## Studijní plán

## Název plánu: Bachelor specialization, Computer Engineering, 2021

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

Katedra:

Obor studia, garantovaný katedrou: Úvodní stránka

Garant oboru studia.:

Program studia: Informatics Typ studia: Bakalá ské prezen ní

P edepsané kredity: 155

Kredity z volitelných p edm t : 25 Kredity v rámci plánu celkem: 180

Poznámka k plánu: This version of the study plan is intended for students who have been enrolled for study from the academic year 2021/2022 into the full-time form of study of the bachelor's program. Guarantor:

doc. Ing. Hana Kubátová, CSc., email: hana.kubatova@fit.cvut.cz

Název bloku: Povinné p edm ty programu

Minimální po et kredit bloku: 110

Role bloku: PP

Kód skupiny: BIE-PP.21

Název skupiny: Compulsory Courses of Bachelor Study Program Informatics, version 2021

Podmínka kredity skupiny: V této skupin musíte získat 110 kredit

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

Kredity skupiny: 110

Poznámka ke

skupině:

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

you can have the subject BIE-EEC recognized for 4 credits.

Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len ) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-AG1.21	Algorithms and Graphs 1 Tomáš Valla, Dušan Knop, Maria Saumell Mendiola <b>Dušan Knop</b> Dušan Knop (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-AAG.21	Automata and Grammars  Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-BPR.21	Bachelor Project Zden k Muziká Zden k Muziká (Gar.)	Z	1		Z,L	PP
BIE-BAP.21	Bachelor Thesis Zden k Muziká Zden k Muziká (Gar.)	Z	14		L,Z	PP
BIE-PSI.21	Computer Networks Yelena Trofimova, Michal Polák, Diana Prokopisina Yelena Trofimova Yelena Trofimova (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BIE-SAP.21	Computer Structures and Architectures Petr Fišer Petr Fišer (Gar.)	Z,ZK	5	2P+1R+2C	L	PP
BIE-KAB.21	Cryptography and Security Ji í Bu ek, Filip Kodýtek, Róbert Lórencz Ji í Bu ek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	L	PP
BIE-DBS.21	Database Systems Josef Pavlí ek, Yelena Trofimova 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 Daniel Dombek Eva Pernecká (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
BIE-TDP.21	Documentation and Presentation Dana Vynikarová Dana Vynikarová (Gar.)	KZ	3	2P+2C	Z,L	PP
BIE-EEC	English language external certificate  Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	4		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 Pavel Hrabák, Francesco Dolce Pavel Hrabák Pavel Hrabák (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-PA1.21	Programming and Algorithmics 1 Josef Vogel, David Bernhauer, Jan Trávní ek, Ladislav Vagner, Radek Hušek Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+2R+2C	Z	PP
BIE-PA2.21	Programming and Algorithmics 2  Josef Vogel, Jan Trávní ek, Ladislav Vagner, Radek Hušek <b>Jan Trávní ek</b> Jan Trávní ek (Gar.)	Z,ZK	7	2P+1R+2C	L	PP
BIE-GIT.21	SW Development Technologies Petr Pulc Petr Pulc Petr Pulc (Gar.)	Z	3	2P	Z	PP
BIE-TZP.21	Technological Fundamentals of Computers Kate ina Hyniová, Martin Novotný Martin Novotný Martin Novotný (Gar.)	Z,ZK	5	2P+2C	Z	PP
BIE-UOS.21	Unix-like Operating Systems Jakub Žitný, Jan Trdli ka, Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	KZ	5	2P+2C	Z	PP

(Gai.)		
Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-PP.21 Název=Compu	Isory Courses of Bachelor Study	Program
Informatics, version 2021		
BIE-AG1.21 Algorithms and Graphs 1	Z,ZK	5
The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the co	1 ,	1
with the concurrent BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed		
practically the asymptotic mathematics.	of time and space complexity of algorithms an	d learn to handle
	7.71/	
BIE-AAG.21 Automata and Grammars	Z,ZK	5
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and	•	
and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal language and the second of t		
Knowledge acquired through the module is applicable in designs of algorithms for searching in text, data compression,		<u> </u>
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	·	orm 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	i.	
BIE-BAP.21 Bachelor Thesis	Z	14
BIE-PSI.21 Computer Networks	Z,ZK	5
The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and s	ervices 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	s. 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, c		-
transfer. In the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs, students gain practical experience with the design and implementation of the logic of a simple produced in the labs.		g
BIE-KAB.21 Cryptography and Security	Z.ZK	5
Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic	'	1
certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic sys		=
will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquain	• •	
expected to be competent programmers in C/C++ (on a small scale). Basic Python knowledge is an advantage.	ned with the basic procedures of cryptanarysis	s. Otadonio arc
	Z.ZK	5
	l ,	1
Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the susing a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL I	, ,	
	5 5	
model. They will get acquainted with the principles of relational database schema normalization. They understand the business assess to a single data acquainted with the principles of relational database schema normalization. They understand the business acquainted with the principles of relational database schema normalization. They understand the business acquainted with the principles of relational database schema normalization. They understand the business acquainted with the principles of relational database schema normalization.		ontroi oi parallei
user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational data		
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 the		•
Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalence	ces, and partial orders. The course also lays de	own the basics of
combinatorics and number theory, with emphasis on modular arithmetics.		
BIE-TDP.21 Documentation and Presentation	KZ	3
The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical rep	ports 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 Bear		
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 teachir	ng. Within the
exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.		
BIE-EEC English language external certificate	Z	4
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demo	onstrates their proficiency in English comparabl	e to or exceeding
the B2 level of the Common European Framework of Reference for Languages.		J
BIE-LA1.21 Linear Algebra 1	Z.ZK	5
We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will de	,	_
and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equ	•	•
the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM.	•	,
matrix. We will also demonstrate some applications of these concepts in computer science.	and orgo	

BIE-MA1.21 Mathematical Analysis 1

Z.ZK

5

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

BIE-MA2.21 Mathematical Analysis 2

Z,ZK

6

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

BIE-OSY.21 Operating Systems

Z,ZK

5

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

BIE-PST.21 Probability and Statistics

Z,ZK

5

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

BIE-PA1.21 Programming and Algorithmics 1

Z,ZK

7

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

BIE-PA2.21 Programming and Algorithmics 2

' 7K

7

Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism).

BIE-GIT.21 SW Development Technologies

3

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

BIE-TZP.21 Technological Fundamentals of Computers

Z,ZK

5

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

BIE-UOS.21 Unix-like Operating Systems

ΚZ

5

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

Název bloku: Povinné p edm ty specializace

Minimální po et kredit bloku: 40

Role bloku: PS

Kód skupiny: BIE-PS-PI.21

Název skupiny: Compulsory Courses for Bachelor Specialization Computer Engineering, version 2021

Podmínka kredity skupiny: V této skupin musíte získat 40 kredit

Podmínka p edm ty skupiny: V této skupin musíte absolvovat 6 p edm t

Kredity skupiny: 40

Poznámka ke skunině:

Garant doc. Ing. Hana Kubátová, CSc., email: Hana.Kubatova@fit.cvut.cz

FOZITATINA NE SKUPITIE. Carant doc. mg. Hana Nubatova, Coc., email. Hana. Nubatova@m.cvut.cz								
Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len ) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role		
BIE-APS.21	Architectures of Computer Systems Michal Štepanovský, Pavel Tvrdík Pavel Tvrdík Pavel Tvrdík (Gar.)	Z,ZK	5	2P+2C	Z	PS		
BIE-ZRS.21	Basics of System Control Kate ina Hyniová Kate ina Hyniová (Gar.)	Z,ZK	5	2P+2C	Z,L	PS		
BIE-JPO.21	Computer Units Pavel Kubalík Pavel Kubalík Pavel Kubalík (Gar.)	Z,ZK	5	2P+2C	Z	PS		
BIE-VES.21	Embedded Systems Miroslav Skrbek Miroslav Skrbek (Gar.)	Z,ZK	5	2P+2C	L	PS		
BIE-LA2.21	Linear Algebra 2 Karel Klouda, Marzieh Forough Karel Klouda (Gar.)	Z,ZK	5	2P+2C	L	PS		
BIE-MPP.21	Methods of interfacing peripheral devices Miroslav Skrbek Miroslav Skrbek (Gar.)	Z,ZK	5	2P+2C	Z	PS		
BIE-PNO.21	Practical Digital Design Martin Novotný Martin Novotný (Gar.)	KZ	5	2P+2C	Z	PS		

BIE-SRC.21	Real-time systems Hana Kubátová <b>Hana Kubátová</b> Hana Kubátová (Gar.)	Z,ZK	5	2P+2C	Z	PS

# Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-PS-PI.21 Název=Compulsory Courses for Bachelor Specialization Computer Engineering, version 2021

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-ZRS.21 Basics of System Control

Z,ZK

5

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

BIE-JPO.21 Computer Units

Z,ZK

5

Students deepen their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail with the internal structure and organization of computer units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using appropriate codes for implementation of multiplication. The organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including codes for error detection and correction for parallel and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of communication of the processor with the environment and the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammed processor simulator and programmable hardware design kits (FPGA).

BIE-VES.21 Embedded Systems

Z,ZK

5

Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.

BIE-LA2.21 Linear Algebra 2

<u>∠,∠</u>K

5

Students will broaden their knowledge gained in the BIE-LA1 introductory course, where only vectors in the form of n-tuples of numbers were considered. Here we will introduce vector spaces in a general abstract form. The notions of a scalar product and a linear map will enable to demonstrate the profound link between linear algebra, geometry, and computer graphics. The other main topic will be numerical linear algebra, in particular problems with solving systems of linear equations on computers. The issues of numerical linear algebra will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be presented.

BIE-MPP.21 Methods of interfacing peripheral devices

Z,ZK

5

The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universal serial bus (USB). The course includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USB devices, Linux and Windows drivers, simple application development, and APIs of selected devices.

BIE-PNO.21 Practical Digital Design

KZ

5

Students get an overview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the basics of the VHDL language and implementation technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern industry-standard CAD design tools.

BIE-SRC.21 Real-time systems

Z,ZK

5

Students obtain the basic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issues. Theoretical knowledge from lectures will be experimentally verified in department specialized labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab are the same as in the BIE-VES course and FPGAs..

Název bloku: Povinn volitelné p edm ty

Minimální po et kredit bloku: 5

Role bloku: PV

Kód skupiny: BIE-PV-PI.21

Název skupiny: Compulsory elective courses for Specialization Computer Engineering, version 2021

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

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

Kredity skupiny: 5

Poznámka ke skupině:

Garant: doc. Ing. Hana Kubátová, CSc., email: Hana.Kubatova@fit.cvut.cz

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Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len ) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+2C	L	PV
BIE-PJP	Programming Languages and Compilers  Jan Janoušek	Z,ZK	5	2P+1C	L	PV
BIE-BEK	Secure Code Róbert Lórencz	Z,ZK	5	2P+2C	L	PV

## Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-PV-PI.21 Název=Compulsory elective courses for Specialization Computer Engineering, version 2021

BIE-ZUM.21 Artificial Intelligence Fundamentals

Z,ZK

5

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

BIE-PJP **Programming Languages and Compilers** 

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-BEK** Secure Code Z,ZK

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

Název bloku: Volitelné p edm ty Minimální po et kredit bloku: 0

Role bloku: V

Kód skupiny: BIE-V.21

Název skupiny: Purely Elective Bachelor Courses, Version 2021

Podmínka kredity skupiny: Podmínka p edm ty skupiny:

Kredity skupiny: 0

Poznámka ke skunině:

Garant: prof. Ing. Róbert Lórencz, CSc., email: robert lorencz@fit.cvut.cz

Poznámka ke	·	encz, CSc., e	email: ro	bert.lore	ncz@fit.c	/ut.cz
Kód	Název p edm tu / Název skupiny p edm t (u skupiny p edm t seznam kód jejích len ) Vyu ující, auto i a garanti (gar.)	Zakon ení	Kredity	Rozsah	Semestr	Role
BIE-ZUM	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	4	2P+2C	L	V
BIE-ZRS	Basics of System Control Kate ina Hyniová	Z,ZK	4	2P+2C	L	V
BIE-CCN	Compiler Construction Christoph Kirsch Christoph Kirsch (Gar.)	Z,ZK	5	3P	L	٧
BIE-SCE1	Computer Engineering Seminar I Hana Kubátová, Miroslav Skrbek <b>Hana Kubátová</b> Hana Kubátová (Gar.)	Z	4	2C	Z	٧
BIE-SCE2	Computer Engineering Seminar II 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 Ivana Vondrá ková, Petra Korfová Zden k Muziká Zden k Muziká (Gar.)	KZ	2	4C	Z,L	V
UKCJP	eština pro pokro ilé Tomáš Houdek, Jakub Šenovský, Jakub Šolc, Adam Vostárek <b>Zden k Muziká</b> Zden k Muziká (Gar.)	Z,ZK	2	2BP+2BC	Z,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	٧
BIE-HAS	Human Factors in Cryptography and Security Ivana Trummová	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 (Gar.)	Z,ZK	3	2P+1C	L	V
BIE-IMA	Introduction to Mathematics Karel Klouda	Z	4	3C	Z	V
BIE-IMA2	Introduction to Mathematics 2 Karel Klouda	Z	2	1C	Z	V
BIE-ST1	Network Technology 1 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BIE-OOP	Object-Oriented Programming Filip K Ikava Filip K Ikava Filip K Ikava (Gar.)	Z,ZK	4	2P+2C	Z	V
BIE-PKM	Preparatory Mathematics  Jitka Rybni 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	٧
BIE-PRR.21	Project ma19nagement David Pešek David Pešek David Pešek (Gar.)	Z,ZK	5	2P+2C	Z,L	V
BIE-SKJ.21	Scripting Languages Jan Ž árek, Lukáš Ba inka Lukáš Ba inka Jan Ž árek (Gar.)	Z,ZK	4	2P+2C	L	V

BIE-VAK.21	Selected Combinatorics Applications Tomáš Valla, Dušan Knop, Maria Saumell Mendiola, Ond ej Suchý, Šimon Schierreich Tomáš Valla Tomáš Valla (Gar.)	Z	3	2R	L	V
BI-SCE1	Seminá po íta ového inženýrství l Hana Kubátová <b>Hana Kubátová</b> Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
BIE-SEG	Systems Engineering Christoph Kirsch Christoph Kirsch (Gar.)	Z	0	2C	Z	V
TVV	T lesná výchova	Z	0	0+2	Z,L	V
TVV0	T lesná výchova 0	Z	0	0+2	Z,L	V
TV2K1	T lesná výchova 2	Z	1		L	V
TVKLV	T lovýchovný kurz	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 Petr Klán (Gar.)	KZ	4	2P+2C	L,Z	V
BIE-ADW.1	Windows Administration Ji í Kašpar, Miroslav Prágl Miroslav Prágl (Gar.)	Z,ZK	4	2P+1C	Z	V
BIE-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+2C	Z	V
BIE-3DT.1	3D Printing Marek Žehra	KZ	4	3C	L	V

Charakteristiky p edmet této skupiny studijního plánu: Kód=BIE-V.21 Název=Purely Elective Bachelor Courses, Version 2021 Artificial Intelligence Fundamentals Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well. Basics of System Control Volitelný p edm t základy ízení systém je ur en pro všechny zájemce o aplikovanou informatiku v bakalá ském studiu. Alespo p ehledové znalosti oboru automatického ízení budou pro naše absolventy jist konkuren ní výhodou a zhodnotí je bezesporu v pr myslové praxi. Studenti získají znalosti v dynamicky se rozvíjejícím oboru s velkou budoucností. Zam íme se zejména na ízení inženýrských a fyzikálních sysém . Poskytneme vám základní informace z oblasti zp tnovazebního ízení lineárních dynamických jednorozm rových systém . Seznámíme vás s metodami vytvá ení popisu a modelu systém , základní analýzou lineárních dynamických systém a návrhem a ov ením jednoduchých zp tnovazebních PID, PSD a fuzzy regulator . Pozornost je v nována rovn ž sníma m a ak ním len m v regula ních obvodech, otázkám stability regula ních obvod , jednorázovému a pr b žnému nastavování parametr regulátoru a n kterým aspekt m pr myslových realizací spojitých a íslicových regulátor . Jednotlivá témata p ednášek jsou provázena množstvím užite ných p íklad a praktických pr myslových realizací. **BIE-CCN** Compiler Construction Z.ZK 5 This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class. BIE-SCE1 Computer Engineering Seminar I 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 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-CZ0 ΚZ 2 Czech Language for Foreigners Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family. BIE-CZ1.21 Czech Language for Foreigners II ΚZ 2 The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The course further expands the basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Republic. eština pro pokro ilé **UKCJP** Z,ZK 2 Kurz pokro ilé eštiny pro ukrajinské studenty, kte í mají status uprchlíka. Zkouška potvrdí znalost eštiny na úrovní B2 s platností pro VUT. **BIE-EPR** Ζ Economic project 1 This course is an extension of the course Introduction to European Economic History (BIE-EHD). BIE-FTR.1 **Financial Markets** Z.ZK Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial

This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before.

P edm t je ur en student m, které zajímá nejen matematická a technická stránka v ci, ale i p emýšlení nad tím, jestli výsledný produkt bude použitelný pro lidi (od t ch, kte í implementují šifry po uživatele aplikací). Studenti budou moci využít nabyté v domosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projekt v kontextu kybernetické bezpe nosti

7.7K

7

2

Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field.

Human Factors in Cryptography and Security

Introduction to Computer Science

**BIE-HAS** 

**BIF-CSI** 

zam ené na lov ka.

The course introduces a	Introduction to European Economic History	Z,ZK	3
	selection of themes from European economic history. It gives the student basic knowledge about forming of the global economic	omy through the d	lescription of the
	s European countries have been dominant actors in this process it focuses predominantly on their roles in economic history.	-	
	e fragmentation of the Middle Ages, from the destruction of WWII to the current affairs, the development of modern financial		-
	ne detailed economic history of particular European countries but rather the impact of trade and the role of particular events, will consist of a mixture of lectures and discussions.	institutions and o	irganizations in
BIE-IMA	Introduction to Mathematics	Z	4
	tend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are	_	•
examples.		,	
BIE-IMA2	Introduction to Mathematics 2	Z	2
	tend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are	re able to apply th	nem in particular
examples.			
BIE-ST1	Network Technology 1	Z	3
· ·	získání základních znalosti z oblasti po íta ových sítí a praktických zkušeností se sí ovými technologiemi. P edm t odpovída amp;S Introduction to Networks.	a latce kurikula C	isco Netacad
BIE-OOP	Object-Oriented Programming	Z,ZK	4
	ming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together		
	of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software deve		-
handing, refactoring and	design patterns.		
BIE-PKM	Preparatory Mathematics	Z	4
	tory Mathematics is to help students revise the most important topics of high-school mathematics.		
BIE-PJV	Programming in Java	Z,ZK	4
	n v angli tin . Existuje ale také eská varianta BI-PJV a BIK-PJV.	7.71/	
BIE-PS2	Programming in shell 2	Z,ZK	4
	iverview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ac and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus		
_	ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, l		
	r, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a se		
techniques used in prac	ice.		
BIE-PRR.21	Project ma19nagement	Z,ZK	5
	to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, an	=	-
	argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk a		-
	chedule, resource balancing, network graphs) and creation of project documentation.The course is designed especially for s ge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in la		
	who will develop software or hardware in the form of team projects.	argo companico.	1110 000100 10
BIE-SKJ.21	Scripting Languages	Z,ZK	4
Students get a general of	overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ac		a deeper insight
into Bourne Again shell a	and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus	s students: We are	e ready do adapt
	ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, l		
techniques used in prac	r, 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 advanc	ea scripting
BIE-VAK.21	Selected Combinatorics Applications	Z	2
	duce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the	_	
		e basic courses.	3 we approach the
	o theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some ba		we approach the
issue from applications t	o theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some ba ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) i	asic data structure	we approach the es. Furthermore,
issue from applications to with the active participat will select problems to b	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimic	asic data structure informatics. Areas	we approach the es. Furthermore, s from which we
issue from applications to with the active participat will select problems to be also try to implement so	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimitutions to the studied problems with a special focus on the effective use of existing tools.	asic data structure informatics. Areas ization and more.	we approach the es. Furthermore, from which we Students will
issue from applications to with the active participat will select problems to be also try to implement so BI-SCE1	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimically utions to the studied problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství l	asic data structure informatics. Areas ization and more. Z	we approach the es. Furthermore, from which we Students will
issue from applications with the active participat will select problems to b also try to implement so BI-SCE1 Seminá po íta ového in	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimical utions to the studied problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství l  iženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno	asic data structure informatics. Areas ization and more.  Z  osti proti poruchá	we approach the es. Furthermore, from which we Students will  4 m a útok m. Ke
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issue from applications of with the active participal will select problems to be also try to implement so BI-SCE1 Seminá po íta ového in student m se v rámci p	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimical utions to the studied problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství l  iženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno	asic data structure informatics. Areas ization and more.  Z  osti proti poruchá em. Sou ástí p ed	we approach the es. Furthermore, from which we Students will  4 m a útok m. Ke dm tu je práce s
issue from applications with the active participal will select problems to b also try to implement so BI-SCE1 Seminá po íta ového ir student m se v rámci p v deckými lánky a jinov nová.	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimically utions to the studied problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství l  uženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno edm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školiteka odbornou literaturou a/nebo práce v laborato ích K N. Kapacita p edm tu je omezena možnostmi u itel seminá e. Probíran	asic data structure informatics. Areas ization and more.  Z  osti proti poruchá em. Sou ástí p ed ná témata jsou pr	we approach the es. Furthermore, from which we Students will  4 m a útok m. Ke dm tu je práce s
issue from applications with the active participal will select problems to be also try to implement so BI-SCE1 Seminá po íta ového is student m se v rámci p v deckými lánky a jinou nová.  BIE-SEG	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimication to the studied problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství l  uženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno edm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školiteka	asic data structure informatics. Areas ization and more.  Z  osti proti poruchá em. Sou ástí p ed ná témata jsou pr	we approach the es. Furthermore, is from which we Students will  4 m a útok m. Ke dm tu je práce s o každý semestr
issue from applications with the active participal will select problems to be also try to implement so BI-SCE1  Seminá po íta ového in student m se v rámci p v deckými lánky a jinou nová.  BIE-SEG  This is an introductory of to understand processor	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimically included problems with a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství I  Jezenýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno edm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školitele i odbornou literaturou a/nebo práce v laborato ích K N. Kapacita p edm tu je omezena možnostmi u itel seminá e. Probíran  Systems Engineering  ass on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking	asic data structure informatics. Areas ization and more.  Z osti proti poruchá em. Sou ástí p ed ná témata jsou pr  Z of operating systeng the class, studi	we approach the es. Furthermore, is from which we Students will  4 m a útok m. Ke dm tu je práce s o každý semestr  0 ems for students ents are able to
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issue from applications with the active participat will select problems to b also try to implement so BI-SCE1 Seminá po íta ového in student m se v rámci p v deckými lánky a jinou nová.  BIE-SEG This is an introductory of to understand processor understand the difference parallelism, and how processor understand the understand the understand the security tools and apply	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) is a solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimized will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimized will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimized will be a solved will include a special focus on the effective use of existing tools.  Seminá po íta ového inženýrství I vizenýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolno dedm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školitek i odbornou literaturou a/nebo práce v laborato ích K N. Kapacita p edm tu je omezena možnostmi u itel seminá e. Probíral Systems Engineering ass on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After takir e between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what coresses and threads synchronize efficiently to overcome concurrency for communication.  T lesná výchova  T lesná výchova  T lesná výchova 0  T lesná výchova 2  T lovýchovný kurz  User Interface Design  Terview of methods for designing and testing common user interfaces. They get experience to solve the problems where softs ser optimally, since the needs and characteristics of users are not taken into account during product development. Students opported to provide the needs and characteristics of users are not taken into account during product development. Students opported to provide the solvent process to ensure optimal interface for them.  Virtual reality	asic data structure informatics. Areas ization and more.  Z osti proti poruchá em. Sou ástí p ec ná témata jsou pr  Z of operating systeng the class, studincurrency is, as of the class, studincurrency is, as of the class of th	we approach the es. Furthermore, from which we Students will  4 m a útok m. Ke dm tu je práce s o každý semestr  0 ems for students ents are able to pposed to  0 1 0 5 oducts do not of methods that  4 on the ways of  4 stration and

BIE-SEP World Economy and Business

Z.ZK

4

The minimum of enrolled students is 8. If the capacity is not fulfilled, the course will not be taught. The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve knowledge in the form of discussions based on individual readings.

BIE-3DT.1

3D Printing

ΚZ

4

Students learn to design three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects, prepare for printing and print in 3D.

Kód skupiny: BIE-PI-VO.21

Název skupiny: Elective courses originating from neighboring specializations for the BIE-PI, ver. 2021

Podmínka kredity skupiny: Podmínka p edm ty skupiny:

Kredity skupiny: 0

Poznámka ke skupině:

Garant: doc. Ing. Hana Kubátová, CSc., email: Hana.Kubatova@fit.cvut.cz // Všechny

povinné předměty specializací s výjimkou této

	povinne predmety specializaci s vyjimi Název p edm tu / Název skupiny p edm t					
Kód	(u skupiny p edm t seznam kód jejích len )	Zakon ení	Kredity	Rozsah	Semestr	Role
	Vyu ující, <b>auto i</b> a garanti (gar.)					
BIE-SPS.21	Administration of Computer Networks and Services Libor Dostálek, Jan Kubr Pavel Tvrdík Pavel Tvrdík (Gar.)	Z,ZK	5	2P+2S	Z	V
BIE-AG2	Algorithms and Graphs 2 Ond ej Suchý	Z,ZK	5	2P+2C	L	V
BIE-TAB.21	Applications of Security in Technology Ji í Dostál Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-ASB.21	Applied Network Security Ji í Dostál Ji í Dostál Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-ZSB.21	Basics of System Security Simona Forn sek, Marián Svetlík Simona Forn sek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-TPS.21	Computer Networks Technologies Vladimír Smotlacha Vladimír Smotlacha (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-KOM	Conceptual Modelling Robert Pergl, Marek Suchánek Robert Pergl Robert Pergl (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-EHA.21	Ethical Hacking Ji í Dostál, Tomáš Kiezler, Martin Kolárik <b>Ji í Dostál</b> Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-HWB	Hardware Security Ji í Bu ek, Filip Kodýtek, Róbert Lórencz <b>Ji í Bu ek</b> Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-IOT.21	Internet of Things Jan Jane ek, Pavel Tvrdík Jan Jane ek Jan Jane ek (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-UKB.21	Introduction to Cybersecurity Jan B Iohoubek, Simona Forn sek, František Ková, Ivana Trummová, David Pokorný, Tomáš Lu ák, Tomáš Rabas Simona Forn sek Róbert Lórencz (Gar.)	Z,ZK	5	3P+1C	Z	V
BIE-IDO.21	Introduction to DevOps Tomáš Vondra, Zden k Rybola Tomáš Vondra Zden k Rybola (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-TJV.21	Java Technology Ond ej Guth Ond ej Guth Ond ej Guth (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-LOG.21	Mathematical Logic Kate ina Trlifajová Kate ina Trlifajová (Gar.)	Z,ZK	5	2P+2C	Z	V
BIE-SIP.21	Network Programming Jan Fesl Jan Fesl (Gar.)	Z	5	2P+2C	Z	V
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	V
BIE-PJP	Programming Languages and Compilers  Jan Janoušek	Z,ZK	5	2P+1C	L	V
BIE-PPA	Programming Paradigms Petr Máj	Z,ZK	5	2P+2C	Z	V
BIE-BEK	Secure Code Róbert Lórencz	Z,ZK	5	2P+2C	L	V
BIE-VPS.21	Selected Topics in Computer Networking Alexandru Moucha, Mohamed Bettaz Pavel Tvrdík Mohamed Bettaz (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-SWI.21	Software Engineering Zden k Rybola Zden k Rybola (Gar.)	Z,ZK	5	2P+1C	L	V
BIE-SP1.21	Team Software Project 1 Ji í Mlejnek, Zden k Rybola Zden k Rybola (Gar.)	KZ	5	4C	L	V
BIE-SP2.21	Team Software Project 2 Zden k Rybola Zden k Rybola (Gar.)	KZ	5	2C	Z	V
BIE-ADU.1	Unix Administration	Z,ZK	5	2P+2C	L	V
BIE-VDC.21	Virtualization and Data Centers Jií Kašpar Jií Kašpar Jií Kašpar (Gar.)	Z,ZK	5	2P+2C	L	V

BIE-AWD.21	Web and Database Server Admi Lukáš Ba inka, Michal Valenta Lukáš B		Z,ZK	5	2P+2C	Z	V
haraktariatiku n	dmet téte ekuniny etudiinihe nlén	w Kád-DIE DI VO 21 Názov-E	lootive cour	oc origin	acting fro	m noighl	oring
	dmet této skupiny studijního plán the BIE-PI, ver. 2021	u: NOU=DIE-PI-VO.21 Nazev=E	lective cours	ses origii	nating iro	m neigni	ooring
BIE-ZUM.21	Artificial Intelligence Fundamentals				Z	,ZK	5
	o the fundamental problems in the Artificial Intelli	,	O	•			
space search, multi-ag oe presented as well.	t systems, game theory, planning, and machine l	earning. Modern soft-computing methods	s, including the ev	olutionary a	lgorithms an	d the neural	networks, will
BIE-PJP	Programming Languages and Compile	ers			7	ZZK	5
-	ethods of implementation of common high-level p		ence with the design	gn and imple	1	, I	-
	language: data types, subroutines, and data abs		-			-	-
•	based on such a specification. The notion of cor g text in a language defined by a LL(1) grammar	•	pilers of program	ming langua	ges, but exte	ends to all ot	her programs
BIE-BEK	Secure Code	·			7	ZZK	5
	vat a zohled ovat bezpe nostní rizika p i návrhu	svého kódu a ešení v b žné inženýrské	praxi. Od teorie i	modelování	1	<i>'</i>	_
· · · · · · · · · · · · · · · · · · ·	program pod nižšími oprávn ními a jak tato oprá				=	-	
	rizika spojená s p ete ením bufferu. Dále se stud at útok m typu DoS (Denial of Service) a obran		at a jak toto zabez	zpe ení sou	∕isí s databá	zovými systé	my a webem.
BIE-SPS.21	Administration of Computer Networks	•			7	ZZK	5
	o deepen the theoretical knowledge of network to		ment of network s	ervers adm	I	·	-
	course syllabus requires the knowledge at the leve	el of courses BIE-PSI, BIE-VPS, and BIE-	OSY. Practical sk	ills will be ga	ined by prac	ctical hands-c	on experience
with real network infras						714	
BIE-AG2	Algorithms and Graphs 2				_	Z,ZK	5 5
BIE-TAB.21 The goal of the course	Applications of Security in Technology to introduce students to selected topics from cyb		utilized in differe	nt industries	1	, ,	-
-	s and extend their knowledge from the cryptology				. Olddorllo g	or a broador	0.001.000.01
BIE-ASB.21	Applied Network Security				Z	,ZK	5
	o introduce selected topics from computer netwo			•	ū		
	the public key infrastructure, encrypted network polications in computer networks.	protocols, link and network layer security	or wireless netwo	orks. After fir	nishing the co	ourse studen	nt will get
BIE-ZSB.21	Basics of System Security				7	,ZK	5
	to provide introduction to basic concepts in secu	rity of computer systems. Further, the co	urse introduces th	ne basics of	1		_
such as malware analy	s or incident response. After finishing the course	student will get both theoretical and pract	tical knowledge in	the area of	modern ope	erating syster	ms security,
	or independent work in the area of operating syst	em security incident analysis.				-11	
BIE-TPS.21	Computer Networks Technologies	managers and interference of contempora	ry computer netu	orko ot the	1	Z,ZK	5
	udents with basic and advanced technologies, co ovide theoretical foundations of these technologie	-					-
•	nes students will get hands-on experience. Then				•		
always with focus on hi	<u>'</u>						
BIE-KOM	Conceptual Modelling				1	.,ZK	5
	e development of abstract thinking skills and pred and also determine the right links in complex sy					_	
_	toUML notation. They will also learn to express the						-
	s a discipline enabling conceptual modeling of the	e structure of enterprises and institutions	and their process	s and learn t	he DEMO m	nethodology.	The course is
	to the continuity of software implementations.					714	
BIE-EHA.21	Ethical Hacking to introduce students to the field of penetration to	octing and othical backing. The course do	als with suborse	surity throats	1	,ZK	5 ir possiblo
•	networks, web applications, wireless networks, op	•	•	•			•
	the following process of penetration test docume					·	
BIE-HWB	Hardware Security				Z	,ZK	5
	rdware resources used to ensure security of com						•
· · · ·	ne security features of modern processors, and s acks and tampering with hardware during manufa			_			
=	ti-factor authentication (biometrics). Students will				00.0		g applications
BIE-IOT.21	nternet of Things				Z	,ZK	5
	overview of technologies and development tools	_					
	echnologies designed primarily for this area, and er labs, students will gain practical experience wi		•				
software - Arduino, Ras		ur developing simple for systems using t	common developi	Helit eliviloi	inienis (naic	iwale - Altivi,	, LOF, OTIVI,
BIE-UKB.21	ntroduction to Cybersecurity				Z	,ZK	5
The goal of the course	to provide students with the introduction of basic	concepts in modern approach to cybers	ecurity. Students	will get a ba	sic overview	of threats in	cyberspace
	security mechanisms in networks, operating syst	ems and applications, as well as of basic	c cyberspace regu	ılations.	T =	714	
BIE-IDO.21	ntroduction to DevOps topic of DevOps and prepares future developers	and administrators for a modern culture	of development	and operation		Z,ZK	5 s The course
	rt software development, testing and compilation		•	•	•		
	ction to technologies that will then be discussed	•		ū	ū	. , ,	
used in practice.							
BIE-TJV.21	Java Technology	undamment of a life life life life		dt '''	1	,ZK	5
	o provide knowledge and skills needed for the de to apply these concepts using libraries and tools	· · · · · · · · · · · · · · · · · · ·	· ·	_	-	_	
•	opment of software systems on the Java platforn				•		
course): Java language	yntax, SQL, git version control system, Docker, c	ontinuous integration.					

BIE-LOG.21 Mathematical Logic 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. 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 Z,ZK Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern. **BIE-PPA Programming Paradigms** Z.ZK 5 BIE-VPS.21 Selected Topics in Computer Networking Z.ZK 5 The course builds upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technologies used in modern computer networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical experience with real network devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security. Software Engineering Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development. BIE-SP1.21 Team Software Project 1 K7 5 Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the BIE-SWI course that runs concurrently and that teaches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software artefact will be further developed and finished in the BIE-SP2 course. BIE-SP2.21 Team Software Project 2 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-ADU.1 Unix Administration Z,ZK 5 Students became familiar with the internal structure of Unix-like systems, with the administration of their basic subsystems and with the principles of their protection against unauthorized use. In the seminars they will verify the information from the lectures on real life examples from practice. They will understand the differences between user and administrator roles. They gain theoretical and practical knowledge of tools for tracking, analyzing, debugging and securing systems, implementing and managing file systems, disk subsystems, processes, memory, network services, shared file systems, name services, remote access, and system boot. Z,ZK BIE-VDC.21 Virtualization and Data Centers The aim of the course is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses. Web and Database Server Administration Students will get acquainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and backup complex database and web service systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an example of a web server.

#### Seznam p edm t tohoto pr chodu:

Kód	Název p edm tu	Zakon ení	Kredity				
BI-SCE1	Seminá po íta ového inženýrství I	Z	4				
Seminá po íta ového inženýrství je výb rový p edm t pro studenty, kte í se cht jí zabývat hloub ji tématy íslicového návrhu, spolehlivosti a odolnosti proti poruchám a útok m. Ke							
student m se v rán	nci p edm tu p istupuje individuáln a každý student i skupinka student eší n jaké zajímavé aktuální téma s vybraným školitelem.	Sou ástí p edm	tu je práce s				
v deckými lánky a	i jinou odbornou literaturou a/nebo práce v laborato ích K N. Kapacita p edm tu je omezena možnostmi u itel seminá e. Probíraná t	émata jsou pro ka	ždý semestr				
	nová.						
BIE-3DT.1	3D Printing	KZ	4				
Students learn to	besign three-dimensional objects optimized for printing on a RepRap printer and the printing itself. They will be able to design objects	, prepare for printii	ng and print				
	in 3D.						
BIE-AAG.21	Automata and Grammars	Z,ZK	5				
Students are introd	uced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite	automata, regular	expressions				
and regular gramm	ars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages, relationships between foi	rmal languages an	d automata.				
Knowledge acqui	red through the module is applicable in designs of algorithms for searching in text, data compression, simple parsing and translation,	and design of digi	tal circuits.				
BIE-ADU.1	Unix Administration	Z,ZK	5				
Students became fa	Students became familiar with the internal structure of Unix-like systems, with the administration of their basic subsystems and with the principles of their protection against unauthorized						
use. In the semina	use. In the seminars they will verify the information from the lectures on real life examples from practice. They will understand the differences between user and administrator roles.						
They gain theoretic	hey gain theoretical and practical knowledge of tools for tracking, analyzing, debugging and securing systems, implementing and managing file systems, disk subsystems, processes,						

memory, network services, shared file systems, name services, remote access, and system boot.

BIE-ADW.1	Windows Administration	Z,ZK	4
	stand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the		
security tools ar	and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.	methods and ad	ministrate
BIE-AG1.21	Algorithms and Graphs 1	Z,ZK	5
	rs the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing	'	-
	t BIE-AAG and BIE-ZDM courses in which the students gain the basic skills and knowledge needed for time and space complexity of a		
	practically the asymptotic mathematics.		
BIE-AG2	Algorithms and Graphs 2	Z,ZK	5
BIE-APS.21	Architectures of Computer Systems	Z,ZK	5
	rn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Spec		
	on processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the princ r processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of	•	
=	se further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coher	=	
programm rife cours	systems.	. 0.100 a.10 001.010	toney in out
BIE-ASB.21	Applied Network Security	Z,ZK	5
	urse is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gaine	d in course BI-PS	SI with actual
security application	tions like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing	g the course stud	ent will get
	knowledge of security applications in computer networks.		
BIE-AWD.21	Web and Database Server Administration	Z,ZK	5
-	cquainted with the administration of database and web servers and services. They will be able to install, configure, operate, test, and be vice systems. The principles will be demonstrated on the PostgreSQL relational database engine and Apache will be used as an exam-		
BIE-BAP.21	Bachelor Thesis	Z	14
BIE-BEK	Secure Code	Z,ZK	5
	posuzovat a zohled ovat bezpe nostní rizika p i návrhu svého kódu a ešení v b žné inženýrské praxi. Od teorie modelování bezpe r		_
	sí b h program pod nižšími oprávn ními a jak tato oprávn ní stanovovat, protože ne každý program musí nutn b žet s administrátor		
	rována rizika spojená s p ete ením bufferu. Dále se studenti budou krátce v novat zabezpe ení dat a jak toto zabezpe ení souvisí s dat		
	V záv ru se budou v novat útok m typu DoS (Denial of Service) a obran proti nim.		
BIE-BPR.21	Bachelor Project	Z	1
At the beginning of	of the semester the student will contact the supervisor of the bachelor thesis he has booked. They will discuss the partial tasks that st	tudent will perforr	n during the
DIE CON	semester. If he fulfill these tasks, the supervisor will award him / her at the end of the semester with the BI-BPR course.	7 71/	
BIE-CCN	Compiler Construction	Z,ZK	5
This is an introdu		of compilers for	students to
This is an introdu	Compiler Construction uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles	of compilers for	students to
This is an introdu understa BIE-CSI	Compiler Construction uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles and the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching	of compilers for stheme of the cla	students to ss.
This is an introductors an introductors and introductors science, high-school	Compiler Construction uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles and the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching  Introduction to Computer Science tory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other field to students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce basic principles and the class is to introduce basic principles and the class is to introduce basic principles.	of compilers for so theme of the cla  Z elds but interested all of the class is	students to ss.  2 d in computer to introduce
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This is an introduct understa  BIE-CSI This is an introduct science, high-scho and relate basic product the way they	Compiler Construction  uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles and the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching Introduction to Computer Science  tory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fie ool students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The governiciples of computer science for students to understand, early on, what computer science is, why things such as high-level programmy are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer no	of compilers for some of the class of the class is ming languages at just basic comp	2 d in computer to introduce and tools are uter science
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BIE-FTR.1 **Financial Markets** Z,ZK 5 Financial sector has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view on the issue of credit risk, and globalization of market activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities, many firms need graduates from technical schools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of financial markets. The Financial Markets course thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical tools used in this field. BIE-GIT.21 SW Development Technologies 7 3 This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use **BIE-HAS** Human Factors in Cryptography and Security 7 7K P edm t je ur en student m, které zajímá nejen matematická a technická stránka v ci, ale i p emýšlení nad tím, jestli výsledný produkt bude použitelný pro lidi (od t ch, kte í implementují šifry po uživatele aplikací). Studenti budou moci využít nabyté v domosti z tohoto kurzu k návrhu, plánování a analýze svých vlastních projekt v kontextu kybernetické bezpe nosti zam ené na lov ka. **BIE-HWB** Hardware Security The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers. BIE-IDO.21 Introduction to DevOps 5 The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice. **BIE-IMA** Introduction to Mathematics Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples. BIF-IMA2 Introduction to Mathematics 2 Ζ 2 Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples. Z,ZK Internet of Things BIE-IOT.21 5 The course focuses on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an overview of sensors and actuators, wireless communication technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architectures for different application areas. Within the computer labs, students will gain practical experience with developing simple IoT systems using common development environments (hardware - ARM, ESP, STM; software - Arduino, Raspberry Pi OS). BIE-JPO.21 Computer Units Students deepen their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail with the internal structure and organization of computer units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using appropriate codes for implementation of multiplication. The organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including codes for error detection and correction for parallel and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of communication of the processor with the environment and the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammed processor simulator and programmable hardware design kits (FPGA). BIE-KAB.21 Cryptography and Security Z,ZK 5 Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis. Students are expected to be competent programmers in C/C++ (on a small scale). Basic Python knowledge is an advantage. BIE-KOM Conceptual Modelling Z,ZK 5 The course focuses on the development of abstract thinking skills and precise specifications in the form of conceptual models. Students will learn the ability to distinguish key concepts in the domain, categorize and also determine the right links in complex systems of social reality, especially enterprises and institutions. Students will learn the basics of ontological structural modeling in OntoUML notation. They will also learn to express the rules and limitations of everyday reality using the OCL language. Students will also learn the basics of Enterprise Engineering as a discipline enabling conceptual modeling of the structure of enterprises and institutions and their process and learn the DEMO methodology. The course is also designed with regard to the continuity of software implementations. BIE-LA1.21 Linear Algebra 1 7.7K We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science. BIE-LA2.21 Linear Algebra 2 Z,ZK Students will broaden their knowledge gained in the BIE-LA1 introductory course, where only vectors in the form of n-tuples of numbers were considered. Here we will introduce vector spaces in a general abstract form. The notions of a scalar product and a linear map will enable to demonstrate the profound link between linear algebra, geometry, and computer graphics. The other main topic will be numerical linear algebra, in particular problems with solving systems of linear equations on computers. The issues of numerical linear algebra will be demonstrated mainly on the matrix factorization problem. Selected applications of linear algebra in various fields will be presented. BIE-LOG.21 Mathematical Logic Z,ZK The course focuses on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability, logical equivalence, and the logical consequence of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are explained. This relates to the P vs. NP problem and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and their models. The syntactic approach to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness theorems is explained. **BIE-MA1.21** Mathematical Analysis 1 Z,ZK 5 We begin the course by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers. Then we study real sequences and real functions of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions. This theoretical foundation is then applied to root-finding problems (iterative method of bisection and Newton's method), construction of cubic interpolation (spline), and formulation and solution of simple optimization problems (i.e., the issue of finding extrema of functions). The course is closed with the Landau's asymptotic notation and methods of mathematical description of complexity of algorithms.

BIE-MA2.21 Mathematical Analysis 2 Z,ZK 6 The course completes the theme of analysis of real functions of a real variable initiated in BIE-MA1 by introducing the Riemann integral. Students will learn how to integrate by parts and use the substitution method. The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylor's theorem to the computation of elementary functions with a prescribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, and its analysis using the Master theorem. Finally, we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and Hessian matrix, we study the analytical method of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integration of multivariate functions. BIE-MPP.21 Methods of interfacing peripheral devices 7 7K 5 The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universal serial bus (USB). The course includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USB devices, Linux and Windows drivers, simple application development, and APIs of selected devices. BIF-OOP 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 we look at some of the main principles of object-oriented programming and design. The emphasis is on practical techniques for software development including testing, error handing, refactoring and design patterns. BIE-OOP.21 Object-Oriented Programming Z,ZK Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern. 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. Programming and Algorithmics 1 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). BIE-PJP Z,ZK **Programming Languages and Compilers** 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 Tento kurz je prezentován v angli tin . Existuje ale také eská varianta BI-PJV a BIK-PJV. **BIE-PKM** Z **Preparatory Mathematics** 4 The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics 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. Students demonstrate practical use of the design techniques in the course project using modern industry-standard CAD design tools. **BIE-PPA Programming Paradigms** Z,ZK 5 BIE-PRR.21 Project ma19nagement 7.7K 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. 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, ln, mkdir, rm...) and useful basic data filtering tools (cut, tr, sort, uniq...) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a selection of advanced scripting techniques used in practice. Computer Networks 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 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. Computer Engineering Seminar II BIF-SCF2 7 4 The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. **BIE-SEG** Systems Engineering 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. World Economy and Business BIF-SEP 7.7K The minimum of enrolled students is 8. If the capacity is not fulfilled, the course will not be taught. The course introduces students of technical universities to international business. It does that predominantly by comparing individual countries and key regions of the world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve knowledge in the form of discussions based on individual readings. BIE-SIP.21 **Network Programming** 5 The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment. BIE-SKJ.21 Scripting Languages 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-SP1.21 ΚZ 5 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. Team Software Project 2 Students gain hands-on experience with the iterative development process while working on a large-scale software project. The first iteration is the result of the BIE-SP1 course project. However, in this follow-up, the functionality, testing, and documentation of the software system being developed will be emphasized. Students will work in teams of 4-6 people. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) the formal as well as material aspects of their solution. Administration of Computer Networks and Services The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure. BIE-SRC.21 Real-time systems Z.ZK Students obtain the basic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issues. Theoretical knowledge from lectures will be experimentally verified in department specialized labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab are the same as in the BIE-VES course and FPGAs.. BIF-ST1 Network Technology 1 Ζ 3 P edm t je zam en na získání základních znalosti z oblasti po íta ových sítí a praktických zkušeností se sí ovými technologiemi. P edm t odpovída látce kurikula Cisco Netacad programu - CCNA1 - R&S Introduction to Networks. Software Engineering Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development. Applications of Security in Technology BIE-TAB.21 Z.ZK 5 The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security. **Documentation and Presentation** 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. BIF-T.IV 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-TPS.21 Z.ZK Computer Networks Technologies 5 The course introduces students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the physical layer with the overlap to the link layer. The lectures provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies will be demonstrated and with the most important ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks, Ethernet, modern wireless networks, always with focus on high-speed networks.

BIE-TUR.21	User Interface Design	Z,ZK	5
-	asic overview of methods for designing and testing common user interfaces. They get experience to solve the problems where software the control of the contr		
communicate with	the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain bring users into the development process to ensure optimal interface for them.	n an overview of	methods that
BIE-TZP.21	Technological Fundamentals of Computers	Z,ZK	5
	inted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer st		1
· · · · · · · · · · · · · · · · · · ·	oduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to redu	=	
limits to the maxim	num 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 bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated, what happens if it is not; how a computer bus needs to be terminated bus needs to be terminated bus needs to be terminated bus needs to be the computer bus needs to be terminated	nputer power sup	ply looks like
BIE-UKB.21	(in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica.	Z.ZK	
	Introduction to Cybersecurity urse is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic over	, ,	5 cvberspace
e gea. e. a.e ee	and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace rec		. 0,20.00400
BIE-UOS.21	Unix-like Operating Systems	KZ	5
-	systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative full		
	uters and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic propert		•
•	eads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level on the level of the toutilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting in		
BIE-VAK.21	Selected Combinatorics Applications	7	3
	introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the ba	asic courses, we	_
issue from applicat	ions to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic	data structures.	Furthermore
-	ticipation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) info		
will select probler	ns to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimize also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.	ation and more. S	students will
BIE-VDC.21	Virtualization and Data Centers	Z,ZK	5
	rse is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and	· '	_
	h as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data cer	-	
	rid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications.		
	ation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, or		
BIE-VES.21	Embedded Systems esign embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedd	Z,ZK	5
Students learn to d	peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.	eu processors, ur	ien integrate
BIE-VPS.21	Selected Topics in Computer Networking	Z.ZK	5
	ipon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technological students are supported by the computer Networks course (BI-PSI), obligatory for the program.	gies used in mod	ern compute
	al area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical	•	real network
	vices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance		1
BIE-VR1.21	Virtual reality I tual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The c	KZ	the ways of
introduction to vii	creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social		tile ways of
BIE-ZRS	Basics of System Control	Z,ZK	4
	t základy ízení systém je ur en pro všechny zájemce o aplikovanou informatiku v bakalá ském studiu. Alespo p ehledové znalosti		
	osolventy jist konkuren ní výhodou a zhodnotí je bezesporu v pr myslové praxi. Studenti získají znalosti v dynamicky se rozvíjejícím		
	éna na ízení inženýrských a fyzikálních sysém . Poskytneme vám základní informace z oblasti zp tnovazebního ízení lineárních dy ne vás s metodami vytvá ení popisu a modelu systém , základní analýzou lineárních dynamických systém a návrhem a ov ením je		
	egulátor. Pozornost je v nována rovn ž sníma m a ak ním len m v regula ních obvodech, otázkám stability regula ních obvod		
	etr regulátoru a n kterým aspekt m pr myslových realizací spojitých a íslicových regulátor . Jednotlivá témata p ednášek jsou pro		
	p íklad a praktických pr myslových realizací.		1
BIE-ZRS.21	Basics of System Control	Z,ZK	5
-	in introduction to the field of automatic control. It focuses particularly on the control of engineering and physical systems. It covers base 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 stal		-
а	nd continuous adjustment of the controller parameters, and certain aspects of the industrial implementations of continuous and digital	al controllers.	
BIE-ZSB.21	Basics of System Security	Z,ZK	5
<del>-</del>	purse is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forensis	=	=
such as maiware a	analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of moder as well as skills needed for independent work in the area of operating system security incident analysis.	n operating syste	ems security,
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
	uced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical		1
	i-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithm		
51E =:	be presented as well.		
BIE-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5
	uced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classicali-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithm		
acc 3001011, 111011	be presented as well.	- s alo ilouidi	
TV2K1	T lesná výchova 2	Z	1
TVKLV	T lovýchovný kurz	Z	0
TVV	T lesná výchova	Z	0
TVV0	T lesná výchova 0	Z	0
UKCJP	eština pro pokro ilé	Z,ZK	2
	Kurz pokro ilé eštiny pro ukrajinské studenty, kte í mají status uprchlíka. Zkouška potvrdí znalost eštiny na úrovní B2 s platností p	oro VUT	•

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