## Study plan

## Name of study plan: Bachelor specialization Web Engineering, in Czech, 2021

Faculty/Institute/Others:

Department: Department of Software Engineering Branch of study guaranteed by the department:

Garantor of the study branch: prof. Ing. Róbert Lórencz, CSc.

Program of study: Informatics
Type of study: Bachelor full-time

Required credits: 156 Elective courses credits: 24 Sum of credits in the plan: 180

Note on the plan: Tato verze studijního plánu je ur ena pro ro níky, které byly p ijaty ke studiu od akademického roku 2021/2022 do prezen ní formy studia bakalá ského programu. . Garant: Ing. Lukáš

Ba inka, email: lukas.barinka@fit.cvut.cz

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 106

The role of the block: PP

Code of the group: BI-PP.21

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

Requirement credits in the group: In this group you have to gain 95 credits

Requirement courses in the group: In this group you have to complete 18 courses

Credits in the group: 95

Note on the group:

If you plan to profile the specialization Information Security, Management Informatics, Computer Networks and Internet, Computer Systems and Virtualization, Software Engineering, or Web Engineering, enroll in the course BI-PSI.21 in your 2nd semester of study. If you plan to profile the specialization Computer Graphics, Computer Engineering, Computer Science, or Artificial Intelligence, enroll in the course BI-PSI.21 in your 4th semester of study. If you plan to profile yourself in the Artificial Intelligence specialization, enroll in the course BI-PST.21 in your 3rd semester of study. Otherwise, enroll in the course BI-PSI.21 in your 5th semester of study. If you plan to profile the specialization Artificial Intelligence or Web Engineering, enroll in the course BI-AAG.21 in your 5th semester of study. Otherwise, enroll in the course BI-PSI.21 in your 3rd semester of study.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-AG1.21	Algorithms and Graphs 1 Dušan Knop, Pavel Tvrdík, Ji ina Scholtzová, Ond ej Suchý Pavel Tvrdík Dušan Knop (Gar.)	Z,ZK	5	2P+2C	Z	PP
BI-AAG.21	Automata and Grammars Jan Holub, Jan Janoušek Jan Janoušek Jan Holub (Gar.)	Z,ZK	5	2P+2C	Z	PP
BI-BAP.21	Bachelor Thesis Zden k Muziká	Z	14		L,Z	PP
BI-BPR.21	Bachelor project  Zden k Muziká	Z	1		Z,L	PP
BI-DBS.21	Database Systems Ji í Hunka, Michal Valenta <b>Ji í Hunka</b> Michal Valenta (Gar.)	Z,ZK	5	2P+2R+1L	L	PP
BI-DML.21	Discrete Mathematics and Logic Jan Sp vák, Daniel Dombek Daniel Dombek Jan Sp vák (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
BI-KAB.21	Cryptography and Security Róbert Lórencz	Z,ZK	5	2P+2C	L	PP
BI-LA1.21	Linear Algebra 1 Lud k Kleprlik, Karel Klouda Karel Klouda (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
BI-OSY.21	Operating Systems Pavel Tvrdík	Z,ZK	5	2P+1R+1L	L	PP
BI-PSI.21	Computer Networks Jan Fesl, Viktor erný, Yelena Trofimova, Pavel Kubalík, Vladimír Smotlacha Jan Fesl Jan Fesl (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BI-PST.21	Probability and Statistics	Z,ZK	5	2P+2C	Z	PP

BI-PA1.21	Programming and Algorithmics 1 Josef Vogel, Miroslav Balík, Ladislav Vagner, Jan Trávní ek Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+2R+2C	Z	PP
BI-PA2.21	Programming and Algorithmics 2 Jan Trávní ek Jan Trávní ek (Gar.)	Z,ZK	7	2P+1R+2C	L	PP
BI-SAP.21	Computer Structure and Architecture Hana Kubátová, Petr Fišer Hana Kubátová Hana Kubátová (Gar.)	Z,ZK	5	2P+1R+2C	L	PP
BI-TZP.21	Technological Fundamentals of Computers  Martin Kohlík, Jaroslav Borecký, Martin Novotný, Jan ezní ek, Miroslav Skrbek, Robert Hülle <b>Martin Novotný</b> Martin Novotný (Gar.)	Z,ZK	5	2P+2C	Z	PP
BI-GIT.21	SW Development Technologies Robin Ob rka, Petr Pulc Robin Ob rka Petr Pulc (Gar.)	Z	3	2P	Z	PP
BI-TDP.21	<b>Documentation and Presentation</b> Dana Vynikarová <b>Dana Vynikarov</b> á (Gar.)	KZ	3	2P+2C	Z,L	PP
BI-UOS.21	Unix-like Operating Systems Viktor erný, Yelena Trofimova, Ji í Borský, Ji í Kašpar, Jan Trdli ka, Zden k Muziká , Jakub Žitný, Tomáš Vondra, Jakub Jan i ka, <b>Zden k Muziká</b> Zden k Muziká (Gar.)	KZ	5	2P+2C	Z	PP

	the courses of this group of Study Plan: Code=BI-PP.21 Name=Compulsory Courses of Ba	achelor Stud	y Program
BI-AG1.21	Algorithms and Graphs 1	Z,ZK	5
The course covers the	basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every comp		Students learn
techniques of proofs of	correctness of algorithms and techniques of asymptotic mathematics for estimation of their complexity in the best, worse, or	average case (the	course includes
basics from probability	theory needed for understanding randomized algorithms). Within exercises students learn applications of studied algorithms	for solving practic	al problems.
BI-AAG.21	Automata and Grammars	Z,ZK	5
	d to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of fin	_	-
1	context-free grammars, construction and use of pushdown automata, and translation grammars and transducers. They know	=	ormal languages
<u> </u>	e relationships between formal languages and automata. They are introduced to the Turing machine and complexity classes l		
BI-BAP.21	Bachelor Thesis	Z	14
BI-BPR.21	Bachelor project	Z	1
1. At the beginning of the	ne semester, the student reserves the topic of the bachelor's thesis and connects with the supervisor. He / she will arrange th	e partial tasks tha	t he / she will
perform during the sem	nester to process the assignment. If he completes these tasks, the supervisor will award him a credit from the subject BI-BPR	at the end of the	semester. 2. The
external supervisor ente	ers the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.	cvut.cz/student/st	udijni/formulare).
The completed and sig	ned form will be handed over by the student to the head of the Department of Defense, who will record the credit in KOS. 3. If	the topic of the w	ork that the
student has reserved is	formulated more generally, the tasks assigned to him by the supervisor for the semester should be aimed primarily at fine-tu	ning the assignm	ent so that the
assignment can be sup	plemented and approved at the end of the semester.		
BI-DBS.21	Database Systems	Z,ZK	5
	d to the database engine architecture and typical user roles. They are briefly introduced to various database models. They lea		
(including integrity cons	straints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with n - the relational database model. They learn the principles of normalizing a relational database schema. They understand the fu	the SQL language	e, as well as with
processing, controlling	parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduce	ed to special ways	of storing data
in relational databases	with respect to speed of access to large quantities of data. This introductory-level course does not cover: Administration of data.	atabase systems,	debugging and
optimizing database ap	plications, distributed database systems, data stores.		
BI-DML.21	Discrete Mathematics and Logic	Z,ZK	5
1	inted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts	=	•
	d to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The co	ourse also lays do	wn the basics of
	iber theory, with emphasis on modular arithmetics.		
BI-KAB.21	Cryptography and Security	Z,ZK	5
	d the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to		=
1	based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in a		-
	sics of information security. Within labs, students will gain practical skills in using standard cryptographic methods with an emp	hasis on security	and will also get
	sic procedures of cryptanalysis.		
BI-LA1.21	Linear Algebra 1	Z,ZK	5
	nts to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the fie		
	ds. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian eli		
	ear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eige	nvalues and eiger	vectors of a
matrix. We will also der	nonstrate some applications of these concepts in computer science.		
BI-OSY.21	Operating Systems	Z,ZK	5
In this course that is a fo	illow-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 m	nonitoring. They a	re able to design
and implement simple	multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS Windows.		
BI-PSI.21	Computer Networks	Z,ZK	5
The course introduces	students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in log		
	e amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced net		
	urations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS	•	
BI-PST.21	Probability and Statistics	Z,ZK	5
_	pasics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variable		
	able distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction	-	
	n distributional parameters from random sample characteristics. They will also be introduced to the methods for testing statistic	•	•
	nce of two or more random variables.		
BI-PA1.21	Programming and Algorithmics 1	Z,ZK	7
	Programming and Argonthinics   y to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, s		•
_	y to formulate algorithms for solving basic problems and write them in the Changuage. They understand data types (simple, sconcept of recursion. They learn to analyse simple cases of algorithm complexity. They know fundamental algorithms for sear	-	
with linked lists and tre		ormig, sorting, and	a mampulating
ו זיינון ווווועט ווטנט מווע ווכי	oo.		

BI-PA2.21 Programming and Algorithmics 2

Z,ZK

K | 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).

BI-SAP.21 Computer Structure and Architecture

Z,ZK

5

Students will get acquainted with the basic architecture and units of a digital computer, understand the structure, function, and implementation of arithmetic-logic unit, controllers, memory, I/O communication, methods of data transfers between the units. The logic design and the implementation of a program-controlled simple processor is practically implemented in the labs using programmable circuits (FPGA), a single-chip microcomputer, and modern design (EDA) tools.

BI-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.

BI-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.

BI-TDP.21 Documentation and Presentation

ΚZ

3

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

BI-UOS.21 Unix-like Operating Systems

⟨Ζ

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.

Code of the group: BI\_ZMA-MA1-MA2.21

Name of the group: Compulsory subject in Module of Bachelor Study Program Informatics Elements of

Calculus, in Czech

Requirement credits in the group: In this group you have to gain 11 credits

Requirement courses in the group: In this group you have to complete 2 courses

Credits in the group: 11

Note on the group:

Tato skupina je určená pro studijní plány BI-xxx.2021. Skupinu lze splnit dvojicemi předmětů MA1+MA2, nebo ZMA+MA2. Předmět ZMA je zde uveden kvůli opakovačům, kterým byl přiřazený

nový studijní plán. Předmět ZMA bude naposledy vyučován v semestru B211.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-MA1.21	Mathematical Analysis 1 Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	5	2P+1R+1C	L	PP
BI-MA2.21	Mathematical Analysis 2 Tomáš Kalvoda	Z,ZK	6	3P+2C	Z	PP
BI-ZMA	Elements of Calculus Tomáš Kalvoda, Ivo Petr Tomáš Kalvoda (Gar.)	Z,ZK	6	3P+2C	Z	PP

Characteristics of the courses of this group of Study Plan: Code=BI\_ZMA-MA1-MA2.21 Name=Compulsory subject in Module of Bachelor Study Program Informatics Elements of Calculus, in Czech

BI-MA1.21 Mathematical Analysis 1 Z,ZK

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.

BI-MA2.21 Mathematical Analysis 2

7 7K

6

The course completes the theme of analysis of real functions of a real variable initiated in BI-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. This course can be enrolled only after successful completion of the course BI-MA1, which can be replaced by the course BI-ZMA in the case of repetitive students.

BI-ZMA Elements of Calculus

Z,ZK

6

Students acquire knowledge and understanding of the fundamentals of classical calculus so that they are able to apply mathematical way of thinking and reasoning and are able to use basic proof techniques. They get skills to practically handle functions of one variable in solving the problems in informatics. They understand the links between the integrals and sums of sequences. They are able to estimate lower or upper bounds of values of real functions and to handle simple asymptotic expressions.

Name of the block: Povinné p edm ty specializace

Minimal number of credits of the block: 43

The role of the block: PS

Code of the group: BI-PS-WI.21

Name of the group: Compulsory courses of specialization Web Engineering, version 2021

Requirement credits in the group: In this group you have to gain 43 credits

Web and Database Server Administration

Requirement courses in the group: In this group you have to complete 9 courses

Credits in the group: 43

Note on the group:

BI-AWD.21

Guarantor: Ing. Lukáš Bařinka, email: Lukas.Barinka@fit.cvut.cz

Z,ZK

5

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-AWD.21	Web and Database Server Administration  Michal Valenta	Z,ZK	5	2P+2C	Z	PS
BI-BIG.21	DB Technologies for Big Data	KZ	5	2P+2C	L	PS
BI-MDF.21	Modern Data Formats Jakub Klímek Jakub Klímek Jakub Klímek (Gar.)	KZ	3	1P+1C	Z	PS
BI-PJS.21	JavaScript Programming  Monika Borkovcová	KZ	5	2P+2C	L	PS
BI-SWI.21	Software Engineering	Z,ZK	5	2P+1C	L	PS
BI-TUR.21	User Interface Design	Z,ZK	5	2P+2C	L	PS
BI-TWA.21	Design of Web Applications David Bernhauer	Z,ZK	5	2P+2C	Z	PS
BI-IDO.21	Introduction to DevOps Tomáš Vondra	Z,ZK	5	2P+2C	Z	PS
BI-VWM.21	Searching the Web and Multimedia Databases Tomáš Skopal, Ji í Novák Ji í Novák Tomáš Skopal (Gar.)	Z,ZK	5	2P+1C	L	PS

# Characteristics of the courses of this group of Study Plan: Code=BI-PS-WI.21 Name=Compulsory courses of specialization Web Engineering, version 2021

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.							
BI-BIG.21	DB Technologies for Big Data	KZ	5				
Students will be introduce	ed into the field of Big Data processing where nonrelational (NoSQL) database engines are typically used today. The course	is focused practic	ally so that after				
finishing the course stud	lents were able to choose suitable tools (mostly open source) and techniques,design and implement a simplest reproducible	method of data p	rocessing (data				
collection, transformatio	n/aggregation, presentation). Students get acquainted with various architectures for processing and storing big data. A theor	etical foundation a	and presentation				
of individual technologies will be supplemented with specific case studies.							
BI-MDF.21	Modern Data Formats	KZ	3				

The goal of the course is to give an overview of commonly used data formats for typical types of data. There will be a description of each data type and the data formats used for that data type along with tools available to work with such data. After finishing the course, the students should know how to work with common data, e.g. on the Web.

BI-PJS.21 JavaScript Programming KZ 5
The course is an introduction to Javascript programming. Students will also learn best practices and get acquai nted with tools that make code development in Javascript easier.

BI-SWI.21 Software Engineering Z,ZK 5

Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course,

students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development.

BI-TUR.21 User Interface Design Z,ZK 5

Students gain a basic overview of methods for designing and testing common user interfaces. They get experience to solve the problems where software and other products do not communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of methods that bring users into the development process to ensure optimal interface for them.

#### BI-TWA.21 Design of Web Applications Z,ZK 5

The basic course of web application development. Initially, the students become familiar with HTTP and its possibilities and partly with some properties of language describing the structure (HTML) and presentation of document on the Web (CSS). These skills provide the necessary basis for the development of Web applications, which will be demonstrated in modern libraries facilitate the development of Web pages applications. Server side will be demonstrated on PHP technology using frameworks Symfony 2, Doctrine 2. Developments on the client side will be demonstrated using a JavaScript language with library jQuery and possibly MV\* framework AngularJS.

BI-IDO.21 Introduction to DevOps

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.

BI-VWM.21 | Searching the Web and Multimedia Databases | Z,ZK | 5

Students get basic overview about search techniques in the web environment that is interpreted as a very large distributed and heterogeneous storage of documents. In particular, students acquire information about search techniques in text and hypertext documents (the web pages themselves) and about feature extraction from web pages. They get detailed knowledge of similarity search in multimedia databases (generally in collections of unstructured data). They also learn techniques for programming web search engines for the mentioned data types (documents).

Name of the block: Compulsory elective courses

Minimal number of credits of the block: 5

The role of the block: PV

Code of the group: BI-PV-WI.21

Name of the group: Compulsory elective courses for the specialization Web engineering, version 2021

Requirement credits in the group: In this group you have to gain at least 5 credits (at most 10)

Requirement courses in the group: In this group you have to complete at least 1 course (at most 2)

Credits in the group: 5

Note on the group: Guarantor: Ing. Lukáš Bařinka, email: Lukas.Barinka@fit.cvut.cz

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-PHP.21	Programing in PHP Monika Borkovcová Monika Borkovcová (Gar.)	Z,ZK	5	2P+2C	Z	PV
BI-PYT.21	Python Programming Ji i Hanuš, Valeriia legorova, Jan Lukány, Vojt ch Van ura Martin Šlapák Voit ch Van ura (Gar.)	KZ	5	3C	Z	PV

# Characteristics of the courses of this group of Study Plan: Code=BI-PV-WI.21 Name=Compulsory elective courses for the specialization Web engineering, version 2021

BI-PHP.21	Programing in PHP	Z,ZK	5				
The course is an introduction to the PHP language and technology. Students will learn also best practices and will use tools that make development in PHP easier.							
BI-PYT.21	Python Programming	KZ	5				
The aim of the course is to get acquainted with basic efficient control and data structures of the Python programming language for text and binary data processing. The differences							
between philosophy of r	programming in Python and in other programming languages will be explained. Each topic is prepared for students in the form	nat of a Jupyter n	otebook, which				

The aim of the course is to get acquainted with basic efficient control and data structures of the Python programming language for text and binary data processing. The differences between philosophy of programming in Python and in other programming languages will be explained. Each topic is prepared for students in the format of a Jupyter notebook, which enables greater accent to individual student work. Before each lab, students pass a short test on the last week topic. Four homeworks plus a semester work will be assigned during the semester.

Name of the block: Povinná zkouška z angli tiny

Minimal number of credits of the block: 2

The role of the block: PJ

Code of the group: BI-ZKA.21

Name of the group: English Language Exam

Requirement credits in the group: In this group you have to gain at least 2 credits (at most 4)

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 2

Note on the group:

BI-ANG, ending with an exam for two credits, is enrolled by students who have completed preparator English courses and have a credit from the BI-A2L course. <br/>
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br> BI-ANG1, ending with an exam for two credits, is enrolled by students who prepared for the exam independently and do not have credit from BI-A2L. These students must complete a credit paper before their own exam. After passing the exam, the student will also be recognized for the course BI-ANGS (Independent preparation for the English exam) for 2 credits. <br/>
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The BIE-ECC course can be recognized for any active semester after the submission of a external certificate at the level of at least B2 according to the Common European Framework of Reference.

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-EEC	English external certificate Zden k Muziká Miroslav Balík Zden k Muziká (Gar.)	Z	4		L	PJ
BI-ANG1	English Language Examination without Preparatory Courses Kate ina Valentová Kate ina Valentová (Gar.)	Z,ZK	2		L	PJ
BI-ANG	English Language, Internal Certificate Kate ina Valentová Kate ina Valentová (Gar.)	ZK	2		Z,L	PJ

Characteristics of the courses of this group of Study Plan: Code=BI-ZKA.21 Name=English Language Exam

BIE-EEC	English external certificate	Z	4				
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding							
the B2 level of the Com	mon European Framework of Reference for Languages.						
BI-ANG1	English Language Examination without Preparatory Courses	Z,ZK	2				
BI-ANG	English Language, Internal Certificate	ZK	2				
Course information and	Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG						

Name of the block: Povinná t lesná výchova, sportovní kurzy

Minimal number of credits of the block: 0

The role of the block: PT

Code of the group: BI-PT.21

Name of the group: Compulsory Physical Education, version 2021

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 2 courses (at most 6)

Credits in the group: 0

Note on the group: Guarantor: prof. lng. Róbert Lórencz, CSc., email: robert.lorencz@fit.cvut.cz

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
TV1	Physical Education	Z	0	0+2	Z	PT
TVV	Physical education	Z	0	0+2	Z,L	PT
TVV0	Physical education	Z	0	0+2	Z,L	PT
TV2	Physical Education	Z	0	0+2	L	PT
TVKLV	Physical Education Course	Z	0	7dní	L	PT
TVKZV	Physical Education Course	Z	0	7dní	Z	PT

Characteristics of the courses of this group of Study Plan: Code=BI-PT.21 Name=Compulsory Physical Education, version 2021

TV1	Physical Education	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0
TV2	Physical Education	Z	0
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0

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

The role of the block: V

Code of the group: BI-WI-VO.21

Name of the group: Elective Vocational Courses for a Bachelor Specialization BI-WI.21, version 2021

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

Credits in the group: 0

Note on the group: Guarantor: Ing. Lukáš Bařinka, email: Lukas.Barinka@fit.cvut.cz

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-ADU.21	Unix Administration  Zden k Muziká	Z,ZK	5	2P+2C	L	٧
BI-AG2.21	Algorithms and Graphs 2 Ond ej Suchý	Z,ZK	5	2P+2C	L	V
BI-ASB.21	Applied Network Security Ji í Dostál	Z,ZK	5	2P+2C	Z	V
BI-APS.21	Architectures of Computer Systems	Z,ZK	5	2P+2C	Z	V
BI-BEK.21	Secure Code Róbert Lórencz	Z,ZK	5	2P+2C	L	V
BI-EPP.21	Economic Business Processes  David Buchtela	Z,ZK	5	2P+2C	L	V
BI-EHA.21	Ethical Hacking Ji í Dostál	Z,ZK	5	2P+2C	L	V
BI-FBI.21	Financial Business Intelligence David Buchtela	Z,ZK	5	2P+2C	L	V
BI-HWB.21	Hardware Security	Z,ZK	5	2P+2C	Z	V
BI-IOT.21	Internet of Things	Z,ZK	5	2P+2C	Z	V
BI-JPO.21	Computer Units Pavel Kubalík	Z,ZK	5	2P+2C	Z	V
BI-KOM.21	Conceptual Modelling Robert Pergl	Z,ZK	5	2P+2C	Z	V

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BI-LA2.21	Linear Algebra 2 Karel Klouda Karel Klouda (Gar.)	Z,ZK	5	2P+2C	L	V
BI-LOG.21	Mathematical Logic Kate ina Trlifajová	Z,ZK	5	2P+2C	Z	V
BI-MPP.21	Methods of interfacing peripheral devices  Miroslav Skrbek	Z,ZK	5	2P+2C	Z	V
BI-MVT.21	Modern Visualisation Technologies Petr Pauš, Ji í Chludil Petr Pauš Petr Pauš (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-MGA.21	Multimedia and Graphics Applications	Z,ZK	5	2P+2C	Z	V
BI-OOP.21	Object-Oriented Programming	Z,ZK	5	2P+2C	Z	V
BI-PGR.21	Computer graphics programming Petr Felkel, Jaroslav Sloup Jaroslav Sloup Petr Felkel (Gar.)	Z,ZK	5	2P+2C	L	V
BI-PRS.21	Practical Statistics	KZ	5	1P+2C	L	V
BI-PNO.21	Practical Digital Design  Martin Novotný	KZ	5	2P+2C	Z	V
BI-PAI.21	Law and Informatics	ZK	5	2P+2C	L	V
BI-PJP.21	Programming Languages and Compilers  Jan Janoušek	Z,ZK	5	2P+1C	L	V
BI-PPA.21	Programming Paradigms  Jan Janoušek	Z,ZK	5	2P+2C	Z	V
BI-PGA.21	Programming of Graphic Applications Radek Richtr	Z,ZK	5	2P+2C	Z	V
BI-PYT.21	Python Programming Ji í Hanuš, Valeriia Iegorova, Jan Lukány, Vojt ch Van ura Martin Šlapák Vojt ch Van ura (Gar.)	KZ	5	3C	Z	V
BI-PRR.21	Project management David Pešek David Pešek David Pešek (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-SIP.21	Network Programming  Jan Fesl	Z	5	2P+2C	Z	V
BI-SP1.21	Team Software Project 1	KZ	5	2C	L	V
BI-SP2.21	Team Software Project 2	KZ	5	2C	Z	V
BI-SPS.21	Administration of Computer Networks and Services  Dana ermáková	Z,ZK	5	2P+2S	Z	V
BI-ML1.21	Machine Learning 1 Daniel Vašata	Z,ZK	5	2P+2C	Z	V
BI-ML2.21	Machine Learning 2 Daniel Vašata	Z,ZK	5	2P+2C	L	V
BI-SVZ.21	Machine vision and image processing  Marcel Ji ina	Z,ZK	5	2P+2C	L,Z	V
BI-SRC.21	Real-time systems  Jaroslav Borecký	Z,ZK	5	2P+2C	Z	V
BI-TAB.21	Applications of Security in Technology Ji í Dostál	Z,ZK	5	2P+2C	L	V
BI-TJV.21	Java Technology	Z,ZK	5	2P+2C	Z	V
BI-TPS.21	Computer Networks Technologies Vladimír Smotlacha	Z,ZK	5	2P+2S	Z	V
BI-TIS.21	Information Systems	Z,ZK	5	2P+2C	Z	V
BI-UKB.21	Introduction to Cybersecurity	Z,ZK	5	3P+1C	Z	V
BI-VES.21	Embedded Systems Miroslav Skrbek	Z,ZK	5	2P+2C	L	V
BI-VDC.21	Virtualization and Data Centers Ji í Kašpar	Z,ZK	5	2P+2C	L	V
BI-VIZ.21	Data Visualization Magda Friedjungová	KZ	5	2P+2C	Z	V
BI-VPS.21	Selected Topics in Computer Networking Pavel Tvrdík	Z,ZK	5	2P+2C	L	V
BI-FEM.21	Fundamentals of Economics	Z,ZK	5	2P+2C	Z	V
BI-ZRS.21	Basics of System Control Kate ina Hyniová	Z,ZK	5	2P+2C	Z	V
BI-ZSB.21	Basics of System Security	Z,ZK	5	2P+2C	Z	V
BI-ZUM.21	Artificial Intelligence Fundamentals Pavel Surynek	Z,ZK	5	2P+2C	L	V

Characteristics of the courses of this group of Study Plan: Code=BI-WI-VO.21 Name=Elective Vocational Courses for a Bachelor Specialization BI-WI.21, version 2021

BI-PYT.21 Python Programming

The aim of the course is to get acquainted with basic efficient control and data structures of the Python programming language for text and binary data processing. The differences between philosophy of programming in Python and in other programming languages will be explained. Each topic is prepared for students in the format of a Jupyter notebook, which enables greater accent to individual student work. Before each lab, students pass a short test on the last week topic. Four homeworks plus a semester work will be assigned during the semester.

BI-ADU.21 Unix Administration Students will learn the internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will understand the differences between user and administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file systems, disk subsystems, processes, memory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge from the lectures on specific examples from practice. Algorithms and Graphs 2 Z,ZK BI-AG2.21 This course, presented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course BI-AG1.21. It further delves into advances data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version of the course see BIE-AG2.21 BI-ASB.21 Applied Network Security 5 Z.ZK The aim of the course is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gained in course BI-PSI with actual security applications like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing the course student will get knowledge of security applications in computer networks. Architectures of Computer Systems RI-APS 21 7.7K 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 Secure Code BI-BEK.21 The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them. BI-EPP.21 **Economic Business Processes** The aim of the course is to present typical processes related to the usual life cycle of a company. The course focuses mainly on the basic economic and financial aspects of business in the market environment of the Czech Republic and the basics of management. In the course, students are acquainted with the typical phases of the company's life cycle, from the establishment of the company, through the management of property and capital structure, financing of the company, determining the cost function of the company and labor costs, to evaluating the financial health of the company and its eventual rehabilitation or termination. BI-EHA.21 **Ethical Hacking** Z,ZK 5 The goal of the course is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vulnerabilities, and their possible exploitation in computer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is on hands-on experience with vulnerabilities testing and the following process of penetration test documentation. BI-FBI 21 Financial Business Intelligence Z,ZK 5 The aim of the course is to acquaint students primarily with financial accounting as a tool for recording business operations and documents for business analysis, determining its value and other indicators for comparison with other companies and management decision process at the tactical and strategic level. The second view is management accounting as a tool for financial management and prediction of business development. Management accounting allows monitoring of the financial status and performance of business activities over several accounting periods, enables a multidimensional view of business data, enables to control effectively factors affecting the return on invested capital and to use value information to assess options related to future business decisions. The principles of management accounting, described in this course, are the basis of Business Intelligence modules in business information systems, decision support systems, and other knowledge-oriented systems. BI-HWB.21  $Z,\overline{ZK}$ Hardware Security 5 The course deals with hardware resources used to ensure security of computer systems including embedded ones. Students become familiar with the operating principles of cryptographic modules, security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand methods of efficient implementations of ciphers. Internet of Things The course focuses on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an overview of sensors and actuators, wireless communication technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architectures for different application areas. Within the computer labs, students will gain practical experience with developing simple IoT systems using common development environments (hardware - ARM, ESP, STM; software - Arduino, Raspberry Pi OS). BI-JPO.21 Computer Units Z,ZK 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). Z.ZK BI-KOM.21 Conceptual Modelling The course is focused on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key terms in a domain, the ability to categorize and specify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological structural modeling in the OntoUML notation. Next, they learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data representation in the Internet. They also learn the foundations of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO method and the BPMN notation will be taught. The course is designed with the respect to continuation in software implementations. Recommended optional follow-up course: BI-ZPI. BI-LA2.21 Linear Algebra 2 Z,ZK 1. Vektorové prostory, 2. Skalární sou in. norma vektoru, ortogonalita, 3. Snalytická geometrie, 4. Lineární zobrazení 5. Matice lineárního zobrazení, 6. [2] Afinní transformace. homogenní sou adnice, projekce a operace v 3D prostoru jako lineární zobrazení. 8. ešení soustav lineárních rovnic. 9. [2] Maticové rozklady (metody LU, SVD, QR) a jejich výpo et. 11. Metoda nejmenších tverc . 12. Lineární programování. 13. Rekurentní rovnice. BI-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.

BI-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 Univ	ersal serial bus (U	SB). 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.		
BI-MVT.21 Modern Visualisation Technologies	Z,ZK	5
The goal of the course is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and a	ugmented reality, v	isualization on
high resolution displays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the men	tioned technologies	s, namely fractal
and procedural visualization, scientific data visualization, and 3D model scanning.		
BI-MGA.21 Multimedia and Graphics Applications	Z,ZK	5
Students get acquainted with multimedia technologies and applications for 2D/3D bitmap and vector graphics. During the course, current tools for w	1 1	
graphics and animation will be introduced. Students learn several basic techniques of creation and editing content in computer graphics, introduction to		
technologies. They learn to use multimedia transmission and representation systems, including real-time multimedia processing. They understand the		-
of graphics processing cards. They gain a number of practical skills, such as vectorizing raster images, retouching photos, or creating 3D models.		
BI-OOP.21 Object-Oriented Programming	Z,ZK	5
Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together.	1 ' 1	_
course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The e		-
for developing software, which includes testing, error handing, refactoring, and application of design pattern.	imphasis is on plac	dodi toomiques
	7.71/	5
BI-PGR.21   Computer graphics programming	Z,ZK	_
After attending this curse, students can program a simple interactive 3D graphical application like a computer game or scientific visualization, designated at the standard standard and the standard sta		_
geometric details and materials (like wall surface, wood, sky), and set up the lighting. At the same time, they understand the fundamental principles and		
such as graphical pipeline, geometric transformations, or lighting model. They gain knowledge allowing orientation in computer graphics and repres	-	=
professional development, e.g., GPU programming and animations. They get used to techniques utilized in geometric modeling, modeling curves and s		
BI-PRS.21 Practical Statistics	KZ	5
The students will be introduced to methods of applied statistics. They will learn how to work with various types of data, perform analyses, and choose	=	
will encompass regression and correlation analysis, analysis of variance and non-parametric methods. Students will learn to use the statistical softw	vare R and will app	ly the studied
methods on data from real problems.		
BI-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 V	HDL language
and implementation technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern	n industry-standard	CAD design
tools.		
BI-PAI.21 Law and Informatics	ZK	5
The aim of the course is to introduce students into the basic legal instruments that they will encounter in their practice. Students will gain knowledge	e of doing business	in the Czech
Republic and will be alerted to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding of the process of the process of concluding of the process of the pr	_	
environment, will know their responsibilities in working with the Internet, will be familiar with the institutes of intellectual property law, and will be able		
and open-source licenses. Emphasis will also be put on the legal protection of data on the Internet, the registration of Internet domains and protecti		
will also be alerted to such behaviour in the field of IT that can be classified as criminal under the Czech law. The course will also include analyses	-	
BI-PJP.21 Programming Languages and Compilers	Z.ZK	5
Students learn basic compiling methods of programming languages. They are introduced to intermediate representations used in current compilers	1 / 1	-
create a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification		-
	iii. Tile complier cal	ii tialisiate liot
only a programming language but any text in a language generated by a given LL input grammar		
only a programming language but any text in a language generated by a given LL input grammar.	7.71/	
BI-PPA.21 Programming Paradigms	Z,ZK	5
BI-PPA.21   Programming Paradigms The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of high-level programming languages.	f particular approac	ches. Functional
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BI-PPA.21   Programming Paradigms The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages or programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern main	f particular approad g. The principles ar	ches. Functional e demonstrated
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BI-ML1.21	Machine Learning 1	Z,ZK	5
-	is to introduce students to the basic methods of machine learning. They get theoretical understanding and practical working k		
	the supervised learning scenario and clustering models in the unsupervised scenario. Students will be aware of the relationsl	•	
	fundamentals of assessing model quality. Moreover, they learn the basic techniques of data preprocessing and multidimensions and scikit libraries in Python will be used.	nai data visualiza	ition. in practical
BI-ML2.21	Machine Learning 2	Z,ZK	5
	is to introduce students to the selected advanced methods of machine learning. In the supervised learning scenario, they, in p	, ,	-
<del>-</del>	the unsupervised learning scenario students learn the principal component analysis and other dimensionality reduction meth		
	prcement learning and natural language processing.		J
BI-SVZ.21	Machine vision and image processing	Z,ZK	5
Camera systems are be	ecoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate	image information	on. The course
	lifferent types of camera systems and a variety of methods for image and video processing. The course is focused on practical transfer in the course is focused on the course in the cou	use of camera sys	stems for solving
	at the graduates may encounter.		
BI-SRC.21	Real-time systems	Z,ZK	5
	iic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issue entally verified in computer labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab		
course.	entally verified in computer labs. The course is mainly locused on embedded IXT systems, therefore the design kits in the lab	are the same as	III tile DIL-VLO
BI-TAB.21	Applications of Security in Technology	Z,ZK	5
	s to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students		_
	ns and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.	J	
BI-TJV.21	Java Technology	Z,ZK	5
The goal is to provide kr	nowledge and skills for developing information systems and applications through concepts used in software development and e	experience with lik	oraries and tools
from Java language eco	system. At the course end, the students are able to develop software systems in Java platform.		
BI-TPS.21	Computer Networks Technologies	Z,ZK	5
	students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the physi	-	-
	provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies are explained to the provide the prov	_	
always with focus on hig	ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks, Ethe	ernet, modern wir	eless networks,
BI-TIS.21	Information Systems	Z,ZK	5
	is to familiarise students with the information systems topic and information systems implementation principles. During the co	, ,	-
<del>-</del>	types of systems and their usage in specific industry segments. Students are familiarised with the CRM, ERP, MRP and other		
_	f the course is the introduction to key ideas of an information system selection, evaluation of information system benefits, way		-
implementation and info	ormation system implementation based on the project management principles. The emphasis is on the initial customer analysis	s, customer insig	ht and ability to
	er to implement any existing information system or to develop a new one from scratch. These factors determine the information	-	
	e information systems security, operation, support, maintenance, legislation impacts, and government information systems to		
BI-UKB.21	Introduction to Cybersecurity	Z,ZK	. 5
-	s to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic or s, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.	verview of threats	in cyberspace
BI-VES.21	Embedded Systems	Z,ZK	5
	ן בחום שמשם במינות במינות Compedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embe	, ,	-
_	ramming methods, and applications. They get practical skills with development kits and tools.	, a a a a a a a a a a a a a a a a a a a	, area magratea
BI-VDC.21	Virtualization and Data Centers	Z,ZK	5
The aim of the course is	s to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design a		on of data center
infrastructure, such as v	various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data c	enter technologie	s from private
	uds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications		
	operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outage		
BI-VIZ.21	Data Visualization	KZ	5
-	s to introduce students to the area of data visualization, its basic principles and methods. The course offers an overview of the alization methods. This will aid the students in understanding data, their content and their application in areas such as data mi		
	/ithin the course, students will be introduced to exploratory data analysis, preprocessing, dimensionality reduction, and ways of	•	•
	ospatial. A part of the course is also dedicated to the area of business intelligence and different visualization tools, which stud		
commercial sphere. Dur	ring labs, students will get hands-on experience in applications of selected methods to real-world examples.		
BI-VPS.21	Selected Topics in Computer Networking	Z,ZK	5
•	the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and techn	•	
	a networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practic	•	h real network
	earning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security		
BI-FEM.21	Fundamentals of Economics	Z,ZK	. 5
	students to discover basics of economic theory, which will then be used in subsequent courses of economics and managemer onomic and macroeconomic topics.	nt. It contains a ge	eneral overview
BI-ZRS.21	Basics of System Control	Z,ZK	5
	roduction to the field of automatic control. Students will gain knowledge in this rapidly evolving field of great future. We will foc		-
<del>-</del>	nd physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems, descripti		
	stems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. Students will learn the methods of creations are stated as a state of creations and the state of creating the state of the s	-	
model, the basic linear	dynamic systems analysis and design verification and simple PID feedback, PSD, and fuzzy controllers. Attention is also give	n to sensors and	actuators in
•	stability in control systems, single and continuous adjustment of the controller parameters, and certain aspects of the industri	al implementation	n of continuous
and digital controllers a			
BI-ZSB.21	Basics of System Security	Z,ZK	5
<del>-</del>	is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forer	=	-
	sis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of mod for independent work in the area of operating system security incident analysis.	em operating sys	oterno occurity,
ao omino mocaed			

BI-ZUM.21 Artificial Intelligence Fundamentals

Z,ZK

5

Basic course on introduction to artificial intelligence with emphasis on symbolic techniques. The design of an intelligent agent and the techniques needed to create it will be discussed, especially at the decision-making level. The intelligent agent in the context of the course can be represented for example by a physical robot, but also by a non-physical entity, such as a virtual assistant or a character in a computer game. We will not only introduce the basics, but also show the current state-of-the-art during the course.

Code of the group: BI-V.21

Name of the group: Purely Elective Courses of Bachelor Programme BI, Version 2021

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

Credits in the group: 0

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

Note on the grou	лр: Guarantor: prof. lng. Róbert L	órencz, CSc., e	mail: rol	bert.lore	ncz@fit.cv	ut.cz
Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-ALO	Algebra and Logic Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+1C	L	V
BI-AVI.21	Algorithms visually Lud k Ku era Lud k Ku era (Gar.)	Z,ZK	4	2P+1C	*	V
BI-A2L	English language, preparation for the B2 level exam Kate ina Valentová Kate ina Valentová (Gar.)	Z	2	2C	L	V
BI-APJ	Aplication Programming in Java Michal Valenta	Z,ZK	4	2P+1R+1C	, z	V
MI-AFP	Applied Functional Programming Robert Pergl	KZ	5	2P+1C	L	V
BIE-ZUM	Artificial Intelligence Fundamentals Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-BLE	Blender Lukáš Ba inka <b>Lukáš Ba inka</b> Lukáš Ba inka (Gar.)	Z,ZK	4	2P+2C	L	V
NI-DSP	Database Systems in Practes Michal Valenta	Z,ZK	4	2P+1C	L	V
BI-STO	Storage and Filesystems Ji í Kašpar Ji í Kašpar (Gar.)	Z,ZK	4	2P+2C	L,Z	V
MI-DZO	Digital Image Processing Daniel Sýkora	Z,ZK	4	2P+1C	L	V
NI-DZO	Digital Image Processing Daniel Sýkora Daniel Sýkora (Gar.)	Z,ZK	4	2P+1C	L	V
MI-DDM	Distributed Data Mining	KZ	4	3C	L	V
NI-DDM	Distributed Data Mining	KZ	4	3C	L	V
BI-EP1	Effective programming 1 Martin Ka er Martin Ka er (Gar.)	Z	4	2P+2C	Z	V
BI-EP2	Efficient Programming 2 Martin Ka er Martin Ka er (Gar.)	KZ	4	2P+2C	L	V
BI-EJA	Enterprise Java Jií Dan ek Jií Dan ek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-EHA.21	Ethical Hacking Ji i Dostál	Z,ZK	5	2P+2C	L	V
BI-FMU	Financial and Management Accounting David Buchtela David Buchtela David Buchtela (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-HAM	HW accelerated network traffic monitoring Tomáš ejka Tomáš ejka Tomáš ejka (Gar.)	KZ	4	2P+1C	L	V
BI-HMI	History of Mathematics and Informatics Alena Šolcová Alena Šolcová (Gar.)	Z,ZK	3	2P+1C	L	V
BI-ARD	Interactive applications on Arduino Robert Hülle Robert Hülle (Gar.)	KZ	4	3C	L	V
NI-IAM	Internet and Multimedia Sven Ubik, Ji í Melnikov Ji í Melnikov Sven Ubik (Gar.)	Z,ZK	4	2P+1C	L	V
BIE-IMA2	Introduction to Mathematics 2 Karel Klouda	Z	2	1C	Z	V
BI-CS2	C# language and data access Pavel Št pán Pavel Št pán Pavel Št pán (Gar.)	KZ	4	0P+3C	Z	V
BI-CS3	Language C# - design of web applications Pavel Št pán Pavel Št pán Pavel Št pán (Gar.)	KZ	4	3C	Z	V
BI-SQL.1	Language SQL, advanced Michal Valenta Michal Valenta (Gar.)	KZ	4	3C	L	V
BI-QAP	Quantum algorithms and programming Tomáš Kalvoda, Ivo Petr Ivo Petr (Gar.)	KZ	5	1P+2C	Z	V
NI-LSM	Statistical Modelling Lab Karel Klouda	KZ	5	3C	L	V
NI-MPL	Managerial Psychology Jan Fiala Jan Fiala Jan Fiala (Gar.)	ZK	2	2P	Z,L	V

MI-MSI	Mathematical Structures in Computer Science  Jan Starý	Z,ZK	4	2P+1C	L	V
BI-MPP	Methods of interfacing peripheral devices  Miroslav Skrbek Miroslav Skrbek Miroslav Skrbek (Gar.)	Z,ZK	4	2P+2C	Z	V
BI-MIT	Mikrotik technologies Jan Fesl Jan Fesl (Gar.)	KZ	3	1P+2C	Z	V
NI-MOP	Modern Object-Oriented Programming in Pharo  Marek Skotnica, Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
BI-MMP	Multimedia team project  Zde ka echová Michal Valenta Zde ka echová (Gar.)	KZ	4	3C	L	V
NI-OLI	Computer Engineering Seminar Master II  Jaroslav Borecký, Miroslav Skrbek Jaroslav Borecký Miroslav Skrbek (Gar.)	Z,ZK	4	2P+2C	L	V
MI-OLI	Linux Drivers Martin Da hel	Z,ZK	4	2P+2C	L	V
BI-ACM	Programming Practices 1 Ivan Šime ek Ond ej Suchý (Gar.)	KZ	5	4C	L	V
BI-ACM2	Programming Practices 2 Jan Matyás K iš an, Ond ej Suchý, Václav Blažej, Tomáš Valla Ivan Šime ek Tomáš Valla (Gar.)	KZ	5	4C	Z	V
BI-ACM3	Programming Practices 3 Jan Matyáš K iš an, Ond ej Suchý, Václav Blažej, Tomáš Valla Ivan Šime ek Tomáš Valla (Gar.)	KZ	5	4C	L	V
BI-ACM4	Programming Practices 4 Ond ej Suchý, Tomáš Valla Tomáš Valla Ond ej Suchý (Gar.)	KZ	5	4C	Z	V
BI-AND.21	Programming for the Android Operating System  Martin P Ipitel Martin P Ipitel (Gar.)	KZ	4	3C	L	V
BI-CS1	Programming in C# Pavel Št pán, Helena Wallenfelsová Helena Wallenfelsová Pavel Št pán (Gar.)	KZ	4	3C	L,Z	٧
BI-PJV	Programming in Java Miroslav Balík, Jan Blizni enko, Vojt ch Knaisl <b>Miroslav Balík</b> Miroslav Balík (Gar.)	Z,ZK	4	2P+2C	Z	V
BI-PJS.1	JavaScript Programming Old ich Malec, Nikita Mironov Nikita Mironov (Gar.)	KZ	4	3C	L	V
ві-кот	Programing in Kotlin Jií Dan ek <b>Jií Dan ek</b> Jií Dan ek (Gar.)	Z,ZK	4	2P+2C	L	V
MI-PSL	Programming in Scala Michal Valenta	Z,ZK	4	2P+1C	L	V
BI-PMA	Programming in Mathematica Zden k Buk Zden k Buk (Gar.)	Z,ZK	4	2P+2C	Z	V
BI-PHP.1	Programing in PHP Old ich Malec, Marek Erben Old ich Malec (Gar.)	KZ	4	3C	Z	٧
MI-PDD.16	Data Preprocessing Daniel Vašata	Z,ZK	5	2P+1C	Z	V
NI-PDD	Data Preprocessing Marcel Ji ina Daniel Vašata Marcel Ji ina (Gar.)	Z,ZK	5	2P+1C	Z	V
BI-PKM	Introduction to mathematics Karel Klouda Karel Klouda (Gar.)	Z	4		Z	V
NI-REV	Reverse Engineering Josef Kokeš, Róbert Lórencz, Ji í Dostál <b>Ji í Dostál</b> Ji í Dostál (Gar.)	Z,ZK	5	1P+2C	Z	V
MI-REV.16	Reverse Engineering	Z,ZK	5	1P+2C	Z	V
BI-SCE1	Computer Engineering Seminar I Hana Kubátová, Martin Novotný Miroslav Skrbek Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
BI-SCE2	Computer Engineering Seminar II Hana Kubátová, Miroslav Skrbek Miroslav Skrbek Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
BI-ST1	Network Technology 1 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BI-ST2	Network Technology 2 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	3C	L	V
BI-ST3	Network Technology 3 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BI-ST4	Network Technology 4 Alexandru Moucha (Gar.)	Z	3	2C	L	٧
BI-SOJ	Machine Oriented Languages	Z,ZK	4	2P+2C	L	V
BI-SVZ.21	Machine vision and image processing  Marcel Ji ina	Z,ZK	5	2P+2C	L,Z	V
MI-SYP.16	Parsing and Compilers  Jan Janoušek	Z,ZK	5	2P+1C	Z	V
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
BI-GIT	Version control system GIT Robin Ob rka, Petr Pulc Petr Pulc Petr Pulc (Gar.)	KZ	2	16P	Z,L	V
BI-TS1	Theoretical Seminar I Ond ej Suchý, Tomáš Valla <b>Jan Janoušek</b> Tomáš Valla (Gar.)	Z	4	2C	Z	V
BI-TS2	Theoretical Seminar II Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	L	V

	Tomas vana (San)		1			
BI-TS4	Theoretical Seminar IV Ond ej Suchý, Tomáš Valla Jan Janoušek Tomáš Valla (Gar.)	Z	4	2C	L	V
BI-TDA	Test driven architecture	KZ	4	2P+1C	Z,L	V
NI-TSP	Testing and Reliability Petr Fišer Martin Da hel Petr Fišer (Gar.)	Z,ZK	5	2P+2C	Z	V
MI-TSP.16	Testing and Reliability Petr Fiser	Z,ZK	5	2P+2C	Z	V
BI-TEX	<b>TeX and Typography</b> Petr Olšák <b>Petr Olšák</b> Petr Olšák (Gar.)	Z,ZK	4	2P+1C	L	V
BI-ULI	Introduction to Linux  Zden k Muziká, Dana ermáková, Jan Ž árek <b>Zden k Muziká</b> Zden k  Muziká (Gar.)	Z	2	4D	Z	V
BI-OPT	Introduction to Optical Networks	Z,ZK	4	2P+1C	Z	V
NI-VCC	Virtualization and Cloud Computing Jan Fesl, Tomáš Vondra Tomáš Vondra Tomáš Vondra (Gar.)	Z,ZK	5	2P+1C	L	V
BI-VHS	Virtual game worlds Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+2C	Z	V
BI-VR1	Virtual reality I Petr Pauš, Petr Klán Petr Klán (Gar.)	KZ	4	2P+2C	L,Z	V
BI-VR2	Virtual reality II Petr Klán <b>Petr Klán</b> Petr Klán (Gar.)	KZ	3	1P+2C	L	V
BI-VAK.21	Selected Applications of Combinatorics Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	3	2R	L	V
BI-VMM	Selected Mathematical Methods Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
MI-VYC	Computability Jan Starý	Z,ZK	4	2P+2C	L	V
NI-VYC	Computability Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
BI-ZS10	Bachelor internship abroad for 10 credits  Miroslav Balík Zden k Muziká (Gar.)	Z	10		Z,L	V
BI-ZS20	Bachelor internship abroad for 20 credits  Miroslav Balík Zden k Muziká (Gar.)	Z	20		Z,L	V
BI-ZS30	Bachelor internship abroad for 30 credits  Miroslav Balík Zden k Muziká (Gar.)	Z	30		Z,L	V
BI-ZIVS	Intelligent Embedded System Fundamentals  Miroslav Skrbek Miroslav Skrbek (Gar.)	KZ	4	1P+3C	Z	V
BI-ZPI	Process engineering Robert Pergl Robert Pergl (Gar.)	KZ	4	1P+2C	L	V
BI-ZNF	PHP Framework Nette - basics Ji í Chludil	KZ	3	2P+1C	L	V
BI-ZRS	Basics of System Control Kate ina Hyniová Kate ina Hyniová (Gar.)	Z,ZK	4	2P+2C	Z	V
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad  Martin P Ipitel, Dominik Veselý Martin P Ipitel (Gar.)	KZ	4	2C	Z	V
BI-ZWU	Introduction to Web and User Interfaces Lukáš Ba inka Jakub Klímek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-ZNS.21	Knowledge-based Systems  Marcel Ji ina	Z,ZK	5	2P+2C	Z	V
BI-3DT.1	3D Printing Miroslav Hron ok Miroslav Hron ok (Gar.)	KZ	4	3C	L	V
Characteristics of the /ersion 2021	e courses of this group of Study Plan: Code=BI-V.21 Name=Pu	rely Elective	Courses	of Bache	lor Progra	amme BI,
	hical Hacking			7	,ZK	5
The goal of the course is to exploitation in computer net	introduce students to the field of penetration testing and ethical hacking. The course d works, web applications, wireless networks, operating systems, and others like the Interview		-	ts, vulnerabili	ties, and thei	r possible
	e following process of penetration test documentation.				7717	
BI-SVZ 21   Ma	achine vision and image processing			7	7K	5

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Theoretical Seminar III Tomáš Valla Tomáš Valla (Gar.)

BI-TS3

The goal of the coul	se is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, v	ulnerabilities, and th	eir possible
exploitation in comp	uter networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focu	ıs is on hands-on ex	perience with
vulnerabilities testin	g and the following process of penetration test documentation.		
BI-SVZ.21	Machine vision and image processing	Z,ZK	5
Camera systems ar	e becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evalua	ate image information	n. The course
introduces students	to different types of camera systems and a variety of methods for image and video processing. The course is focused on practica	al use of camera syst	tems for solving
problems of practice	that the graduates may encounter.		
BI-ALO	Algebra and Logic	Z,ZK	4
The course extends	and deepens the study of topics touched upon in the basic course in logic.	·	
BI-AVI.21	Algorithms visually	Z,ZK	4
The course compler	nents other algorithm courses at FIT. It brings knowledge about particular important algorithms from different fields of the comput	er science that exter	nd substantially
knowledge presente	I in BI-AG1 and BI-AG2. A wide scope of covered subject is made possible due to using visualization bz Algovision (www.algovision.	org <http: td="" www.alg<=""><td>ovision.org&gt;)</td></http:>	ovision.org>)
that make understar	ding the principles of algorithms easy		

BI-A2L	English language, preparation for the B2 level exam	Z	2
· ·	e corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achieveme	nt - students are	due to: -Take an
active part in the langua	ge instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both	the midterm and	the final term
tests with the success ra	te set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by it	individual teacher	s during the first
class of the term.			
,	Aplication Programming in Java	Z,ZK	4
· · · · · · · · · · · · · · · · · · ·	in Czech. Advanced technologies in Java.		
	Applied Functional Programming	, KZ	5
•	in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming paradigms becomes an important construct of traditionally important paradigms. (C. L. Ctt., love). As such most		
-	ne functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mast of a software engineer: the theory and especially the practice.	tering tris paradiç	giii becoilles a
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4
- 1	to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the clas		· ·
	nt systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorit		
be presented as well.			
BI-BLE	Blender	Z,ZK	4
The course extends kno	wledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those	interested in 3D	graphics and
animation. It offers a cor	plete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphic	es applications) co	ourse.
NI-DSP	Database Systems in Practes	Z,ZK	4
This course is presented	in Czech.		
· ·	Storage and Filesystems	Z,ZK	4
•	nciples and current solutions of storage systems architecture. The module explains principles of data store, protection, and a	rchiving, as so as	storage scaling,
load balancing and high	·		
	Digital Image Processing	Z,ZK	4
•	comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical a	ŭ	•
•	nteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ng. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR		
	action, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray c	· ·	_
•	ssible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, ac		
	Digital Image Processing	Z,ZK	4
l l	comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical a	,	
· ·	nteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is	_	=
of digital image process	ng. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR	compression, de	e-blurring in
•	action, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray c		t enhancement,
interactive as-rigid-as-po	ssible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, ac		
· ·	Distributed Data Mining	KZ	4
Course focuses on state	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand	KZ Is on experience	4 with large scale
Course focuses on state data processing framew	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation	KZ Is on experience	4 with large scale
Course focuses on state data processing framew approaches to paralleliz	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.	KZ ds on experience s and will be capa	4 with large scale able to propose
Course focuses on state data processing framew approaches to paralleliz NI-DDM	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining	KZ Is on experience s and will be capa	4 with large scale able to propose
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand	KZ Is on experience s and will be capa  KZ Is on experience	4 with large scale able to propose  4 with large scale
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand bork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining	KZ Is on experience s and will be capa  KZ Is on experience	4 with large scale able to propose  4 with large scale
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand a cork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation	KZ Is on experience s and will be capa  KZ Is on experience	4 with large scale able to propose  4 with large scale
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew approaches to paralleliz	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1	KZ ds on experience s and will be capa KZ ds on experience s and will be capa	4 with large scale able to propose  4 with large scale able to propose
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew approaches to paralleliz BI-EP1	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1	KZ ds on experience s and will be capa KZ ds on experience s and will be capa	4 with large scale able to propose  4 with large scale able to propose
Course focuses on state data processing framew approaches to paralleliz NI-DDM  Course focuses on state data processing framew approaches to paralleliz BI-EP1  The course is taught in BI-EP2	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation of other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Ezech.	KZ ds on experience s and will be capa KZ ds on experience s and will be capa Z	4 with large scale able to propose  4 with large scale able to propose  4 4
Course focuses on state data processing framew approaches to paralleliz NI-DDM  Course focuses on state data processing framew approaches to paralleliz BI-EP1  The course is taught in BI-EP2  Continuation of Efficient	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Efficient Programming 2	KZ ds on experience s and will be capa KZ ds on experience s and will be capa Z	4 with large scale able to propose  4 with large scale able to propose  4 4 4 4
Course focuses on state data processing framew approaches to paralleliz NI-DDM  Course focuses on state data processing framew approaches to paralleliz BI-EP1  The course is taught in BI-EP2  Continuation of Efficient	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand onk Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand the park Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Efficient Programming 2  Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving indicates the parallel implementation of algorithms by solving typical problems.	KZ ds on experience s and will be capa KZ ds on experience s and will be capa Z	4 with large scale able to propose  4 with large scale able to propose  4 4 4 4
Course focuses on state data processing framew approaches to paralleliz NI-DDM  Course focuses on state data processing framew approaches to paralleliz BI-EP1  The course is taught in the course is taught in the aim to choose the BI-EJA  The course is on advance.	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand onk Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the parallel stributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Ezech.  Efficient Programming 2  Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving indicate best one and avoid implementation errors.  Enterprise Java ed technologies in the Java programming language. The focus is on technologies for development of enterprise information	KZ Is on experience s and will be capa KZ Is on experience s and will be capa Z KZ Is on experience and will be capa Z	4 with large scale able to propose  4 with large scale able to propose  4  4  4  are discussed,
Course focuses on state data processing framew approaches to paralleliz NI-DDM  Course focuses on state data processing framew approaches to paralleliz BI-EP1  The course is taught in the course is taught in the aim to choose the BI-EJA  The course is on advance a database and are according approaches.	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand onk Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the parallel stributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Ezech.  Efficient Programming 2  Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving indicate best one and avoid implementation errors.  Enterprise Java  ed technologies in the Java programming language. The focus is on technologies for development of enterprise information assed through the web interface.	KZ Is on experience s and will be capa Is on experience s and will be capa Is on experience s and will be capa Is on experience and will be ca	4 with large scale able to propose  4 with large scale able to propose  4  4  4  4  are discussed,  4  4  ce connected to
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew approaches to paralleliz BI-EP1 The course is taught in OBI-EP2 Continuation of Efficient with the aim to choose to BI-EJA The course is on advance a database and are according a database.	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand onk Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the parallel existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Ezech.  Efficient Programming 2  Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving indicate best one and avoid implementation errors.  Enterprise Java ed technologies in the Java programming language. The focus is on technologies for development of enterprise information essed through the web interface.  Financial and Management Accounting	KZ Is on experience s and will be capa Is on experience s and will be capa Is on experience s and will be capa Is on experience and will be ca	4 with large scale able to propose  4 with large scale able to propose  4 4 4 are discussed, 4 re connected to
Course focuses on state data processing framew approaches to paralleliz NI-DDM Course focuses on state data processing framew approaches to paralleliz BI-EP1 The course is taught in CBI-EP2 Continuation of Efficient with the aim to choose the BI-EJA The course is on advance a database and are accomblished.	Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand onk Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Distributed Data Mining -of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the parallel stributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Effective programming 1  Except.  Efficient Programming 2  Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving indicate best one and avoid implementation errors.  Enterprise Java  ed technologies in the Java programming language. The focus is on technologies for development of enterprise information assed through the web interface.  Financial and Management Accounting explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the	KZ Is on experience s and will be capa Is on experience s and will be capa Is on experience s and will be capa Is on experience and will be ca	4 with large scale able to propose  4 with large scale able to propose  4  4 are discussed,  4 re connected to  5 nting operations,
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NI-IAM Internet and Multimedia	Z,ZK	4
The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes account of the syllab		` ' ' '
presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practicely assemble AV transmissions that and SW technologies and verify the		
audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the ethe quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording		
for audience.	the scene up to t	ne presentation
BIE-IMA2 Introduction to Mathematics 2	Z	2
Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are		
examples.	c abic to apply the	ciii iii particulai
BI-CS2 C# language and data access	KZ	4
The C# language and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Micro	I I	
get to know objects used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current tec		
of features for querying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL	-	
and LINQ to SQL). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data	using domain-spe	ecific objects
(ORM). This part of the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Mo	del, Storage Mode	el and Mapping
(XML description).		
BI-CS3 Language C# - design of web applications	KZ	4
The students will be introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview	w of the developm	ent possibilities
on thisplatform. They will learn to create WebAPI and to use it by client programs.		
BI-SQL.1 Language SQL, advanced	KZ	4
Module is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In	-	-
triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the pol	•	
structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan	-	- 1
will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS.	cie DBMS and pa	rtially on
PostgreSQL.	1/7	
BI-QAP Quantum algorithms and programming	KZ	5
Course aims at giving students hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanics	=	- 1
are based, and algorithms showing advantages and limitations of quantum computing. During tutorials students work in open-source software develor on Python language. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VM	•	
might be an advantage. No previous knowledge of physics is assumed.	iivi and expenence	e with Fython
NI-LSM Statistical Modelling Lab	KZ	5
The subject is oriented on a low-level approach to Bayesian statistical and information-theoretical modelling, where the student both learns the existi	1	-
Kalman filtering, models fusion, etc.) and tries to implement them. That is, instead of the (standard) intensive use of high-level libraries like pandas, s		
stress is put on the use of numpy and scipy, as well as the low-level algebra and calculus. The second half of the semester is focused on the design of		
analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor the		
NI-MPL Managerial Psychology	ZK	2
Students will get acquainted with the basic psychological basis for managerial practice and personnel management. They will understand the basics of c		
the importance of the manager's personality, his internal attitudes, behavior, interaction and communication. They will get acquainted with theories of personality and the importance of the manager's personality, his internal attitudes, behavior, interaction and communication.	-	
cognitive and affective processes. Selected techniques will be practiced during practical exercises. The knowledge acquired in the course can be approximately approximately acquired to the course can be approximately acquired to the course ca	lied in future emp	loyment and in
everyday life.		
MI-MSI Mathematical Structures in Computer Science	Z,ZK	4
Mathematical semantics of programming languages.	<u> </u>	
BI-MPP Methods of interfacing peripheral devices	Z,ZK	4
The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on University	ersal serial bus (US	SB). The course
includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of U	ISB devices, Linux	and Windows
drivers, simple application development, and APIs of selected devices.		
BI-MIT Mikrotik technologies	KZ	3
The main motivation of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are continuous control of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are continuous control of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and some network Mikrotik technologies which are control of the RouterOS operating system and system and system are control of the RouterOS operation of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system and system are control of the RouterOS operation system a		
middle internet service providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the	-	
and how to administrate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary compute	r networks concep	ts like protocols
and technologies of the data-link, network and transport layer of the OSI model.		
NI-MOP   Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, who	=	
is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the si of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development	•	
addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to wor		
technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involv		·
BI-MMP Multimedia team project	KZ	4
This course is presented in Czech.	IXZ	7
NI-OLI Computer Engineering Seminar Master II	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining	· .	
increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development.		
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience.		idente. The
MI-OLI Linux Drivers	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining		
increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development		
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience.		
BI-ACM Programming Practices 1	KZ	5
This course is presented in Czech.		<u> </u>
BI-ACM2 Programming Practices 2	KZ	5
This course is presented in Czech.		<u> </u>
BI-ACM3 Programming Practices 3	KZ	5
This course is presented in Czech.	114	·

BI-ACM4	Programming Practices 4	KZ	5
This course is preser BI-AND.21	Programming for the Android Operating System	KZ	4
This course is preser		1 112	7
BI-CS1	Programming in C#	KZ	4
-	se is to introduce .NET Framework as a multi-language development platform.Then, programming language C#, its fundamenta ops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class de	-	
	ds, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugg		-
well as work with file			
BI-PJV	Programming in Java	Z,ZK	4
The course is taught		147	
BI-PJS.1	JavaScript Programming rse is an introduction to Javascript programming. Students will learn also best practices and will use tool that eases development	KZ	4
-	idents of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register f		
of study.			
BI-KOT	Programing in Kotlin	Z,ZK	4
	tatically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of adv		
	Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of er-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages).	r a modern, objec	a-iunctional wa
MI-PSL	Programming in Scala	Z,ZK	4
	es the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language fea	1	n matching and
	rary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks	and libraries e.g.	Play, Cassand
Scalaz, etc.	December of the Mathematica	7.71/	
BI-PMA Students will be work	Programming in Mathematica king with modern technical and scientific software. Students will learn how to use different programming styles (functional progra	Z,ZK	4 ed programmin
	dynamic interactive applications and visualisations, data processing and presentations.	amming, rule-bas	eu programmi
BI-PHP.1	Programing in PHP	KZ	4
_	in Czech Main goal of the course is an introduction to PHP - language and technology. Students will learn also best practices		
•	The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register	for BIE-TWA.1. T	hey should
	se in their 3rd semester of study.	7 71/	5
MI-PDD.16 Students learn to pre	Data Preprocessing  pare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various da	Z,ZK	1
-	I learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction		_
VI-PDD	Data Preprocessing	Z,ZK	5
Students learn to pre	pare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various da	ata sources, such	ac images toy
			-
	l learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of character		-
pages.	l learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characte	eristics from imag	es or from web
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BI-ST4	Network Technology 4	Z	3
	nance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching		-
_	ner extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased eff gy, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completel		-
	ess) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and swit		•
· · · · · · · · · · · · · · · · · · ·	ncy procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigate	-	-
network running.			_
BI-SOJ	Machine Oriented Languages	Z,ZK	4
	vill gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal	•	
	n of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view	w linked to higher l	evel languages.
	used during reverse engineering, optimization, and evaluation of code security.	7.71/	
MI-SYP.16	Parsing and Compilers	Z,ZK	5
•	the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge o troduced to special applications of parsers, such as incremental and parallel parsing.	or various variants	and applications
NI-SYP	Parsing and Compilers	Z,ZK	5
	the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of		_
•	atroduced to special applications of parsers, such as incremental and parallel parsing.		
BI-GIT	Version control system GIT	KZ	2
Students will be introdu	ced to basic principles of version control systems. These principles will be then shown on DCVS Git both theoretically and practically and pra	actically. In this pa	rticular system
even the implementation	n details will be shown. Students will be challenged to use Git as users, project managers, team leaders as well as Git server	administrators.	
BI-TS1	Theoretical Seminar I	Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		-
-	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scier	ntific papers and
BI-TS2	e. The capacity is limited by the the potentials of the teachers of the seminar.	7	4
	Theoretical Seminar II  Intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	Z Z	4 in The students
	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is		-
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BI-TS3	Theoretical Seminar III	Z	4
Theoretical seminar is in	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	ssical reading grou	p. The students
are treated individually	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scier	ntific papers and
-	e. The capacity is limited by the the potentials of the teachers of the seminar.		
BI-TS4	Theoretical Seminar IV	Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		-
· · · · · · · · · · · · · · · · · · ·	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scier	itilic papers and
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BI-VR1	Virtual reality I	KZ	4
	eality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements he ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds and improves o		
social activities.	the ways of teaching using virtual reality technologies and interactive activities in educational virtual 5D worlds and improves c	omputational think	ding and shared
BI-VR2	Virtual reality II	KZ	3
Continuation of the cour	se Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The o	bjective is to devel	lop applications
	d gamification in various social metaverse and desktop engines.		
BI-VAK.21	Selected Applications of Combinatorics	Z	3
	duce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some base.		
	ion of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) i		
will select problems to b	e solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimize	ization and more.	Students will
	lutions to the studied problems with a special focus on the effective use of existing tools.		
BI-VMM	Selected Mathematical Methods	Z,ZK	4
	netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and erential calculus of functions involving multiple variables. We present methods for the localization of extreme values of function	· · · · · · · · · · · · · · · · · · ·	
	nd quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization ar		-
and the Simplex method	is analyzed in more detail.		
MI-VYC	Computability	Z,ZK	4
-	sive functions and effective computability.		
NI-VYC	Computability	Z,ZK	4
	rsive functions and effective computability.	Z	10
BI-ZS10	Bachelor internship abroad for 10 credits  within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or i	_	10 Before the
	ne FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the profess		
	rses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits		
· ·	gn institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided	I into two subjects	if the internship
exceeds the academic y			
BI-ZS20	Bachelor internship abroad for 20 credits	Z	20
	within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or in FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the profess		
•	rses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits of the second secon		
	gn institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided	•	
exceeds the academic y	ear's dead-line		
BI-ZS30	Bachelor internship abroad for 30 credits	Z	30
Each student can once	Bachelor internship abroad for 30 credits within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign scientific and/or internship at a foreign university or other foreign uni	research institution	n. Before the
Each student can once internship the Dean of the	Bachelor internship abroad for 30 credits  within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content.	research institution sional content and	n. Before the extent of the
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Each student can once internship the Dean of the internship. Auxiliary cou	Bachelor internship abroad for 30 credits  within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or interest, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional scientific and/or interest, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional scientific and or the internship in IS KOS. Every 10 credits of institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided	research institution sional content and correspond to 4 we I into two subjects	n. Before the extent of the eeks of full-time
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# List of courses of this pass:

Code	Name of the course Com	pletion	Credit
BI-3DT.1	3D Printing	KZ	4
active part in the langu	English language, preparation for the B2 level exam se corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement - student uage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both the midter ate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by individual te class of the term.	erm and the	e final tern
BI-AAG.21	Automata and Grammars Z	Z,ZK	5
students are introduced nd regular grammars, c	to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automate context-free grammars, construction and use of pushdown automata, and translation grammars and transducers. They know the hierarch derstand the relationships between formal languages and automata. They are introduced to the Turing machine and complexity classes	a, regular of hy of forma	expression al languag
BI-ACM	Programming Practices 1  This course is presented in Czech.	KZ	5
BI-ACM2	Programming Practices 2 This course is presented in Czech.	KZ	5
BI-ACM3	Programming Practices 3  This course is presented in Czech.	KZ	5
BI-ACM4	Programming Practices 4 This course is presented in Czech.	KZ	5
BI-ADU.21		Z,ZK	5
etween user and admir processes, memory, ne	ternal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will under nistrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file system etwork services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge specific examples from practice.	ems, disk	subsysten ectures or
BI-AG1.21	<b>3</b> · · · · · · · · · · · · · · · · · · ·	z,zk	5
echniques of proofs of o	basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curric correctness of algorithms and techniques of asymptotic mathematics for estimation of their complexity in the best, worse, or average cas y theory needed for understanding randomized algorithms). Within exercises students learn applications of studied algorithms for solving	se (the cou	rse includ
BI-AG2.21	Algorithms and Graphs 2		i
·	Algorithms and Graphs 2  d in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version BIE-AG2.21.	Z,ZK BI-AG1.2	5 1. It furthe
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This course, presented delves into advances d  BI-ALO  BI-AND.21  BI-ANG  BI-ANG1  BI-APJ  BI-APS.21	d in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English versing BIE-AG2.21.  Algebra and Logic  The course extends and deepens the study of topics touched upon in the basic course in logic.  Programming for the Android Operating System  This course is presented in Czech.  English Language, Internal Certificate  Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG  English Language Examination without Preparatory Courses  Aplication Programming in Java  This course is presented in Czech. Advanced technologies in Java.	Z,ZK  BI-AG1.2  BI-AG1.2  Z,ZK  Z,ZK  ZZK  Z,ZK  Z,ZK  Z,ZK	5 1. It further course see 4 4 2 2 4 5
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This course, presented delves into advances delves delves into advances delves into advances delves into advances	d in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English versing BIE-AG2.21.  Algebra and Logic The course extends and deepens the study of topics touched upon in the basic course in logic.  Programming for the Android Operating System This course is presented in Czech.  English Language, Internal Certificate Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG  English Language Examination without Preparatory Courses Aplication Programming in Java Z This course is presented in Czech. Advanced technologies in Java.  Architectures of Computer Systems Construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special employeesing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of cessors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequence of the seq	Z,ZK BI-AG1.2 Sion of the Polysister Size Size Size Size Size Size Size Size	5 1. It further course see  4  4  2  2  4  5  ven on their processing del of the ency in sure the ency in sure the result the result the result.
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BI-BEK.21	Secure Code	Z,ZK	5
	arn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting fa gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every		
	ileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing		
	database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and th		
BI-BIG.21	DB Technologies for Big Data	KZ	5
Students will be int	roduced into the field of Big Data processing where nonrelational (NoSQL) database engines are typically used today. The course is for	cused practically	so that after
-	e students were able to choose suitable tools (mostly open source) and techniques, design and implement a simplest reproducible me	-	
collection, transforr	nation/aggregation, presentation). Students get acquainted with various architectures for processing and storing big data. A theoretical of individual technologies will be supplemented with specific case studies.	al foundation and p	resentation
BI-BLE	Blender	Z,ZK	4
	ds knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those in	,	-
	ffers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graph	-	-
BI-BPR.21	Bachelor project	Z	1
_	g of the semester, the student reserves the topic of the bachelor's thesis and connects with the supervisor. He / she will arrange the		
-	semester to process the assignment. If he completes these tasks, the supervisor will award him a credit from the subject BI-BPR at the		
•	enters the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut nd signed form will be handed over by the student to the head of the Department of Defense, who will record the credit in KOS. 3. If t	-	
•	ved is formulated more generally, the tasks assigned to him by the supervisor for the semester should be aimed primarily at fine-tunir	•	
	assignment can be supplemented and approved at the end of the semester.	<b>3</b> · · · · · · <b>3</b> · · · ·	
BI-CS1	Programming in C#	KZ	4
The goal of the cou	urse is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental co	nstruction, types o	f variables,
	s, loops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class defi		_
constructors, meth	ods, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugging	and exception prod	cessing, as
BI-CS2	well as work with files are emphasized.	KZ	4
	C# language and data access and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Micros	ı	-
	s used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current techn	-	
of features for que	rying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL (L	INQ to Objects, LII	NQ to XML
	). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data u	-	=
(ORM). This part o	f the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Model	, Storage Model ar	nd Mapping
DI CCO	(XML description).	1/7	4
BI-CS3	Language C# - design of web applications introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview of	KZ	4 nossihilities
ne stadents will be	on thisplatform. They will learn to create WebAPI and to use it by client programs.	in the development	possibilities
BI-DBS.21	Database Systems	Z,ZK	5
	oduced to the database engine architecture and typical user roles. They are briefly introduced to various database models. They learn		_
	constraints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with the		
	ation - the relational database model. They learn the principles of normalizing a relational database schema. They understand the funda	· ·	
_	lling parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduced t ases with respect to speed of access to large quantities of data. This introductory-level course does not cover: Administration of datab		_
iii relational databa	optimizing database applications, distributed database systems, data stores.	ase systems, debt	agging and
BI-DML.21	Discrete Mathematics and Logic	Z,ZK	5
	equainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from		_
Special attention is	paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The cours	e also lays down th	ne basics of
	combinatorics and number theory, with emphasis on modular arithmetics.		
BI-EHA.21	Ethical Hacking	Z,ZK	5
_	ourse is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vulnices and the set of This are a closed. The fewer is		-
exploitation in con	nputer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is vulnerabilities testing and the following process of penetration test documentation.	on nands-on exper	rience with
BI-EJA	Enterprise Java	Z,ZK	4
	dvanced technologies in the Java programming language. The focus is on technologies for development of enterprise information sys	, ,	-
	a database and are accessed through the web interface.		
BI-EP1	Effective programming 1	Z	4
	The course is taught in Czech.	'	
BI-EP2	Efficient Programming 2	KZ	4
Continuation of Ef	ficient Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving individual to the control of	dual problems are	discussed,
DI EDDO1	with the aim to choose the best one and avoid implementation errors.	<b>7.7</b> (	
BI-EPP.21	Economic Business Processes	Z,ZK	5
	rse is to present typical processes related to the usual life cycle of a company. The course focuses mainly on the basic economic and conment of the Czech Republic and the basics of management. In the course, students are acquainted with the typical phases of the	=	
	the company, through the management of property and capital structure, financing of the company, determining the cost function of the		
	evaluating the financial health of the company and its eventual rehabilitation or termination.		
BI-FBI.21	Financial Business Intelligence	Z,ZK	5
	se is to acquaint students primarily with financial accounting as a tool for recording business operations and documents for business	analysis, determini	-
	a for comparison with other companies and management decision process at the testical and strategic level. The accord view is man	agement accountir	ng as a tool
and other indicator	s for comparison with other companies and management decision process at the tactical and strategic level. The second view is man		
and other indicator or financial manag	ement and prediction of business development. Management accounting allows monitoring of the financial status and performance of business.		
and other indicator or financial manag accounting perio	ement and prediction of business development. Management accounting allows monitoring of the financial status and performance of business data, enables a multidimensional view of business data, enables to control effectively factors affecting the return on invested capital and	I to use value infor	mation to
and other indicator or financial manag accounting perio	ement and prediction of business development. Management accounting allows monitoring of the financial status and performance of business.	I to use value infor	mation to
and other indicator or financial manag accounting perior	ement and prediction of business development. Management accounting allows monitoring of the financial status and performance of business data, enables to control effectively factors affecting the return on invested capital and lated to future business decisions. The principles of management accounting, described in this course, are the basis of Business Inte	I to use value infor	mation to

BI-FEM.21	Fundamentals of Economics	Z,ZK	5
The course allows	the students to discover basics of economic theory, which will then be used in subsequent courses of economics and management.  of fundamental microeconomic and macroeconomic topics.	It contains a gener	al overview
BI-FMU	Financial and Management Accounting	Z,ZK	5
The aim of the cou	rse is explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the pa	rticular accounting	
•	unts and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modification		
of economic oper	ations based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of manage Business Inteligence moduls in Business information systems.	ment accounting a	e base of
BI-GIT	Version control system GIT	KZ	2
	troduced to basic principles of version control systems. These principles will be then shown on DCVS Git both theoretically and pract		-
	mplementation details will be shown. Students will be challenged to use Git as users, project managers, team leaders as well as Git s		
BI-GIT.21	SW Development Technologies	Z	3
i nis course is aime	ed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use		on manager
BI-HAM	HW accelerated network traffic monitoring	KZ	4
	duces students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring. The		-
	mandatory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as a stoals of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network traff level and to develop their practical abilities in this field.		
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
DI-I IIVII	This course is presented in Czech.	Z,Zr\	3
BI-HWB.21	Hardware Security	Z,ZK	5
	ith hardware resources used to ensure security of computer systems including embedded ones. Students become familiar with the opera	· · · · · · · · · · · · · · · · · · ·	
modules, security fe	eatures of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW res	sources, including s	ide-channel
attacks and tampe	ering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including a	pplications and rela	ated topics
	for multi-factor authentication (biometrics). Students will understand methods of efficient implementations of ciphers.		_
BI-IDO.21	Introduction to DevOps	Z,ZK	5
	vith the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of syst support software development, testing and compilation. It also focuses on tools for automating infrastructure management and build		
	introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquaint used in practice.		
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad  This course is presented in Czech.	KZ	4
BI-IOT.21	Internet of Things	Z.ZK	5
wireless communi	s on an overview of technologies and development tools used in the field of the Internet of Things (IoT). Lectures are devoted to an over cation technologies designed primarily for this area, and appropriate programming methods. They include an overview of IoT architectomputer labs, students will gain practical experience with developing simple IoT systems using common development environments software - Arduino, Raspberry Pi OS).	ctures for different	application
organization of com of multiplication. Th correction for parall	Computer Units their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail value to the program (BIE-SAP), get acquainted in detail value to the program (BIE-SAP), get acquainted in detail value to the program to the program to the program of the environment, including accelerating arithmetic-logic units and using appropre organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including let and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of commod the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammable hardware design kits (FPGA).	riate codes for imp g codes for error de unication of the pro	lementation etection and cessor with
BI-KAB.21	Cryptography and Security	Z,ZK	5
certificates in syst	lerstand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to ems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in app a basics of information security. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasa acquainted with the basic procedures of cryptanalysis.	lications. Finally, st	udents get
BI-KOM.21	Conceptual Modelling	Z,ZK	5
The course is focu	sed on developing abstract thinking and precise formulation skills using conceptual models. Students learn skills of discerning key te		-
	cify correct relations in complex systems of social reality, mostly enterprises and institutions. Students learn basics of ontological struc	-	
-	r learn how to express business rules and constraints using the OCL language and foundations of OWL/RDF semantic data represent		-
	ns of enterprise engineering, being a discipline for conceptual modelling of enterprises and institutes and their processes. The DEMO n Il be taught. The course is designed with the respect to continuation in software implementations. Recommended optional follow-up c		viin notation
BI-KOT	Programing in Kotlin	Z,ZK	4
	n, statically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of advar	,	
	illy Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of a		
	with minimum of boiler-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages)		
BI-LA1.21	Linear Algebra 1	Z,ZK	5
	students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field	•	
	fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination that linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvectors matrix. We will also demonstrate some applications of these concepts in computer science.	•	
BI-LA2.21	Linear Algebra 2	Z,ZK	5
	ostory. 2. Skalární sou in, norma vektoru, ortogonalita. 3. Snalytická geometrie. 4. Lineární zobrazení 5. Matice lineárního zobrazení.	6. [2] Afinní transfo	rmace,
homogenní sou ad	nice, projekce a operace v 3D prostoru jako lineární zobrazení. 8. ešení soustav lineárních rovnic. 9. [2] Maticové rozklady (metody l	_U, SVD, QR) a jeji	ch výpo et.
	11. Metoda nejmenších tverc . 12. Lineární programování. 13. Rekurentní rovnice.		_
BI-LOG.21	Mathematical Logic	Z,ZK	5
	s on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability se of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are a		

	and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness the		-
BI-MA1.21	Mathematical Analysis 1	Z,ZK	5
	se by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers.		
and real functions o	of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions	ons. This theoretical	I foundation
	ot-finding problems (iterative method of bisection and Newton's method), construction of cubic interpolation (spline), and formulation and	· · · · · · · · · · · · · · · · · · ·	
	ssue of finding extrema of functions). The course is closed with the Landau's asymptotic notation and methods of mathematical descript		
BI-MA2.21	Mathematical Analysis 2	Z,ZK	6
-	etes the theme of analysis of real functions of a real variable initiated in BI-MA1 by introducing the Riemann integral. Students will learn In method.The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylor's theorem to t		
	escribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, ar		, ,
•	we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and h	, ,	
analytical method o	of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integ	ration of multivariate	e functions.
	se can be enrolled only after successful completion of the course BI-MA1, which can be replaced by the course BI-ZMA in the case of		
BI-MDF.21	Modern Data Formats	KZ	3
_	urse is to give an overview of commonly used data formats for typical types of data. There will be a description of each data type and		
BI-MGA.21	e along with tools available to work with such data. After finishing the course, the students should know how to work with common date.  Multimedia and Graphics Applications	Z,ZK	5
	uainted with multimedia technologies and applications for 2D/3D bitmap and vector graphics. During the course, current tools for wor		
	ation will be introduced. Students learn several basic techniques of creation and editing content in computer graphics, introduction to gra		
technologies. They	y learn to use multimedia transmission and representation systems, including real-time multimedia processing. They understand the	orinciple of operatio	n and use
C	of graphics processing cards. They gain a number of practical skills, such as vectorizing raster images, retouching photos, or creating	3D models.	
BI-MIT	Mikrotik technologies	KZ	3
	on of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are cor		
	vice providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the m	· •	
and now to adminis	strate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary computer no and technologies of the data-link, network and transport layer of the OSI model.	itworks concepts lik	e protocois
BI-ML1.21	Machine Learning 1	Z.ZK	5
	course is to introduce students to the basic methods of machine learning. They get theoretical understanding and practical working k	, ,	-
<del>-</del>	dels in the supervised learning scenario and clustering models in the unsupervised scenario. Students will be aware of the relationsh		
variance, and know	the fundamentals of assessing model quality. Moreover, they learn the basic techniques of data preprocessing and multidimensional	data visualization.	In practical
	demonstrations, pandas and scikit libraries in Python will be used.		
BI-ML2.21	Machine Learning 2	Z,ZK	5
•	purse is to introduce students to the selected advanced methods of machine learning. In the supervised learning scenario, they, in pa		
and neural networ	ks. In the unsupervised learning scenario students learn the principal component analysis and other dimensionality reduction method basic principles of reinforcement learning and natural language processing.	is. Moreover, stude	nts get the
BI-MMP	Multimedia team project	KZ	4
DI WIWI	This course is presented in Czech.	112	7
BI-MPP	Methods of interfacing peripheral devices	Z,ZK	4
The course is focus	sed on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universa	al serial bus (USB).	The course
includes both PC s	side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USI	3 devices, Linux and	d Windows
	drivers, simple application development, and APIs of selected devices.		
BI-MPP.21	Methods of interfacing peripheral devices	Z,ZK	5
	sed on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universa Side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USI		
includes both i O s	drivers, simple application development, and APIs of selected devices.	devices, Linux and	a vviilaows
BI-MVT.21	Modern Visualisation Technologies	Z,ZK	5
	urse is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and augn		
high resolution disp	plays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the mentione	ed technologies, nar	mely fractal
	and procedural visualization, scientific data visualization, and 3D model scanning.		
BI-OOP.21	Object-Oriented Programming	Z,ZK	5
	programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together		١ .
course students ge	t acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The empt	asis is on practical	techniques
BI-OPT	for developing software, which includes testing, error handing, refactoring, and application of design pattern.  Introduction to Optical Networks	Z,ZK	4
_	overview of optical networking technology with the emphasis on practical utilization in Internet and in network infrastructures, on poss		
•	stechnology and on their solutions. The course will include the history of optical communications, an overview of passive components	•	
•	sators, and others), and an overview of active components (optical switches and amplifiers, high-speed coherent transmission system		
the most up-to-date	e topics presented at premium research conferences, such as ECOC or OFC. Attention will also be paid to new applications, such as	the accurate time of	on Internet,
ultrastable freque	ncy transfer, or sensor networks. The labs will focus on real work with optical components and on measurement of their parameters.	Students will solve	real tasks
DI 00\(0.1	from practice.	771	
BI-OSY.21	Operating Systems	Z,ZK	5
	s a follow-up of the Unix-like operating systems course students deepen their knowledge in areas of OS kernels, process and thread im <sub>l</sub> ead scheduling, shared resource allocation and deadlocks, management of virtual memory and data storages, file systems, OS moni		
oa. rogiono, unit		g. riio, aic abi	0 0001911
	and implement simple multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS W	indows.	
BI-PA1.21			7
BI-PA1.21 Students gain the	and implement simple multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS W  Programming and Algorithmics 1 ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, stru-	Z,ZK	
Students gain the	Programming and Algorithmics 1 ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, struons, concept of recursion. They learn to analyse simple cases of algorithm complexity. They know fundamental algorithms for search	Z,ZK ctured, pointers), ex	ressions,
Students gain the	Programming and Algorithmics 1 ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, stru	Z,ZK ctured, pointers), ex	ressions,

BI-PA2.21	Programming and Algorithmics 2	Z,ZK	7
	instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, quently in these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e		
table). They lear	copying/moving of objects, operator overloading, inheritance, polymorphism).	s.g., template progr	arriiriiig,
BI-PAI.21	Law and Informatics	ZK	5
The aim of the cou	urse is to introduce students into the basic legal instruments that they will encounter in their practice. Students will gain knowledge of	doing business in	the Czech
-	ill be alerted to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding control to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding control to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding control to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding control to the pitfalls that await them in business from the point of view of law. They will understand the process of concluding control to the pitfalls that await them in business from the point of view of law.		
	now their responsibilities in working with the Internet, will be familiar with the institutes of intellectual property law, and will be able to		
-	censes. Emphasis will also be put on the legal protection of data on the Internet, the registration of Internet domains and protection a ted to such behaviour in the field of IT that can be classified as criminal under the Czech law. The course will also include analyses of	-	
BI-PGA.21	Programming of Graphic Applications	Z,ZK	5
	sent the possibilities of current professional open-source tools for image editing, video editing, 3D animation (GIMP, Blender) and their		
data (3D scenes, n	nathematical data). Emphasis will be placed on the possibilities of further enhancement of the presented software tools, both using b	uilt-in scripting land	guages and
	by implementation of plugins.		_
BI-PGR.21	Computer graphics programming	Z,ZK	5
_	curse, students can program a simple interactive 3D graphical application like a computer game or scientific visualization, design the nd materials (like wall surface, wood, sky), and set up the lighting. At the same time, they understand the fundamental principles and ter		-
-	pipeline, geometric transformations, or lighting model. They gain knowledge allowing orientation in computer graphics and representi	· · · · · · · · · · · · · · · · · · ·	
professional develo	pment, e.g., GPU programming and animations. They get used to techniques utilized in geometric modeling, modeling curves and surface	ces, and scientific v	isualization.
BI-PHP.1	Programing in PHP	KZ	4
	aught in Czech Main goal of the course is an introduction to PHP - language and technology. Students will learn also best practices		
development in I	PHP. The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register register for this course in their 3rd semester of study.	for BIE-TWA.1. The	ey should
BI-PHP.21	Programing in PHP	Z.ZK	5
	r rograming in rining in rining starting the rining in rining starting starting the rining starting st	, ,	
BI-PJP.21	Programming Languages and Compilers	Z,ZK	5
	asic compiling methods of programming languages. They are introduced to intermediate representations used in current compilers G		
create a specificat	ion of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification.	The compiler can tr	anslate not
	only a programming language but any text in a language generated by a given LL input grammar.		
BI-PJS.1	JavaScript Programming	KZ	4
=	course is an introduction to Javascript programming. Students will learn also best practices and will use tool that eases development tudents of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register for the		
recommended for 3	of study.	113 000130 111 111011 4	ur scinosioi
BI-PJS.21	JavaScript Programming	KZ	5
The course is an	introduction to Javascript programming. Students will also learn best practices and get acquai nted with tools that make code development	opment in Javascri	pt easier.
BI-PJV	Programming in Java	Z,ZK	4
DI DIAM	The course is taught in Czech.		4
BI-PKM	Introduction to mathematics	_	
		Z	4
RI-PMΔ	This course is presented in Czech.		
BI-PMA Students will be wo	This course is presented in Czech.  Programming in Mathematica	Z,ZK	4
	This course is presented in Czech.	Z,ZK	4
	This course is presented in Czech.  Programming in Mathematica rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programm	Z,ZK	4
Students will be wo	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programm etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the	Z,ZK ning, rule-based pr  KZ basics of the VHD	4 ogramming, 5
Students will be wo	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programm etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in	Z,ZK ning, rule-based pr  KZ basics of the VHD	4 ogramming, 5
Students will be wo	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programm etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.	Z,ZK ning, rule-based pr  KZ basics of the VHD idustry-standard C.	4 ogramming,  5 L language AD design
Students will be wo BI-PNO.21 Students get an ov and implementation BI-PPA.21	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programmetc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms	Z,ZK ning, rule-based pr  KZ basics of the VHD ndustry-standard C.	4 ogramming, 5 L language AD design 5
BI-PNO.21 Students get an ov and implementation BI-PPA.21 The course deals w	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programm etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.	Z,ZK ning, rule-based pr  KZ basics of the VHD idustry-standard C.  Z,ZK rticular approaches	4 ogramming, 5 L language AD design 5 . Functional
BI-PNO.21 Students get an ov and implementation BI-PPA.21 The course deals we programming parace	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programmetc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms  rith basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrated.	Z,ZK ning, rule-based pr  KZ basics of the VHD idustry-standard C.  Z,ZK rticular approaches ne principles are de	4 ogramming, 5 L language AD design 5 s. Functional emonstrated
BI-PNO.21 Students get an ovand implementation BI-PPA.21 The course deals was programming paracon lambda calculus	This course is presented in Czech.  Programming in Mathematica  riking with modern technical and scientific software. Students will learn how to use different programming styles (functional programment etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming languages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrated as C++ and Java.	Z,ZK ning, rule-based pr  KZ basics of the VHD ndustry-standard C.  Z,ZK rticular approaches ne principles are de- ream programming	4 ogramming,  5 L language AD design  5 s. Functional amonstrated languages
BI-PNO.21 Students get an ovand implementation BI-PPA.21 The course deals was programming paraction on lambda calculus	This course is presented in Czech.  Programming in Mathematica  riking with modern technical and scientific software. Students will learn how to use different programming styles (functional programmetc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  rerview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms  rith basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrated as C++ and Java.  Project management	Z,ZK ning, rule-based pr  KZ basics of the VHD dustry-standard C.  Z,ZK rticular approaches ne principles are de ream programming	4 ogramming, 5 L language AD design 5 s. Functional emonstrated languages
BI-PPA.21 The course deals w programming paracon lambda calculus  BI-PRR.21 The aim of the co	This course is presented in Czech.  Programming in Mathematica  riking with modern technical and scientific software. Students will learn how to use different programming styles (functional programmetc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  Practical Digital Design  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming Ianguages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrate as C++ and Java.  Project management  urse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, ana	Z,ZK ning, rule-based pr  KZ basics of the VHD dustry-standard C.  Z,ZK rticular approaches ne principles are de ream programming  Z,ZK lysis, crisis manage	4 ogramming, 5 L language AD design 5 s. Functional emonstrated languages 5 ement in a
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BI-PR.21 The caim of the coproject, communic Gantt charts, rescond	This course is presented in Czech.  Programming in Mathematica  riking with modern technical and scientific software. Students will learn how to use different programming styles (functional programment) etc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  Preview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the contechnologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming Paradigms  Programming Paradigms  Stith basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrated as C++ and Java.  Project management  urse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, and cation, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk as cource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for stonowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in land	Z,ZK ning, rule-based pr  KZ basics of the VHD dustry-standard C.  Z,ZK rticular approaches ne principles are de ream programming  Z,ZK lysis, crisis manages sessment and manudents who are int	4 ogramming,  5 L language AD design  5 s. Functional emonstrated languages  5 ement in a nagement, erested in
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BI-PRS.21 The aim of the coproject, communic Gantt charts, resc deepening their kr	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programmetc.), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  verview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms  ith basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstrate and on Lisp (Racket) and Prolog programming languages.  Project management  urse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, and cation, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk as cource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for st nowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in lar also suitable for all those who will develop software or hardware in the form of team projects.  Practical Statistics	Z,ZK ning, rule-based pr  KZ basics of the VHD dustry-standard C.  Z,ZK rticular approaches re principles are de ream programming  Z,ZK lysis, crisis manage ssessment and man udents who are int rge companies. The	4 ogramming, 5 L language AD design 5 s. Functional emonstrated languages 5 ement in a nagement, erested in e course is
BI-PRS.21 The students will be wo	This course is presented in Czech.  Programming in Mathematica  rking with modern technical and scientific software. Students will learn how to use different programming styles (functional programment), how to create dynamic interactive applications and visualisations, data processing and presentations.  Practical Digital Design  verview of the contemporary digital design flow and learn practical skills to use synchronous design techniques. They understand the on technologies FPGA and ASIC. Students demonstrate practical use of the design techniques in the course project using modern in tools.  Programming Paradigms  ith basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of partigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The sand on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstract as C++ and Java.  Project management  urse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, and acation, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk as cource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for st nowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in language outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in language outside IT to select the projects.  Practical Statistics  introduced to methods of applied statistics. They will learn how to work with various types of data, perform analyses, and choose models.	Z,ZK ning, rule-based pr  KZ basics of the VHD dustry-standard C.  Z,ZK rticular approaches re principles are de ream programming  Z,ZK lysis, crisis manage ssessment and man udents who are int rge companies. The  KZ dels fitting the data.	4 ogramming, 5 L language AD design 5 s. Functional emonstrated languages 5 ement in a nagement, erested in e course is 5 The course
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between philosophy of			
between philosophy of	Python Programming	KZ	5
	is to get acquainted with basic efficient control and data structures of the Python programming language for text and binary data	-	
enables greater accert	programming in Python and in other programming languages will be explained. Each topic is prepared for students in the format of the individual attudent work. Before each lab attudents page a short test on the last week topic. Four homeworks also a competer of the individual attudent work.		
	to individual student work. Before each lab, students pass a short test on the last week topic. Four homeworks plus a semester the semester.	WORK WIII DE ASSI	gnea auring
BI-QAP	Quantum algorithms and programming	KZ	5
Course aims at giving st	udents hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanics, on	which quantum	technologies
-	ms showing advantages and limitations of quantum computing. During tutorials students work in open-source software developm		
on Python language. K	nowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VMM might be an advantage. No previous knowledge of physics is assumed.	and experience	with Python
BI-SAP.21	Computer Structure and Architecture	Z.ZK	5
	ainted with the basic architecture and units of a digital computer, understand the structure, function, and implementation of arithn	,	_
	tion, methods of data transfers between the units. The logic design and the implementation of a program-controlled simple process		
	in the labs using programmable circuits (FPGA), a single-chip microcomputer, and modern design (EDA) tools.		
BI-SCE1	Computer Engineering Seminar I	Z	4
•	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to		
* *	ually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the s	· =	
articles and other profes	sional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers semester.	. The topics are	new for each
BI-SCE2	Computer Engineering Seminar II	Z	4
	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to		1
•	ually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other profes	sional 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.		
BI-SIP.21	Network Programming	Z	5
	amental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming network applications.		
	o designing communication protocols and their verification. The third part introduces the principles and applications of middlewar ern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in com		
introduces basic mod	programming language environment.	iputer labs usiriç	a chosen
BI-SOJ	Machine Oriented Languages	Z,ZK	4
l l	rill gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal use		1
	of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view link	-	
	This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
BI-SP1.21	Team Software Project 1	KZ	5
-	on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the		
· · · · · · · · · · · · · · · · · · ·	aches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teache		
project leader, regularly	consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software arte and finished in the BIE-SP2 course.	iaci wili be iurin	er developed
BI-SP2.21	Team Software Project 2	KZ	5
- 1	experience with the iterative development process while working on a large-scale software project. The first iteration is the result o		_
	-up, the functionality, testing, and documentation of the software system being developed will be emphasized. Students will work		people. The
	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.	
BI-SPS.21	Administration of Computer Networks and Services	Z,ZK	5
	to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated		
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 p with real network infrastructure.	ractical nands-c	n experience
BI-SOL 1	Language SOL advanced		1
BI-SQL.1	Language SQL, advanced  Language SQL, advanced    wledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In par	KZ	4
Module is based on know	Language SQL, advanced  wledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In pares, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of	KZ ticular stored pro	ogram unites,
Module is based on known triggers, recursive querie	wledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In par	KZ ticular stored pro view of speciali	ogram unites, zed database
Module is based on knot triggers, recursive querie structures like indexes,	wledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In pares, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and ctures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle	KZ ticular stored pro view of specialid possibilities of	ogram unites, zed database its. changes
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**BI-STO** Storage and Filesystems Z,ZK 4 The student will learn principles and current solutions of storage systems architecture. The module explains principles of data store, protection, and archiving, as so as storage scaling, load balancing and high availability. Machine vision and image processing Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving problems of practice that the graduates may encounter. 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 BI-TAB.21 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 BI-TDA Test driven architecture 4 The course is focused on practical examples of how to develop, test, and deploy software with tools like GitLab, Docker, Kubernetes, and more that are well known in the DevOps world. This course has a strong connection on courses like BI(E)-SI1 and BI(E)-SI2. The main goal of this course is to learn by examples that occur in the semester project. BI-TDP.21 **Documentation and Presentation** The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed. TeX and Typography **BI-TEX** Z,ZK 4 This course is presented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the course focuses on typographic rules. Information Systems The goal of this course is to familiarise students with the information systems topic and information systems implementation principles. During the course, students are introduced to "on the market" existing types of systems and their usage in specific industry segments. Students are familiarised with the CRM, ERP, MRP and other types of information systems. The fundamental part of the course is the introduction to key ideas of an information system selection, evaluation of information system benefits, ways of information systems implementation and information system implementation based on the project management principles. The emphasis is on the initial customer analysis, customer insight and ability to decide whether it is better to implement any existing information system or to develop a new one from scratch. These factors determine the information system implementation success At the end of the course information systems security, operation, support, maintenance, legislation impacts, and government information systems topics are discussed. BI-TJV.21 Java Technology 5 The goal is to provide knowledge and skills for developing information systems and applications through concepts used in software development and experience with libraries and tools from Java language ecosystem. At the course end, the students are able to develop software systems in Java platform. BI-TPS.21 Computer Networks Technologies Z.ZK 5 The course introduces students with basic and advanced technologies, components, and interfaces of contemporary computer networks at the physical layer with the overlap to the link layer. The lectures provide theoretical foundations of these technologies and explain relevant physical principles. In the labs, the respective technologies will be demonstrated and with the most important ones students will get hands-on experience. Thematically, the course covers both local and long-range optical networks. Ethernet, modern wireless networks, always with focus on high-speed networks. BI-TS1 Theoretical Seminar I Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. BI-TS2 Theoretical Seminar II Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. BI-TS3 Theoretical Seminar III Ζ 4 Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. BI-TS4 Theoretical Seminar IV Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. BI-TUR.21 User Interface Design Z,ZK 5 Students gain a basic overview of methods for designing and testing common user interfaces. They get experience to solve the problems where software and other products do not communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of methods that bring users into the development process to ensure optimal interface for them. BI-TWA.21 Design of Web Applications Z,ZK The basic course of web application development. Initially, the students become familiar with HTTP and its possibilities and partly with some properties of language describing the structure (HTML) and presentation of document on the Web (CSS). These skills provide the necessary basis for the development of Web applications, which will be demonstrated in modern libraries facilitate the development of Web pages applications. Server side will be demonstrated on PHP technology using frameworks Symfony 2, Doctrine 2. Developments on the client side will be demonstrated using a JavaScript language with library jQuery and possibly MV\* framework AngularJS. BI-TZP.21 Technological Fundamentals of Computers Z,ZK Students get acquainted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer structures look like at the lowest level. They are introduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to reduce the consumption; what the limits to the maximum operating frequency are and how to raise them; why a computer bus needs to be terminated, what happens if it is not; how a computer power supply looks like (in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica.

BI-UKB.21   Introduction to Cybersecurity  The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic ove and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace re	
BI-ULI Introduction to Linux Students become familiar with the basics of the Linux operating system using e-learning form. They learn to work with the command line and become and techniques of a Unix-like system. Topics can be studied first theoretically and then practically verified in a virtual machine (te	
BI-UOS.21 Unix-like Operating Systems Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative further systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic proper 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 the computers and the computers and the computers and their networks and clusters.	KZ 5 nctions of multiuser operating ties of this OS family, such as
only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting in	terface, called shell.
BI-VAK.21 Selected Applications of Combinatorics	Z 3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the b	asic courses, we approach the
issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) infocusing will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimiz also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.	ormatics. Areas from which we
BI-VDC.21 Virtualization and Data Centers	Z,ZK 5
The aim of the course is to familiarize students with technology basis of cloud computer systems. It shows principles and techniques used in design and infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data cer to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications.	implementation of data center nter technologies from private
design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, o	utages, and data losses.
BI-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 systems are developed by the state of the most common microcontrollers and embedded systems.	ed processors, their integrated
peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.	
BI-VHS   Virtual game worlds The course leads students to create a complex virtual world. The course is a continuation of basic graphical courses (MGA, PGR, BLE,). This current students to create a complex virtual world.	ZK 4  dents knowledge is furthermore
complemented by the theory of game design, principles of writing dialogues and characters in order to create a functional and complex virtual world. The course MI-PVR with the task of converting scenes and their dynamics into a fully virtual environment suitable for VR devi	
BI-VIZ.21 Data Visualization	KZ 5
The goal of the course is to introduce students to the area of data visualization, its basic principles and methods. The course offers an overview of the ty as well as suitable visualization methods. This will aid the students in understanding data, their content and their application in areas such as data mi	·
business intelligence. Within the course, students will be introduced to exploratory data analysis, preprocessing, dimensionality reduction, and ways o	
data such as text or geospatial. A part of the course is also dedicated to the area of business intelligence and different visualization tools, which study	-
commercial sphere. During labs, students will get hands-on experience in applications of selected methods to real-world exam	ples.
BI-VMM Selected Mathematical Methods	Z,ZK 4
We start reviewing geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and	
Further we deal with differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of function	' ' ' '
normed linear spaces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and c and the Simplex method is analyzed in more detail.	nuality. The linear programming
BI-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 technology	- · · · · · · · · · · · · · · · · · · ·
networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance	
BI-VR1   Virtual reality I Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of	KZ   4
The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds and improves com	
social activities.	
BI-VR2 Virtual reality II	KZ 3
Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objection	ctive is to develop applications
for computer science and gamification in various social metaverse and desktop engines.	
BI-VWM.21 Searching the Web and Multimedia Databases	Z,ZK 5
Students get basic overview about search techniques in the web environment that is interpreted as a very large distributed and heterogeneous storag	· · · · · · · · · · · · · · · · · · ·
students acquire information about search techniques in text and hypertext documents (the web pages themselves) and about feature extraction from knowledge of similarity search in multimedia databases (generally in collections of unstructured data). They also learn techniques for programming web se	
data types (documents).	aron engines for the mentioned
BI-ZIVS Intelligent Embedded System Fundamentals	KZ 4
Intelligent embedded system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim of t	he course is to teach students
modern humanoid robot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion cont	- ' '
interfaces, robot navigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to get p technologies.	practical experience with these
BI-ZMA Elements of Calculus	Z,ZK 6
Students acquire knowledge and understanding of the fundamentals of classical calculus so that they are able to apply mathematical way of thinking a	-
use basic proof techniques. They get skills to practically handle functions of one variable in solving the problems in informatics. They understand the lin	- 1
sums of sequences. They are able to estimate lower or upper bounds of values of real functions and to handle simple asymptotic ex	
BI-ZNF   PHP Framework Nette - basics Students will gain the basics of PHP framework Nette. They will learn how to practically work with MVP architecture and various libraries of this Czech po	KZ 3
Students will gain the basics of PHP framework Nette. They will learn how to practically work with MVP architecture and various libraries of this Czech poknowledge should serve for the efficient creation of a web backend in PHP language.	pulai Italiiework. The resulting
BI-ZNS.21 Knowledge-based Systems	Z,ZK 5
Students will become familiar with the systems based on knowledge (knowledge-based systems), which are systems that usetechniques of artificial inte	
require human judgment, learning and reasoning from findingsand actions. The course introduces students to the philosophy and architecture of knowle	- ' '
decision-makingand planning. The course assumes knowledge of set theory, probability theory, artificial neural networks, and evolutions	ary algorithms.

BI-ZPI Process engineering ΚZ Students will learn fundamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles of process modelling and they will learn basics of the used notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of business processes using modern CASE tools. The role of process engineering for information systems development is discussed as well as its importance in the overall context of information and business strategy of an enterprise. **BI-ZRS** Basics of System Control The course gives an introduction to the field of automatic control. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems, description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. Students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters, and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. Basics of System Control BI-ZRS.21 Z,ZK 5 The course gives an introduction to the field of automatic control. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems, description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD, and fuzzy controllers. Students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD, and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters, and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. BI-ZS10 Bachelor internship abroad for 10 credits Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. BI-ZS20 Bachelor internship abroad for 20 credits Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. Bachelor internship abroad for 30 credits Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. BI-ZSB.21 Basics of System Security Z,ZK The goal of the course is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forensic analysis and related topics such as malware analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of modern operating systems security, as well as skills needed for independent work in the area of operating system security incident analysis. BI-ZUM.21 Artificial Intelligence Fundamentals 5 Basic course on introduction to artificial intelligence with emphasis on symbolic techniques. The design of an intelligent agent and the techniques needed to create it will be discussed, especially at the decision-making level. The intelligent agent in the context of the course can be represented for example by a physical robot, but also by a non-physical entity, such as a virtual assistant or a character in a computer game. We will not only introduce the basics, but also show the current state-of-the-art during the course. BI-ZWU Introduction to Web and User Interfaces Z.ZK 4 This course is presented in Czech. **BIE-EEC** English external certificate 4 The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding the B2 level of the Common European Framework of Reference for Languages. BIE-IMA2 Introduction to Mathematics 2 2 Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples **BIE-ZUM** Artificial Intelligence Fundamentals Z,ZK Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well. MI-AFP Applied Functional Programming This course is prezented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice. Distributed Data Mining MI-DDM Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language. Digital Image Processing This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting.

MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4
MI-OLI	Mathematical semantics of programming languages.  Linux Drivers	Z,ZK	4
	LITIUX DITVETS g system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining po		1 1
	ability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development		
	urse provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practic		
MI-PDD.16	Data Preprocessing repare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various data s	Z,ZK	5
· · · · · · · · · · · · · · · · · · ·	nd learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction from		- 1
MI-PSL	Programming in Scala	Z,ZK	4
	uces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language featur		
advance standard I	ibrary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.	l libraries e.g. Play	y, Cassandra,
MI-REV.16	Reverse Engineering	Z,ZK	5
Students will get ac	equainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before	ore and after the r	
	will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dediction in CVI. Students will also understand principles of disconnection and obfiguration to be included as well also be designed.		
* *	ten in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be de Bugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer	_	
30	the course is on the seminars, where students will solve practically oriented tasks from the real world.		
MI-SYP.16	Parsing and Compilers	Z,ZK	5
The module builds u	upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of va of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.	rious variants and	d applications
MI-TSP.16	Testing and Reliability	Z,ZK	5
	wledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare		-
intuitive path sensi	itization and to use an ATPG for automatic test generation. They will be able to design easy testable circuits and systems with built-in	-self-test equipme	ent. They will
MI-VYC	be able to analyze and control reliability and availability of the designed circuits.	Z,ZK	4
IVII-V T C	Computability Classical theory of recursive functions and effective computability.	Z,ZR	4
NI-DDM	Distributed Data Mining	KZ	4
	state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of	=	-
data processing fra	amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.	ind will be capable	e to propose
NI-DSP	Database Systems in Practes	Z,ZK	4
	This course is presented in Czech.	. ,	!
NI-DZO	Digital Image Processing	Z,ZK	4
•	ents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical alg e an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is als		
•	processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR		
	abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray converses.		
	gid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, at		
NI-IAM The NI-IAM cours	Internet and Multimedia se is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acq	Z,ZK	4 anals (input).
	signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical u		
	nissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the eff		
the quality and late	ncy of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording th for audience.	e scene up to the	presentation
NI-LSM	Statistical Modelling Lab	KZ	5
	nted on a low-level approach to Bayesian statistical and information-theoretical modelling, where the student both learns the existing	1	
_	models fusion, etc.) and tries to implement them. That is, instead of the (standard) intensive use of high-level libraries like pandas, so		
•	e use of numpy and scipy, as well as the low-level algebra and calculus. The second half of the semester is focused on the design of ses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or	ŭ	orithms, and
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
_	pgramming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where	l	
	pplex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills	Ü	
	in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development n ing object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work of		
	rns of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involven		
NI-MPL	Managerial Psychology	ZK	2
	quainted with the basic psychological basis for managerial practice and personnel management. They will understand the basics of cogi	ı	1
	ne manager's personality, his internal attitudes, behavior, interaction and communication. They will get acquainted with theories of personality, his internal attitudes, behavior, interaction and communication. They will get acquainted with theories of personality, his internal attitudes, behavior, interaction and communication. They will get acquainted with theories of personality, his internal attitudes, behavior, interaction and communication. They will get acquainted with theories of personality, his internal attitudes, behavior, interaction and communication.		
cognitive and affect	tive processes. Selected techniques will be practiced during practical exercises. The knowledge acquired in the course can be applie everyday life.	d in future employ	yment and in
NI-OLI	Computer Engineering Seminar Master II	Z,ZK	4
	g system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining po		1
	ability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development at the course of the specific software profited type of development of various type drivers including practice.		idents. The
NI-PDD	urse provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practic  Data Preprocessing	Z,ZK	5
	Data Fτεριοcessing repare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data s	,	
	and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteris		- 1
	pages.		

NI-REV	Reverse Engineering	Z,ZK	5
	quainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before		
	will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated and how they interact with 3rd party libraries.		
	ten in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be do	•	•
debuggers and de	sbugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer	malware scene. T	he focus of
	the course is on the seminars, where students will solve practically oriented tasks from the real world.		
NI-SYP	Parsing and Compilers	Z,ZK	5
The module builds (	pon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of va	arious variants and	applications
	of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.		
NI-TSP	Testing and Reliability	Z,ZK	5
Students will gain I	knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prej	pare a test set wit	n the help of
the intuitive path se	ensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with bu	ilt-in-self-test equi	pment. They
	will be able to compute, analyze, and control the reliability and availability of the designed circuits.		
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
Students will gai	n knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and	organizations. Th	ey will get
acquainted with vi	rtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficie	ently operate and	optimize the
performance pa	rameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effecti	ve technology tod	ay for the
management of cor	mplex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills ir	n the use of moder	n integration
	and development tools (Continuous integration and development).		
NI-VYC	Computability	Z,ZK	4
	Classical theory of recursive functions and effective computability.	'	,
TV1	Physical Education	Z	0
TV2	Physical Education	Z	0
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0

For updated information see <a href="http://bilakniha.cvut.cz/en/FF.html">http://bilakniha.cvut.cz/en/FF.html</a> Generated: day 03. 12. 2021, time 04:10.