Students master basic methods of implementation of common high-level programming languages. They get experience with the design and implementation of individual compiler parts for a simple programming language: data types, subroutines, and data abstractions. Students are able to formally specify a translation of a text that has a certain syntax into a target form and write a compiler based on such a specification. The notion of compiler in this context is not limited to compilers of programming languages, but extends to all other programs for parsing and processing text in a language defined by a LL(1) grammar. BIE-PJV Programming in Java Z,ZK 4 The course Programming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java language the fundamental APIs will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs. BIE-PKM **Preparatory Mathematics** Ζ The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics. ΚZ **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-PPA **Programming Paradigms** Z,ZK 5 BIE-PRR.21 Z.ZK Project management 5 The aim of the course is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, analysis, crisis management in a project, communication, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk assessment and management, Gantt charts, resource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for students who are interested in deepening their knowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in large companies. The course is also suitable for all those who will develop software or hardware in the form of team projects. BIE-PS2 Programming in shell 2 Students get a general overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into Bourne Again shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus students: We are ready do adapt the lectures to provide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, In, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice. BIE-PSI.21 7.7K Computer Networks 5 The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS. BIE-PST.21 Probability and Statistics 5 Students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods for testing statistical hypotheses and determining the statistical dependence of two or more random variables. BIE-SAP.21 Computer Structures and Architectures 5 Students understand basic digital computer units and their structures, functions, and hardware implementation: ALU, control unit, memory system, inputs, outputs, data storage and transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple processor using modern digital design tools BIE-SCE1 Computer Engineering Seminar I The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. BIE-SCE2 Computer Engineering Seminar II Ζ 4 The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each Systems Engineering This is an introductory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of operating systems for students to understand processor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking the class, students are able to understand the difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what concurrency is, as opposed to parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication. **BIE-SEP** World Economy and Business Z,ZK The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite. Network Programming BIE-SIP.21 The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment.

BIE-SKJ.21 Scripting Languages Z,ZK 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 K7 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 ΚZ 5 Students gain hands-on experience with the iterative development process while working on a large-scale software project. The first iteration is the result of the BIE-SP1 course project. However, in this follow-up, the functionality, testing, and documentation of the software system being developed will be emphasized. Students will work in teams of 4-6 people. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) the formal as well as material aspects of their solution. BIE-SPS.21 Administration of Computer Networks and Services Z,ZK 5 The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure. BIE-SRC.21 Real-time systems Z,ZK 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. Network Technology 1 7 BIF-ST1 3 The course is focused on essentials of computer networks and practice with network technologies. The course corresponds to the Cisco Netacad curriculum, CCNA1 - R&S Introduction to Networks. BIE-SWI.21 Software Engineering Z,ZK 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. Applications of Security in Technology BIE-TAB.21 Z,ZK The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security. BIE-TDP.21 **Documentation and Presentation** 3 The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed. BIE-TJV.21 Z,ZK 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 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 7.7K Students gain a basic overview of methods for designing and testing common user interfaces. They get experience to solve the problems where software and other products do not communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of methods that bring users into the development process to ensure optimal interface for them. BIE-TZP.21 Technological Fundamentals of Computers Z.ZK 5 Students get acquainted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer structures look like at the lowest level. They are introduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to reduce the consumption; what the limits to the maximum operating frequency are and how to raise them; why a computer bus needs to be terminated, what happens if it is not; how a computer power supply looks like (in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica. BIE-UKB.21 Introduction to Cybersecurity Z,ZK 5 The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations. BIE-UOS.21 Unix-like Operating Systems Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell. BIE-VAK.21 **Selected Combinatorics Applications** Ζ 3 The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we

will select proble	ms to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimiz also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.	ation and more. Stu	udents will
BIE-VDC.21	Virtualization and Data Centers	Z,ZK	5
	rise is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and		_
infrastructure, suc	ch as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data cer	nter technologies fr	om private
	orid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications.		
	lation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, or		
BIE-VES	Embedded Systems	Z,ZK	5
Students learn to d	lesign embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedd	ed processors, the	ir integrated
DIE 1/E0 04	peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.	7.71	
BIE-VES.21	Embedded Systems	Z,ZK	5
Students learn to d	lesign embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedd	ea processors, the	ir integrated
DIE VANA	peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.	7 71/	4
BIE-VMM	Selected Mathematical Methods s with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then ad	Z,ZK	•
•	or, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the w		
	the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting		o onamino
BIE-VPS.21	Selected Topics in Computer Networking	Z,ZK	5
	upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technology		
networks from loc	al area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical	experience with re	eal network
de	vices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance	, and security.	
BIE-VR1.21	Virtual reality I	KZ	4
Introduction to Vi	rtual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The c	ourse focuses on t	he ways of
	creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social		
BIE-ZRS	Basics of Systems Control	Z,ZK	4
	Basics of System Control is designed for anyone interested in applied computer science in bachelor studies. A brief introduction to the		
•	uated by our graduates in the industrial practice. Students will gain knowledge in this rapidly evolving field of great future. We will focu	•	
_	ring and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems. We will tea sic linear dynamic systems analysis and design verification, simple PID feedback, PSD and fuzzy controllers. This is a survey course		
-	g a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD		
	nsors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller paramet	•	
-	nentation of continuous and digital controllers and PLC control. The themes of lectures are accompanied by a number of useful exam	-	
	implementations.		
BIE-ZRS.21	Basics of System Control	Z,ZK	5
The course gives	an introduction to the field of automatic control. It focuses particularly on the control of engineering and physical systems. It covers ba	sic knowledge of the	ne feedback
-	namical single-input-single-output systems. Students will learn the methods of creating descriptions of system models, basic linear d		-
•	tion of simple feedback PID, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of sta		tems, single
BIE-ZSB.21	and continuous adjustment of the controller parameters, and certain aspects of the industrial implementations of continuous and digita Basics of System Security	Z,ZK	5
	pasies of System Security ourse is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forens		_
-	analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of model	-	
	as well as skills needed for independent work in the area of operating system security incident analysis.	3 - 7	,
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
	duced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classic		eas of state
space search, mul	ti-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithm	s and the neural ne	etworks, will
	be presented as well.		
BIE-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5
	duced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classic		
space search, mul	ti-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithm	s and the neural ne	etworks, will
CITE CUD	be presented as well.	7 71/	
FITE-EHD	Introduction to European Economic History uces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global eco	Z,ZK	3 description
	s in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic	· -	-
	pire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institution	, ,	
	etailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and controls are talked as a second control of the co	· · · · · · · · · · · · · · · · · · ·	
	meetings will consist of a mixture of lecture and discussion.		
FITE-SEP	World Economy and Business	Z,ZK	4
	luces students of technical university to the international business. It does that predominantly by comparing individual countries and k	-	=
-	know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedor	-	
aevelopment, which	ch are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on indiv	ridual readings. It is	advised to
T) /0//4	take bachelor level of this course BIE-SEP as a prerequisite.	7	
TV2K1	Physical Education 2	Z	1
TVKLV	Physical Education Course	Z	0
TVV			
	Physical education	Z	0
TVV0	Physical education	Z Z	0
UKCJP	·	Z Z Z,ZK	0

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