

## Recommended pass through the study plan

### Name of the pass: Computer Systems and Networks, Presented in English, Version 2016 - 2020

Faculty/Institute/Others:

Department: Department of Computer Systems

Pass through the study plan: Computer Systems and Networks, Presented in English, Version 2016 až 2020

Branch of study guaranteed by the department: Computer Systems and Networks

Guarantor of the study branch: prof. Ing. Pavel Tvrđík, CSc.

Program of study: Informatics (in English)

Type of study: Follow-up master full-time

Note on the pass:

**Coding of roles of courses and groups of courses:**

**P - compulsory courses of the program, PO - compulsory courses of the branch, Z - compulsory courses, S - compulsory elective courses, PV - compulsory elective courses, F - elective specialized courses, V - elective courses, T - physical training courses**

**Coding of ways of completion of courses (KZ/Z/ZK) and coding of semesters (Z/L):**

**KZ - graded assesment, Z - assesment, ZK - examination, L - summer semester, Z - winter semester**

Number of semester: 1

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
MIE-MPI	<b>Mathematics for Informatics</b> Francesco Dolce, Št pán Starosta Št pán Starosta (Gar.)	Z,ZK	7	3P+1R+1C	Z	PP
MIE-PAA	<b>Problems and Algorithms</b> Petr Fišer <b>Petr Fišer</b> Petr Fišer (Gar.)	Z,ZK	5	2P+1R+1C	Z	PP
MIE-MTI.16	<b>Modern Internet Technologies</b> Alexandru Moucha, Viktor erný <b>Alexandru Moucha</b> Alexandru Moucha (Gar.)	Z,ZK	5	2P+1C	Z	PO
MIE-MDW.16	<b>Web Services and Middleware</b> Milan Doj inovski <b>Tomáš Vitvar</b> Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	Z	PO
MIE-V.2017	<b>Purely Elective Master Courses, version 2017</b> MIE-LCF,MIE-ARI,..... (see the list of groups below)	Min. cours. 0	Min/Max 0/0			V

Number of semester: 2

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
MIE-PDP.16	<b>Parallel and Distributed Programming</b> Pavel Tvrđík <b>Pavel Tvrđík</b> Pavel Tvrđík (Gar.)	Z,ZK	5	2P+2C	L	PP
MIE-SPI.16	<b>Statistics for Informatics</b> Petr Novák <b>Pavel Hrabák</b> Pavel Hrabák (Gar.)	Z,ZK	7	4P+2C	L	PP
MIE-POA.16	<b>Advanced Computer System Architectures</b> Pavel Tvrđík, Ji í Kašpar <b>Pavel Tvrđík</b> Pavel Tvrđík (Gar.)	Z,ZK	5	2P+1C	L	PO
MIE-PAP.16	<b>Parallel Computer Architectures</b> Ivan Šime ek <b>Ivan Šime ek</b> Ivan Šime ek (Gar.)	Z,ZK	5	2P+1C	L	PO
MIE-SYB.16	<b>System Security</b> Róbert Lórencz, Simona Buchovecká, Ji í Bu ek, Ji í Smítka <b>Simona Buchovecká</b> Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	L	PO
MIE-V.2017	<b>Purely Elective Master Courses, version 2017</b> MIE-LCF,MIE-ARI,..... (see the list of groups below)	Min. cours. 0	Min/Max 0/0			V

Number of semester: 3

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
MIE-MPR	<b>Master Project</b> Zden k Muziká Zden k Muziká (Gar.)	Z	7		Z	PP

MIE-DSV.16	<b>Distributed Systems and Computing</b> <i>Jan Jane ek, Peter Macejko Peter Macejko Jan Jane ek (Gar.)</i>	Z,ZK	5	2P+1C	Z	PO
MIE-SIB.16	<b>Network Security</b> <i>Simona Buchovecká, Tomáš ejka Tomáš ejka Simona Buchovecká (Gar.)</i>	Z,ZK	5	2P+1C	Z	PO
MIE-PV-EM.2016	<b>Compulsory Elective Master Economics and Management Courses , in English, Ver. 2016</b> <i>MIE-IBE,MIE-SEP</i>	Min. cours. 1 Max. cours. 2	Min/Max 2/6			VE
MIE-V.2017	<b>Purely Elective Master Courses, version 2017</b> <i>MIE-LCF,MIE-ARI,..... (see the list of groups below)</i>	Min. cours. 0	Min/Max 0/0			V

Number of semester: 4

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
MIE-DIP	<b>Diploma Project</b> <i>Zden k Muziká (Gar.)</i>	Z	23		Z,L	PP
MIE-PV-HU.2016	<b>Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver. 2016, English</b> <i>MIE-KYB.16,MIE-HMI</i>	Min. cours. 1 Max. cours. 2	Min/Max 2/5			VH
MIE-V.2017	<b>Purely Elective Master Courses, version 2017</b> <i>MIE-LCF,MIE-ARI,..... (see the list of groups below)</i>	Min. cours. 0	Min/Max 0/0			V

### List of groups of courses of this pass with the complete content of members of individual groups

Kód	Name of the group of courses and codes of members of this group (for specification see here or below the list of courses)	Completion	Credits	Scope	Semester	Role
MIE-PV-EM.2016	<b>Compulsory Elective Master Economics and Management Courses , in English, Ver. 2016</b>	Min. cours. 1 Max. cours. 2	Min/Max 2/6			VE
MIE-IBE	Information Security	MIE-SEP	World Economy and Business			
MIE-PV-HU.2016	<b>Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver. 2016, English</b>	Min. cours. 1 Max. cours. 2	Min/Max 2/5			VH
MIE-KYB.16	Cybernatality	MIE-HMI	History of Mathematics and Infor ...			
MIE-V.2017	<b>Purely Elective Master Courses, version 2017</b>	Min. cours. 0	Min/Max 0/0			V
MIE-LCF	Compiling system LLVM	MIE-ARI	Computer Arithmetic	MIE-KOD.16	Data Compression	
MI-GLR	Games and reinforcement learning	NI-GLR	Games and reinforcement learning	MIE-MZI	Mathematics for data science	
MIE-ROZ.16	Pattern Recognition	NIE-VPR	Research Project	MI-SCE1	Computer Engineering Seminar Mas ...	
NIE-HSC	Side-Channel Analysis in Hardwar ...	MIE-BPS	Wireless Computer Networks			

### List of courses of this pass:

Code	Name of the course	Completion	Credits
MI-GLR	Games and reinforcement learning	Z,ZK	4
The field of reinforcement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence. This course is intended to give you both theoretical and practical background so you can participate in related research activities. Presented in English.			

MI-SCE1	Computer Engineering Seminar Master I	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.			
MIE-ARI	Computer Arithmetic	Z,ZK	4
Students will learn various data representations used in digital devices and will be able to design units realizing arithmetic operations.			
MIE-BPS	Wireless Computer Networks	Z,ZK	4
Students will learn about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad-hoc networks, multicast and broadcast mechanisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowledge of security mechanisms for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools.			
MIE-DIP	Diploma Project	Z	23
MIE-DSV.16	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.			
MIE-HMI	History of Mathematics and Informatics	Z,ZK	3
The course focuses on selected topics from calculus, general algebra, number theory, numerical mathematics and logic - useful for today computer science The topics are selected for finding some relations between computer science and mathematical methods. Some examples of applications of mathematics to computer sciences will be showed.			
MIE-IBE	Information Security	ZK	2
Students learn information and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and international standards in this area. They understand methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., penetration testing).			
MIE-KOD.16	Data Compression	Z,ZK	5
Students are introduced to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data compression methods being used in practice. The overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, students learn the fundamentals of lossy data compression methods used in image, audio, and video compression.			
MIE-KYB.16	Cybernality	ZK	5
Students get acquainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the classification of attacks and have an overview of systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activities and behavior. The course will also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).			
MIE-LCF	Compiling system LLVM	Z,ZK	4
MIE-MDW.16	Web Services and Middleware	Z,ZK	5
Students learn new trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including their theoretical background.			
MIE-MPI	Mathematics for Informatics	Z,ZK	7
The course comprises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analysis, smooth optimization and multi-variate integration. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last topic includes selected numerical algorithm and their stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear presentation and argumentation.			
MIE-MPR	Master Project	Z	7
1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the IS based on the confirmation of the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.			
MIE-MTI.16	Modern Internet Technologies	Z,ZK	5
Students learn technologies of the modern Internet. links of the IP technology to the modern communication networks, mechanisms for multicasting and real-time communication, more efficient mechanisms of virtual channels, and the new IPv6 architecture. They will understand the issues of monitoring and management of large computer networks. They are introduced to the technologies of interconnection networks for HPC systems.			
MIE-MZI	Mathematics for data science	Z,ZK	4
In this course, the students are introduced to the domains of mathematics necessary for understanding the standard methods and algorithms used in data science. The studied topics include mainly: linear algebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality principle, gradient methods) and selected notions from probability theory and statistics.			
MIE-PAA	Problems and Algorithms	Z,ZK	5
Students are able to evaluate discrete problems by complexity and by the purpose of optimisation (on-line tasks, multicriterial optimisation). They understand principles and properties of heuristics and exact algorithms and, therefore, are able to select, apply, and experimentally evaluate a suitable heuristics for a practical problem.			
MIE-PAP.16	Parallel Computer Architectures	Z,ZK	5
The students gain a good overview of present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore processors, SoCs and MPSoCs, GPUs, and neural processors. Students also get hands-on experience with programming these systems.			
MIE-PDP.16	Parallel and Distributed Programming	Z,ZK	5
Due to the development of cloud, web, and communication technologies and due to the shift of the Moore law into parallelization of CPUs, parallel and distributed applications are becoming dominant. Students get acquainted with architectures of parallel and distributed computing systems and their models and with languages and environments for their programming. They learn the pattern designs for parallel and distributed programming and important parallel algorithms.			
MIE-POA.16	Advanced Computer System Architectures	Z,ZK	5
The student will learn the current trends in infrastructure architecture of complex business computer systems. After completion of the module, the student will be able to design a complex system infrastructure that meets availability and scalability requirements given by the business environment.			
MIE-ROZ.16	Pattern Recognition	Z,ZK	5
The aim of the module is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the statistical approach to pattern recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.			

<b>MIE-SEP</b>	<b>World Economy and Business</b>	<b>Z,ZK</b>	<b>4</b>
<p>The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.</p>			
<b>MIE-SIB.16</b>	<b>Network Security</b>	<b>Z,ZK</b>	<b>5</b>
<p>The students will gain theoretical and practical experience with technologies and systems for detection of intrusions in large-scale high-speed networks. They will also learn basic concepts of statistical modeling of communication protocols. Students will also gain basic theoretical and practical skills required to perform realistic simulations of computer networks. They will also be introduced to basic psychological aspects of network security and the role of the human factor in attacks on information systems.</p>			
<b>MIE-SPI.16</b>	<b>Statistics for Informatics</b>	<b>Z,ZK</b>	<b>7</b>
<p>The students will learn the basics of the probability theory, elements of information theory and stochastic processes, and some methods of computational statistics. They will understand the methods for statistical processing of large volumes of data. They will get skills in using computational methods and statistical software for these tasks.</p>			
<b>MIE-SYB.16</b>	<b>System Security</b>	<b>Z,ZK</b>	<b>5</b>
<p>Students will familiarize themselves with the actual ICT security needs in all ICT disciplines. Students will gain knowledge of typical network attacks and protection against them, together with essential communication encryption techniques. They will learn how to work with certain aspects of encryption techniques - passwords and certificates. After that, students will learn the basics of anti-virus, anti-spam and heuristic analyses used in modern anti-virus solutions or Unified Threat Management (UTM) based solutions. They will also learn the principles of securing websites, web applications and databases. Upon completion of the module, students will have a broad overview of IT security and will be able to apply it to the integration of various software systems and applications.</p>			
<b>NI-GLR</b>	<b>Games and reinforcement learning</b>	<b>Z,ZK</b>	<b>4</b>
<p>The field of reinforcement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence. This course is intended to give you both theoretical and practical background so you can participate in related research activities. Presented in English.</p>			
<b>NIE-HSC</b>	<b>Side-Channel Analysis in Hardware</b>	<b>Z,ZK</b>	<b>4</b>
<p>This course is dedicated to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical attacks. Students get familiar with various kinds of side channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and get familiar with higher-order attacks. They also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel information leakage.</p>			
<b>NIE-VPR</b>	<b>Research Project</b>	<b>Z</b>	<b>5</b>
<p>1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the IS based on the confirmation of the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.</p>			

For updated information see <http://bilakniha.cvut.cz/en/FF.html>

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