### Study plan

# Name of study plan: Master branch Design and Programming of Embedded Systems, in Czech, 2016-2019

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch:

Program of study: Informatics, valid until 2024 Type of study: Follow-up master full-time

Required credits: 94

Elective courses credits: 26 Sum of credits in the plan: 120

Note on the plan: Tato verze studijního plánu je ur ena pro ro ník, který byl p ijat ke studiu v akademickém

roce 2016/2017 do prezen ní formy studia magisterského programu.

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 54

The role of the block: PP

Code of the group: MI-PP.2016

Name of the group: Compulsory Courses of Master Study Program, Version 2016, in Czech

Requirement credits in the group: In this group you have to gain 54 credits

Requirement courses in the group: In this group you have to complete at least 6 courses

Credits in the group: 54

Note on the group: Opakovaně do studia zapsaní studenti s uznatelnou zkouškou z PAR mohou požádat o uznání

zkoušky z předmětu PDP.# Opozdilcům: Student, kteremu chybí PPR, si zapíše PDP a získá z něj zápočet.# Do studia opakovaně zapsaným studentů: student se zkouškou z PPR má právou na

uznání zápočtu z PDP.

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
MI-DIP	Diploma Project	Z	23		L,Z	PP
MI-MPR	Master Project	Z	7		Z,L	PP
MI-MPI	Mathematics for Informatics Št pán Starosta	Z,ZK	7	3P+2C	Z	PP
MI-PDP.16	Parallel and Distributed Programming	Z,ZK	5	2P+2C	L	PP
MI-PAA	Problems and Algorithms Petr Fišer	Z,ZK	5	2P+1R+1C	Z	PP
MI-SPI.16	Statistics for Informatics	Z,ZK	7	4P+2C	L	PP

## Characteristics of the courses of this group of Study Plan: Code=MI-PP.2016 Name=Compulsory Courses of Master Study Program, Version 2016, in Czech

MI-DIP	Diploma Project	Z	23
MI-MPR	Master Project	Z	7

<sup>1.</sup> 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.

MI-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.

MI-PDP.16 Parallel and Distributed Programming Due to the development of cloud, web, and communication technologies and due to the shift of the Moore law into multicore and manycore CPUs, parallel and distributed applications are becoming ubiquitous. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconnection networks, and languages and environments for parallel programming of shared and distributed memory computers. On selected problems, they will learn the techniques of design of efficient and scalable parallel algorithms and methods of performance evaluation of their implementations. MI-PAA Z,ZK Problems and Algorithms 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

Summary of probability theory; Multivariate normal distribution; Entropy and its application to coding; Statistical tests: T-tests, goodness of fit tests, independence test; Random processes

Z,ZK

Name of the block: Compulsory courses of the specialization

Minimal number of credits of the block: 35

stacionarity; Markov chains and limiting properties; Queuing theory

Statistics for Informatics

The role of the block: PO

Code of the group: MI-PO-NPVS.2016

Name of the group: Compulsory Courses of Master Branch Design and Programming of Embedded Systems,

in Czech, 2016

Requirement credits in the group: In this group you have to gain 35 credits

Requirement courses in the group: In this group you have to complete 7 courses

Credits in the group: 35 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
MI-BHW.16	Security and Hardware  Martin Novotný	Z,ZK	5	2P+2C	L	PO
MI-BKO.16	Error Control Codes	Z,ZK	5	2P+1C	L	PO
MI-NFA.16	Design for the FPGA and ASIC Technology	Z,ZK	5	2P+1C	Z	PO
MI-SIM.16	Digital Circuit Simulation	Z,ZK	5	2P+1C	L,Z	PO
MI-SOC.16	Systems on Chip	Z,ZK	5	2P+1C	Z	PO
MI-TES.16	Systems Theory	Z,ZK	5	2P+1C	Z	PO
MI-TSP.16	Testing and Reliability Petr Fiser	Z,ZK	5	2P+2C	Z	PO

Characteristics of	f the courses of this group of Study Plan: Code=MI-PO-NPVS.2016 Name=Compulsory Coւ	irses of Mast	er Branch
<b>Design and Prog</b>	ramming of Embedded Systems, in Czech, 2016		
MI-BHW.16	Security and Hardware	Z,ZK	5
Students gain a basic	knowledge in selected topics of cryptography and cruptanalysis. The module focuses particularly on elliptic curve cryptograph	y, and on contemp	orary attacks on
cryptographic systems	. Students gain a good overview of the functionality of (hardware) cryptographic accelerators, random number generators, smar	t cards, and resou	rces for securing
of internal functions of	computer systems.		
MI-BKO.16	Error Control Codes	Z,ZK	5
The goal of the course	is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transmitted v	ia channels.	'
MI-NFA.16	Design for the FPGA and ASIC Technology	Z,ZK	5
Students gain the bas	c knowledge needed to start a career in a design house. They will understand the FPGA and ASIC implementation technolog	ies and the limitat	ions that the
technologies impose o	in the design. They are able to perform and to manage typical workflows, their analytic and synthetic steps, with an emphasis	on basic verificati	on. They know
the structure and dem	ands of software tools, as well as what to expect from them.		
MI-SIM.16	Digital Circuit Simulation	Z,ZK	5
Students gain informa	tion regarding the usage of basic tools for the design and simulation of VLSI (very large scale integration) digital circuits (VHD	L, Verilog). They a	also get some
knowledge about adva	nced tools System Verilog & SystemC.		
MI-SOC.16	Systems on Chip	Z,ZK	5
Students gain key kno	wledge and skills in the design of large-scale digital systems. They will be familiar with architectures of such systems and comr	nunication among	their parts. They
will use an appropriate	workflow to design these architectures, their hardware and software. They will also have knowledge of contemporary method	s of large system	s verification and
fault-tolerant systems	design.		
MI-TES.16	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	er, the costs of m	anaging this
complexity and of ens	uring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage	of models that des	scribe only those
aspects of the system	s that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and	algorithms that fo	orm the basis for
the modeling and anal	ysis of complex systems.		
MI-TSP.16	Testing and Reliability	Z,ZK	5

Name of the block: Compulsory elective economic-management courses

be able to analyze and control reliability and availability of the designed circuits.

Students 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 easy testable circuits and systems with built-in-self-test equipment. They will

Minimal number of credits of the block: 2

The role of the block: VE

Code of the group: MI-PV-EM.2016

Name of the group: Compulsory Elective Master Economics and Management Courses, in Czech, Ver. 2016

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

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

Credits in the group: 2

Note on the group:

Opakovaně do studia zapsaným studentům: Má-li student uznaný předmět PRM, nelze ho

uznat jako náhradu za nový předmět PCM (student musí vypracovat projekt).

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
FI-VEZ	economic-managerial course from a study abroad	Z	4	0+0	Z,L	VE
MI-IBE	Information Security	ZK	2	2P	Z	VE
MI-MPX	Management practice	Z	4	5XD	Z,L	VE
MI-PCM.16	Project And Change Management	KZ	3	1P+2C	Z,L	VE
MI-SEP	World Economy and Business	Z,ZK	4	2P+1C	Z	VE

# Characteristics of the courses of this group of Study Plan: Code=MI-PV-EM.2016 Name=Compulsory Elective Master Economics and Management Courses, in Czech, Ver. 2016

FI-VEZ	economic-managerial course from a study abroad	Z	4
A "Humanities subject the	hat has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module t	hat is required in	the curriculum.
The substitution is appre	oved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.		

MI-IBE Information Security

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).

MI-MPX | Management practice | Z | 4

The Student can once, within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the operational, tactical or strategic level of management (typically at the position of project manager, middle or top manager). The selected subject of practice and professional filling is assessed well in advance the course guarantor. In the selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the relatives of the student (e.g. as a member of the top management).

IVII-PCIVI. 16	Project And Change Management	<u>N</u> Z	
This course is presente	d in Czech.		
MI-SEP	World Economy and Business	Z,ZK	4
			·

This course is presented in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). 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.

Name of the block: Compulsory elective humanities courses

Minimal number of credits of the block: 3

The role of the block: VH

Code of the group: MI-PV-HU.2016

Name of the group: Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver.

2016, in Czech

Requirement credits in the group: In this group you have to gain at least 3 credits (at most 6)

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

Credits in the group: 3

Note on the group:

If a student has attended one of the hum. courses offered here in bc. study, he must choose another

Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their Code Completion Credits | Scope | Semester Role members) Tutors, authors and guarantors (gar.) Cultural and Social Anthropology Alena Libánská, Tomáš Houdek, Jakub Šenovský **Jakub Šenovský** Alena NI-CAP Ζ ZK 2 2P VН Libánská (Gar.) **Philosophy** FI-FIL ZK 2 2P Z.L VΗ Peter Zamarovský Peter Zamarovský (Gar.) MI-HMI2 ZK 3 2P+1C Z VΗ **History of Mathematics and Informatics** 

FI-HTE	History of Technology and Economics  Jan Mikeš, Marcela Efmertová Jan Mikeš Jan Mikeš (Gar.)	ZK	2	2+0	Z,L	VH
FI-HPZ	Humanities subject from a study abroad	Z	3	0+0	Z,L	VH
MI-KYB.16	Cybernality	ZK	5	2P	Z	VH
FI-MPL	Managerial Psychology	ZK	2	2+0	Z,L	VH
FI-KSA	Cultural and Social Anthropology  Jakub Šenovský	ZK	2	2P	L,Z	VH
FI-ULI	Introduction to Linguistics for Computer	ZK	2	2P	L	VH

Characteristics of the courses of this group of Study Plan: Code=MI-PV-HU.2016 Name=Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver. 2016, in Czech

	Cultural and Social Anthropology	ZK	2
The one-semester co	urse aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the div	ersity of the world -	examples from
anthropological resea	rch from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, h	nealth, history, deat	h, etc) will be
shown. The course is	presented in Czech.		
FI-FIL	Philosophy	ZK	2
see A0B16			
MI-HMI2	History of Mathematics and Informatics	ZK	3
Selected topics (Infin	tesimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive func	tions, eliptic curves	s, etc.) note on
possibilities of applica	tions of some mathematical methods in informatics and its development.		
FI-HTE	History of Technology and Economics	ZK	2
The course introduce	s the scientific disciplines of history and technology , economic and social history of the Czech lands and Czechoslovakia in c	omparison with the	development of
the European region	19 to 21 century .		
FI-HPZ	Humanities subject from a study abroad	Z	3
A "Humanities subject	t that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module	that is required in t	
	t that has been studied abroad is covered by the numanities subject from a study abroad in Compulsory numanities woulde	triat is required in t	ne curriculum.
•	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.	triat is required in t	ne curriculum.
•		ZK	ne curriculum.
The substitution is ap	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.	ZK	5
The substitution is ap MI-KYB.16 Students get acquain	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality	ZK the classification o	5 f attacks and
The substitution is ap MI-KYB.16 Students get acquain have an overview of s	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality  ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand	ZK the classification o	5 f attacks and
The substitution is ap MI-KYB.16 Students get acquain have an overview of s will also discuss the o	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker	ZK the classification o	5 f attacks and
The substitution is ap MI-KYB.16 Students get acquain have an overview of swill also discuss the cFI-MPL	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality  ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).	ZK the classification o	5 f attacks and avior. The course
The substitution is ap MI-KYB.16 Students get acquain have an overview of swill also discuss the of FI-MPL FI-KSA	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality  ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).  Managerial Psychology	the classification o activities and beha	5 f attacks and avior. The course
The substitution is ap MI-KYB.16 Students get acquain have an overview of swill also discuss the of FI-MPL FI-KSA The one-semester co	cybernality ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand ystems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).  Managerial Psychology  Cultural and Social Anthropology	the classification of activities and behativities and beh	5 f attacks and avior. The course  2 2 - examples from
The substitution is ap MI-KYB.16 Students get acquain have an overview of swill also discuss the of FI-MPL FI-KSA The one-semester coanthropological research	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality  ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand ystems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).  Managerial Psychology  Cultural and Social Anthropology  urse aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the div	the classification of activities and behativities and beh	5 f attacks and avior. The course  2 2 - examples from
The substitution is ap MI-KYB.16 Students get acquain have an overview of swill also discuss the of FI-MPL FI-KSA The one-semester coanthropological research	proved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.  Cybernality  ted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand ystems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).  Managerial Psychology  Cultural and Social Anthropology  urse aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the div rich from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, h	the classification of activities and behativities and beh	5 f attacks and avior. The course  2 2 - examples from

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: MI-V.2017

Name of the group: Purely Elective Master Courses, Version 2017

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

Credits in the group: 0

Note on the group:

In addition to the courses listed here, you can enroll as an elective any course that is offered within your study program and form of study that you did not enroll as a compulsory subject in the program/branch/specialization or a compulsory elective course. Courses of this group that a student

has completed in the bachelor study at CTU cannot be re-completed.

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
MI-IKM	Internet and Classification Methods	Z,ZK	4	1P+1C	L	V
MI-AFP	Applied Functional Programming Robert Pergl	KZ	5	2P+1C	L	V
MI-APH	Architecture of computer games	Z,ZK	4	2P+1C	Z	V
MI-BML	Bayesian Methods for Machine Learning	KZ	5	2P+1C	L	V
MI-BPS	Wireless Computer Networks	Z,ZK	4	2P+1C	L	V
MI-DSP	Database Systems in Practes	Z,ZK	4	2P+1C	L	V
MI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
MI-DDM	Distributed Data Mining	KZ	4	3C	L	V

MI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4	2P+1C	L	V
MI-GLR	Games and reinforcement learning	Z,ZK	4	2P+2C	L	V
NI-HSC	Side-Channel Analysis in Hardware Vojt ch Miškovský, Petr Socha Petr Socha Vojt ch Miškovský (Gar.)	Z,ZK	4	2P+2C	Z	V
MI-HMI2	History of Mathematics and Informatics	ZK	3	2P+1C	Z	V
MI-IVS	Intelligent embedded systems	KZ	4	1P+3C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
MI-IOT	Internet of Things	Z,ZK	4	2P+1C	L	V
MI-ATH	Combinatorial Theories of Games	Z,ZK	4	2P+2C	L	V
NI-CCC	Creative Coding and Computational Art  Josef Kortán, Radek Richtr Radek Richtr (Gar.)	KZ	4	1P+2C	Z,L	V
NI-LSM	Statistical Modelling Lab  Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	L	V
MI-LOM.16	Linear Optimization and Methods	Z,ZK	5	2P+1C	Z	V
MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4	2P+1C	L	V
MI-MZI	Mathematics for data science	Z,ZK	4	2P+1C	L	V
NI-MOP	Modern Object-Oriented Programming in Pharo  Marek Skotnica, Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
MI-MPC	Modern programming in C ++	Z,ZK	5	2P+1C	Z	V
MI-MAI	Multimedia and Internet	Z,ZK	3	2P+1C	L	V
MI-OLI	Linux Drivers	Z,ZK	4	2P+2C	L	V
MI-ARI	Computer arithmetic	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	V
MI-PVR	Advanced Virtual Reality	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning Miroslav epek, Petr Šimánek, Vojt ch Rybá , Rodrigo Augusto Da Silva Alves,	Z,ZK	5	2P + 1C	L	V
MI-IOS	Zden k Buk Miroslav epek Miroslav epek (Gar.)  Advanced techniques in iOS applications	KZ	4	2P+2C	L	V
MI-PVS	Advanced techniques in 103 applications  Advanced embedded systems	Z,ZK	4	2P+2C	Z	V
MI-DNP	Advanced embedded systems  Advanced .NET	Z,ZK	4	2P+1C	 	V
MI-PYT	Advanced Net	KZ	4	3C		V
MI-PRC	Programming in CUDA	Z,ZK	4	2P+1C		V
MI-PSL	Programming in Scala	Z,ZK	4	2P+1C		V
MI-RUB	Programming in Ruby	KZ	4	3C	 Z	V
MI-ROZ.16	Pattern Recognition	Z,ZK	5	2P+1C	Z	V
MI-RRI	Risk Management in Informatics	ZK	3	2P		V
MI-SCE1	Computer Engineering Seminar Master I	Z	4	2C	L,Z	V
MI-SCE2	Computer Engineering Seminar Master II	Z	4	2C	L,Z	V
MI-SZ1	Knowledge Engineering Seminar Master I	Z	4	2C	L,Z	V
PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V
MI-SCR	Statistical Analysis of Time Series	Z,ZK	4	2P+1C	Z	V
BI-SOJ	Machine Oriented Languages	Z,ZK	4	2P+2C		V
MI-TS1	Theoretical Seminar Master I	Z	4	2C	Z	V
MI-TS2	Theoretical Seminar Master II	Z	4	2C	L	V
MI-TS3	Theoretical Seminar Master III	Z	4	2C	Z	V
MI-TS4	Theoretical Seminar Master IV	 Z	4	2C	 L	V
MI-TNN	Theory of Neural Networks	Z,ZK	4	1P+1C	L	V
MI-VEM	Scientific thinking	KZ	2	1P+1C	L	V
MI-MCS	Multicore Systems	KZ	4	1P+2C	 Z	V
MI-VYC	Computability	Z,ZK	4	2P+2C		V
NI-VPR	Research Project Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
MI-ZS10	Master internship abroad for 10 credits	Z	10		Z,L	V
MI-ZS20	Master internship abroad for 20 credits	Z	20		Z,L	V
	I MAGICI IIICI IIGIIID ADIVAU IVI EV CICUILO	_				

Characteristics of the courses of this group of Study Plan: Code=MI-V.2017 Name=Purely Elective Master Courses, Version 2017

	Listan, of Mathematics and Informatics	71/	
MI-HMI2	History of Mathematics and Informatics	ZK	3
	esimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive func ions of some mathematical methods in informatics and its development.	tions, eliptic curve	s, etc.) note on
MI-IKM	Internet and Classification Methods	Z,ZK	4
	Internet and Glassification Methods lents get acquainted with classification methods used in four important internet, or generally network applications: in spam filtr		
	ystems and in intrusion detection systems. However, they will learn more than only how classification is performed when solv	•	•
	these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cyc	-	-
=	exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult the		
MI-AFP	Applied Functional Programming	KZ	5
	ு அறாகப் பெல்லான் டார் என்னாள் இருக்கியாள் இ ed in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel function		_
•	the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, magnetic forms of the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, magnetic forms of the functional programming paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, magnetic forms of the functional programming paradigms in the functional programming paradigms.		
-	e of a software engineer: the theory and especially the practice.	storing tino paradit	giii boooiiioo a
MI-APH	Architecture of computer games	Z.ZK	4
	sic understanding of the various issues in the field of computer game development, from both the technical and creative poin	1 '	-
-	rchitecture, game mechanics, and game Al that form an integral part of most games. They will also understand the basics of pa	=	
and apply them in prac		g,	
MI-BML	Bayesian Methods for Machine Learning	KZ	5
	on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it students	1	_
-	ription of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidde		
	s etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpos	,	
•	e presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imagin		
some of them.			,
MI-BPS	Wireless Computer Networks	Z,ZK	4
_	but the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in		· ·
	s, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get kno		
	and get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools.	g	,
MI-DSP	Database Systems in Practes	Z,ZK	4
This course is presente		2,21	, -
MI-DZO	Digital Image Processing	Z.ZK	4
	Digital image Frocessing a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical	1 '	•
	n interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that	-	=
•	sing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HD		
	straction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray	•	_
•	possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, a		
MI-DDM	Distributed Data Mining	KZ	4
MI-DDM Course focuses on sta	Distributed Data Mining te-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain han	KZ ds on experience	4 with large scal
MI-DDM Course focuses on sta data processing frame	Distributed Data Mining te-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain han work Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementatio	KZ ds on experience	4 with large scal
MI-DDM Course focuses on sta data processing frame approaches to paralleli	Distributed Data Mining te-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain han work Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementatio ize other algorithms. The course is prezented in czech language.	KZ ds on experience ns and will be capa	4 with large scale able to propose
MI-DDM Course focuses on sta data processing frame approaches to paralleli MI-PAM	Distributed Data Mining te-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain han work Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementatio ize other algorithms. The course is prezented in czech language.  Efficient Preprocessing and Parameterized Algorithms	KZ ds on experience ns and will be capa	4 with large scal able to propose
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NI-CCC Creative Coding and Computational Art	KZ	4
Students work on practical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows		
BLE,) and introduces students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technologies. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture all	•	· ·
(Institute of Intermedia FEL).	ia monopoman i	.ag/ aa
NI-LSM Statistical Modelling Lab	KZ	5
The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is	-	
available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms,	and analyses of t	heir properties.
At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).  MI-LOM.16  Linear Optimization and Methods	Z,ZK	5
Students learn the applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of line		_
are able to work with optimization software and are familiar with languages used in programming of that software. They get skills in formalization of o		
science (such as scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, transportation problems,		
issues from economics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. in linear programming.	ney get orientation	on in algorithms
MI-MSI Mathematical Structures in Computer Science	Z,ZK	4
Mathematical semantics of programming languages.	, —,—. :	
MI-MZI Mathematics for data science	Z,ZK	4
In this course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in the course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in the course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in the course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in the course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in the course of the co		
include mainly: linear algebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prir selected notions from probability theory and statistics.	iciple, gradient me	ethods) and
NI-MOP Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, wh		· ·
is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the	skills of design and	dimplementation
of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their developmen		
addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to we technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involved.		-
MI-MPC Modern programming in C ++	Z.ZK	5
Students learn how to use the modern features of contemporary versions of the C++ programming language for software development. The course f	,	_
and efficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor time requ	uirements.	
MI-MAI Multimedia and Internet	Z,ZK	3
The course will cover principles and technologies for processing and network transmissions of multimedia signals, stereoscopy and visualizations in happlication areas of networked multimedia, transmission formats, interfaces, codecs, technologies for acquisition and reproduction of multimedia data	-	
and distributed collaboration using networking and immersive environments.	and technologies	ioi visualizations
MI-OLI Linux Drivers	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining	g powerful proces	sors and FPGAs
increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developm		udents. The
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience MI-ARI Computer arithmetic	z,ZK	4
Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.	2,213	+
NI-PG1 Computer Grafics 1	ZK	4
The course builds on graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge		•
interested in advanced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the students will be followed by a gauge PC3 supplementing the knowledge of PC4 on other stages and		-
articles and their subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas an MI-PVR Advanced Virtual Reality	KZ	ter graphics.
The course introduces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D m.		
things, it introduces students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will a		-
in available 3D engines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the	e knowledge gain	ed in this subject
in virtual reality, or directly create a complex game for VR.	7.71/	
NI-AML Advanced machine learning The course introduces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field o	Z,ZK	systems image
processing, control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the		
MI-IOS Advanced techniques in iOS applications	KZ	4
Students will learn the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the	e basics from the	beginners class
BI-IOS.	7.71/	
MI-PVS Advanced embedded systems The course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advanced embedded systems	Z,ZK	4 ecurity support
working with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also pract	-	
systems.		
MI-DNP Advanced .NET	Z,ZK	4
Students acquire a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation Communication Foundation) and Entity France and Language and Applications of Applications and Applica		(Windows
Communication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET applications  MI-PYT  Advanced Python	KZ	4
The goal of this course is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python.	1	I -
very hands-on and it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursew		
teachers from Red Hat.		
MI-PRC Programming in CUDA  The students gain a good everyion of present parallel architectures in CPUs. Students also get hands an experience with programming these systems.	Z,ZK	4
The students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming these system MI-PSL Programming in Scala	ms. Z,ZK	4
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language fea		· ·
advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks		_
Scalaz, etc.		

MI-RUB Programming in Ruby	KZ	4
This course is presented in Czech.		
MI-ROZ.16   Pattern Recognition	Z,ZK	
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 recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, a		
MI-RRI Risk Management in Informatics	ZK	3
Information security is very often considered as one of main objectives to secure targets of information processing. However, to focus on this info se	1	-
IT systems against viruses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which are		
other malware. The necessity to continue with business after disaster is also slightly ignored. International standards which are focused on informati	-	
during last years started to anticipate necessity of risk management. There is no commonly accepted methodology used for this task. Threats which	are currently poss	ible to see
worldwide, invoke pressures to prepare plans for business continuity management even in the case of dramatic political changes, natural disasters	etc.	
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 resistan		
are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of		
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 tea semester.	cners. The topics a	re new for each
	Z	4
MI-SCE2   Computer Engineering Seminar Master II The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistan	. – .	•
are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of		
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 tea		
semester.	·	
MI-SZ1 Knowledge Engineering Seminar Master I	Z	4
On this seminar you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top rese	arch labs around th	ne world.
Additionally, you will learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top may	achine learning and	I AI conferences
and summer schools, as well as FIT's own Summer Research Program (VyLet).		
PI-SCN   Seminars on Digital Design	ZK	4
This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description	_	- 1
synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial		
MI-SCR Statistical Analysis of Time Series	Z,ZK	4
The course deals with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices and extension). The students leave to exlect a constant leave of the students leave to exlect a constant leave to extension.		
problems (modelling of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a coits parameters, analyze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the		
real-world examples. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward tra		
the academic to the real world.		
BI-SOJ Machine Oriented Languages	Z,ZK	4
Students of the course will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal		essor's features
and efficient cooperation of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of views.	w linked to higher l	evel languages.
This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
MI-TS1 Theoretical Seminar Master I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cla		•
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scier	itific papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	7	4
MI-TS2   Theoretical Seminar Master II Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cla		4 In The students
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is		•
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	o a	iiiio paporo arra
MI-TS3 Theoretical Seminar Master III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cla		ıp. The students
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scier	tific papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
MI-TS4 Theoretical Seminar Master IV	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cla		•
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course in the latest research in the area.	s a work with scier	tific papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
	7 71/	
MI-TNN Theory of Neural Networks	Z,ZK	4
MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory	y. At first, we recall	basic concepts
MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmissions.	y. At first, we recall on, network topolo	basic concepts gy, somatic and
MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory	y. At first, we recall on, network topolo rmation into a cand	basic concepts gy, somatic and onical topology,
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MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theor pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmiss synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transfo and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with transformation.	y. At first, we recall on, network topolo rmation into a cand aining, we pay atte t important optimiz	basic concepts gy, somatic and onical topology, intion to the ation methods
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MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theor pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmissi synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transfo and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with training and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the mos employed for neural network training. We will see the meaning of all these concepts in the context of common kinds of forward neural networks. Within to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Kintheorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mapping dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect	y. At first, we recall on, network topolo rmation into a cancaining, we pay attet important optimizate the topic approximation the topic approximation of the topic approximation and train ow it is possible to	basic concepts gy, somatic and onical topology, ntion to the ation methods nation approach n, Vituškin neural networks e, spaces of ing based on a get an estimate
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Students understand a	architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy	with shared last le	evel. They learn		
parallel algorithm class	sification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorith	ms. After this cour	se, students can		
design MTMD program	ns (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for	contemporary mu	ulticore systems.		
MI-VYC	Computability	Z,ZK	4		
Classical theory of rec	ursive functions and effective computability, with applications in provability theory.	'	'		
NI-VPR	Research Project	Z	5		
Student obtains the cr	Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.				
MI-ZS10	Master internship abroad for 10 credits	Z	10		

Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

MI-ZS20 Master internship abroad for 20 credits

Multicore Systems

20 Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the

Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

MI-ZS30 Master internship abroad for 30 credits

Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

Code of the group: MI-NVPS-VO.2017

Name of the group: Elective Vocational Courses for Master Branch MI-NVPS, version 2017

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

Credits in the group: 0

Note on the group:

MI-MCS

Compulsory courses of all branches and specializations with the exception of this specialization

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
MI-ADM.16	Data Mining Algorithms	Z,ZK	5	2P+1C	L	V
MI-ADP.16	Architecture and Design Patterns	Z,ZK	5	2P+1C	Z	V
MI-AVY	Automata in Text Pattern Matching Ond ej Guth, Tomáš Pecka, Št pán Plachý, Jan Trávní ek, Jan Ž árek Ond ej Guth Ond ej Guth (Gar.)	Z,ZK	4	2P+1C	L	V
MI-BPR	Security and Secure Programming	Z,ZK	4	2P+1C	Z	V
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5	2P+1C	Z	V
MI-DDW.16	Web Data Mining	Z,ZK	5	2P+1C	L	V
MI-FME.16	Formal Methods and Specifications	Z,ZK	5	2P+1C	L	V
MI-FLP	Functional and Logical Programming	Z,ZK	4	2P+1C	L	V
MI-GEN	Code Generators	Z,ZK	4	2P+1C	L	V
MI-HWB.16	Hardware Security	Z,ZK	5	2P+2C	L	V
MI-KOD.16	Data Compression	Z,ZK	5	2P+1C	L	V
MI-MKY.16	Mathematics for Cryptology	Z,ZK	5	3P+1C	L	V
MI-MVI.16	Computational Intelligence Methods	Z,ZK	5	2P+1C	Z	V
MI-MEP.16	Modelling of Business Processes Robert Pergl	Z,ZK	5	2P+1C	Z	٧
MI-MTI.16	Modern Internet Technologies	Z,ZK	5	2P+1C	Z	V
MI-NUR.16	User Interface Design	Z,ZK	5	2P+1C	Z	V
MI-NSS.16	Normalized Software Systems Robert Pergl	ZK	5	2P	L	V
MI-PAP.16	Parallel Computer Architectures	Z,ZK	5	2P+1C	L	V
MI-EDW.16	Enterprise Data Warehouse Systems	Z,ZK	5	2P+1C	L	V
MI-PAL	Advanced Algorithms	Z,ZK	4	2P+1C	L	V
MI-KRY.16	Advanced Cryptology	Z,ZK	5	2P+2C	Z	V

MI-POA.16	<b>Advanced Computer System Architectures</b>	Z,ZK	5	2P+1C	L	V
MI-PDB.16	Advanced Database Systems	Z,ZK	5	2P+1C	Z	V
MI-PIS.16	Advanced Information Systems	Z,ZK	5	2P+1C	L	V
MI-PCM.16	Project And Change Management	KZ	3	1P+2C	Z,L	V
MI-PDD.16	Data Preprocessing	Z,ZK	5	2P+1C	Z	V
MI-REV.16	Reverse Engineering	Z,ZK	5	1P+2C	Z	V
MI-MBI.16	Management of Business Informatics	Z,ZK	5	3P+1C	L	V
MI-SWE.16	Semantic Web	Z,ZK	5	2P+1C	Z	V
MI-SIB.16	Network Security	Z,ZK	5	2P+1C	L	V
MI-SMI.16	Strategic Management of Informatics	Z,ZK	5	3P+1C	Z	V
MI-SYB.16	System Security	Z,ZK	5	2P+2C	L	V
MI-CPX	Complexity Theory	Z,ZK	5	3P+1C	Z	V
MI-VMM.16	Retrieval from Multimedia	Z,ZK	5	2P+1C	Z	V
MI-W20.16	Web 2.0	Z,ZK	5	2P+1C	L	V
MI-MDW.16	Web Services and Middleware	Z,ZK	5	2P+1C	Z	V
	of the courses of this group of Study Plan: Code=MI-NVPS-S, version 2017    Project And Change Management nted in Czech.	VO.2017 Name=Elect	ive Voca		urses for	Master 3
MI-ADM.16	Data Mining Algorithms			Z	,ZK	5
he course focuses	on algorithms used in the fields of machine learning and data mining. However, this is is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of m	•		students shou	ild know ma	
oasics. The emphasi nethods).	10 to part of autralised algorithmic (org., gradient 2000thig) and not 2000 things of the					

architectures used in large-scale distributed systems. MI-AVY Automata in Text Pattern Matching

Z,ZK

Searching in a text (pattern matching) and generally in data is an area of problems and exciting solutions from theoretical and practical perspectives. We may interpret and search the data as one-dimensional (text) or multi-dimensional (tree, picture). We may search for something known (a pattern: a string or a set specified by regular expression) or unknown (for example, a regularity). Matching can be either exact or approximate. This course presents a taxonomy of searching problems. It focuses on algorithms based on some automaton (finite, pushdown, linear-bounded, or tree).

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

MI-BPR Security and Secure Programming

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.

MI-DSV.16 Distributed Systems and Computing

7.7K

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.

MI-DDW.16 Web Data Mining Z,ZK

5

Students will learn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain an overview of Web mining techniques for Web crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview of most recent developments in the field of social web and recommendation systems.

MI-FMF.16 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

MI-FLP Functional and Logical Programming Students will be acquainted with principles of functional and logic programming. They will be able to write their programs in Lisp and Prolog programming languages

Z,ZK

4

MI-GEN Code Generators

Z,ZK

4

Students will become acquainted with both theoretical and practical aspects of back-end of an optimizing programming language compiler.

MI-HWB.16 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.

Data Compression MI-KOD 16

Z.ZK

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.

MI-MKY 16 Mathematics for Cryptology 7 7K

5

Students become familiar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptography. They learn the mathematical principles on which security of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptography are based.

MI-MVI.16 Computational Intelligence Methods  Students will understand methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to	Z,ZK many problems. T	5 hey will learn
how these methods work and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc.		
MI-MEP.16 Modelling of Business Processes	Z,ZK	5
The subject is focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approach	, i	
implementation of processes, organisation structures and information support in big enterprises and institutions.		J
MI-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 ar		
efficient mechanisms of virtual channels, and the new IPv6 architecture. They will understand the issues of monitoring and management of large compu		
to the technologies of interconnection networks for HPC systems.	itei networks. me	y are introduced
	7.71/	_
MI-NUR.16 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, for		
notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able		
MI-NSS.16   Normalized Software Systems	ZK	5
Students will learn the foundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engin	eering such as st	ability from
systems theory and entropy from thermodynamics. Initially, the theory was developed at the level of software architectures, where the concept of stabilit	y was translated ir	nto the definition
of so-called combinatorial effects. These effects occur when the impact of a change to the software architecture is dependent on the change itself, as	well as on the size	e of the system.
The latter is highly undesirable, as it will cause even a simple change to incur an ever-increasing impact as the size of the system grows over time. A	s such, combinate	orial effects can
be considered as a main cause of Lehman?s Law of Increasing Complexity (see, e.g., http://en.wikipedia.org/wiki/Lehman's_laws_of_software_evolution.	ition). Additionally	, the concept of
entropy was used in the study of which micro-states in a modular structure correspond with a given macro-state. This is related mainly to issues such as	s testing in softwar	re architectures.
Normalized Systems theory consists first of a set of principles which indicate where violations of stability and entropy-related issues occur in any give	en software archit	ecture. These
principles indicate that very fine-grained modular structures are required in order to control them. In the second part of the theoretical framework, it is s	shown how softwa	re architectures
can be constructed based on a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms		
workflows, connectors and triggers, while controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evo	-	-
Recently, Normalized Systems theory was also applied to the modular structures in business processes and enterprise architectures, with the goal of or	-	
for Enterprise Engineering.		,
	7 71/	5
MI-PAP.16   Parallel Computer Architectures	Z,ZK	- 1
The students gain a good overview of present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore processors.	ocessors, Sous a	na MPSocs,
GPUs, and neural processors. Students also get hands-on experience with programming these systems.		
MI-EDW.16   Enterprise Data Warehouse Systems	Z,ZK	5
The Enterprise Data Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods a	and will gain pract	ical knowledge
not only in designing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to	the area of repor	ting and data
visualization.		
MI-PAL Advanced Algorithms	Z,ZK	4
The students will learn the most important advanced algorithms in different domains of the computer science that are not covered by modules of the E	, ,	Informatics and
other modules of the Master program. They will also learn how to cope with problems that, according to the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge, are not solvable optimately and the control of the present knowledge of the control of the present knowledge of the present knowledge of the control of the present knowledge of the control of the cont		
time.		any boundou
MI-KRY.16 Advanced Cryptology	7 71/	5
1	Z,ZK	
Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know		
random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they	can apply to the if	ntegration of
their own systems or to the creation of their own software solutions.		
MI-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 learn the current trends in infrastructure architecture of complex business computer systems.	ident will be able t	to design a
complex system infrastructure that meets availability and scalability requirements given by the business environment.		
MI-PDB.16 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 datab.		called NoSQL
databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CY	,	
the course deals with performance evaluation of database machines.	, , .	
<u> </u>	7 7V	5
1	Z,ZK	
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the no		
enterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about ac		- 1
artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of busing the control of the c	ness processes, b	usiness rules,
processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.		
MI-PDD.16 Data Preprocessing	Z,ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various data	ta sources, such a	s images, texts,
time series, etc., and learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction	from image data o	or from Internet.
MI-REV.16 Reverse Engineering	Z,ZK	5
Students will get acquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens I		
is called. Students will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is ded		
applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be do		
debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the compute	_	-
the course is on the seminars, where students will solve practically oriented tasks from the real world.		. ,
	7 71/	5
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Z,ZK	ິນ
This course is presented in Czech.		_
MI-SWE.16   Semantic Web	Z,ZK	5
Students learn standards used for processing and sharing knowledge mainly in the area of web. They get used to designing and using knowledge mainly in the area of web.	_	· .
and practical aspects as publishing, sharing, exchange, and acquisition of knowledge on the web. The presentation is based on the idea of the sema	ntic web, including	g its standards
and technologies (RDF, RDFS, OWL) and formal models.		
MI-SIB.16 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 at	, i	
course explains basic pricipals of security monitoring, packet-based and flow-based analysis, in order to detect anomalies and suspicious network tra		
explanation and practical examples of various mechanisms of securing network infrastructure and detection in real time. The course covers general programme and detection in real time.		
security events (i.e. incident handling and incident response).	,	3
> - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		

MI-SMI.16	Strategic Management of Informatics	Z,ZK	5
The course focuses o	n the strategic management of information systems. Students will learn the process of creation and implementation of an infor	mation strategy, IT	governance,
the importance of ICT	for business and interrelations between information strategies and lobal business strategies. Furthermore, they gain the know	ledge in the areas	of economic
management of IS/IT,	management of investments and ROI, assessment of IT investments and management of human resources in IT (the role of	CIO, CEO, CFO). 1	The part of the
course is the role of p	roject management, risk management and quality assessment of informatics.		
MI-SYB.16	System Security	Z,ZK	5
Students will familiariz	e themselves with the actual ICT security needs in all ICT disciplines. Students will gain knowledge of typical network attacks an	d protection agains	st them, together
with essential commu	nication encryption techniques. They will learn how to work with certain aspects of encryption techniques - passwords and cer	tificates. After that	, students will
earn the basics of an	ti-virus, anti-spam and heuristic analyses used in modern anti-virus solutions or Unified Threat Management (UTM) based sol	utions. They will al	so 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
ntegration of various	software systems and applications.		
MI-CPX	Complexity Theory	Z,ZK	5
Students will learn ab	out the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of t	he theory concern	ing practical
(un)solvability of diffic	ult problems.		
MI-VMM.16	Retrieval from Multimedia	Z,ZK	5
The student obtains g	eneral knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of	feature extraction	from multimedia
objects, indexing, and	structure of distributed search engines.		
MI-W20.16	Web 2.0	Z,ZK	5
Students will learn ne	, trends and technologies on the Web including theoretical foundations. Students will gain an overview about Web application	s architectures, co	ncepts and
technologies about pr	ogrammable Web (REST Architectures, Mashups), basic mechanisms for knowledge representation on the Web (microformats,	meta-data, ontolog	gies, open linked
data, etc.), mechanisı	ns about collective intelligence (collaborative filtering, predictions of users' behaviours), social networks, and security.		
AL MONA/ 40	Web Carriage and Middleware	Z,ZK	5
MI-MDW.16	Web Services and Middleware	<u>Z,</u> ZN	5

### List of courses of this pass:

Code	Name of the course	Completion	Credits
	Machine Oriented Languages  Irse will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal us ration of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view ling This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
FI-FIL	Philosophy	ZK	2
FIFFIL	see A0B16	211	2
FI-HPZ	Humanities subject from a study abroad	Z	3
	oject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that  The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.	t is required in the	curriculum.
FI-HTE	History of Technology and Economics	ZK	2
The course introdu	ces the scientific disciplines of history and technology , economic and social history of the Czech lands and Czechoslovakia in compatible European region 19 to 21 century .	arison with the dev	elopment o
FI-KSA	Cultural and Social Anthropology	ZK	2
anthropological res	course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversit search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, healt shown. The course is an interesting alternative to other humanities, taught at FIT.	h, history, death, e	tc) will be
FI-MPL	Managerial Psychology	ZK	2
FI-ULI	Introduction to Linguistics for Computer This course is presented in Czech.	ZK	2
FI-VEZ	economic-managerial course from a study abroad	Z	4
A "Humanities sub	ject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.	t is required in the	curriculum.
MI-ADM.16	Data Mining Algorithms	Z,ZK	5
	s on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students sis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation sys methods).		•
MI-ADP.16	Architecture and Design Patterns	Z,ZK	5
the challenges, isso and get familiar with	is course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as ues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge of the the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. In the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems.	f object-oriented p In the second part	rogramming the students
MI-AFP	Applied Functional Programming	KZ	5
This course is prez	ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional pseudostant in the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice.	rogramming langu	ages are on

MI-APH			
04	Architecture of computer games	Z,ZK	4
	i basic understanding of the various issues in the field of computer game development, from both the technical and creative points of d architecture, game mechanics, and game Al that form an integral part of most games. They will also understand the basics of pathfine		
component onemed	and apply them in practical exercises (labs).	ang, networking, e	and sompting
MI-ARI	Computer arithmetic	Z,ZK	4
	Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementations	,	
MI-ATH	Combinatorial Theories of Games	Z,ZK	4
ı	This course is presented in Czech.	,	I
MI-AVY	Automata in Text Pattern Matching	Z,ZK	4
Searching in a text	(pattern matching) and generally in data is an area of problems and exciting solutions from theoretical and practical perspectives. We	may interpret and	search the
	sional (text) or multi-dimensional (tree, picture). We may search for something known (a pattern: a string or a set specified by regular		
example, a regula	arity). Matching can be either exact or approximate. This course presents a taxonomy of searching problems. It focuses on algorithms	based on some a	utomaton
141 51 1144 40	(finite, pushdown, linear-bounded, or tree).	7 714	
MI-BHW.16	Security and Hardware	Z,ZK	5
	sic knowledge in selected topics of cryptography and cruptanalysis. The module focuses particularly on elliptic curve cryptography, an ms. Students gain a good overview of the functionality of (hardware) cryptographic accelerators, random number generators, smart car		
cryptograpriic syster	of internal functions of computer systems.	us, and resources	ioi secuiiii
MI-BKO.16	Error Control Codes	Z,ZK	5
	I of the course is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transn	•	
MI-BML	Bayesian Methods for Machine Learning	KZ	5
	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies t		1
models providing of	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden v	ariables (true obje	ct position
from noisy observat	tions etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose, a	number of real wor	ld example
and applications w	vill be presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging.	The students will t	ry to solve
	some of them.	7 714	
MI-BPR	Security and Secure Programming	Z,ZK	4
	arn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting fa gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every		
-	gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every illeges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing		
•	database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the		
MI-BPS	Wireless Computer Networks	Z,ZK	4
	about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad	,	1
broadcast mechan	nisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowle	edge of security m	echanisms
	for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitab	le tools.	
MI-CPX	Complexity Theory	Z,ZK	5
Students will learn	n about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the	theory concerning	a proofice!
	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	theory concerning	y practical
MI DDM	(un)solvability of difficult problems.		
MI-DDM	Distributed Data Mining	KZ	4
Course focuses on	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of	KZ n experience with	4 large scale
Course focuses on	Distributed Data Mining	KZ n experience with	4 large scale
Course focuses on data processing fra	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.	KZ n experience with nd will be capable	4 large scale to propose
Course focuses on data processing fra	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a	KZ n experience with nd will be capable Z,ZK	4 large scale to propose
Course focuses on data processing fra  MI-DDW.16  Students will lear	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining	KZ n experience with nd will be capable  Z,ZK an overview of We	4 large scale to propose 5
Course focuses on data processing fra  MI-DDW.16  Students will lear	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining rn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain	KZ n experience with nd will be capable  Z,ZK an overview of We	4 large scale to propose 5
Course focuses on data processing fra  MI-DDW.16  Students will lear	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining rn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain ab crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will al	KZ n experience with nd will be capable  Z,ZK an overview of We	4 large scale to propose 5
Course focuses on data processing fra  MI-DDW.16  Students will lear techniques for We	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining orn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain ab crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will all recent developments in the field of social web and recommendation systems.	KZ In experience with Ind will be capable Z,ZK In overview of We Indicate the control of the con	4 large scale to propose 5 beb mining ew of most
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Course focuses on data processing fra  MI-DDW.16  Students will lear techniques for We  MI-DIP  MI-DNP  Students acquire	Distributed Data Mining state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining rn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain eb crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will all recent developments in the field of social web and recommendation systems.  Diploma Project  Advanced .NET  e a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation purmunication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET  Database Systems in Practes	KZ n experience with nd will be capable  Z,ZK an overview of We so gain an overvie  Z  Z,ZK ), WCF/WebAPI (V	4 large scale to propose 5 be mining ew of most 23 4
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MI-GEN	Code Generators	Z,ZK	4
MICLD	Students will become acquainted with both theoretical and practical aspects of back-end of an optimizing programming language of the state of the st		4
MI-GLR The field of reinfor	Games and reinforcement learning cement learning cement learning cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligen	Z,ZK nce. This course is i	4 intended to
	give you both theoretical and practical background so you can participate in related research activities. Presented in English	h.	
MI-HMI2	History of Mathematics and Informatics	ZK	3
Selected topics (In	finitesimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive function possibilities of applications of some mathematical methods in informatics and its development.	s, eliptic curves, et	c.) note on
MI-HWB.16	Hardware Security	Z,ZK	5
-	es the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguard	-	-
	eans. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Studer ptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions,		edge about
MI-IBE	Information Security	ZK	2
Students learn info	prmation and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internation	al standards in this	area. They
	d methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g.		
MI-IKM In this course, the s	Internet and Classification Methods students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering	Z,ZK	4 on systems.
	ion systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving		-
_	d of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle w		
MI-IOS	During the exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consultable.  Advanced techniques in iOS applications	KZ	4 4
	the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the bases to the latest trends in mobile development technologies for iOS platform.		-
	BI-IOS.		
MI-IOT	Internet of Things ocused on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa	Z,ZK	4
The subject is it	development elements (Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (G		avallable
MI-IVS	Intelligent embedded systems	KZ	4
_	ded systems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The		
_	mbedded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot programn ares provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students of	•	
	combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technology	-	
MI-KOD.16	Data Compression	Z,ZK	5
	educed to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data ne overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, stude	•	_
acca practice	lossy data compression methods used in image, audio, and video compression.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
MI-KRY.16	Advanced Cryptology	Z,ZK	5
	n the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know th generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they c		
Tanaon nambor (	their own systems or to the creation of their own software solutions.	an apply to the line	ogration of
MI-KYB.16	Cybernality	ZK	5
	uainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the f systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activ		
	vill also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CE		The course
MI-LOM.16	Linear Optimization and Methods	Z,ZK	5
	applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear a th optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optir		
	scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelli		
issues from econo	mics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. The	y get orientation in	algorithms
MI-MAI	in linear programming.  Multimedia and Internet	Z,ZK	3
	er principles and technologies for processing and network transmissions of multimedia signals, stereoscopy and visualizations in high		
	f networked multimedia, transmission formats, interfaces, codecs, technologies for acquisition and reproduction of multimedia data and		
MI-MBI.16	and distributed collaboration using networking and immersive environments.	Z,ZK	5
IVII-IVIDI. I O	Management of Business Informatics  This course is presented in Czech.	_ Z,ZR	5
MI-MCS	Multicore Systems	KZ	4
	nd architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy with		=
	lassification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorithms. grams (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for cor		
MI-MDW.16	Web Services and Middleware	Z,ZK	5
	ew trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including t		
MI-MEP.16	Modelling of Business Processes focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approa	Z,ZK	5
THE SUBJECT IS I	incused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approa implementation of processes, organisation structures and information support in big enterprises and institutions.	on for (rejengineer	ing anu
MI-MKY.16	Mathematics for Cryptology	Z,ZK	5
	amiliar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptograph		athematical
MI-MPC	rinciples on which security of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptograph  Modern programming in C ++	z,ZK	5
	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus		
and eff	iciency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t	ime requirements.	

MI-MPI	Mathematics for Informatics	Z,ZK	7
	orises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analy	•	
	ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top		
MI-MPR	stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre  Master Project	Z	7
	of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial ta		
	er. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the er		
	) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the		
•	s, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the a		
	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 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	· ·	
for the topic of the	aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.	ic apcoming semice	otor oriodia
MI-MPX	Management practice	Z	4
The Student can or	nce, within its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on the	perational, tactical	or strategic
-	nent (typically at the position of project manager, middle or top manager). The selected subject of practice and professional filling is a		
course guarantor.	In the selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the relament of the top management).	tives of the student	(e.g. as a
MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4
	Mathematical semantics of programming languages.	_,	·
MI-MTI.16	Modern Internet Technologies	Z,ZK	5
	inologies of the modern Internet. links of the IP technology to the modern communication networks, mechanisms for multicasting and		
efficient mechanisn	ns of virtual channels, and the new IPv6 architecture. They will understand the issues of monitoring and management of large computer	networks. They are	introduced
MI-MVI.16	to the technologies of interconnection networks for HPC systems.  Computational Intelligence Methods	Z,ZK	5
	erstand methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to m		
	how these methods work and how to apply them to problems related to data mining, control, intelligen games, optimizations,		
MI-MZI	Mathematics for data science	Z,ZK	4
	ents are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in d		
include mainly: li	near algebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality princ selected notions from probability theory and statistics.	ciple, gradient meth	ods) and
MI-NFA.16	Design for the FPGA and ASIC Technology	Z,ZK	5
	e basic knowledge needed to start a career in a design house. They will understand the FPGA and ASIC implementation technologie	ı ' ı	
_	se on the design. They are able to perform and to manage typical workflows, their analytic and synthetic steps, with an emphasis on		
	the structure and demands of software tools, as well as what to expect from them.		
MI-NSS.16	Normalized Software Systems	ZK	5
	rn the foundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engin I entropy from thermodynamics. Initially, the theory was developed at the level of software architectures, where the concept of stability w	=	-
-	natorial effects. These effects occur when the impact of a change to the software architecture is dependent on the change itself, as we		
The latter is highly	undesirable, as it will cause even a simple change to incur an ever-increasing impact as the size of the system grows over time. As s	uch, combinatorial	effects can
	main cause of Lehman?s Law of Increasing Complexity (see, e.g., http://en.wikipedia.org/wiki/Lehman's_laws_of_software_evolution	-	
	n the study of which micro-states in a modular structure correspond with a given macro-state. This is related mainly to issues such as te ms theory consists first of a set of principles which indicate where violations of stability and entropy-related issues occur in any giver	_	
	hat very fine-grained modular structures are required in order to control them. In the second part of the theoretical framework, it is sho		
can be constructed	based on a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of	storing data, execut	ing actions,
	ors and triggers, while controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy-related principles, allowing them to realize new levels of evolving the stability and entropy related principles, allowing them to realize new levels of evolving the stability and entropy related principles, allowing them to realize new levels of evolving the stability and entropy related principles, allowing them to realize new levels of evolving the stability and entropy related principles, allowing them to realize new levels of evolving the stability and entropy related principles.	=	
Recently, Normalize	ed Systems theory was also applied to the modular structures in business processes and enterprise architectures, with the goal of cor for Enterprise Engineering.	structing a foundati	ional theory
MI-NUR.16	User Interface Design	Z,ZK	5
	stand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, forma		
notions and pr	ocesures. They get acquainted with graphical, speech, and multimodal Uls. Thanks to the gained knowledge, the students will be abl	e to design advance	ed Uls.
MI-OLI	Linux Drivers	Z,ZK	4
	g system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining po ability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developme	•	
	ability of periprieral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development urse provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practic		onia. III <del>U</del>
MI-PAA	Problems and Algorithms	Z,ZK	5
	o evaluate discrete problems by complexity and by the purpose of optimisation (on-line tasks, multicriterial optimisation). They under		
	heuristics and exact algorithms and, therefore, are able to select, apply, and experimentally evaluate a suitable heuristics for a practice.		
MI-PAL	Advanced Algorithms	Z,ZK	. 4
	arn the most important advanced algorithms in different domains of the computer science that are not covered by modules of the Bac the Master program. They will also learn how to cope with problems that, according to the present knowledge, are not solvable optim		
other modules of	time.	any in polynomiany	bounded
MI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4
-	optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often neces	-	
	We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one		
	nputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity expone n the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial ti		
	sible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution		
-	eterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (pr	= :	t exist. We
	will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximatio		
NAL DAD 15			
MI-PAP.16	Parallel Computer Architectures	Z,ZK	5 MPSoCs
	Parallel Computer Architectures  a good overview of present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore pro GPUs, and neural processors. Students also get hands-on experience with programming these systems.		

MI-PCM.16	Project And Change Management This course is presented in Czech.	KZ	3
MI-PDB.16	Advanced Database Systems	Z,ZK	5
	emselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database		1
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.			
MI-PDD.16	Data Preprocessing	Z,ZK	5
	ן bata Freprocessing repare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various data s	· '	_
-	nd learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction from		-
MI-PDP.16	Parallel and Distributed Programming	Z,ZK	5
	ratalier and Distributed in rogramming ment of cloud, web, and communication technologies and due to the shift of the Moore law into multicore and manycore CPUs, paral	· '	-
· ·	quitous. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconnec		
-	for parallel programming of shared and distributed memory computers. On selected problems, they will learn the techniques of design c		
	algorithms and methods of performance evaluation of their implementations.	ara oca	iabio parano.
MI-PIS.16	Advanced Information Systems	Z,ZK	5
	notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the notio	·	1
	is and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about agili		
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.			
MI DOA 16		7 71/	
MI-POA.16	Advanced Computer System Architectures	Z,ZK	5
rne student will	learn the current trends in infrastructure architecture of complex business computer systems. After completion of the module, the stu- complex system infrastructure that meets availability and scalability requirements given by the business environment.	dent will be able to	design a
MUDDO		7 71/	
MI-PRC	Programming in CUDA	Z,ZK	4
	e students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming		
MI-PSL	Programming in Scala	Z,ZK	4
	uces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language feature	• .	•
advance standard I	ibrary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and	l libraries e.g. Play	, Cassandra,
	Scalaz, etc.	<b>-</b>	
MI-PVR	Advanced Virtual Reality	KZ	4
	ces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D model		_
-	s students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also	_	
in available 3D eng	ines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kn	lowledge gained in	n this subject
	in virtual reality, or directly create a complex game for VR.		
MI-PVS	Advanced embedded systems	Z,ZK	4
	used on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advance	•	
working with mass	s storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practica	l experiences with	embedded
	systems.		
MI-PYT	Advanced Python	KZ	4
-	urse is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python		
very hands-on and	it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework	The course is lead	d by external
	teachers from Red Hat.		
MI-REV.16	Reverse Engineering	Z,ZK	5
•	cquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before		
is called. Students will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated to reverse engineering of			
applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be dedicated to debuggers: how			
debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer malware scene. The focus of			
NU DOZ 10	the course is on the seminars, where students will solve practically oriented tasks from the real world.	7.71	
MI-ROZ.16	Pattern Recognition	Z,ZK	5
	nodule is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the st		-
	udents will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, an		
MI-RRI	Risk Management in Informatics	ZK	3
	ty is very often considered as one of main objectives to secure targets of information processing. However, to focus on this info secur	-	
	viruses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which are mo	_	
	ne necessity to continue with business after disaster is also slightly ignored. International standards which are focused on informatics		
	s started to anticipate necessity of risk management. There is no commonly accepted methodology used for this task. Threats which a		bie to see
	rldwide, invoke pressures to prepare plans for business continuity management even in the case of dramatic political changes, natura		
MI-RUB	Programming in Ruby	KZ	4
	This course is presented in Czech.	_	
MI-SCE1	Computer Engineering Seminar Master I	Z	4
	mputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to		
	idividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the	•	
articles and other p	professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher.	rs. The topics are i	new for each
	semester.	_	
MI-SCE2	Computer Engineering Seminar Master II	Z	4
	mputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to		
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.		
MI-SCR	Statistical Analysis of Time Series	Z,ZK	4
	with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices		
problems (modelling of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a convenient process model, estimate			
its parameters, analyze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the main principles based on practical			

real-world examples. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfer of students' knowledge from the academic to the real world. MI-SEP World Economy and Business Z.ZK 4 This course is presented in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). 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. Network Security 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). MI-SIM.16 **Digital Circuit Simulation** 7.7K 5 Students gain information regarding the usage of basic tools for the design and simulation of VLSI (very large scale integration) digital circuits (VHDL, Verilog). They also get some knowledge about advanced tools System Verilog & Dystem C. MI-SMI.16 Strategic Management of Informatics Z,ZK The course focuses on the strategic management of information systems. Students will learn the process of creation and implementation of an information strategy, IT governance, the importance of ICT for business and interrelations between information strategies and lobal business strategies. Furthermore, they gain the knowledge in the areas of economic management of IS/IT, management of investments and ROI, assessment of IT investments and management of human resources in IT (the role of CIO, CEO, CFO). The part of the course is the role of project management, risk management and quality assessment of informatics. Systems on Chip MI-SOC.16 Students gain key knowledge and skills in the design of large-scale digital systems. They will be familiar with architectures of such systems and communication among their parts. They will use an appropriate workflow to design these architectures, their hardware and software. They will also have knowledge of contemporary methods of large systems verification and fault-tolerant systems design. MI-SPI.16 Statistics for Informatics Summary of probability theory; Multivariate normal distribution; Entropy and its application to coding; Statistical tests: T-tests, goodness of fit tests, independence test; Random processes - stacionarity; Markov chains and limiting properties; Queuing theory MI-SWE.16 Semantic Web Z.ZK 5 Students learn standards used for processing and sharing knowledge mainly in the area of web. They get used to designing and using knowledge models, knowledge representation, and practical aspects as publishing, sharing, exchange, and acquisition of knowledge on the web. The presentation is based on the idea of the semantic web, including its standards and technologies (RDF, RDFS, OWL) and formal models. MI-SYB.16 System Security 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. MI-SZ1 Knowledge Engineering Seminar Master I On this seminar you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research labs around the world. Additionally, you will learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet). MI-TFS 16 Systems Theory Z.ZK 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. MI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory. At first, we recall basic concepts pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission, network topology, somatic and synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transformation into a canonical topology, and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with training, we pay attention to the problem of overtraining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most important optimization methods employed for neural network training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within the topic approximation approach to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Kolmogorov theorem, Vituškin theorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappings computed by neural networks being dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect to a finite measure, spaces of functions with continuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on expectation and training based on a random sample, and with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see how it is possible to get an estimate of the conditional expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak law of large numbers and get acquainted with an analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the central limit theorem, get acquinted with its analogy for neural networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be employed to search for the topology of the network. Theoretical Seminar Master I MI-TS1 7 4 Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TS2 7 Theoretical Seminar Master II Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.

MI-TS3 Theoretical Seminar Master III Ζ Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TS4 Ζ Theoretical Seminar Master IV 4 Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. MI-TSP.16 Testing and Reliability Z,ZK Students 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 easy testable circuits and systems with built-in-self-test equipment. They will be able to analyze and control reliability and availability of the designed circuits. Scientific thinking ΚZ The objective of the course is to get acquainted with scientific methods and discovery of order and laws of the universe, including the aspects of human life. The subject combines scientific methods in natural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of scientific communication via research papers and posters. Retrieval from Multimedia Z,ZK The student obtains general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of feature extraction from multimedia objects, indexing, and structure of distributed search engines. MI-VYC Computability Z,ZK 4 Classical theory of recursive functions and effective computability, with applications in provability theory. MI-W20.16 Web 2.0 Z,ZK 5 Students will learn new trends and technologies on the Web including theoretical foundations. Students will gain an overview about Web applications architectures, concepts and technologies about programmable Web (REST Architectures, Mashups), basic mechanisms for knowledge representation on the Web (microformats, meta-data, ontologies, open linked data, etc.), mechanisms about collective intelligence (collaborative filtering, predictions of users' behaviours), social networks, and security. MI-ZS10 Master internship abroad for 10 credits 10 Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. MI-ZS20 Master internship abroad for 20 credits 20 Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. MI-ZS30 Master internship abroad for 30 credits Each student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. NI-AML Advanced machine learning Z,ZK 5 The course introduces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of recommendation systems, image processing, control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the methods discussed. Cultural and Social Anthropology 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 "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is presented in Czech. NI-CCC Creative Coding and Computational Art Students work on practical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows the basic graphics courses (MGA, BLE,...) and introduces students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization techniques with artistic methods using modern technologies. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and Metropolitan Planning) and IIM (Institute of Intermedia FEL). NI-HSC Side-Channel Analysis in Hardware Z.ZK 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 NI-IAM Internet and Multimedia Z,ZK The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acquisition of AV signals (input), presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical use case scenarios of real-time audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effect of various components on the quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the scene up to the presentation for audience Statistical Modelling Lab The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is put on the effective use of the available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis). Modern Object-Oriented Programming in Pharo Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation

of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium. NI-PG1 Computer Grafics 1 The course builds on graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. The course is designed for those interested in advanced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the course is the study of scientific articles and their subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and topics of computer graphics. Research Project Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en. PI-SCN ZK 4 Seminars on Digital Design This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.

For updated information see <a href="http://bilakniha.cvut.cz/en/FF.html">http://bilakniha.cvut.cz/en/FF.html</a> Generated: day 2024-05-17, time 05:16.