Study plan

Name of study plan: Bachelor Specialization Computer Systems and Virtualization, part-time, in Czech, 2021

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Informatika
Type of study: Bachelor combined
Required credits: 153
Elective courses credits: 27
Sum of credits in the plan: 180
Note on the plan: Tato verze studijního plánu je určena pro ročníky, které byly přijaty ke studiu od akademického roku 2021/2022 do kombinované formy studia bakalářského programu. . Garant: prof. Ing. Pavel Tvrdík, CSc., email: pavel.tvrdik@fit.cvut.cz

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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: BIK-PP.21
Name of the group: Compulsory Courses of Bachelor Study Program Informatics, part-time study, version 2021
Requirement credits in the group: In this group you have to gain 106 credits
Requirement courses in the group: In this group you have to complete 20 courses
Credits in the group: 106
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIK-AG1.21	**Algorithms and Graphs 1** *Radek Hušek, Dušan Knop **Dušan Knop** Dušan Knop (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP
BIK-AAG.21	**Automata and Grammars** *Štěpán Plachý, Jan Holub **Jan Holub** Jan Holub (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP
BI-BAP.21	**Bachelor Thesis** *Zdeněk Muzikář **Zdeněk Muzikář** Zdeněk Muzikář (Gar.)*	Z	14		L,Z	PP
BIK-BPR.21	**Bachelor project** *Zdeněk Muzikář **Zdeněk Muzikář** Zdeněk Muzikář (Gar.)*	Z	1		Z,L	PP
BIK-DBS.21	**Database Systems** *Monika Borkovcová, Michal Valenta, Andrii Plyskach **Monika Borkovcová** Monika Borkovcová (Gar.)*	Z,ZK	5	14KP+6KC	L	PP
BIK-DML.21	**Discrete Mathematics and Logic** *Eva Pernecká **Eva Pernecká** Eva Pernecká (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP
BIK-KAB.21	**Cryptography and Security** *Filip Kodýtek, Jaroslav Kříž, Róbert Lórencz, Jiří Buček, Jiří Dostál, Ivana Trummová, František Kovář, David Pokorný **Róbert Lórencz** Róbert Lórencz (Gar.)*	Z,ZK	5	14KP+4KC	L	PP
BIK-LA1.21	**Linear Algebra 1** *Karel Klouda **Karel Klouda** Karel Klouda (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP
BIK-MA1.21	**Mathematical Analysis 1** *Petr Olšák **Ivo Petr** Ivo Petr (Gar.)*	Z,ZK	5	14KP+4KC	L	PP
BIK-MA2.21	**Mathematical Analysis 2** *Petr Olšák **Tomáš Kalvoda** Tomáš Kalvoda (Gar.)*	Z,ZK	6	21KP+4KC	Z	PP
BIK-OSY.21	**Operating Systems** *Michal Šoch, Jan Trdlička, Pavel Tvrdík **Michal Šoch** Michal Šoch (Gar.)*	Z,ZK	5	14KP+4KC	L	PP
BIK-PSI.21	**Computer Networks** *Vladimír Smotlacha, Yelena Trofimova, Josef Zápotocký **Vladimír Smotlacha** Vladimír Smotlacha (Gar.)*	Z,ZK	5	14KP+4KC	L	PP
BIK-PST.21	**Probability and Statistics** *Daniel Vašata **Pavel Hrabák** Pavel Hrabák (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP

BIK-PA1.21	**Programming and Algorithmics 1** *Radek Hušek, Jan Trávníček, Ladislav Vagner, Josef Vogel* ***Jan Trávníček*** *Jan Trávníček (Gar.)*	Z,ZK	7	14KP+8KC	Z	PP
BIK-PA2.21	**Programming and Algorithmics 2** *Radek Hušek, Ondřej Štorc, Jan Trávníček, Ladislav Vagner, Josef Vogel, Barbora Kolomazníková* ***Jan Trávníček*** *Jan Trávníček (Gar.)*	Z,ZK	7	14KP+6KC	L	PP
BIK-SAP.21	**Computer Structure and Architecture** *Martin Daňhel* ***Martin Daňhel*** *Martin Daňhel (Gar.)*	Z,ZK	5	14KP+6KC	L	PP
BIK-TZP.21	**Technological Fundamentals of Computers** *Martin Daňhel, Kateřina Hyniová* ***Martin Daňhel*** *Martin Daňhel (Gar.)*	Z,ZK	5	14KP+4KC	Z	PP
BIK-GIT.21	**SW Development Technologies** *Petr Pulc* ***Petr Pulc*** *Petr Pulc (Gar.)*	Z	3	14KP	Z	PP
BIK-TDP.21	**Documentation and Presentation** *Tomáš Nováček, Dana Vynikarová* ***Tomáš Nováček*** *Dana Vynikarová (Gar.)*	KZ	3	14KP+4KC	Z,L	PP
BIK-UOS.21	**Unix-like Operating Systems** *Jakub Žitný, Petr Zemánek* ***Petr Zemánek*** *Petr Zemánek (Gar.)*	KZ	5	14KP+4KC	Z	PP

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

BIK-AG1.21	Algorithms and Graphs 1	Z,ZK	5

The course is presented in Czech. The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. 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 practical problems.

BIK-AAG.21	Automata and Grammars	Z,ZK	5

Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions, and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages. Knowledge acquired through the module is applicable to creation of algorithms for pattern matching, data compression, translation, simple parsing, and creation of digital circuits.

BI-BAP.21	Bachelor Thesis	Z	14
BIK-BPR.21	Bachelor project	Z	1

1. At the beginning of the semester, the student reserves the topic of the bachelor's thesis and connects with the supervisor. He / she will arrange the partial tasks that he / she will perform during 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 end of the semester. 2. The external supervisor enters the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut.cz/student/studijni/formulare). The completed and signed form must be delivered in person or by email to the SZZ coordinator, who will arrange for the credit to be granted. 3. If the topic of the work 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-tuning the assignment so that the assignment can be supplemented and approved at the end of the semester.

BIK-DBS.21	Database Systems	Z,ZK	5

Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (including integrity constraints) using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoretical basis - relational database model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction processing and control of parallel user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database models.

BIK-DML.21	Discrete Mathematics and Logic	Z,ZK	5

Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from set theory will be explained. Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course also lays down the basics of combinatorics and number theory, with emphasis on modular arithmetics.

BIK-KAB.21	Cryptography and Security	Z,ZK	5

Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis.

BIK-LA1.21	Linear Algebra 1	Z,ZK	5

We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science.

BIK-MA1.21	Mathematical Analysis 1	Z,ZK	5

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

BIK-MA2.21	Mathematical Analysis 2	Z,ZK	6

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

BIK-OSY.21	Operating Systems	Z,ZK	5

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

BIK-PSI.21	Computer Networks	Z,ZK	5

The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS.

BIK-PST.21	Probability and Statistics	Z,ZK	5
Students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods for testing statistical hypotheses and determining the statistical dependence of two or more random variables.			
BIK-PA1.21	Programming and Algorithmics 1	Z,ZK	7
Students gain the ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn to analyse simple cases of algorithm complexity. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.			
BIK-PA2.21	Programming and Algorithmics 2	Z,ZK	7
Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism).			
BIK-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.			
BIK-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.			
BIK-GIT.21	SW Development Technologies	Z	3
This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use.			
BIK-TDP.21	Documentation and Presentation	KZ	3
The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.			
BIK-UOS.21	Unix-like Operating Systems	KZ	5
Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell.			

Name of the block: Compulsory courses in the specialization
Minimal number of credits of the block: 40
The role of the block: PS

Code of the group: BIK-PS-PV.21
Name of the group: Compulsory courses of specialization Computer Systems and Virtualization, part-time study, 2021
Requirement credits in the group: In this group you have to gain 40 credits
Requirement courses in the group: In this group you have to complete 8 courses
Credits in the group: 40
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIK-ADU.21	**Unix Administration** *Zdeněk Muzikář, Petr Zemánek **Petr Zemánek** Zdeněk Muzikář (Gar.)*	Z,ZK	5	14KP+4KC	L	PS
BIK-AWD.21	**Web and Database Server Administration** *Lukáš Bařinka, Michal Valenta **Lukáš Bařinka** Michal Valenta (Gar.)*	Z,ZK	5	14KP+4KC	Z	PS
BIK-APS.21	**Architectures of Computer Systems** *Michal Štepanovský **Michal Štepanovský** Michal Štepanovský (Gar.)*	Z,ZK	5	14KP+4KC	Z	PS
BIK-SPS.21	**Administration of Computer Networks and Services** *Libor Dostálek, Jan Kubr **Pavel Tvrdík** Libor Dostálek (Gar.)*	Z,ZK	5	14KP+4KC	Z	PS
BIK-IDO.21	**Introduction to DevOps** *Jiří Mlejnek, Tomáš Vondra **Tomáš Vondra** Jiří Mlejnek (Gar.)*	Z,ZK	5	14KP+4KC	Z	PS
BIK-VDC.21	**Virtualization and Data Centers** *Jiří Kašpar **Jiří Kašpar** Jiří Kašpar (Gar.)*	Z,ZK	5	14KP+4KC	L	PS
BIK-VPS.21	**Selected Topics in Computer Networking** *Alexandru Moucha, Mohamed Bettaz **Pavel Tvrdík** Mohamed Bettaz (Gar.)*	Z,ZK	5	14KP+4KC	L	PS
BIK-ZSB.21	**Basics of System Security** *Jiří Dostál, Marián Svetlík **Jiří Dostál** Marián Svetlík (Gar.)*	Z,ZK	5	14KP+4KC	Z	PS

Characteristics of the courses of this group of Study Plan: Code=BIK-PS-PV.21 Name=Compulsory courses of specialization Computer Systems and Virtualization, part-time study, 2021

BIK-ADU.21	Unix Administration	Z,ZK	5

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

BIK-AWD.21	Web and Database Server Administration	Z,ZK	5

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.

BIK-APS.21	Architectures of Computer Systems	Z,ZK	5

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

BIK-SPS.21	Administration of Computer Networks and Services	Z,ZK	5

The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure.

BIK-IDO.21	Introduction to DevOps	Z,ZK	5

The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice.

BIK-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 implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses.

BIK-VPS.21	Selected Topics in Computer Networking	Z,ZK	5

The course builds upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technologies used in modern computer networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical experience with real network devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security.

BIK-ZSB.21	Basics of System Security	Z,ZK	5

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

Name of the block: Elective vocational courses in the branch/specialization
Minimal number of credits of the block: 0
The role of the block: VO

Code of the group: BIK-PV-VO.21
Name of the group: Elective Vocational Courses for a Bachelor Specialization, part-time study, version 2021
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIK-ASB.21	**Applied Network Security** *Jiří Dostál* ***Jiří Dostál*** *Jiří Dostál (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-BEK.21	**Secure Code** *Josef Kokeš* ***Josef Kokeš*** *Josef Kokeš (Gar.)*	Z,ZK	5	14KP+4KC	L	VO
BIK-EHA.21	**Ethical Hacking** *Jiří Dostál, Andrej Šimko, Martin Kolárik* ***Jiří Dostál*** *Jiří Dostál (Gar.)*	Z,ZK	5	14KP+4KC	L	VO
BIK-HWB	**Hardware Security** ***Jiří Buček***	Z,ZK	5	14KP+4KC	Z	VO
BIK-IOT.21	**Internet of Things** *Jan Janeček* ***Jan Janeček*** *Jan Janeček (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-KOM.21	**Conceptual Modelling** *Robert Pergl, Mohamed Bettaz* ***Robert Pergl*** *Robert Pergl (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-OOP.21	**Object-Oriented Programming** *Filip Křikava, Filip Říha* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-PPA	**Programming Paradigms** ***Jan Janoušek***	Z,ZK	5	14KP+4KC	Z	VO
BIK-SIP.21	**Network Programming** *Jan Fesl* ***Jan Fesl*** *Jan Fesl (Gar.)*	Z	5	14KP+4KC	Z	VO

BIK-SWI.21	**Software Engineering** *Jiří Mlejnek, Zdeněk Rybola* ***Zdeněk Rybola*** *Jiří Mlejnek (Gar.)*	Z,ZK	5	14KP+2KC	L	VO
BIK-SP1.21	**Team Software Project 1** *Jiří Mlejnek* ***Jiří Mlejnek*** *Jiří Mlejnek (Gar.)*	KZ	5	8KC		VO
BIK-SP2.21	**Team Software Project 2** *Jiří Mlejnek* ***Jiří Mlejnek*** *Jiří Mlejnek (Gar.)*	KZ	5	4KC		VO
BIK-SPS.21	**Administration of Computer Networks and Services** *Libor Dostálek, Jan Kubr* ***Pavel Tvrdík*** *Libor Dostálek (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-TAB.21	**Applications of Security in Technology** ***Jiří Dostál***	Z,ZK	5	14KP+4KC	L	VO
BIK-TJV.21	**Java Technology** *Jiří Daněček Ondřej Guth (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-TPS.21	**Computer Networks Technologies** ***Vladimír Smotlacha***	Z,ZK	5	14KP+4KC	Z	VO
BIK-IDO.21	**Introduction to DevOps** *Jiří Mlejnek, Tomáš Vondra* ***Tomáš Vondra*** *Jiří Mlejnek (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO
BIK-UKB.21	**Introduction to Cybersecurity** *Jan Bělohoubek, Jakub Tetera* ***Jakub Tetera*** *Jan Bělohoubek (Gar.)*	Z,ZK	5	21KP+2KC	Z	VO
BIK-VDC.21	**Virtualization and Data Centers** *Jiří Kašpar* ***Jiří Kašpar*** *Jiří Kašpar (Gar.)*	Z,ZK	5	14KP+4KC	L	VO
BIK-ZSB.21	**Basics of System Security** *Jiří Dostál, Marián Svetlík* ***Jiří Dostál*** *Marián Svetlík (Gar.)*	Z,ZK	5	14KP+4KC	Z	VO

Characteristics of the courses of this group of Study Plan: Code=BIK-PV-VO.21 Name=Elective Vocational Courses for a Bachelor Specialization, part-time study, version 2021

BIK-SPS.21	Administration of Computer Networks and Services	Z,ZK	5

The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure.

BIK-IDO.21	Introduction to DevOps	Z,ZK	5

The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice.

BIK-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 implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses.

BIK-ZSB.21	Basics of System Security	Z,ZK	5

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

BIK-ASB.21	Applied Network Security	Z,ZK	5

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

BIK-BEK.21	Secure Code	Z,ZK	5

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

BIK-EHA.21	Ethical Hacking	Z,ZK	5

The course gives a professional and academic introduction to computer and information security using the ethical hacking approach, which enables improved defence thanks to adopting an attacker mindset when discovering vulnerabilities, hands-on experience with different attacks, facilitates linking theory and practice in significant areas of one's digital literacy, and can therefore be utilized by (future) security professionals, (informed) decision-makers, (savvy) users and developers alike.

BIK-HWB	Hardware Security	Z,ZK	5

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

BIK-IOT.21	Internet of Things	Z,ZK	5

The course is focused 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).

BIK-KOM.21	Conceptual Modelling	Z,ZK	5

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.

BIK-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 by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.			
BIK-PPA	Programming Paradigms	Z,ZK	5
The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and limitations of particular approaches. Functional programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The principles are demonstrated on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstream programming languages such as C++ and Java.			
BIK-SIP.21	Network Programming	Z	5
The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment.			
BIK-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.			
BIK-SP1.21	Team Software Project 1	KZ	5
Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the BIE-SWI course that runs concurrently and that teaches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software artefact will be further developed and finished in the BIE-SP2 course.			
BIK-SP2.21	Team Software Project 2	KZ	5
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BIK-TAB.21	Applications of Security in Technology	Z,ZK	5
The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.			
BIK-TJV.21	Java Technology	Z,ZK	5
The aim of the course is to provide knowledge and skills needed for the development of smaller and larger information systems. Students will get acquainted with general theoretical concepts and will be able to apply these concepts using libraries and tools from the ecosystem of the Java programming language. After completing the course students will be able to participate in the development of software systems on the Java platform.			
BIK-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.			
BIK-UKB.21	Introduction to Cybersecurity	Z,ZK	5
The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.			

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: BIK-PV-PV.21
Name of the group: Compulsory elective courses of specialization Computer Systems and Virtualization, 2021
Requirement credits in the group: In this group you have to gain at least 5 credits (at most 15)
Requirement courses in the group: In this group you have to complete at least 1 course (at most 3)
Credits in the group: 5
Note on the group:

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIK-BIG.21	**DB Technologies for Big Data** ***Josef Gattermayer***	KZ	5	14KP+4KC	L	PV
BIK-TAB.21	**Applications of Security in Technology** ***Jiří Dostál***	Z,ZK	5	14KP+4KC	L	PV
BIK-VES	**Embedded Systems** ***Miroslav Skrbek***	Z,ZK	5	13KP+4KC	L	PV

Characteristics of the courses of this group of Study Plan: Code=BIK-PV-PV.21 Name=Compulsory elective courses of specialization Computer Systems and Virtualization, 2021

BIK-TAB.21	Applications of Security in Technology	Z,ZK	5
The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.			

BIK-BIG.21	DB Technologies for Big Data	KZ	5
Students will be introduced into the field of Big Data processing where nonrelational (NoSQL) database engines are typically used today. The course is focused practically so that after finishing the course students were able to choose suitable tools (mostly open source) and techniques,design and implement a simplest reproducible method of data processing (data collection, transformation/aggregation, presentation). Students get acquainted with various architectures for processing and storing big data. A theoretical foundation and presentation of individual technologies will be supplemented with specific case studies.			
BIK-VES	Embedded Systems	Z,ZK	5
Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.			

Name of the block: Povinná zkouška z angličtiny
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.
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 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.
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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
BI-ANG1	**English Language Examination without Preparatory Courses** *Kateřina Valentová **Kateřina Valentová** Kateřina Valentová (Gar.)*	Z,ZK	2	2D	L	PJ
BIE-EEC	**English language external certificate** *Zdeněk Muzikář **Zdeněk Muzikář** Zdeněk Muzikář (Gar.)*	Z	4	2D	L	PJ
BI-ANG	**English Language, Internal Certificate** *Kateřina Valentová **Kateřina Valentová** Kateřina Valentová (Gar.)*	ZK	2	2D	Z,L	PJ

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

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

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: BIK-V.2021
Name of the group: Purely Elective Courses of Bachelor Programme, part-time Study, Version 2021 till 2024
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BIK-ADW.1	**Windows Administration** *Miroslav Prágl **Miroslav Prágl** Miroslav Prágl (Gar.)*	Z,ZK	4	1+4KP+2KC	Z	V
BIK-STO	**Storage and Filesystems** ***Jiří Kašpar***	Z,ZK	4	1+3KP+4KC	L,Z	V
BIE-DIF	**Differential equations** *Antonella Marchesiello, Ondřej Bouchala, Jan Valdman **Tomáš Kalvoda** Ondřej Bouchala (Gar.)*	Z,ZK	5	2P+2C	L	V

BIK-EJA	**Enterprise Java** ***Jiří Daněček***	KZ	4	13KP+4KC	Z	v
BIK-HMI	**History of Mathematics and Informatics** *Alena Šolcová* ***Alena Šolcová*** *Alena Šolcová (Gar.)*	ZK	3	13KP+2KC	L	v
BIK-SQL.1	**Language SQL** *Michal Valenta* ***Michal Valenta*** *Michal Valenta (Gar.)*	KZ	4	13KP+4KC	L	v
BIK-OOP.21	**Object-Oriented Programming** *Filip Křikava, Filip Říha* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	5	14KP+4KC	Z	v
BIK-PJV	**Programming in Java** *Jan Blizničenko* ***Jan Blizničenko*** *Jan Blizničenko (Gar.)*	Z,ZK	4	13KP+4KC	Z	v
BIK-PRR.21	**Project management** *David Pešek* ***David Pešek*** *Petra Pavlíčková (Gar.)*	Z,ZK	5	14KP+4KC	Z	v
BIK-PKM	**Introduction to Mathematics** ***Karel Klouda*** *Tomáš Kalvoda (Gar.)*	Z	4		Z	v
BIK-TAB.21	**Applications of Security in Technology** ***Jiří Dostál***	Z,ZK	5	14KP+4KC	L	v
TVV	**Physical education**	Z	0	0+2	Z,L	v
TV1	**Physical Education**	Z	0	0+2	Z	v
TVV0	**Physical education**	Z	0	0+2	Z,L	v
TV2K1	**Physical Education 2**	Z	1		L,Z	v
BIK-TUR.21	**User Interface Design** *Jan Schmidt* ***Jan Schmidt*** *Jan Schmidt (Gar.)*	Z,ZK	5	14KP+4KC	L	v
BIK-KSA	**Cultural and Social Anthropology** *Alena Libánská, Tomáš Houdek, Jakub Šenovský* ***Jakub Šenovský*** *Alena Libánská (Gar.)*	ZK	2	13KP	L	v
BIK-ZWU	**Introduction to Web and User Interfaces** ***Jiří Pavelka***	Z,ZK	4	13KP+4KC	Z	v

Characteristics of the courses of this group of Study Plan: Code=BIK-V.2021 Name=Purely Elective Courses of Bachelor Programme, part-time Study, Version 2021 till 2024

BIK-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 by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.

BIK-TAB.21	Applications of Security in Technology	Z,ZK	5

The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.

BIK-ADW.1	Windows Administration	Z,ZK	4

This course is presented in Czech.

BIK-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.

BIE-DIF	Differential equations	Z,ZK	5

This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.

BIK-EJA	Enterprise Java	KZ	4

The course covers Java technologies (Jakarta EE, Microprofile, etc.) which are used for the development of EIS (Enterprise Information Systems). These applications typically manage persistent data, are accessible to clients via the REST API and are created in the microservice architecture and deployed into orchestrated containers.

BIK-HMI	History of Mathematics and Informatics	ZK	3

This course is presented in Czech.

BIK-SQL.1	Language SQL	KZ	4

Course is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In particular stored program unites, triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of view of specialized database structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and possibilities of its. changes will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS and partially on PostgreSQL.

BIK-PJV	Programming in Java	Z,ZK	4

This course is presented in Czech. However, there is an English variant in the full-time program Informatics (B1801 / 4753).

BIK-PRR.21	Project management	Z,ZK	5

Project management not only as a common dictionary and setting necessary processes while preparing and / or managing projects, but also as a social art. 20 years of experience not only in IT in various positions and different projects available at your hands.

BIK-PKM	Introduction to Mathematics	Z	4

This course is presented in Czech.

TVV	Physical education	Z	0
TV1	Physical Education	Z	0
TVV0	Physical education	Z	0
TV2K1	Physical Education 2	Z	1

BIK-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.			
BIK-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our culture as well as from the "exotic" ones (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...). The course is an interesting alternative to other humanities, taught at FIT.			
BIK-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
This course is presented in Czech.			

List of courses of this pass:

Code	Name of the course	Completion	Credits
BI-ANG	English Language, Internal Certificate	ZK	2
Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG			
BI-ANG1	English Language Examination without Preparatory Courses	Z,ZK	2
BI-BAP.21	Bachelor Thesis	Z	14
BIE-DIF	Differential equations	Z,ZK	5
This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.			
BIE-EEC	English language external certificate	Z	4
The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding the B2 level of the Common European Framework of Reference for Languages.			
BIK-AAG.21	Automata and Grammars	Z,ZK	5
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions, and regular grammars, translation finite automata, construction and use of pushdown automata, hierarchy of formal languages. Knowledge acquired through the module is applicable to creation of algorithms for pattern matching, data compression, translation, simple parsing, and creation of digital circuits.			
BIK-ADU.21	Unix Administration	Z,ZK	5
Students will learn the internal structure of the UNIX operating system, with the administration of its basic subsystems and with the security principles. They will understand the differences between user and administrator roles. They will get theoretical and practical knowledge of user management and administration, of users access rights, file systems, disk subsystems, processes, memory, network services and remote access, and in the areas of system deployment and virtualization. In the labs, they will verify the knowledge from the lectures on specific examples from practice.			
BIK-ADW.1	Windows Administration	Z,ZK	4
This course is presented in Czech.			
BIK-AG1.21	Algorithms and Graphs 1	Z,ZK	5
The course is presented in Czech. The course covers the basics from the efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. 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 practical problems.			
BIK-APS.21	Architectures of Computer Systems	Z,ZK	5
Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of the program. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.			
BIK-ASB.21	Applied Network Security	Z,ZK	5
The aim of the course is to introduce selected topics from computer networks in terms of cybersecurity. These topics extend the basic knowledge gained in course BI-PSI with actual security applications like the public key infrastructure, encrypted network protocols, link and network layer security or wireless networks. After finishing the course student will get knowledge of security applications in computer networks.			
BIK-AWD.21	Web and Database Server Administration	Z,ZK	5
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.			
BIK-BEK.21	Secure Code	Z,ZK	5
The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.			
BIK-BIG.21	DB Technologies for Big Data	KZ	5
Students will be introduced into the field of Big Data processing where nonrelational (NoSQL) database engines are typically used today. The course is focused practically so that after finishing the course students were able to choose suitable tools (mostly open source) and techniques,design and implement a simplest reproducible method of data processing (data collection, transformation/aggregation, presentation). Students get acquainted with various architectures for processing and storing big data. A theoretical foundation and presentation of individual technologies will be supplemented with specific case studies.			

BIK-BPR.21	Bachelor project	Z	1
1. At the beginning of the semester, the student reserves the topic of the bachelor's thesis and connects with the supervisor. He / she will arrange the partial tasks that he / she will perform during 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 end of the semester. 2. The external supervisor enters the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut.cz/student/studijni/formulare). The completed and signed form must be delivered in person or by email to the SZZ coordinator, who will arrange for the credit to be granted. 3. If the topic of the work 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-tuning the assignment so that the assignment can be supplemented and approved at the end of the semester.			
BIK-DBS.21	Database Systems	Z,ZK	5
Students get acquainted with the architecture of the database engine and typical user roles. They learn to design the structure of a smaller data store (including integrity constraints) using a conceptual model and then implement them in a relational database engine. They get acquainted with the SQL language and also with its theoretical basis - relational database model. They will get acquainted with the principles of relational database schema normalization. They understand the basic concepts of transaction processing and control of parallel user access to a single data source. At the end of the course, students will be introduced to alternative nonrelational database models.			
BIK-DML.21	Discrete Mathematics and Logic	Z,ZK	5
Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from set theory will be explained. Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course also lays down the basics of combinatorics and number theory, with emphasis on modular arithmetics.			
BIK-EHA.21	Ethical Hacking	Z,ZK	5
The course gives a professional and academic introduction to computer and information security using the ethical hacking approach, which enables improved defence thanks to adopting an attacker mindset when discovering vulnerabilities, hands-on experience with different attacks, facilitates linking theory and practice in significant areas of one's digital literacy, and can therefore be utilized by (future) security professionals, (informed) decision-makers, (savvy) users and developers alike.			
BIK-EJA	Enterprise Java	KZ	4
The course covers Java technologies (Jakarta EE, Microprofile, etc.) which are used for the development of EIS (Enterprise Information Systems). These applications typically manage persistent data, are accessible to clients via the REST API and are created in the microservice architecture and deployed into orchestrated containers.			
BIK-GIT.21	SW Development Technologies	Z	3
This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use.			
BIK-HMI	History of Mathematics and Informatics	ZK	3
This course is presented in Czech.			
BIK-HWB	Hardware Security	Z,ZK	5
The course deals with hardware resources used to ensure security of computer systems including embedded ones. The students become familiar with the operating principles of cryptographic modules, the security features of modern processors, and storage media protection through encryption. They will gain knowledge about vulnerabilities of HW resources, including side-channel attacks and tampering with hardware during manufacture. Students will have an overview of contact and contactless smart card technology including applications and related topics for multi-factor authentication (biometrics). Students will understand the problems of effective implementation of ciphers.			
BIK-IDO.21	Introduction to DevOps	Z,ZK	5
The course deals with the topic of DevOps and prepares future developers and administrators for a modern culture of development and operation of systems and services. The course covers the tools to support software development, testing and compilation. It also focuses on tools for automating infrastructure management and building and deploying software to the Cloud. It is an introduction to technologies that will then be discussed in more detail in related follow-up courses. The student will also get acquainted with modern technologies used in practice.			
BIK-IOT.21	Internet of Things	Z,ZK	5
The course is focused 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).			
BIK-KAB.21	Cryptography and Security	Z,ZK	5
Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis.			
BIK-KOM.21	Conceptual Modelling	Z,ZK	5
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.			
BIK-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our culture as well as from the "exotic" ones (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...). The course is an interesting alternative to other humanities, taught at FIT.			
BIK-LA1.21	Linear Algebra 1	Z,ZK	5
We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science.			
BIK-MA1.21	Mathematical Analysis 1	Z,ZK	5
We begin the course by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers. Then we study real sequences and real functions of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions. This theoretical foundation is then applied to root-finding problems (iterative method of bisection and Newtons method), construction of cubic interpolation (spline), and formulation and solution of simple optimization problems (i.e., the issue of finding extrema of functions). The course is closed with the Landaus asymptotic notation and methods of mathematical description of complexity of algorithms.			
BIK-MA2.21	Mathematical Analysis 2	Z,ZK	6
The course completes the theme of analysis of real functions of a real variable initiated in BIK-MA1 by introducing the Riemann integral. Students will learn how to integrate by parts and use the substitution method.The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylors theorem to the computation of elementary functions with a prescribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, and its analysis using the Master theorem. Finally, we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and Hessian matrix, we study the			

analytical method of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integration of multivariate functions. This course can be enrolled only after successful completion of the course BIK-MA1, which can be replaced by the course BIK-ZMA in the case of repetitive students.

BIK-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 by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.

BIK-OSY.21	Operating Systems	Z,ZK	5

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

BIK-PA1.21	Programming and Algorithmics 1	Z,ZK	7

Students gain the ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn to analyse simple cases of algorithm complexity. They know fundamental algorithms for searching, sorting, and manipulating with linked lists.

BIK-PA2.21	Programming and Algorithmics 2	Z,ZK	7

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

BIK-PJV	Programming in Java	Z,ZK	4

This course is presented in Czech. However, there is an English variant in the full-time program Informatics (B1801 / 4753).

BIK-PKM	Introduction to Mathematics	Z	4

This course is presented in Czech.

BIK-PPA	Programming Paradigms	Z,ZK	5

The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and limitations of particular approaches. Functional programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The principles are demonstrated on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstream programming languages such as C++ and Java.

BIK-PRR.21	Project management	Z,ZK	5

Project management not only as a common dictionary and setting necessary processes while preparing and / or managing projects, but also as a social art. 20 years of experience not only in IT in various positions and different projects available at your hands.

BIK-PSI.21	Computer Networks	Z,ZK	5

The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS.

BIK-PST.21	Probability and Statistics	Z,ZK	5

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

BIK-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.

BIK-SIP.21	Network Programming	Z	5

The course covers fundamental topics of programming network applications. It consists of 4 parts. The introductory part is focused on low-level programming using BSD sockets. The second part is devoted to designing communication protocols and their verification. The third part introduces the principles and applications of middleware technologies. The final part introduces basic modern models of distributed computing - P2P and blockchain. All topics will be first explained theoretically and then practices in computer labs using a chosen programming language environment.

BIK-SP1.21	Team Software Project 1	KZ	5

Students gain hands-on experience with the analysis, design, and prototyping of a large-scale software system. Theoretical support is provided in the BIE-SWI course that runs concurrently and that teaches students necessary techniques and principles. Teams consisting of 4-6 students will work on a specific project. The teacher, in the role of the team and project leader, regularly consults with the team (at the seminars) both the formal and material aspects of the software design. The resulting software artefact will be further developed and finished in the BIE-SP2 course.

BIK-SP2.21	Team Software Project 2	KZ	5

This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).

BIK-SPS.21	Administration of Computer Networks and Services	Z,ZK	5

The aim of the course is to deepen the theoretical knowledge of network technologies and protocols in the environment of network servers administrated under the operating systems Linux and Windows. The course syllabus requires the knowledge at the level of courses BIE-PSI, BIE-VPS, and BIE-OSY. Practical skills will be gained by practical hands-on experience with real network infrastructure.

BIK-SQL.1	Language SQL	KZ	4

Course is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In particular stored program unites, triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of view of specialized database structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and possibilities of its. changes will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS and partially on PostgreSQL.

BIK-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.

BIK-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.		
BIK-TAB.21	Applications of Security in Technology	Z,ZK	5
	The goal of the course is to introduce students to selected topics from cybersecurity technical applications that are utilized in different industries. Students get a broader overview of cybersecurity applications and extend their knowledge from the cryptology, the secure code, and system, network, and hardware security.		
BIK-TDP.21	Documentation and Presentation	KZ	3
	The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.		
BIK-TJV.21	Java Technology	Z,ZK	5
	The aim of the course is to provide knowledge and skills needed for the development of smaller and larger information systems. Students will get acquainted with general theoretical concepts and will be able to apply these concepts using libraries and tools from the ecosystem of the Java programming language. After completing the course students will be able to participate in the development of software systems on the Java platform.		
BIK-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.		
BIK-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.		
BIK-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.		
BIK-UKB.21	Introduction to Cybersecurity	Z,ZK	5
	The goal of the course is to provide students with the introduction of basic concepts in modern approach to cybersecurity. Students will get a basic overview of threats in cyberspace and attacker techniques, security mechanisms in networks, operating systems and applications, as well as of basic cyberspace regulations.		
BIK-UOS.21	Unix-like Operating Systems	KZ	5
	Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell.		
BIK-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 implementation of data center infrastructure, such as various kinds of virtualization and high availability of servers, storages, and software layers. The course guides through data center technologies from private to public and hybrid clouds. Student learn current trends in the architecture of IT infrastructure and its configuration for classic and cloud applications. Students will understand the design, validation, and operation of complex infrastructures for modern applications with respect to scalability and protection against overloads, outages, and data losses.		
BIK-VES	Embedded Systems	Z,ZK	5
	Students learn to design embedded systems and develop software for them. They get basic knowledge of the most common microcontrollers and embedded processors, their integrated peripheral circuits, programming methods, and applications. They get practical skills with development kits and tools.		
BIK-VPS.21	Selected Topics in Computer Networking	Z,ZK	5
	The course builds upon the Computer Networks course (BI-PSI), obligatory for the program. Students will learn in detail principles, protocols, and technologies used in modern computer networks from local area networks up to Internet, with focus on switching, routing, security, and virtualization. The emphasis will be on gaining practical experience with real network devices in the lab and learning important methods of local area and wide area networks from the viewpoint of functionality, performance, and security.		
BIK-ZSB.21	Basics of System Security	Z,ZK	5
	The goal of the course is to provide introduction to basic concepts in security of computer systems. Further, the course introduces the basics of forensic analysis and related topics such as malware analysis or incident response. After finishing the course student will get both theoretical and practical knowledge in the area of modern operating systems security, as well as skills needed for independent work in the area of operating system security incident analysis.		
BIK-ZWU	Introduction to Web and User Interfaces	Z,ZK	4
	This course is presented in Czech.		
TV1	Physical Education	Z	0
TV2K1	Physical Education 2	Z	1
TVV	Physical education	Z	0
TVV0	Physical education	Z	0

For updated information see http://bilakniha.cvut.cz/en/FF.html
Generated: day 2025-08-23, time 07:42.