Study plan

Name of study plan: Teaching Informatics for Secondary Schools

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Učitelství informatiky pro střední školy
Type of study: Follow-up master full-time
Required credits: 102
Elective courses credits: 18
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 90
The role of the block: PP

Code of the group: UNI_PP_UCIPKA1
Name of the group: Teacher propedeutics 1, Compulsory courses
Requirement credits in the group: In this group you have to gain at least 6 credits (at most 24)
Requirement courses in the group: In this group you have to complete at least 2 courses (at most 6)
Credits in the group: 6
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**
32MC-P-MSVV-01	**Social Science Research Methods**	Z,ZK	3	1P+1C		PP
32MC-P-ODID-01	**General Didactics**	Z,ZK	5	2P+1C		PP
32MC-P-PEDO-01	**General Pedagogy**	Z,ZK	5	2P+1C		PP
32MC-P-PSEP-01	**Psychology in Educational Process**	Z,ZK	5	2P+1C		PP
32MC-P-UČSP-01	**Role of Teachers in Modern Society**	ZK	3	2P+0C		PP
32MC-P-PEDS-01	**Social Pedagogy**	ZK	3	2P+0C		PP

Characteristics of the courses of this group of Study Plan: Code=UNI_PP_UCIPKA1 Name=Teacher propedeutics 1, Compulsory courses

32MC-P-MSVV-01	Social Science Research Methods	Z,ZK	3
32MC-P-ODID-01	General Didactics	Z,ZK	5
32MC-P-PEDO-01	General Pedagogy	Z,ZK	5
32MC-P-PSEP-01	Psychology in Educational Process	Z,ZK	5
32MC-P-UČSP-01	Role of Teachers in Modern Society	ZK	3
32MC-P-PEDS-01	Social Pedagogy	ZK	3

Code of the group: UNI-PP-OBD
Name of the group: Sector didactics - compulsory courses of the program Teaching Computer Science for secondary school
Requirement credits in the group: In this group you have to gain 32 credits
Requirement courses in the group: In this group you have to complete 6 courses
Credits in the group: 32
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
UNI-DI1	**Didactics of Informatics I**	Z,ZK	6	2P+2C	L	PP
UNI-DI2	**Didactics of Informatics II**	KZ	7	1P+2C	L	PP
UNI-IB	**Information security** ***Jiří Buček***	Z,ZK	5	2P+2C	L	PP
UNI-MTUI	**Modern technology and artificial intelligence**	Z,ZK	5	2P+2C	L	PP
UNI-SPD	**Semester project for thesis**	Z	3	90ZP	Z	PP
UNI-TP	**Computer technology** ***Martin Kohlík***	Z,ZK	6	2P+2C	Z	PP

Characteristics of the courses of this group of Study Plan: Code=UNI-PP-OBD Name=Sector didactics - compulsory courses of the program Teaching Computer Science for secondary school

UNI-DI1	Didactics of Informatics I	Z,ZK	6

The course builds on the subjects General Pedagogy and General Didactics and applies the acquired knowledge to didactics in the field of informatics and related technologies. The student will get acquainted with the ways of theoretical teaching of information technologies and in connection with their practical practice and verification of knowledge.

UNI-DI2	Didactics of Informatics II	KZ	7

The course builds on the subject Didactics of Informatics I and applies the knowledge to the practical use of evaluation tools for various types of tests Moodle (theory), Marast (examples, mathematics, informatics), Progtest (programs in C/C++), LearnShell (bash scripts). Students learn to work with the tools, prepare/program examples and test them on each other. Students get acquainted and help with preparing real tests from selected topics, get acquainted and help with the preparation of programming competitions for secondary school. The course is significantly built on independent work and processing of semester project (this corresponds to the credit load).

UNI-IB	Information security	Z,ZK	5

The course covers the area of description of basic cryptographic schemes and also introduces students to the basics of network and system security. Great attention is paid to current topics of cyber security, such as ethical hacking, penetration testing and malware. At the end of the course students are introduced to the issues of secure programming, security of web applications. Student learns how to avoid traps that can be set for users and thus basics of safe behavior of users and risk minimization.

UNI-MTUI	Modern technology and artificial intelligence	Z,ZK	5

Students will get acquainted with selected tools that can be used for data acquisition and processing and subsequently for their analysis and visualization. Using real data and problems, the basics of machine learning and artificial intelligence will be explained. In the next part of the course, the acquired knowledge will be used to work with tools for working with image data. In the last part of the course, students will get acquainted with the basics of robotics, especially agent systems and motion planning.

UNI-SPD	Semester project for thesis	Z	3

The aim of the course is to deepen standards and requirements for theses. It takes place mainly in the form of individual consultations with supervisors of theses and independent work. At the beginning of the course there is a block meeting with students, which introduces the student to the requirements for theses and the interconnection of professional and didactic issues. Total burden in the range of 3 ECTS. The student prepares a research of resources according to the supervisor's request, chooses a method of work, or prepares a separate chapter.

UNI-TP	Computer technology	Z,ZK	6

The course practically focuses on embedded systems and low-level software. It explains that the basis is the design of algorithms and their implementation, whether in hardware or in software, with regard to limiting conditions (size, speed, reliability). Topics are discussed in an overview form and practiced on specific examples in the laboratory. Laboratory exercises are aimed at getting students acquainted with teaching methods, e.g. how to show that there is not only reconfigurable software (a program in rewritable memory) but also hardware (FPGA). It demonstrates how to adapt tasks to the teaching of secondary school students and their expected knowledge, e.g. by means of interactive tutorials.

Code of the group: UNI-PP-PR

Name of the group: Practice - compulsory courses of the programme Teaching Informatics for Secondary Schools

Requirement credits in the group: In this group you have to gain 24 credits

Requirement courses in the group: In this group you have to complete 3 courses

Credits in the group: 24

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
UNI-PPP	**Propedeutics of pedagogical practice**	KZ	6	2P+2C	L	PP
UNI-RPP	**Reflection of teaching practice**	Z	3	26XH	Z	PP
UNI-SPP	**Continuous teaching practice**	KZ	15	450XH	Z	PP

Characteristics of the courses of this group of Study Plan: Code=UNI-PP-PR Name=Practice - compulsory courses of the programme Teaching Informatics for Secondary Schools

UNI-PPP	Propedeutics of pedagogical practice	KZ	6

The course is focused on the preparation of students for lessons before teaching practice.

UNI-RPP	Reflection of teaching practice	Z	3

In the practically focused subject, special attention will be paid to the joint search for suitable solutions to the most common difficulties of pedagogical practice, as well as to effective ways of coping with dynamic changes in contemporary education. Teaching mainly builds on the targeted building of a safe space to reflect one's own dispositions for learning, to share and process emotions as well as challenging topics from practice, including presentation and communication of students' first pedagogical outputs. Procedures included: structured discussion, feedback interviews and mentoring.

UNI-SPP	Continuous teaching practice	KZ	15

Before entering the practice, the student undergoes the propedeutic of the teaching practice. The first part of the direct practice includes, in particular, hospitalization at a particular school and the processing of hospitalization protocols. In the next part, students also directly enter the lessons and engage in activities related to the running of the school. At least 192 hours participate in the direct teaching activity, of which 96 hours directly teach either alone or in a couple. Home preparation for teaching, protocol processing, etc., i.e. a total of 450 hours is included in the 15 credits.

Code of the group: UNI-PP-PO
Name of the group: compulsory Sectorials of the program Teaching Informatics for secondary schools
Requirement credits in the group: In this group you have to gain 19 credits
Requirement courses in the group: In this group you have to complete 3 courses
Credits in the group: 19
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
UNI-ADS	**Algorithms and data structures**	Z,ZK	7	2P+2C	L	PP
UNI-PS	**Computers and networks**	Z,ZK	6	2P+2C	Z	PP
UNI-VSA	**Development of SW applications**	Z,ZK	6	2P+2C	L	PP

Characteristics of the courses of this group of Study Plan: Code=UNI-PP-PO Name=compulsory Sectorials of the program Teaching Informatics for secondary schools

UNI-ADS	Algorithms and data structures	Z,ZK	7

The course covers the most basic of the efficient algorithms, data structures and graph theory that every computer scientist should know. As part of the exercise, students are introduced to the use of explained algorithms for solving practical problems. Furthermore, students gain basic knowledge of the design and use of finite automata, regular expressions, the use of context-free grammars and the design and use of stack automata. They are introduced to the Turing machine and to the complexity classes P and NP.

UNI-PS	Computers and networks	Z,ZK	6

Students are generally explained the principles of the internal organization and architecture of computer systems. Using simple examples, they will understand how a standard multi-core, vector- and GPU-accelerated computer connected to the Internet processes, stores and sends data in a multi-user operating system. The work at the command-line level penetrates the entire subject and will be explained continuously.

UNI-VSA	Development of SW applications	Z,ZK	6

The lectures consist of topics devoted to methodology, SW systems architectures, technology platforms as well as support tools used in practice shared code repositories, CI/CD (Continuous Integration / Continuous Delivery) tools, application repositories (Google Play, App Store, Github, Gitlab,). The space will also be devoted to the use of SW components and services provided to developers, often free of charge (cloud storage, bug logging, authentication/authorization using Google or Facebook accounts and others). The seminars/exercises are designed so that students can try out at least one of many possible ways of developing and deploying a simple SW application.

Code of the group: UNI-DIP
Name of the group: Diploma Thesis of the Computer Science Teaching Program
Requirement credits in the group: In this group you have to gain 9 credits
Requirement courses in the group: In this group you have to complete 1 course
Credits in the group: 9
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
UNI-DIP	**Diploma thesis**	Z	9	270ZP	L	PP

Characteristics of the courses of this group of Study Plan: Code=UNI-DIP Name=Diploma Thesis of the Computer Science Teaching Program

UNI-DIP	Diploma thesis	Z	9

The eaching is based on individual consultations with the supervisor of the thesis or another consultant (didactic part). The scope of the 9 ECTS lessons (i.e. about 270 hours) includes consultations, preparation of the theoretical part, practical part, writing and defence of the thesis before the commission.

Name of the block: Compulsory elective courses
Minimal number of credits of the block: 12
The role of the block: PV

Code of the group: UNI-PV-SZ
Name of the group: Study bases - compulsory elective courses of the program Teaching Informatics for Secondary Schools
Requirement credits in the group: In this group you have to gain at least 6 credits (at most 135)
Requirement courses in the group: In this group you have to complete at least 2 courses (at most 27)

Credits in the group: 6
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
NIE-KRY	**Advanced Cryptology** *Róbert Lórencz, Jiří Buček* ***Jiří Buček*** *Róbert Lórencz (Gar.)*	Z,ZK	5	2P+2C	Z	PV
NIE-PDB	**Advanced Database Systems** *Martin Svoboda* ***Martin Svoboda*** *Martin Svoboda (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-PIS	**Advanced Information Systems** *Petra Pavlíčková, Petr Kroha* ***Petra Pavlíčková*** *Petr Kroha (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-AIB	**Algorithms of Information Security** *Róbert Lórencz, Martin Jureček* ***Martin Jureček*** *Róbert Lórencz (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-ADP	**Architecture and Design patterns** *Jiří Borský* ***Jiří Borský*** *Filip Křikava (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-SIM	**Digital Circuit Simulation and Verification** *Martin Kohlík* ***Martin Kohlík*** *Martin Kohlík (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-DSV	**Distributed Systems and Computing** *Pavel Tvrdík, Peter Macejko* ***Peter Macejko*** *Pavel Tvrdík (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-EPC	**Effective C++ programming** *Daniel Langr* ***Daniel Langr*** *Daniel Langr (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-EHW	**Embedded Hardware** *Jan Schmidt* ***Jan Schmidt*** *Jan Schmidt (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-BVS	**Embedded Security** *Jiří Buček, Martin Novotný* ***Martin Novotný*** *Martin Novotný (Gar.)*	Z,ZK	5	2P+2C	L	PV
NIE-ESW	**Embedded Software** *Miroslav Skrbek, Hana Kubátová* ***Miroslav Skrbek*** *Hana Kubátová (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-BKO	**Error Control Codes** *Pavel Kubalík* ***Pavel Kubalík*** *Pavel Kubalík (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-FME	**Formal Methods and Specifications** *Stefan Ratschan* ***Stefan Ratschan*** *Stefan Ratschan (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-GPU	**GPU Architectures and Programming** *Ivan Šimeček* ***Ivan Šimeček*** *Ivan Šimeček (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-HWB	**Hardware Security** *Jiří Buček* ***Jiří Buček*** *Jiří Buček (Gar.)*	Z,ZK	5	2P+2C	L	PV
NIE-MKY	**Mathematics for Cryptology** *Róbert Lórencz, Martin Jureček, Olha Jurečková* ***Róbert Lórencz*** *Róbert Lórencz (Gar.)*	Z,ZK	5	3P+1C	L	PV
NIE-AM1	**Middleware Architectures 1** *Milan Dojčinovski, Tomáš Vitvar, Jaroslav Kuchař* ***Jaroslav Kuchař*** *Tomáš Vitvar (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-MTI	**Modern Internet Technologies** *Alexandru Moucha, Viktor Černý* ***Alexandru Moucha*** *Alexandru Moucha (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-MCC	**Multicore CPU Computing** *Daniel Langr, Ivan Šimeček* ***Ivan Šimeček*** *Ivan Šimeček (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-SIB	**Network Security** *Simona Fornůsek, Jiří Dostál, Tomáš Zahradnický, Gramoz Cubreli* ***Simona Fornůsek*** *Jiří Dostál (Gar.)*	Z,ZK	5	2P+1C	L	PV
NIE-NSS	**Normalized Software Systems** *Robert Pergl, Marek Suchánek, Jan Verelst* ***Robert Pergl*** *Robert Pergl (Gar.)*	ZK	5	2P	L	PV
NIE-REV	**Reverse Engineering** *Josef Kokeš* ***Josef Kokeš*** *Josef Kokeš (Gar.)*	Z,ZK	5	1P+2C	Z	PV
NIE-SBF	**System Security and Forensics** *Jiří Buček, Simona Fornůsek, Tomáš Zahradnický, Marián Svetlík* ***Simona Fornůsek*** *Simona Fornůsek (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-TES	**Systems Theory** *Stefan Ratschan, Jiří Vyskočil, Tomáš Kolárik* ***Stefan Ratschan*** *Stefan Ratschan (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-TSP	**Testing and Reliability** *Petr Fišer* ***Petr Fišer*** *Petr Fišer (Gar.)*	Z,ZK	5	2P+2C	Z	PV
NIE-NUR	**User Interface Design** *Josef Pavlíček* ***Josef Pavlíček*** *Josef Pavlíček (Gar.)*	Z,ZK	5	2P+1C	Z	PV
NIE-VCC	**Virtualization and Cloud Computing** *Jan Fesl, Tomáš Vondra* ***Tomáš Vondra*** *Tomáš Vondra (Gar.)*	Z,ZK	5	2P+1C	L	PV

Characteristics of the courses of this group of Study Plan: Code=UNI-PV-SZ Name=Study bases - compulsory elective courses of the program Teaching Informatics for Secondary Schools

NIE-KRY	Advanced Cryptology	Z,ZK	5

Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the mathematical principles of random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can apply to the integration of their own systems or to the creation of their own software solutions.

NIE-PDB	Advanced Database Systems	Z,ZK	5
Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database machines (so called NoSQL databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPHER, Gremlin). The last part of the course deals with performance evaluation of database machines. This course is equivalent to the course MIE-PDB.			
NIE-PIS	Advanced Information Systems	Z,ZK	5
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the notion of service oriented company, enterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about agility and adaptivity and using of artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of business processes, business rules, processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.			
NIE-AIB	Algorithms of Information Security	Z,ZK	5
Students will get acquainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, students will learn the mathematical principles of cryptographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detection and the use of machine learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic systems.			
NIE-ADP	Architecture and Design patterns	Z,ZK	5
The objective of this course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as well as with understanding of the challenges, issues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge of object-oriented programming and get familiar with the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. In the second part the students will be introduced to the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, and some advanced software architectures used in large-scale distributed systems.			
NIE-SIM	Digital Circuit Simulation and Verification	Z,ZK	5
Aim of the course is to acquaint the students with principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level Modeling) levels and with the properties of proper tools. The course covers today recent verification methods, too.			
NIE-DSV	Distributed Systems and Computing	Z,ZK	5
Students are introduced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing processes and communication channels. They learn basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that support high availability of both data and services, and safety in case of failures.			
NIE-EPC	Effective C++ programming	Z,ZK	5
Students learn how to use the modern features of contemporary versions of the C++ programming language for software development. The course focuses on programming effectivity and efficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor time requirements.			
NIE-EHW	Embedded Hardware	Z,ZK	5
The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures.			
NIE-BVS	Embedded Security	Z,ZK	5
Students gain basic knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of cryptographic primitives in hardware and software (in embedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources for securing internal functions of computer systems.			
NIE-ESW	Embedded Software	Z,ZK	5
Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence.			
NIE-BKO	Error Control Codes	Z,ZK	5
The course expands the basic knowledge of security codes used in current systems for error detection and correction. It provides the necessary mathematical theory and principles of linear, cyclic codes and codes for the correction of multiple errors, clusters of errors and whole syllables (bytes). Students will also learn how to implement these detections and corrections for different types of transmissions (parallel, serial) when storing data in memory and when transmitting over telecommunication channels.			
NIE-FME	Formal Methods and Specifications	Z,ZK	5
Students are able to describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some software tools that allow to prove basic properties of software.			
NIE-GPU	GPU Architectures and Programming	Z,ZK	5
Students will gain knowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUDA programming environment, which is already a widespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical computational structures, students will also learn optimization programming techniques and methods of programming multiprocessor GPU systems.			
NIE-HWB	Hardware Security	Z,ZK	5
The course provides the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards against abuse of the system using hardware means. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Students will gain knowledge about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the computer.			
NIE-MKY	Mathematics for Cryptology	Z,ZK	5
Students will gain deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In particular, the course focuses on the problem of solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discrete logarithm. The problem of factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based on lattices.			
NIE-AM1	Middleware Architectures 1	Z,ZK	5
Students will study new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information system architecture, web service architecture and aplication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous communications and high availability of applications. This course replaces the course MIE-MDW.			
NIE-MTI	Modern Internet Technologies	Z,ZK	5
Students learn advanced networking technologies and protocols for both local area networks and wide area networks. They get acquainted with routing techniques and transfer technologies of modern internet, including multimedia data transfer, with various types of network virtualization, and with last-mile security.			
NIE-MCC	Multicore CPU Computing	Z,ZK	5
Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memory, which are today the most common computing nodes of powerful computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the decrease in computing power due to the widening performance gap between the computational requirements of multi-core CPUs and memory interface throughput. On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications.			

NIE-SIB	Network Security	Z,ZK	5
The students will gain theoretical and practical knowledge and experience in the area of current security threats in computer networks, specifically about detection and defense. The course explains basic pricipals of security monitoring, packet-based and flow-based analysis, in order to detect anomalies and suspicious network traffic. The course focuses on explanation and practical examples of various mechanisms of securing network infrastructure and detection in real time. The course covers general principals of handling detected security events (i.e. incident handling and incident response).			
NIE-NSS	Normalized Software Systems	ZK	5
Students will learn the foundations of normalized systems theory that studies the evolvability of modular structures based on concepts from engineering, such as stability from system theory and entropy from thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related issues occur in any given software architecture. In the second part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stability and entropy-related principles. This knowledge allows students to realize new levels of evolvability in software architectures.			
NIE-REV	Reverse Engineering	Z,ZK	5
Students will learn fundamentals of reverse engineering of computer software (methods of executing and initializing programs, organization of executable files, work with third-party libraries). Special attention will be paid to C ++. Students will also become familiar with the principles of debugging tools, disassemblers and obfuscation methods. Finally, the course will focus on code compression and decompression and executable file reconstruction.			
NIE-SBF	System Security and Forensics	Z,ZK	5
Students will be introduced to various aspects of system security (principles of endpoint security, principles of security policies, security models, authentication concepts). Students will also learn about forensic analysis as a tool for investigating security incidents (techniques used by malicious software or attackers, forensic analysis techniques, and the importance of memory or file system artifacts for attack analysis and detection).			
NIE-TES	Systems Theory	Z,ZK	5
Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However, the costs of managing this complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of models that describe only those aspects of the systems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and algorithms that form the basis for the modeling and analysis of complex systems.			
NIE-TSP	Testing and Reliability	Z,ZK	5
Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits.			
NIE-NUR	User Interface Design	Z,ZK	5
Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal user models, the fundamental notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able to design advanced UIs.			
NIE-VCC	Virtualization and Cloud Computing	Z,ZK	5
Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development).			

Code of the group: UNI-PV-UCIPKA2
Name of the group: Teacher propedeutics 2 - Compulsory elective courses
Requirement credits in the group: In this group you have to gain at least 6 credits (at most 18)
Requirement courses in the group: In this group you have to complete at least 2 courses (at most 6)
Credits in the group: 6
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
32MC-P-DLAB-01	**Didactics of Laboratories**	KZ	3	0P+2C		PV
32MC-P-OSPN-01	**Personality: Pathology and Normality**	KZ	3	1P+1C		PV
32MC-P-PSHY-01	**Psycho-hygiene Aspects of Teaching Profession**	Z,ZK	3	1P+1C		PV
32MC-P-SPKO-01	**Social and Pedagogical Communication**	KZ	3	0P+2C		PV
32MC-P-TECR-01	**Impacts of Information Technology on Society**	Z,ZK	3	1P+1C		PV
32MC-P-RIZZ-01	**Risk Behavior of Pupils**	KZ	3	1P+1C		PV

Characteristics of the courses of this group of Study Plan: Code=UNI-PV-UCIPKA2 Name=Teacher propedeutics 2 - Compulsory elective courses

32MC-P-DLAB-01	Didactics of Laboratories	KZ	3
32MC-P-OSPN-01	Personality: Pathology and Normality	KZ	3
32MC-P-PSHY-01	Psycho-hygiene Aspects of Teaching Profession	Z,ZK	3
32MC-P-SPKO-01	Social and Pedagogical Communication	KZ	3
32MC-P-TECR-01	Impacts of Information Technology on Society	Z,ZK	3
32MC-P-RIZZ-01	Risk Behavior of Pupils	KZ	3

List of courses of this pass:

Code	Name of the course	Completion	Credits
32MC-P-DLAB-01	Didactics of Laboratories	KZ	3
32MC-P-MSVV-01	Social Science Research Methods	Z,ZK	3
32MC-P-ODID-01	General Didactics	Z,ZK	5
32MC-P-OSPN-01	Personality: Pathology and Normality	KZ	3
32MC-P-PEDO-01	General Pedagogy	Z,ZK	5
32MC-P-PEDS-01	Social Pedagogy	ZK	3
32MC-P-PSEP-01	Psychology in Educational Process	Z,ZK	5
32MC-P-PSHY-01	Psycho-hygiene Aspects of Teaching Profession	Z,ZK	3
32MC-P-RIZZ-01	Risk Behavior of Pupils	KZ	3
32MC-P-SPKO-01	Social and Pedagogical Communication	KZ	3
32MC-P-TECR-01	Impacts of Information Technology on Society	Z,ZK	3
32MC-P-UČSP-01	Role of Teachers in Modern Society	ZK	3
NIE-ADP	Architecture and Design patterns	Z,ZK	5
The objective of this course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as well as with understanding of the challenges, issues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge of object-oriented programming and get familiar with the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. In the second part the students will be introduced to the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, and some advanced software architectures used in large-scale distributed systems.			
NIE-AIB	Algorithms of Information Security	Z,ZK	5
Students will get acquainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, students will learn the mathematical principles of cryptographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detection and the use of machine learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic systems.			
NIE-AM1	Middleware Architectures 1	Z,ZK	5
Students will study new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information system architecture, web service architecture and aplication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous communications and high availability of applications. This course replaces the course MIE-MDW.			
NIE-BKO	Error Control Codes	Z,ZK	5
The course expands the basic knowledge of security codes used in current systems for error detection and correction. It provides the necessary mathematical theory and principles of linear, cyclic codes and codes for the correction of multiple errors, clusters of errors and whole syllables (bytes). Students will also learn how to implement these detections and corrections for different types of transmissions (parallel, serial) when storing data in memory and when transmitting over telecommunication channels.			
NIE-BVS	Embedded Security	Z,ZK	5
Students gain basic knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of cryptographic primitives in hardware and software (in embedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources for securing internal functions of computer systems.			
NIE-DSV	Distributed Systems and Computing	Z,ZK	5
Students are introduced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing processes and communication channels. They learn basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that support high availability of both data and services, and safety in case of failures.			
NIE-EHW	Embedded Hardware	Z,ZK	5
The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures.			
NIE-EPC	Effective C++ programming	Z,ZK	5
Students learn how to use the modern features of contemporary versions of the C++ programming language for software development. The course focuses on programming effectivity and efficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor time requirements.			
NIE-ESW	Embedded Software	Z,ZK	5
Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence.			
NIE-FME	Formal Methods and Specifications	Z,ZK	5
Students are able to describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some software tools that allow to prove basic properties of software.			
NIE-GPU	GPU Architectures and Programming	Z,ZK	5
Students will gain knowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUDA programming environment, which is already a widespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical computational structures, students will also learn optimization programming techniques and methods of programming multiprocessor GPU systems.			
NIE-HWB	Hardware Security	Z,ZK	5
The course provides the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards against abuse of the system using hardware means. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Students will gain knowledge about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the computer.			

NIE-KRY	Advanced Cryptology	Z,ZK	5
Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the mathematical principles of random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can apply to the integration of their own systems or to the creation of their own software solutions.			
NIE-MCC	Multicore CPU Computing	Z,ZK	5
Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memory, which are today the most common computing nodes of powerful computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the decrease in computing power due to the widening performance gap between the computational requirements of multi-core CPUs and memory interface throughput. On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications.			
NIE-MKY	Mathematics for Cryptology	Z,ZK	5
Students will gain deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In particular, the course focuses on the problem of solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discrete logarithm. The problem of factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based on lattices.			
NIE-MTI	Modern Internet Technologies	Z,ZK	5
Students learn advanced networking technologies and protocols for both local area networks and wide area networks. They get acquainted with routing techniques and transfer technologies of modern internet, including multimedia data transfer, with various types of network virtualization, and with last-mile security.			
NIE-NSS	Normalized Software Systems	ZK	5
Students will learn the foundations of normalized systems theory that studies the evolvability of modular structures based on concepts from engineering, such as stability from system theory and entropy from thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related issues occur in any given software architecture. In the second part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stability and entropy-related principles. This knowledge allows students to realize new levels of evolvability in software architectures.			
NIE-NUR	User Interface Design	Z,ZK	5
Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal user models, the fundamental notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able to design advanced UIs.			
NIE-PDB	Advanced Database Systems	Z,ZK	5
Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database machines (so called NoSQL databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPHER, Gremlin). The last part of the course deals with performance evaluation of database machines. This course is equivalent to the course MIE-PDB.			
NIE-PIS	Advanced Information Systems	Z,ZK	5
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the notion of service oriented company, enterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about agility and adaptivity and using of artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of business processes, business rules, processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.			
NIE-REV	Reverse Engineering	Z,ZK	5
Students will learn fundamentals of reverse engineering of computer software (methods of executing and initializing programs, organization of executable files, work with third-party libraries). Special attention will be paid to C ++. Students will also become familiar with the principles of debugging tools, disassemblers and obfuscation methods. Finally, the course will focus on code compression and decompression and executable file reconstruction.			
NIE-SBF	System Security and Forensics	Z,ZK	5
Students will be introduced to various aspects of system security (principles of endpoint security, principles of security policies, security models, authentication concepts). Students will also learn about forensic analysis as a tool for investigating security incidents (techniques used by malicious software or attackers, forensic analysis techniques, and the importance of memory or file system artifacts for attack analysis and detection).			
NIE-SIB	Network Security	Z,ZK	5
The students will gain theoretical and practical knowledge and experience in the area of current security threats in computer networks, specifically about detection and defense. The course explains basic pricipals of security monitoring, packet-based and flow-based analysis, in order to detect anomalies and suspicious network traffic. The course focuses on explanation and practical examples of various mechanisms of securing network infrastructure and detection in real time. The course covers general principals of handling detected security events (i.e. incident handling and incident response).			
NIE-SIM	Digital Circuit Simulation and Verification	Z,ZK	5
Aim of the course is to acquaint the students with principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level Modeling) levels and with the properties of proper tools. The course covers today recent verification methods, too.			
NIE-TES	Systems Theory	Z,ZK	5
Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However, the costs of managing this complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of models that describe only those aspects of the systems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and algorithms that form the basis for the modeling and analysis of complex systems.			
NIE-TSP	Testing and Reliability	Z,ZK	5
Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits.			
NIE-VCC	Virtualization and Cloud Computing	Z,ZK	5
Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development).			
UNI-ADS	Algorithms and data structures	Z,ZK	7
The course covers the most basic of the efficient algorithms, data structures and graph theory that every computer scientist should know. As part of the exercise, students are introduced to the use of explained algorithms for solving practical problems. Furthermore, students gain basic knowledge of the design and use of finite automata, regular expressions, the use of context-free grammars and the design and use of stack automata. They are introduced to the Turing machine and to the complexity classes P and NP.			
UNI-DI1	Didactics of Informatics I	Z,ZK	6
The course builds on the subjects General Pedagogy and General Didactics and applies the acquired knowledge to didactics in the field of informatics and related technologies. The student will get acquainted with the ways of theoretical teaching of information technologies and in connection with their practical practice and verification of knowledge.			

UNI-DI2	Didactics of Informatics II	KZ	7
The course builds on the subject Didactics of Informatics I and applies the knowledge to the practical use of evaluation tools for various types of tests Moodle (theory), Marast (examples, mathematics, informatics), Progtest (programs in C/C++), LearnShell (bash scripts). Students learn to work with the tools, prepare/program examples and test them on each other. Students get acquainted and help with preparing real tests from selected topics, get acquainted and help with the preparation of programming competitions for secondary school. The course is significantly built on independent work and processing of semester project (this corresponds to the credit load).			
UNI-DIP	Diploma thesis	Z	9
The eaching is based on individual consultations with the supervisor of the thesis or another consultant (didactic part). The scope of the 9 ECTS lessons (i.e. about 270 hours) includes consultations, preparation of the theoretical part, practical part, writing and defence of the thesis before the commission.			
UNI-IB	Information security	Z,ZK	5
The course covers the area of description of basic cryptographic schemes and also introduces students to the basics of network and system security. Great attention is paid to current topics of cyber security, such as ethical hacking, penetration testing and malware. At the end of the course students are introduced to the issues of secure programming, security of web applications. Student learns how to avoid traps that can be set for users and thus basics of safe behavior of users and risk minimization.			
UNI-MTUI	Modern technology and artificial intelligence	Z,ZK	5
Students will get acquainted with selected tools that can be used for data acquisition and processing and subsequently for their analysis and visualization. Using real data and problems, the basics of machine learning and artificial intelligence will be explained. In the next part of the course, the acquired knowledge will be used to work with tools for working with image data. In the last part of the course, students will get acquainted with the basics of robotics, especially agent systems and motion planning.			
UNI-PPP	Propedeutics of pedagogical practice	KZ	6
The course is focused on the preparation of students for lessons before teaching practice.			
UNI-PS	Computers and networks	Z,ZK	6
Students are generally explained the principles of the internal organization and architecture of computer systems. Using simple examples, they will understand how a standard multi-core, vector- and GPU-accelerated computer connected to the Internet processes, stores and sends data in a multi-user operating system. The work at the command-line level penetrates the entire subject and will be explained continuously.			
UNI-RPP	Reflection of teaching practice	Z	3
In the practically focused subject, special attention will be paid to the joint search for suitable solutions to the most common difficulties of pedagogical practice, as well as to effective ways of coping with dynamic changes in contemporary education. Teaching mainly builds on the targeted building of a safe space to reflect one's own dispositions for learning, to share and process emotions as well as challenging topics from practice, including presentation and communication of students' first pedagogical outputs. Procedures included: structured discussion, feedback interviews and mentoring.			
UNI-SPD	Semester project for thesis	Z	3
The aim of the course is to deepen standards and requirements for theses. It takes place mainly in the form of individual consultations with supervisors of theses and independent work. At the beginning of the course there is a block meeting with students, which introduces the student to the requirements for theses and the interconnection of professional and didactic issues. Total burden in the range of 3 ECTS. The student prepares a research of resources according to the supervisor's request, chooses a method of work, or prepares a separate chapter.			
UNI-SPP	Continuous teaching practice	KZ	15
Before entering the practice, the student undergoes the propedeutic of the teaching practice. The first part of the direct practice includes, in particular, hospitalization at a particular school and the processing of hospitalization protocols. In the next part, students also directly enter the lessons and engage in activities related to the running of the school. At least 192 hours participate in the direct teaching activity, of which 96 hours directly teach either alone or in a couple. Home preparation for teaching, protocol processing, etc., i.e. a total of 450 hours is included in the 15 credits.			
UNI-TP	Computer technology	Z,ZK	6
The course practically focuses on embedded systems and low-level software. It explains that the basis is the design of algorithms and their implementation, whether in hardware or in software, with regard to limiting conditions (size, speed, reliability). Topics are discussed in an overview form and practiced on specific examples in the laboratory. Laboratory exercises are aimed at getting students acquainted with teaching methods, e.g. how to show that there is not only reconfigurable software (a program in rewritable memory) but also hardware (FPGA). It demonstrates how to adapt tasks to the teaching of secondary school students and their expected knowledge, e.g. by means of interactive tutorials.			
UNI-VSA	Development of SW applications	Z,ZK	6
The lectures consist of topics devoted to methodology, SW systems architectures, technology platforms as well as support tools used in practice shared code repositories, CI/CD (Continuous Integration / Continuous Delivery) tools, application repositories (Google Play, App Store, Github, Gitlab,). The space will also be devoted to the use of SW components and services provided to developers, often free of charge (cloud storage, bug logging, authentication/authorization using Google or Facebook accounts and others). The seminars/exercises are designed so that students can try out at least one of many possible ways of developing and deploying a simple SW application.			

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