## Study plan

## Name of study plan: Study plan for Ukrainian refugees

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Unspecified Specialisation of Study

Garantor of the study branch: doc. RNDr. Ing. Marcel Ji ina, Ph.D.

Program of study: Welcome page

Type of study: unknown Required credits: 15 Elective courses credits: 0 Sum of credits in the plan: 15

Note on the plan:

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 15

The role of the block: P

Code of the group: BIE-PP-UKR

Name of the group: Compulsory bachelor courses for Ukrainian refugees

Requirement credits in the group: In this group you have to gain at least 15 credits (at most 23)

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

Credits in the group: 15 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
UKCJ7	Czech Language 7 for Ukrainian refugees  Zden k Muziká	ZK	10	10C	Z,L	Р
UKMAT	Mathematics UK	Z,ZK	5	3P+2C		Р
UKR-PKM	Preparatory Mathematics for Ukrainian refugees	Z	5		Z,L	Р

# Characteristics of the courses of this group of Study Plan: Code=BIE-PP-UKR Name=Compulsory bachelor courses for Ukrainian refugees

UKCJ7	Czech Language 7 for Ukrainian refugees	ZK	10		
Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.					
UKMAT	Mathematics UK	Z,ZK	5		
UKR-PKM	Preparatory Mathematics for Ukrainian refugees	Z	5		
The purpose of Prepara	The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.				

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

The role of the block: V

Code of the group: BI-V.2021

Name of the group: Purely Elective Courses of Bachelor Programme Informatics, version from 2021/22 till

2024/25

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

Credits in the group: 0 Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BI-ADW.1	Windows Administration Ji í Kašpar, Miroslav Prágl Miroslav Prágl (Gar.)	Z,ZK	4	2P+1C	Z	V
BI-ALO	Algebra and Logic Jan Starý Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+1C	L	V
BI-AVI.21	Algorithms visually Lud k Ku era Lud k Ku era Lud k Ku era (Gar.)	Z,ZK	4	2P+1C	L	V
BI-A2L	English language, preparation for the B2 level exam Kate ina Valentová Kate ina Valentová (Gar.)	Z	2	2C	L	V
NI-AFP	Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.)	KZ	5	2P+1C	L	V
BI-BLE	Blender  Lukáš Ba inka Lukáš Ba inka Lukáš Ba inka (Gar.)	Z,ZK	4	2P+2C	L	V
NI-DSP	Database Systems in Practes Tomáš Vichta Tomáš Vichta (Gar.)	Z,ZK	4	2P+1C	L	V
NI-PSD	Public Services Design	KZ	4	1P+2C		V
BIE-DIF	Ond ej Brém, David Pešek David Pešek Ond ej Brém (Gar.)  Differential equations Ond ej Bouchala, Antonella Marchesiello, Jan Valdman Tomáš Kalvoda Ond ej Bouchala (Gar.)	Z,ZK	5	2P+2C	L	V
NI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
NI-DDM	Distributed Data Mining	KZ	4	3C	L	V
BI-EP1.24	Effective programming 1  Martin Ka er Martin Ka er Martin Ka er (Gar.)	KZ	4	2P+2C	Z	V
BI-EP2	Efficient Programming 2 Martin Ka er Martin Ka er Martin Ka er (Gar.)	KZ	4	2P+2C	L	V
BI-ANGK	English language, contact preparation for the B2 level exam Kate ina Valentová Kate ina Valentová (Gar.)	Z	2	2C	Z,L	V
BI-EJK	Enterprise Java and Kotlin  Ji í Dan ek <b>Ji í Dan ek</b> Ji í Dan ek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-HAM	HW accelerated network traffic monitoring  Tomáš ejka, Karel Hynek Tomáš ejka Tomáš ejka (Gar.)	KZ	4	2P+1C	L	V
BI-HMI	History of Mathematics and Informatics  Alena Solcová Alena Šolcová (Gar.)	Z,ZK	3	2P+1C	L	V
BI-ARD	Interactive applications on Arduino Ji í Cvr ek, Vojt ch Miškovský, Robert Hülle, Jan ezní ek Robert Hülle Robert Hülle (Gar.)	KZ	4	3C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
BIE-CSI	Introduction to Computer Science Christoph Kirsch Christoph Kirsch (Gar.)	Z	2	2C	Z	V
BIE-IMA2	Introduction to Mathematics 2 Karel Klouda	Z	2	1C	Z	V
BI-CS2	C# language and data access Pavel Št pán Pavel Št pán Pavel Št pán (Gar.)	KZ	4	0P+3C	Z	V
BI-CS3	Language C# - design of web applications Pavel Št pán Pavel Št pán Pavel Št pán (Gar.)	KZ	4	3C	Z	V
BI-SQL.1	Language SQL, advanced  Michal Valenta Michal Valenta (Gar.)	KZ	4	3C	L	V
BI-QAP	Quantum algorithms and programming Ivo Petr. Tomáš Kalvoda Ivo Petr Ivo Petr (Gar.)	KZ	5	1P+2C	Z	V
NI-LSM	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	L	V
BI-HAS	Human Aspects in Cryptography and Security Ivana Trummová Ivana Trummová (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPL	Managerial Psychology Jan Fiala Jan Fiala (Gar.)	ZK	2	2P	Z,L	V
NI-MSI	Mathematical Structures in Computer Science  Jan Starý	Z,ZK	4	2P+1C	L	V
BI-MPP.21	Methods of interfacing peripheral devices  Miroslav Skrbek Miroslav Skrbek (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-MIT	Mikrotik technologies  Jan Fesl Jan Fesl (Gar.)	KZ	3	1P+2C	Z	V
NI-MOP	Modern Object-Oriented Programming in Pharo Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
BI-MVT.21	Modern Visualisation Technologies Petr Pauš, Ji í Chludil Petr Pauš Petr Pauš (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-MMP	Multimedia team project  Zde ka echová Zde ka echová Zde ka echová (Gar.)	KZ	4	3C	Z,L	V
BI-ORL	Operations Research and Linear Programming  Dušan Knop Dušan Knop Dušan Knop (Gar.)	KZ	5	1P+2C	L	V

NI-OLI	Linux Drivers Miroslav Skrbek, Jaroslav Borecký Jaroslav Borecký Miroslav Skrbek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-ACM	Programming Practices 1 Tomáš Valla Tomáš Valla (Gar.)	KZ	5	4C	L	V
BI-ACM2	Programming Practices 2 Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	KZ	5	4C	Z	V
BI-ACM3	Programming Practices 3 Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	KZ	5	4C	L	V
BI-ACM4	Programming Practices 4 Tomás Valla, Ond ej Suchý (Gar.)	KZ	5	4C	Z	V
BI-AND.21	Programming for the Android Operating System  Jan Mottl, Jan Vep ek, Marek Kodr, Petr Šíma Jan Mottl Marek Kodr (Gar.)	KZ	4	3C	L	V
BI-CS1	Programming in C# Pavel Št pán, Helena Wallenfelsová Helena Wallenfelsová Pavel Št pán (Gar.)	KZ	4	3C	L,Z	V
BI-PJV	Programming in Java Jan Blizni enko, Miroslav Balík, Ji í Borský, Jan Zimolka Miroslav Balík Miroslav Balík (Gar.)	Z,ZK	4	2P+2C	Z,L	V
BI-KOT	Programing in Kotlin Ji Dan ek <b>Ji i Dan ek</b> Ji i Dan ek (Gar.)	Z,ZK	4	2P+2C	L	V
NI-PSL	Programming in Scala Ji í Dan ek <b>Ji í Dan ek</b> Ji í Dan ek (Gar.)	Z,ZK	4	2P+1C	Z	V
BI-PMA	Programming in Mathematica  Zden k Buk Zden k Buk Zden k Buk (Gar.)	Z,ZK	4	2P+2C	Z,L	V
BI-PS2	Programming in shell 2	Z,ZK	4	2P+2C	L	V
NI-PDD	Lukáš Ba inka  Data Preprocessing		5	2P+1C	Z	V
BI-PKM	Marcel Ji ina Marcel Ji ina Marcel Ji ina (Gar.)  Introduction to mathematics		4		Z	V
NI-REV	Tomáš Kalvoda <b>Tomáš Kalvoda</b> Tomáš Kalvoda (Gar.)  Reverse Engineering	Z,ZK	5	1P+2C	Z	V
BI-SCE1	Josef Kokeš Josef Kokeš Josef Kokeš (Gar.)  Computer Engineering Seminar I	Z	4	2C	L,Z	V
BI-SCE2	Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)  Computer Engineering Seminar II	Z	-	2C	,	
	Computer Engineering Seminar II  Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)  Network Technology 1		4		L,Z	V
BI-ST1	Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BI-ST2	Network Technology 2 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	3C	L	V
BI-ST3	Network Technology 3 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V
BI-ST4	Network Technology 4 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	L	V
BI-SKJ.21	Scripting Languages Lukáš Ba inka, Jan Ž árek Lukáš Ba inka Jan Ž árek (Gar.)	Z,ZK	4	2+2	L	V
BI-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+2C	L	V
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
BIE-SEG	Systems Engineering	Z	0	2C	Z	V
TVK1	Christoph Kirsch Christoph Kirsch Christoph Kirsch (Gar.)  Physical Education	Z	1		L,Z	V
TVV	Luboš Neuman Ji í Drnek (Gar.)  Physical education	Z	0	0+2	Z,L	V
TV1	Physical Education	Z	0	0+2	Z	V
TVV0	Physical education	Z	0	0+2	Z,L	V
TV2	Physical Education	Z	0	0+2	L	V
TVKZV	Physical Education Course	Z	0	7dní	Z	V
TVKLV	Physical Education Course	Z	0	7dní	L	V
BI-TS1	Theoretical Seminar I Dušan Knop, Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
BI-TS2	Theoretical Seminar II  Dušan Knop, Tomáš Valla, Ond ej Suchý Tomáš Valla Ond ej Suchý (Gar.)	Z	4	2C	L	V
BI-TS3	Theoretical Seminar III Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
BI-TS4	Theoretical Seminar IV Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	L	V
NI-TSP	Testing and Reliability Petr Fišer Martin Da hel Petr Fišer (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-QUA	Quality Assurance Marek Kodr, Martin Pilný, Kate ina Kalášková Kate ina Kalášková Marek Kodr (Gar.)	KZ	4	3C	Z	V

FI-TOP	Academic writing Tomáš Nová ek	Z	2	10B	Z	V
BI-CCN	Compiler Construction Christoph Kirsch Christoph Kirsch (Gar.)	Z,ZK	5	2P+1C	L	V
BI-TEX	TeX and Typography Petr Olšák Petr Olšák Petr Olšák (Gar.)	Z,ZK	4	2P+1C	L	V
BI-EHD	Introduction to European Economic History Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	3	2P+1C	Z,L	V
BI-KSA	Cultural and Social Anthropology Alena Libánská, Jakub Šenovský, Tomáš Houdek <b>Jakub Šenovský</b> Alena Libánská (Gar.)	ZK	2	2P	Z,L	V
BI-ULI	Introduction to Linux Jan Ž árek, Petr Zemánek, Zden k Muziká Zden k Muziká (Gar.)	Z	2	4D	Z	V
NI-VCC	Virtualization and Cloud Computing Jan Fesl, Tomáš Vondra Tomáš Vondra Tomáš Vondra (Gar.)	Z,ZK	5	2P+1C	L	V
BI-VR1	Virtual reality I Petr Pauš, Petr Klán Petr Klán (Gar.)	KZ	4	2P+2C	L,Z	V
BI-VR2	Virtual reality II Petr Klán <b>Petr Klán</b> Petr Klán (Gar.)	KZ	3	1P+2C	L	V
BI-VAK.21	Selected Applications of Combinatorics  Michal Opler Michal Opler Michal Opler (Gar.)	Z	3	2R	L	V
BI-VMM	Selected Mathematical Methods  Marzieh Forough Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
NI-VYC	Computability Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
BI-ZS10	Bachelor internship abroad for 10 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	10		Z,L	V
BI-ZS20	Bachelor internship abroad for 20 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	20		Z,L	V
BI-ZS30	Bachelor internship abroad for 30 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	30		Z,L	V
BI-ZIVS	Intelligent Embedded System Fundamentals Miroslav Skrbek Miroslav Skrbek (Gar.)	KZ	4	1P+3C	Z	V
BI-ZPI	Process engineering Robert Pergl Robert Pergl (Gar.)	KZ	4	1P+2C	L	V
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad  Rostislav Babá ek, Igor Rosocha Martin P Ipitel Martin P Ipitel (Gar.)	KZ	4	2C	Z	V
BI-ZWU	Introduction to Web and User Interfaces  Lukáš Ba inka Lukáš Ba inka Jakub Klímek (Gar.)	Z,ZK	4	2P+2C	L	V
BI-3DT.1	3D Printing Miroslav Hron ok, Tomáš Sýkora Tomáš Sýkora Miroslav Hron ok (Gar.)	KZ	4	3C	L	٧

# Characteristics of the courses of this group of Study Plan: Code=BI-V.2021 Name=Purely Elective Courses of Bachelor Programme Informatics, version from 2021/22 till 2024/25 BI-ADW.1 Windows Administration Z,ZK 4

This course is presented in Czech. However, there is an Engl	ish variant in the program Informatics (B1801 / 4753).		
BI-ALO Algebra and Logic		Z,ZK	4
The course extends and deepens the study of topics touched	d upon in the basic course in logic.	' '	
BI-AVI.21 Algorithms visually		Z,ZK	4
The course complements other algorithm courses at FIT. It bri	ngs knowledge about particular important algorithms from different fields of the compute	r science that exte	end substantially
knowledge presented in BI-AG1 and BI-AG2. A wide scope of co	overed subject is made possible due to using visualization bz Algovision (www.algovision.o	rg <http: td="" www.alg<=""><td>govision.org&gt;)</td></http:>	govision.org>)
that make understanding the principles of algorithms easy.			
BI-A2L English language, preparation	on for the B2 level exam	Z	2
The content of the course corresponds to the preparation for	the English exam at the B2 level. Requirements for course credit. Academic Achievements	ent - students are	due to: -Take an
active part in the language instructionMeet the requirement	ts for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both	the midterm and	the final term
tests with the success rate set at 70%80% and over in BOT	TH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by	individual teacher	s during the first
class of the term.			
NI-AFP Applied Functional Program		KZ	5
	represents one of the traditional programming paradigms. Traditional and novel function		
, , ,	mportant construct of traditionally imperative languages (C++, C#, Java). As such, mas	tering this paradig	ım becomes a
necessary competence of a software engineer: the theory an	d especially the practice.		
BI-BLE Blender		Z,ZK	4
The course extends knowledge of opensource program Blend	der from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those	e interested in 3D	graphics and
animation. It offers a complete and practically oriented introd	uction to Blender environment. Students may continue to BI-PGA (Programming graphic	cs applications) co	ourse.
NI-DSP Database Systems in Practe	es established	Z,ZK	4
This course is presented in Czech.			
NI-PSD Public Services Design		KZ	4
The course will introduce students to specifics of UX, Service	e design and development for public sector. We will look into the design and development	nt process from th	e perspective of
suppliers (devs and designesr) as well as clients. In small tea	ams students will work on projects from partner organizations and will try out collaborati	on with client repr	esentatives.
Course is aimed at students-designers as well as clients.			

BIE-DIF	Differential equations	Z,ZK	5
This course provides a for	pundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essentia		-
•	ns on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered		
polynomial analysis, foll	owed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world application	ons. Finally, an int	roduction to
	ons (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODI	Es and PDEs, incl	uding implicit
	ds, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.		
NI-DZO	Digital Image Processing	Z,ZK	4
	comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical is	_	
-	nteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDF		
	raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray c		•
	ossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, ac		
NI-DDM	Distributed Data Mining	KZ	4
	e-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand	l .	-
	ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation		
approaches to paralleliz	e other algorithms. The course is prezented in czech language.		
BI-EP1.24	Effective programming 1	KZ	4
The course is taught in	Czech.		
BI-EP2	Efficient Programming 2	KZ	4
	Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving ind	ividual problems a	are discussed,
	he best one and avoid implementation errors.		
BI-ANGK	English language, contact preparation for the B2 level exam	Z	2
	se corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievements		
	ge instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both		
	ate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by	individual teacher	s during the first
class of the term.	Fotomories design and Kettin	7.71	
BI-EJK	Enterprise Java and Kotlin	Z,ZK	4
architecture, that can be	ced technologies in the Java and Kotlin programming languages. The focus is on technologies for developing enterprise infor	mation systems w	illi microservice
	• •	V7	1
BI-HAM	HW accelerated network traffic monitoring students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring.	KZ	d analysis of
	latory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as	_	-
	of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network t		
- · · ·	r practical abilities in this field.		
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
This course is presented		, ,	
BI-ARD	Interactive applications on Arduino	KZ	4
The additional in the city of the control of			
i ne subject is designed	for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple appl		n programmable
	for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple appl eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded	ications for moder	
kits and control varied p		ications for moder d systems, i.e. to s	ee the results
kits and control varied p not only on display of a Software Engineering st	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefore	ications for moder d systems, i.e. to s e is suitable even	ee the results
kits and control varied p not only on display of a Software Engineering st NI-IAM	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefor udents.  Internet and Multimedia	ications for moder d systems, i.e. to s e is suitable even	ee the results for Web and
kits and control varied p not only on display of a Software Engineering st NI-IAM The NI-IAM course is fo	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefor udents.  Internet and Multimedia cused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes and	ications for moder d systems, i.e. to s e is suitable even  Z,ZK  cquisition of AV sig	ee the results for Web and 4 gnals (input),
kits and control varied p not only on display of a Software Engineering st NI-IAM The NI-IAM course is fo presentation of AV signa	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefor udents.  Internet and Multimedia cused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes at lis (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practice	ications for moder d systems, i.e. to s e is suitable even  Z,ZK  cquisition of AV signal use case scenario	ee the results for Web and  4 gnals (input), arios of real-time
kits and control varied p not only on display of a Software Engineering st NI-IAM The NI-IAM course is fo presentation of AV signal audiovisual transmission	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefor udents.  Internet and Multimedia cused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes at als (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practices. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the	ications for moder d systems, i.e. to see is suitable even  Z,ZK  cquisition of AV signal use case scenare effect of various of	ee the results for Web and  4 gnals (input), arios of real-time omponents on
kits and control varied p not only on display of a Software Engineering st NI-IAM The NI-IAM course is fo presentation of AV signa audiovisual transmission the quality and latency of	eripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefor udents.  Internet and Multimedia cused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes at lis (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practice	ications for moder d systems, i.e. to see is suitable even  Z,ZK  cquisition of AV signal use case scenare effect of various of	ee the results for Web and  4 gnals (input), arios of real-time omponents on
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BI-QAP Quantum algorithms and programming	KZ	5
Course aims at giving students hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanic	· ·	-
are based, and algorithms showing advantages and limitations of quantum computing. During tutorials students work in open-source software devel	-	
on Python language. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VI	MM and experienc	e with Python
might be an advantage. No previous knowledge of physics is assumed.  NULL SM  Statistical Modelling Lob	KZ	5
NI-LSM   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		_
available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms,	-	
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).	a.i.a.y 000 0. 1	propertion
BI-HAS Human Aspects in Cryptography and Security	Z,ZK	5
This course is for students interested not only in technical scope of computer science, but also in making products usable - for users and for develop	' '	_
use their gained knowledge to design, plan and analyse their own projects in the context of human-centered security.		
NI-MPL Managerial Psychology	ZK	2
NI-MSI Mathematical Structures in Computer Science	Z,ZK	4
Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Sco	tt model of lambda	a calculus.
Introduction to category theory.		
BI-MPP.21 Methods of interfacing peripheral devices	Z,ZK	5
The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Univ	·	•
includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of the control of the cont	JSB devices, Linu	x and Windows
drivers, simple application development, and APIs of selected devices.	147	
BI-MIT Mikrotik technologies	KZ	3
The main motivation of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are middle internet service providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the		
and how to administrate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary computer		
and technologies of the data-link, network and transport layer of the OSI model.	i networks conce	oto inte protocolo
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		
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 wo		
technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involved	ement in the Pha	ro Consortium.
BI-MVT.21 Modern Visualisation Technologies	Z,ZK	5
The goal of the course is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and at	igmented reality, v	risualization on
high resolution displays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the ment	ioned technologie	s, namely fractal
and procedural visualization, scientific data visualization, and 3D model scanning.		
BI-MMP Multimedia team project	KZ	4
This course is presented in Czech.		
BI-ORL Operations Research and Linear Programming	KZ	5
The subject aims to introduce students to the issues of operational research and primarily to the practical application of linear programming as a fun	-	ation technique.
Operational research primarily focuses on the use of engineering methods (with a mathematical background) to solve practical problems (such as mathematical background) to solve practical		
NI-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 combinin increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developm		
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience		uuenis. me
BI-ACM Programming Practices 1	. KZ	5
This is a selective course for preparing talented student for representation in international programming contests.	I NZ	5
BI-ACM2 Programming Practices 2	KZ	5
This is a selective course for preparing talented student for representation in international programming contests.	I NZ	3
BI-ACM3 Programming Practices 3	KZ	5
	1\2	5
This is a selective course for preparing talented student for representation in international programming contests.  Programming Practices 4	K7	5
BI-ACM4 Programming Practices 4	KZ	5
BI-ACM4 Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.		
BI-ACM4 Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.  BI-AND.21 Programming for the Android Operating System	KZ KZ	5 4
BI-ACM4 Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.  BI-AND.21 Programming for the Android Operating System This course is presented in Czech.	KZ	4
BI-ACM4 Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.  BI-AND.21 Programming for the Android Operating System This course is presented in Czech.  BI-CS1 Programming in C#	KZ KZ	4
BI-ACM4 Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.  BI-AND.21 Programming for the Android Operating System This course is presented in Czech.  BI-CS1 Programming in C# The goal of the course is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental	KZ KZ	4 es of variables,
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	Programming in shell 2	Z,ZK	4
	overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In add or particular scripting languages and will get practical experience with shell script programming.	lition, they gain a	deeper insight
NI-PDD	Data Preprocessing	Z,ZK	5
	e raw data for further processing and analysis. They learn what algorithms can be used to extract information from various dat		-
time series, etc., and lea pages.	rn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteri	istics from image:	s or from web
	Introduction to mathematics	Z	4
This course is presented		_	7
NI-REV	Reverse Engineering	Z,ZK	5
	nted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens be		
	nderstand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedi ++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be de		
• •	ng work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the compute		·
	inars, where students will solve practically oriented tasks from the real world.		
BI-SCE1	Computer Engineering Seminar I	Z	4
=	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance		
* *	ally within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of th sional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacl	=	
semester.	some merature and/or work in the relationes. The capacity of the subject is infinited by the possibilities of the seminar teach	ners. The topics c	ic new ior cacin
BI-SCE2	Computer Engineering Seminar II	Z	4
The Seminar of Computer	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance	e to failures and a	ttacks. Students
	ally within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the	-	
semester.	sional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teach	ners. The topics a	re new for each
	Network Technology 1	Z	3
1	p providing the students basic information and practical skills from the area of digital and IP networks. The subject is acredite	_	
CCNA1 - R&S Intro	duction to Networks.		
	Network Technology 2	Z	3
This course is presented			
	Network Technology 3 ance their knowledge acquired from previous BI-ST1 and BI-ST2 courses. Principles of routing and switching presented during	Z	3
	ne course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred	_	
simple topology, security		7,	,.
BI-ST4	Network Technology 4	Z	3
	ance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switchin		- 1
<del>_</del>	er extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased effic y, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely		-
	ss) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switc		
•	ncy procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitiga		·
network running.			
BI-SKJ.21	Scripting Languages	Z,ZK	4
	overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In add	Date of the second second	
into shell and some other	r particular scripting languages and will get practical experience with shell script programming	lition, they gain a	
	r particular scripting languages and will get practical experience with shell script programming.  World Economy and Business		deeper insight
BI-SEP	r particular scripting languages and will get practical experience with shell script programming.  World Economy and Business I in Czech. The course introduces students of technical university to the international business. It does that predominantly by	Z,ZK	deeper insight  4
BI-SEP This course is presented and key regions of world	World Economy and Business I in Czech. The course introduces students of technical university to the international business. It does that predominantly by economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well	Z,ZK comparing individual as indexes of eco	4 lual countries nomic freedom,
BI-SEP This course is presented and key regions of world corruption and economic	World Economy and Business I in Czech. The course introduces students of technical university to the international business. It does that predominantly by economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of	Z,ZK comparing individual as indexes of eco	4 lual countries nomic freedom,
BI-SEP This course is presented and key regions of world corruption and economic readings. It is advised to	World Economy and Business In Czech. The course introduces students of technical university to the international business. It does that predominantly by economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well expected to the repair of the right investment decision. Seminars help to improve on the knowledge in the form of take bachelor level of this course BIE-SEP as a prerequisite.	Z,ZK comparing individual as indexes of eco f discussions bas	4 lual countries nomic freedom, ed on individual
BI-SEP This course is presented and key regions of world corruption and economic readings. It is advised to NI-SYP	World Economy and Business In Czech. The course introduces students of technical university to the international business. It does that predominantly by economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well expected are needed for the right investment decision. Seminars help to improve on the knowledge in the form of take bachelor level of this course BIE-SEP as a prerequisite.  Parsing and Compilers	Z,ZK comparing individual as indexes of econor of discussions base Z,ZK	deeper insight  4 dual countries nomic freedom, ed on individual
BI-SEP This course is presented and key regions of world corruption and economic readings. It is advised to NI-SYP The module builds upon	World Economy and Business In Czech. The course introduces students of technical university to the international business. It does that predominantly by economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well expected to the repair of the right investment decision. Seminars help to improve on the knowledge in the form of take bachelor level of this course BIE-SEP as a prerequisite.	Z,ZK comparing individual as indexes of econor of discussions base Z,ZK	deeper insight  4 dual countries nomic freedom, ed on individual
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Theoretical Seminar III 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. Theoretical Seminar IV Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. NI-TSP Testing and Reliability Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits. **BI-QUA Quality Assurance** This course introduces students to the fundamentals of testing and quality management. Students will learn what the role of a tester is in the context of different types of software development and will experience hands-on application testing using both manual and automated testing. At the end of the semester, the student should be prepared to perform a test analysis, design a set of test scenarios, prepare test data, automate an appropriate portion of the scenarios, and prepare a report on the bugs found in the product under test. FI-TOP Academic writing Ζ 2 Publishing is an important and required part of research activity. It is not only about obtaining research results but also about applying them in the form of publication. Writing scientific publications can be useful for students not only in their own publishing activities but also in the preparation of a bachelor's or master's thesis. In the course, students will learn how to write a scientific article, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an article and reviewing someone else's article. The course will be taught in blocks, with one lecture at the beginning of the semester and one practicum in the middle of the semester. Dates will be determined based on the availability of enrolled students. **BI-CCN Compiler Construction** 5 This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class. TeX and Typography This course is presented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the course focuses on typographic rules Z,ZK **BI-EHD** Introduction to European Economic History 3 This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753). Cultural and Social Anthropology ZK 2 **BI-KSA** 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. BI-ULI Introduction to Linux 2 Students become familiar with the basics of the Linux operating system using e-learning form. They learn to work with the command line and become familiar with basic commands and techniques of a Unix-like system. Topics can be studied first theoretically and then practically verified in a virtual machine (terminal). Virtualization and Cloud Computing NI-VCC 5 Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development). BI-VR1 Virtual reality I Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of virtual worlds communication. The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds. It improves computational thinking, empathy and shared social activities BI-VR2 Virtual reality II ΚZ 3 Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objective is to develop applications for computer science and gamification in various social metaverse and desktop engines. Z Selected Applications of Combinatorics The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools. Selected Mathematical Methods Z,ZK The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples. NI-VYC Z,ZK Computability 4 Classical theory of recursive functions and effective computability. BI-ZS10 Bachelor internship abroad for 10 credits Ζ 10 Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

BI-ZS20	Bachelor internship abroad for 20 credits	Z	20
Each student can o	nce within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or	research institutio	n. Before the
internship the Dear	of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the profess	sional content and	extent of the
internship. Auxiliary	courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits	correspond to 4 v	eeks of full-time
employment with a	oreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided	d into two subjects	if the internship
exceeds the acade	nic year's dead-line.		
BI-ZS30	Bachelor internship abroad for 30 credits	Z	30
Each student can o	nce within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or	research institutio	n. Before the
internship the Dear	of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the profess	sional content and	extent of the
internship. Auxiliary	courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits	correspond to 4 v	eeks of full-time
employment with a	oreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided	d into two subjects	if the internship
exceeds the acade	nic year's dead-line.		
BI-ZIVS	Intelligent Embedded System Fundamentals	KZ	4
Intelligent embedde	d system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim	of the course is to	teach students
modern humanoid	obot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion c	ontrol, sensor rea	ding, application
interfaces, robot na	rigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to g	et practical experi	ence with these
technologies.			
DI 7DI			
BI-ZPI	Process engineering	KZ	4
	Process engineering   Process engineering in this subject. Students will get necessary foundations for understanding formal principles	· · · · · · · · · · · · · · · · · · ·	•
Students will learn		of process model	ing and they will
Students will learn learn basics of the	undamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles	of process model ousiness process	ing and they will es using modern
Students will learn learn basics of the CASE tools. The ro	undamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles sed notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of t	of process model ousiness process	ing and they will es using modern
Students will learn learn basics of the CASE tools. The ro	undamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles sed notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of t	of process model ousiness process	ing and they will es using modern
Students will learn learn basics of the CASE tools. The ro an enterprise.	undamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles sed notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of the of process engineering for information systems development is discussed as well as its importance in the overall context of information systems development for iPhone and iPad	of process model pusiness processormation and busi	ing and they will es using modern ness strategy of
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ΚZ

Code of the group: BIE-V.2021

Name of the group: Purely Elective Bachelor Courses, Version 2021 till 2024/25

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

3D Printing

Credits in the group: 0 Note on the group:

This course is presented in Czech.

BI-3DT.1

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
BIE-ZRS	Basics of Systems Control	Z,ZK	4	2P+2C	L	V
BIE-CCN	Compiler Construction Christoph Kirsch Christoph Kirsch (Gar.)	Z,ZK	5	2P+1C	L	V
BIE-SCE1	Computer Engineering Seminar I Miroslav Skrbek, Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	Z	V
BIE-SCE2	Computer Engineering Seminar II Hana Kubátová, Ji í Vysko il <b>Hana Kubátová</b> Hana Kubátová (Gar.)	Z	4	2C	L	V
BIE-CZ0	Czech Language for Foreigners Tomáš Houdek, Markéta Hofmannová, Ivana Vondrá ková, Petra Korfová Zden k Muziká Zden k Muziká (Gar.)	KZ	2	4C	Z,L	V
BIE-CZ1.21	Czech Language for Foreigners II Tomáš Houdek, Ivana Vondrá ková, Petra Korfová Zden k Muziká Zden k Muziká (Gar.)	KZ	2	4C	Z,L	V
UKCJP	Czech language for advanced Jakub Šenovský, Tomáš Houdek, Jakub Šolc, Adam Vostárek Zden k Muziká Zden k Muziká (Gar.)	Z,ZK	2	2BP+2BC	Z,L	V
BIE-DIF	Differential equations Ond ej Bouchala, Antonella Marchesiello, Jan Valdman Tomáš Kalvoda Ond ej Bouchala (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-EPR	Economic project Tomáš Evan Tomáš Evan (Gar.)	Z	1		L	V
BIE-FTR.1	Financial Markets	Z,ZK	5	2P+2C	L	V
BIE-HAS	Human Factors in Cryptography and Security Ivana Trummová Ivana Trummová (Gar.)	Z,ZK	5	2P+1C	Z	V
BIE-CSI	Introduction to Computer Science Christoph Kirsch Christoph Kirsch (Gar.)	Z	2	2C	Z	V
BIE-EHD	Introduction to European Economic History Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	3	2P+1C	L	V
BIE-IMA2	Introduction to Mathematics 2 Karel Klouda	Z	2	1C	Z	V
BIE-ST1	Network Technology 1 Alexandru Moucha Alexandru Moucha (Gar.)	Z	3	2C	Z	V

BIE-PKM	Preparatory Mathematics Jitka Rybní ková Tomáš Kalvoda (Gar.)	Z	4		Z	V
BIE-PJV	Programming in Java Jan Blizni enko Jan Blizni enko (Gar.)	Z,ZK	4	2P+2C	Z	V
BIE-PS2	Programming in shell 2 Lukáš Ba inka	Z,ZK	4	2P+2C	L	V
BIE-PRR.21	Project management David Pešek David Pešek David Pešek (Gar.)	Z,ZK	5	2P+2C	Z,L	V
BIE-SKJ.21	Scripting Languages Lukáš Ba inka, Jan Ž árek Lukáš Ba inka Jan Ž árek (Gar.)	Z,ZK	4	2P+2C	L	V
BIE-VAK.21	Selected Combinatorics Applications  Dušan Knop, Michal Opler Michal Opler Michal Opler (Gar.)	Z	3	2R	L	V
BIE-VMM	Selected Mathematical Methods Marzieh Forough Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
BI-SCE1	Computer Engineering Seminar I Hana Kubátová <b>Hana Kubátová</b> Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
BIE-SEG	Systems Engineering Christoph Kirsch Christoph Kirsch (Gar.)	Z	0	2C	Z	V
TVV	Physical education	Z	0	0+2	Z,L	V
TVV0	Physical education	Z	0	0+2	Z,L	V
TVKLV	Physical Education Course	Z	0	7dní	L	V
BIE-TUR.21	User Interface Design Jan Schmidt Jan Schmidt Jan Schmidt (Gar.)	Z,ZK	5	2P+2C	L	V
BIE-VR1.21	Virtual reality I Petr Klán Petr Klán Petr Klán (Gar.)	KZ	4	2P+2C	L,Z	V
BIE-ADW.1	Windows Administration Ji í Kašpar, Miroslav Prágl Miroslav Prágl (Gar.)	Z,ZK	4	2P+1C	Z	V
BIE-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+2C	Z	V

## Characteristics of the courses of this group of Study Plan: Code=BIE-V.2021 Name=Purely Elective Bachelor Courses, Version 2021 till 2024/25

BIE-DIF Differential equations Z,ZK 5

This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to

partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.

**BIE-CSI** 

Introduction to Computer Science

This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before.

BIE-IMA2 Introduction to Mathematics 2 Z 2

Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.

BI-SCE1 Computer Engineering Seminar I Z 4

The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.

BIE-SEG Systems Engineering Z 0

This is an introductory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of operating systems for students to understand processor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking the class, students are able to understand the difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what concurrency is, as opposed to parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication.

 TVV
 Physical education
 Z
 0

 TVV0
 Physical education
 Z
 0

 TVKLV
 Physical Education Course
 Z
 0

 BIE-ZRS
 Basics of Systems Control
 Z,ZK
 4

Optional subject Basics of System Control is designed for anyone interested in applied computer science in bachelor studies. A brief introduction to the field of automatic control will be definitely evaluated by our graduates in the industrial practice. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems. We will teach you description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD and fuzzy controllers. This is a survey course in which students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. The themes of lectures are accompanied by a number of useful examples and practical industrial implementations.

BIE-CCN Compiler Construction Z,ZK 5

This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.

BIE-SCE1	Computer Engineering Seminar I	Z	4
·	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance		
• •	ally within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of t sional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teac	•	
semester.	sional literature and/or work in K. In laboratories. The capacity of the subject is limited by the possibilities of the seminal lead	iners. The topics	are new ior each
BIE-SCE2	Computer Engineering Seminar II	7	4
	er Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance	_	•
· · · · · · · · · · · · · · · · · · ·	ally within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other profes	sional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teac	chers. The topics	are new for each
semester.			
BIE-CZ0	Czech Language for Foreigners	KZ	2
	ners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.		
BIE-CZ1.21	Czech Language for Foreigners II	KZ	2
	or Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. T		r expands the
	arifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Rep		
UKCJP	Czech language for advanced rise for Ukrainian students with refugee status. The exam will confirm knowledge of Czech at B2 level with validity for CTU.	Z,ZK	2
		Z	1
BIE-EPR	Economic project   ion of the course Introduction to European Economic History (BIE-EHD). There is no fixed schedule for BIE-EPR. A teacher was a contract of the course Introduction to European Economic History (BIE-EHD).		•
the semester.	ion of the course introduction to European Economic ristory (BIE ETD). There is no fixed screed to BIE ETX. A teacher to	wiii contact you b	ciore tric start of
BIE-FTR.1	Financial Markets	Z,ZK	5
	en deeply transformed in the recent years, which led to a development of structured financial products, a new point of view or		_
	ctivities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activ		
from technical schools v	ho have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of f	financial markets.	The Financial
Markets course thus en	plobes both a description of financial markets and related economic theories, and an overview of mathematical and statistical	I tools used in thi	s field.
BIE-HAS	Human Factors in Cryptography and Security	Z,ZK	5
	its interested not only in technical scope of computer science, but also in making products usable - for users and for develop	ers. Students of t	nis course can
	dge to design, plan and analyse their own projects in the context of human-centered security.		
BIE-EHD	Introduction to European Economic History	Z,ZK	3
	selection of themes from the European economic history. It gives the student basic knowledge about forming of the global e		=
	ory. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economi o fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial insti		-
-	economic history of particular European countries but rather the impact of trade and role of particular events, institutions and		
	a mixture of lecture and discussion.	J	•
BIE-ST1	Network Technology 1	Z	3
The course is focused of	n essentials of computer networks and practice with network technologies. The course corresponds to the Cisco Netacad cui	rriculum, CCNA1	- R&S
Introduction to Networks			
BIE-PKM	Preparatory Mathematics	Z	4
The purpose of Prepara	tory Mathematics is to help students revise the most important topics of high-school mathematics.		
BIE-PJV	Programming in Java	Z,ZK	4
	g in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java		ndamental APIs
will also be presented, e		a language the fu	
DIE DOG	specially data structures, files, GUI, networking, databases and concurrent APIs.		
BIE-PS2	Programming in shell 2	Z,ZK	4
Students get a general	Programming in shell 2 programming languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In additional control of the control	Z,ZK ddition, they gain	4 a deeper insight
Students get a general of into Bourne Again shell	Programming in shell 2 programming in shell 2 programming style, data structures, pros and cons. In additional some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus	Z,ZK ddition, they gain s students: We are	4 a deeper insight e ready do adapt
Students get a general dinto Bourne Again shell the lectures to provide e	Programming in shell 2 programming languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In additional control of the control	Z,ZK ddition, they gain s students: We are In, mkdir, rm) ar	4 a deeper insight e ready do adapt nd useful basic
Students get a general dinto Bourne Again shell the lectures to provide e	Programming in shell 2  overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ad and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, Ir, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a se	Z,ZK ddition, they gain s students: We are In, mkdir, rm) ar	4 a deeper insight e ready do adapt nd useful basic
Students get a general of into Bourne Again shell the lectures to provide edata filtering tools (cut, to	Programming in shell 2 preview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ad and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, Ir, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a settice.	Z,ZK ddition, they gain s students: We are In, mkdir, rm) ar	4 a deeper insight e ready do adapt nd useful basic
Students get a general of into Bourne Again shell is the lectures to provide edata filtering tools (cut, 1 techniques used in practice BIE-PRR.21	Programming in shell 2  overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ad and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, Ir, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a se	Z,ZK ddition, they gain s students: We are In, mkdir, rm) a election of advance Z,ZK	4 a deeper insight e ready do adapt nd useful basic ed scripting
Students get a general of into Bourne Again shell is the lectures to provide edata filtering tools (cut, techniques used in practice bile-PRR.21  The aim of the course is	Programming in shell 2 preview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In ad and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, I r, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a serice.  Project management	Z,ZK ddition, they gain s students: We are In, mkdir, rm) are election of advance  Z,ZK allysis, crisis man	4 a deeper insight e ready do adapt nd useful basic ed scripting  5 agement in a
Students get a general of into Bourne Again shell into Bourne Again shell into Bourne Again shell into Bourne Again shell into Burne stephing the lectures to provide educate filtering tools (cut, to techniques used in prace BIE-PRR.21  The aim of the course is project, communication, Gantt charts, resource stephing shell into Burne shell into B	Programming in shell 2  overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In additional some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, I r, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a serice.  Project management to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, and argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk and chedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for states.	Z,ZK ddition, they gain s students: We are ln, mkdir, rm) are election of advance  Z,ZK alysis, crisis man assessment and students who are	4 a deeper insight e ready do adapt nd useful basic ed scripting  5 agement in a management, interested in
Students get a general of into Bourne Again shell into BIE-PRR.21  The aim of the course is project, communication, Gantt charts, resource is deepening their knowled.	Programming in shell 2 preview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In additional some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus ven very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, I r, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a serice.  Project management to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, an argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk a chedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for sige outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in lateral contents.	Z,ZK ddition, they gain s students: We are ln, mkdir, rm) are election of advance  Z,ZK alysis, crisis man assessment and students who are	4 a deeper insight e ready do adapt nd useful basic ed scripting  5 agement in a management, interested in
Students get a general into Bourne Again shell into Bourne Again shell ithe lectures to provide edata filtering tools (cut, techniques used in prace BIE-PRR.21  The aim of the course is project, communication, Gantt charts, resource sepening their knowled also suitable for all those	Programming in shell 2 preview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In additional some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, I r, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a serice.  Project management to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, an argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk a chedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for sign outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in lage who will develop software or hardware in the form of team projects.	Z,ZK ddition, they gain s students: We are In, mkdir, rm) are election of advance  Z,ZK alysis, crisis man assessment and students who are arge companies.	4 a deeper insight e ready do adapt nd useful basic ed scripting  5 agement in a management, interested in The course is
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BIE-TUR.21 User Interface Design Students gain a basic overview of methods for designing and testing common user interfaces. They get experience to solve the problems where software and other products do not

communicate with the user optimally, since the needs and characteristics of users are not taken into account during product development. Students gain an overview of methods that bring users into the development process to ensure optimal interface for them.

Virtual reality I

Introduction to Virtual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The course focuses on the ways of creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social activities.

BIE-ADW.1 Windows Administration Z,ZK

Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network.

**BIE-SEP** World Economy and Business Z,ZK

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.

Code of the group: NIE-V.21

Name of the group: Purely elective master's courses

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

Credits in the group: 0 Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
NIE-BLO	Blockchain Josef Gattermayer, Marek Bielik, Jakub R ži ka, Róbert Lórencz <b>Josef</b> Gattermayer Róbert Lórencz (Gar.)	Z,ZK	5	1P+2C	Z	V
NIE-CPX	Complexity Theory Dušan Knop, Ond ej Suchý Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	3P+1C	Z	V
NIE-VYC	Computability Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
NIE-MVI	Computational Intelligence Methods Pavel Kordík, Miroslav epek Pavel Kordík Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	Z	V
NIE-ARI	Computer arithmetic Pavel Kubalík Pavel Kubalík Pavel Kubalík (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NIE-SCE1	Computer Engineering Seminar Master I Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	Z	V
NIE-SCE2	Computer Engineering Seminar Master II Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L	V
NI-DSW	Design Sprint Ond ej Brém, Michal Manda Michal Manda David Pešek (Gar.)	Z	2	30B	Z	V
NI-DID	Digital drawing  Denisa Nová ková, Eliška Novotná Denisa Nová ková Denisa Nová ková (Gar.)	Z	2	4C	Z,L	V
NIE-EVY	Efficient Text Pattern Matching  Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-GLR	Games and reinforcement learning	Z,ZK	4	2P+2C	L	V
NI-GRI	Grid Computing André Sopczak, Petr Fiedler André Sopczak (Gar.)	Z,ZK	5	2P+1C	Z	V
NIE-HMI	History of Mathematics and Informatics  Alena Šolcová Alena Šolcová (Gar.)	Z,ZK	3	2P+1C	Z	V
NIE-DVG	Introduction to Discrete and Computational Geometry Maria Saumell Mendiola Maria Saumell Mendiola (Gar.)	Z,ZK	5	2P+1C	L	V
NIE-AM2	Middleware Architectures 2 Milan Doj inovski Milan Doj inovski (Gar.)	Z,ZK	5	2P+1C	L	V
NIE-PAM	Parameterized Algorithms Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	4	2P+1C	L	V
NIE-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
NIE-ROZ	Pattern Recognition Michal Haindl Michal Haindl (Gar.)	Z,ZK	5	2P+1C	Z	V
NIE-PML	Personalized Machine Learning Rodrigo Augusto Da Silva Alves Karel Klouda Rodrigo Augusto Da Silva Alves (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AML	Advanced machine learning Zden k Buk, Miroslav epek, Rodrigo Augusto Da Silva Alves, Petr Šimánek, Vojt ch Rybá <b>Miroslav epek</b> Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	V

NIE-PDL	Practical Deep Learning Martin Barus, Yauhen Babakhin Karel Klouda Karel Klouda (Gar.)	KZ	5	2P+1C	Z	V
NIE-VPR	Research Project Št pán Starosta Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
NIE-SWE	Semantic Web and Knowledge Graphs Milan Doj inovski Milan Doj inovski (Gar.)	Z,ZK	5	2P+1C	Z	V
NIE-HSC	Side-Channel Analysis in Hardware Vojt ch Miškovský, Petr Socha Vojt ch Miškovský Vojt ch Miškovský (Gar.)	Z,ZK	4	2P+2C	Z	٧
NIE-DDW	Web Data Mining Milan Doj inovski Milan Doj inovski (Gar.)	Z,ZK	5	2P+1C	L	V
NIE-BPS	Wireless Computer Networks Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	4	2P+1C	Ĺ	V
NIE-SEP	World Economy and Business Tomáš Evan	Z,ZK	4	2P+1C	Z	V

NIE-BLO Slockchain Suddents will understand the foundations of blockchain technology, arrunt contract programming, and gain an overview of most notable blockchain platform. They will be able to design code and deploy a secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course places an increased emphasis on the relationship between blockchains and information security it is concluded with a defense of a research or applied semester project, which prepares the suitables for implementing or supervising implementation of blockchain-based solutions in both academia and business.  NIE-CPX Completally Theory Suddents will acan about the fundamental classes of problems in the complexity theory and different models of algorithms and about implications of the theory concerning practical (intrinstance) and the fundamental classes of problems in the complexity theory and different models of algorithms and about implications of the theory computers in the complexity theory and different models of algorithms and about implications of the theory computers in the complexity theory and different models of algorithms and about implications of the theory computers in the complexity theory and different models of algorithms and about implications of the theory computers in the computers of the computer of the computers of the property of the computer of the computers of the property of the computer	Characteristic	s of the courses of this group of Study Plan: Code=NIE-V.21 Name=Purely elective master's	000.000	
code and deploy a secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course places an increased emphasis on the relationship between blockchains and information security is concluded with a defense of a research or applied semester project, which prepares the students for implementing or supervising implementation of blockchain-based solutions in both academia and business.  NIE-CPX  Complexity Theory  Students will learn about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the theory concerning practical intrinsactibility of difficult problems.  NIE-VYC  Computability  Computational intelligence Methods  NIE-WIV   Computational intelligence Methods  Students will understand the basic methods and techniques of computational intelligence, which are based on traditional antificial intelligence, are panillel in nature and are applicable to a lowing a wide a manager of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these real-to-exist and tow to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc.  NIE-SCET  Computer Engineering is a (e)elective course for students who want to deal with deeper topics of digital design, reliability and resistant to the subject is also device to or group of students who want to deal with deeper topics of digital design, reliability and resistant to the subject is limited by the possibilities of the seminar teachers. The topics are new for exemental distribute 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 exemental to a subject is subject is subject is with scientific and exemption of propries and other professional literature and/or work in K. N. laboratories. The capaci	NIE-BLO	Blockchain	Z,ZK	5
relationship between blookshins and information security. It is concluded with a defense of a research or applied semester project, which prepares the students for implementing or supervising implementation of blookshim-based solutions in both academia and business.  NIE-CPX   Complexity Theory    Students will learn about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the theory concerning practical (in)tractability of difficult problems.  NIE-WYC   Computational Intelligence Methods    Sudents will learn be considered with the students of the complexity of recursive functions and effective computability.  INE-WIVI   Computational Intelligence Methods    Sudents will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these method work and how to apply them to problems related to date extraction, management, intelligence in agents and opinions action.  NIE-SCE1   Computer Engineering is a (legislate devices and will be able to design arithmetic operations implementation units.  NIE-SCE1   Computer Engineering as (application cause for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student 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 fore semesters.  NIE-SCE2   Computer Engineering is a (spelective course for students who want to deal with deeper topics of digital design,	Students will under	stand the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain p	platforms. They will be	able to design
supervising implementation of blockchain-based solutions in both academia and business.  NIE-CPX Complexity Theory Students will learn about the Indiamental classes of problems in the complexity theory and different models of algoritms and about implications of the theory concerning practical (instructional problems.)  NIE-WYC Computability Computational Intelligence Methods Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolutions. Students will bean how to apply them to problems related to data extraction, management, intelligence, which are based on traditional artificial intelligence. Students will be an about the problems of the problems related to data extraction, management, intelligence in games and optimisation, etc.  INE-ARI Computer Engineering is a (selective course for students will be able to design arithmetic operations implementation units.  NIE-SCEI Computer Engineering is a (selective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and stractions 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 liboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for exterements.  INE-SCEI Computer Engineering is a (selective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student are approached individually with the subject is students. Will not subject is limited by the possibilities of the seminar teachers. The topics are new for extereme	code and deploy a	secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course place	aces an increased en	nphasis on the
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Students will learn about the fundamental classes of problems in the complexity theory and different models of algorithms and about implications of the theory concerning practical (intributability of difficult problems.)  NIE-VYC Computability  NIE-WY Computability  Computability  Computational Intelligence Methods  Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a value range of problems. The subject is also devoted to modern neutral networks and the ways in which they learn and neuroevolution. Students will kean how these methods work and how to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc.  NIE-SCE1  Computer Engineering Seminar Master I  The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and restance to failures and attacks. Student are approached individually within the subject cash students or group of students solvens 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 excementar of Computer Engineering is a (s)elective course for 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 excementar approached individually within the subject is active that 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 teach	supervising implen	nentation of blockchain-based solutions in both academia and business.		
Instructionally of difficult problems.   NE-VC   Computability   Classical theory of recursive functions and effective computability   Classical theory of recursive functions and effective computability   Computational Intelligence Methods   Students will understand the basis methods and retentiouse of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these method work and how to apply them to problems related to date extraction, management, intelligence in games and optimisation, etc.   NE-ARI   Computer arithmetic extraction, management, intelligence in games and optimisation.   Z,ZK   4   Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.   NIE-SCE1   Computer Engineering is a (selective course for students with warm of Computer Engineering is a (selective course for students with warm of Computer Engineering is a (selective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student 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 excessmester.  NIE-SCE2   Computer Engineering is a (se)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student are approached individually within the subject: Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject	NIE-CPX	Complexity Theory	Z,ZK	5
NIE-XVC Classical theory of recursive functions and effective computability.  IVE-MVI Computational Intelligence Methods Students will undeststand the basic methods and reflective computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to soking a wide range of problems. The subject is also deviced to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these methods to soking a wide range of problems. The subject is also deviced to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these methods work and how to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc.  NIE-SRI Computer Tribmetic Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.  NIE-SCEI Computer Engineering Seminar Master I The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student 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 and other professional ilterature and/or work in K. I Naboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for excenents are approached individually within the subject. Each students or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional ilterature and/or work in K. I laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for excenents and other professional ilterature and/or work in K. In laboratories. The capacity of the sub	Students will learn	about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications o	of the theory concerni	ng practical
Classical theory of recursive functions and effective computability.  NIE-MVI Computational Intelligence Methods Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and necuroevolution. Students will learn how these method work and how to apply them to problems related to date extraction, management, intelligence in games and optimisation, etc.  NIE-ARI Computer arithmetic Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.  NIE-SCE1 Computer Engineering Seminar Master I The Seminar of Computer Engineering is a (splectore ourse for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Student 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 scientifications 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 exist semester.  NIE-SCE2 Computer Engineering is a (splectore ourse for students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific 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 expressional 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 expressional literature and/or work in K. N. laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The to	(in)tractability of dif	ficult problems.		
NIE-MVI Computational Intelligence Methods Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is allowed covered to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these method work and how to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc.  NIE-ARI Computer arithmetic    Z	NIE-VYC	Computability	Z,ZK	4
Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicate solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these method work and how to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc.  NIE-ARI Computer arithmetic Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units.  NIE-SCE1 Computer Engineering Seminar Master I The Seminar of Computer Engineering is e)lelective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and addicts. Studen 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 extension of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Studen 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 aridles 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 seminate.  NI-DSW Design Sprint  Students will work on projects using the Design Sprint method, developed by Google. Thanks to this method the teams are able to go from idea to validated prototype in 5 days. Durit the	Classical theory of	recursive functions and effective computability.	1 , 1	
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	articles and other presenter.  NI-DSW Students will work he course the studesting the prototypy NI-DID  The course will intrhey will practically practice or learn drawies. WIE-EVY Students get knowled from the studen	Design Sprint on projects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to clents will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting les (plus final presentation).  Digital drawing oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The cawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice  Efficient Text Pattern Matching edge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both to use the knowledge in design of applications that utilize pattern matching.  Games and reinforcement learning ement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial integetical and practical background so you can participate in related research activities. Presented in English.  Grid Computing digain knowledge about the world-wide network and computing infrastructure.  History of Mathematics and Informatics so ne selected topics from calculus, general algebra, number theory, numerical mathematics and logic - useful for today compute ations between computer science and mathematical methods. Some examples of applications of mathematics to computer science introduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familia do to be able to solve simple algorithmic problems with a geometric component.  Middleware Architectures 2 new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application archin	of the subject is work eachers. The topics a Z validated prototype ir g with research and file Z, perspective and colorourse is fit for anyone gained knowledge.  Z,ZK access time and mem  Z,ZK elligence. This course  Z,ZK er science The topics iences will be showed Z,ZK ar with the most fundation.	with scientific re new for each re new for theory, which who wants to some selected to the selected lates are selected to the selected lates re new for each r

NIE-PAM Parameterized Algorithms There are many optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessary to solve these problems exactly in practice. We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one can find a common property (parameter) of the inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponentially in this (small) parameter and polynomially in the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time preprocessing of the input, which is not possible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution method. We will present a plethora of parameterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (presumably) does not exist. We will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation schemes. NIE-SYP Parsing and Compilers Z.ZK 5 The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing. NIE-ROZ Pattern Recognition The aim of the module is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the statistical approach to pattern recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects. NIE-PML Personalized Machine Learning 5 Personalized machine learning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteristics and behaviors of individual entities. While PML is commonly used in applications such as recommender systems, which recommend items to users based on their personal interests, its principles can be applied to a wide range of other fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from theoretical, algorithmic, and practical perspectives. Specifically, we will focus on cutting-edge models that are of interest to both the research and commercial communities. Advanced machine learning NI-AML 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. NIE-PDL Practical Deep Learning This course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine learning framework. Throughout the course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such as computer vision and natural language processing. NIE-VPR Research Project 1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the IS based on the confirmation of the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester. Semantic Web and Knowledge Graphs The students will learn the most recent concepts and technologies of the Semantic Web. The course will provide an overview of the Semantic Web technologies, methods and best practices for modelling, integration, publishing, querying and consumption of semantic data. The students will also gain skills in creation of knowledge graphs and their systematic quality assurance. NIE-HSC Side-Channel Analysis in Hardware 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. **NIE-DDW** 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, 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. **NIE-BPS** Wireless Computer Networks Z,ZK Students will learn about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad-hoc networks, multicast and broadcast mechanisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowledge of security mechanisms for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools. NIE-SEP World Economy and Business Z,ZK 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.

Code of the group: NI-V.2021

Name of the group: Purely Elective Master Courses

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)	Completion	Credits	Scope	Semester	Role
	Tutors, authors and guarantors (gar.)  Completing a professional event	_				
NI-AOA	Zden k Muziká	Z	1			V
NI-ATH	AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	4	2P+2C	L	V
NI-AFP	Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.)	KZ	5	2P+1C	L	٧
NI-APH	Architecture of computer games  Adam Vesecký Adam Vesecký Adam Vesecký (Gar.)	Z,ZK	4	2P+1C	Z	٧
ANI-VGA	Video Games Architecture  Jan Matoušek	Z,ZK	5	2P+1C	Z	V
NI-BPS	Wireless Computer Networks Ji í Kašpar, Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	4	2P+1C	L	V
NIE-BLO	Blockchain Josef Gattermayer, Marek Bielik, Jakub R ži ka, Róbert Lórencz Josef Gattermayer Róbert Lórencz (Gar.)	Z,ZK	5	1P+2C	Z	V
NI-CTF	Capture The Flag Ivana Trummová, Ji í Dostál, Martin Šutovský, Ladislav Marko, František Ková Ji í Dostál Ji í Dostál (Gar.)	KZ	4	3C	Z	V
NI-DPH	Game Design Adam Vesecký	Z,ZK	5	2P+1C	L	٧
NI-DSW	Design Sprint Ond ej Brém, Michal Manda Michal Manda David Pešek (Gar.)	Z	2	30B	Z	V
NI-PSD	Public Services Design Ond ej Brém, David Pešek David Pešek Ond ej Brém (Gar.)	KZ	4	1P+2C		V
NI-DID	Digital drawing Denisa Nová ková, Eliška Novotná Denisa Nová ková Denisa Nová ková (Gar.)	Z	2	4C	Z,L	V
NI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
NI-DDM	Distributed Data Mining	KZ	4	3C	L	V
NI-PAM	Efficient Preprocessing and Parameterized Algorithms Ond ej Suchý Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	4	2P+1C	L	٧
NI-ESC	Experimental Project Course Ond ej Brém, Jan Matoušek Ond ej Brém Ond ej Brém (Gar.)	KZ	8	0P+30R+52C	L	V
NI-GLR	Games and reinforcement learning	Z,ZK	4	2P+2C	L	V
NI-GNN	Graph Neural Networks Miroslav epek Miroslav epek (Gar.)	Z,ZK	4	1P+1C	L	٧
NI-GRI	Grid Computing André Sopczak, Petr Fiedler André Sopczak (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-HCM	Mind Hacking Marcel Ji ina, Josef Holý Marcel Ji ina Marcel Ji ina (Gar.)	ZK	5	2P+1C	Z	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	٧
NI-HMI2	History of Mathematics and Informatics  Alena Šolcová Alena Šolcová (Gar.)	ZK	3	2P+1C	Z	V
NI-IBE	Information Security	ZK	2	2P	Z	V
NI-IVS	Intelligent embedded systems Miroslav Skrbek Miroslav Skrbek (Gar.)	KZ	4	1P+3C	L	٧
NI-IKM	Internet and Classification Methods  Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	4	1P+1C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
NI-IOT	Internet of Things	Z,ZK	4	2P+1C	L	V
NI-KTH	Combinatorial Theories of Games Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	4	2P+1C	L	V
NI-FMT	Finite model theory Tomáš Jakl Tomáš Jakl (Gar.)	Z,ZK	4	2P+1C	L	V
NI-CCC	Creative Coding and Computational Art Radek Richtr, Josef Kortán Radek Richtr (Gar.)	KZ	4	1P+2C	Z,L	٧
NI-KYB	Cybernality	ZK	5	2P	Z	V
NI-LSM2	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	Z,L	V
NI-LOM	Linear Optimization and Methods  Dušan Knop Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPL	Managerial Psychology Jan Fiala Jan Fiala (Gar.)	ZK	2	2P	Z,L	V
NI-MSI	Mathematical Structures in Computer Science  Jan Starý	Z,ZK	4	2P+1C	L	V
NI-MZI	Mathematics for data science Št pán Starosta	Z,ZK	4	2P+1C	L	V

NI-MOP	Modern Object-Oriented Programming in Pharo Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
NI-NLM	Neural Language Models	Z	5	2P+1C	L	V
NI-NMU	New media in art and design Zden k Svejkovský Zden k Svejkovský (Gar.)	ZK	3	2P+0C	Z	V
NI-OLI	Linux Drivers Miroslav Skrbek, Jaroslav Borecký Jaroslav Borecký Miroslav Skrbek (Gar.)	Z,ZK	4	2P+2C	L	V
NIE-PML	Personalized Machine Learning Rodrigo Augusto Da Silva Alves Karel Klouda Rodrigo Augusto Da Silva Alves (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ARI	Computer arithmetic Pavel Kubalík Pavel Kubalík Alois Pluhá ek (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	V
NI-EDW	Enterprise Data Warehouse Systems  Jakub Krej í, Robert Kotlá Jakub Krej í Magda Friedjungová (Gar.)	Z,ZK	5	1P+1C	L	V
NI-PVR	Advanced Virtual Reality Petr Pauš Petr Pauš Petr Pauš (Gar.)	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning  Zden k Buk, Miroslav epek, Rodrigo Augusto Da Silva Alves, Petr Šimánek,  Vojt ch Rybá <b>Miroslav epek</b> Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	V
NI-IOS	Advanced techniques in iOS applications Rostislav Babá ek, Igor Rosocha, Jakub Olejník Martin P Ipitel Martin P Ipitel (Gar.)	KZ	4	2P+2C	L	V
NI-APT	Advanced Program Testing Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PVS	Advanced embedded systems Miroslav Skrbek	Z,ZK	4	2P+2C	Z	V
NI-DNP	Advanced .NET Nikolas Jiša, David Šenký David Šenký Nikolas Jiša (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-PYT	Advanced Python Miroslay Hron ok	KZ	4	3C	Z	V
NIE-PDL	Practical Deep Learning  Martin Barus, Yauhen Babakhin Karel Klouda Karel Klouda (Gar.)	KZ	5	2P+1C	Z	V
NI-GOL	Programming of distributed systems in GO	KZ	5	0P+3C	Z	V
NI-PSL	Programming in Scala Ji í Dan ek Ji í Dan ek (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-RUB	Programming in Ruby Cyril erný Cyril erný (Gar.)	KZ	4	3C	Z	V
NI-ROZ	Pattern Recognition Michal Haindl, Radek Richtr Michal Haindl Michal Haindl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PLS1	Programming Language Seminar Pierre Donat-Bouillud	Z	2	0P+1C	Z	V
NI-PLS2	Programming Language Seminar Pierre Donat-Bouillud	Z	2	0P+1C	L	V
NI-PLS3	Programming Language Seminar Pierre Donat-Bouillud	Z	2	0P+1C	Z	V
NI-PLS4	Programming Language Seminar Pierre Donat-Bouillud, Filip K ikava Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z	2	0P+1C	L	V
NI-SCE1	Computer Engineering Seminar Master I Hana Kubátová Miroslav Skrbek Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SCE2	Computer Engineering Seminar Master II  Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SZ1	Knowledge Engineering Seminar Master I Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
NI-SZ2	Knowledge Engineering Seminar Master II Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V
NI-MLP	Machine Learning in Practice  Jan Hu in Daniel Vašata Daniel Vašata (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NI-TVR	Virtual Reality Technology Tomáš Nová ek Tomáš Nová ek (Gar.)	Z,ZK	3	1P+1C	L,Z	V
NI-TS1	Theoretical Seminar Master I  Dušan Knop, Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
NI-TS2	Theoretical Seminar Master II Tomáš Valla, Ond ej Suchý Tomáš Valla (Gar.)	Z	4	2C	L	V
NI-TS3	Theoretical Seminar Master III Tomáš Valla, Ond ej Suchý Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
NI-TS4	Theoretical Seminar Master IV	Z	4	2C		V

NI-TKA	Category Theory Jan Starý Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+1C	L	V
NI-TNN	Theory of Neural Networks Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	5	2P+1C	L	V
NI-CPX	Complexity Theory Dušan Knop, Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	5	3P+1C	Z	V
FI-TOP	Academic writing Tomáš Nová ek	Z	2	10B	Z	V
NI-DVG	Introduction to Discrete and Computational Geometry Maria Saumell Mendiola Maria Saumell Mendiola (Gar.)	Z,ZK	5	2P+1C	L	V
NI-VOL	Elections Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	L	V
NI-VYC	Computability Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
NI-VPR	Research Project Št pán Starosta Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
NI-ZS10	Master internship abroad for 10 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	10		Z,L	V
NI-ZS20	Master internship abroad for 20 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	20		Z,L	V
NI-ZS30	Master internship abroad for 30 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	30		Z,L	V

Characteristics of the courses of this group of Study Plan: Code=NI-V.2021 Name=Purely Elective Master Courses Applied Functional Programming This course is presented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice. NI-PSD Public Services Design The course will introduce students to specifics of UX, Service design and development for public sector. We will look into the design and development process from the perspective of suppliers (devs and designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration with client representatives. Course is aimed at students-designers as well as clients. NI-DZO Digital Image Processing This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting. Distributed Data Mining NI-DDM Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language. 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. NI-MPL Managerial Psychology ZK 2 NI-MSI Mathematical Structures in Computer Science Z,ZK 4 Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. Modern Object-Oriented Programming in Pharo NI-MOP ΚZ 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. Linux Drivers The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining powerful processors and FPGAs increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development for master's students. The course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience Programming in Scala The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g.pattern matching and advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and libraries e.g. Play, Cassandra, Scalaz, etc. FI-TOP Academic writing Publishing is an important and required part of research activity. It is not only about obtaining research results but also about applying them in the form of publication. Writing scientific publications can be useful for students not only in their own publishing activities but also in the preparation of a bachelor's or master's thesis. In the course, students will learn how to

write a scientific article, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an article and reviewing someone else's article. The course will be taught in blocks, with one lecture at the beginning of the semester and one practicum in the middle of the semester. Dates will be determined based

on the availability of enrolled students.

NI-VYC Classical theory of recu	Computability     Irsive functions and effective computability.	Z,ZK	4
NIE-BLO	Blockchain	Z,ZK	5
	d the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain plat	•	• •
	ıre decentralized application, and assess whether integration of a blockchain is suitable for a given problem.The course place ockchains and information security. It is concluded with a defense of a research or applied semester project, which prepares t		•
•	ockchains and miormation security. It is concluded with a defense of a research of applied semester project, which prepares t ation of blockchain-based solutions in both academia and business.	rie students for im	pierrieriting or
NI-DSW	Design Sprint	Z	2
	rojects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to val	idated prototype in	_
	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting w	ith research and fi	nishing with
testing the prototypes (	·		
NI-DID	Digital drawing	Z	2
	ce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, ρε ly in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The cour	•	-
	g and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gai	=	wile wants to
NI-GLR	Games and reinforcement learning	Z,ZK	4
	ent learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intellig	ence. This course	is intended to
<u> </u>	al and practical background so you can participate in related research activities. Presented in English.		
NI-GRI	Grid Computing	Z,ZK	5
	n knowledge about the world-wide network and computing infrastructure.	7.71	
NIE-PML	Personalized Machine Learning   earning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characterist	Z,ZK	5 of individual
	ommonly used in applications such as recommender systems, which recommend items to users based on their personal inter		
	fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from the		
perspectives. Specifical	ly, we will focus on cutting-edge models that are of interest to both the research and commercial communities.		
NI-AML	Advanced machine learning	Z,ZK	5
	students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of		
	interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is to familiarize students with the research of the exercise is the exercise of the exercis		
NIE-PDL	Practical Deep Learning to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine I	KZ	5
<del>-</del>	Il develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields suc	=	-
language processing.	,		
NI-AOA	Completing a professional event	Z	1
	tion in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drawn in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drawn in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drawn in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drawn in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop at test, drawn in a one-off professional event, and the concluded with a workshop of the fit of the f		
	lvance by the vice-dean for pedagogical activities or the vice-dean for science and research and is presented within the FIT the		
NI-ATH	AlgorithmicTheories of Games   is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory stu	Z,ZK	4
- · · · · · · · · · · · · · · · · · · ·	ompetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game		-
	the game where no player wants to deviate from his strategy. Due to the recent development of computers, internet, social netw	-	•
multiagent systems and	dother concepts the algorithmic point of view is gaining attention. In addition to existential questions we study the problems of	efficient computat	tion of various
	is course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods of their c		
	Architecture of computer games	Z,ZK	4
<del>-</del>	ic understanding of the various issues in the field of computer games development, especially from a technical point of view, but a et a grasp of component-oriented and functional-oriented architecture, game mechanics, decision-making processes and base	_	-
	ey will also understand the basics of pathfinding, networking and scripting and apply them in practical exercises (labs). An imp	=	_
	pple game, with a strong focus on nontrivial game mechanics.	, , , , , , , , , , , , , , , , , , , ,	
ANI-VGA	Video Games Architecture	Z,ZK	5
	de range of topics, procedures and methodologies related to the development of computer games - from a technical point of		- 1
	ew. In the lectures, students will be guided through the history of development, the structure of game engines, component and		
	/sics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater deta , in the form of practical demonstrations.	ii, including ways c	or implementing
NI-BPS	Wireless Computer Networks	Z,ZK	4
_	ut the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in a	, ,	
	, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get know		
for wireless networks a	nd get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools.		
NI-CTF	Capture The Flag	KZ	4
	to introduce students to CTF competitions and let them gain practical experience in the field of cyber security.	7.71	
NI-DPH	Game Design	Z,ZK	5
· · · · · · · · · · · · · · · · · · ·	its the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on gam owledge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics	-	
•	students will get an overview of game development from the designer's perspective, from theoretical concepts to practical imp		
projects.			
NI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4
	ration problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessary	=	= -
	will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often c is from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity expo		
	s from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity expo input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial		
	the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution		
· ·	ed algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (p		•
will also not miss out th	e relations to other approaches to hard problems such as moderately exponential algorithms or approximation schemes.		

NI-ESC	Experimental Project Course	KZ	8
"The Design Project cou	urse offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles	s, methodologies,	and tools used
in designing technology	driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design	projects, collabora	ate with industry
-	egrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their ski	lls in user-centere	ed design and
	ion, as well as gain experience working in a team to design and prototype a functional solution."	7 714	
NI-GNN	Graph Neural Networks	Z,ZK	. 4
	students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural n		- 1
· ·	s, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last terpretability of graph neural networks. In the exercises, students will try out selected techniques and problems.	part of the course	e also covers
NI-HCM	Mind Hacking	ZK	5
	emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks,		-
-	security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive sec	-	
the context of informatio	n warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Interi	net environment h	ave real societal
impacts such as disrupt	ion of social cohesion, threats to democracy or war.		
NI-HSC	Side-Channel Analysis in Hardware	Z,ZK	4
	to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical atta	-	
	annels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks are	-	n higher-order
	ractice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel inform		
NI-HMI2	History of Mathematics and Informatics	ZK	3
•	d in Czech. Selected topics {Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithm	ns, transformation	is, recursive
·	etc.) note on possibilities of applications of some mathematical methods in informatics and its development.	ZK	2
NI-IBE Students learn informat	Information Security on and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internat		_
	management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., pen		tilis area. Triey
NI-IVS	Intelligent embedded systems	KZ	4
_	stems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The		
	ded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot prograi		
-	provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, studer	_	
combining knowledge o	f various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies		
NI-IKM	Internet and Classification Methods	Z,ZK	4
	nts get acquainted with classification methods used in four important internet, or generally network applications: in spam filte		
	stems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving		
_	lese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl		ures and 2-hour
	ercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult their		
NI-IOT	Internet of Things	Z,ZK	4
-	on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (GNU Forth).	imilianzation with	avaliable
NI-KTH	Combinatorial Theories of Games	Z,ZK	4
	Combinatorial medites of Games		
Traditional game theory	is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory sti		-
	is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory st mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game	udies the behavio	ur of agents
(players) of a certain co	is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory st mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game he game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl	udies the behavior	ur of agents the equilibria,
(players) of a certain co which are the states of t	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game	udies the behavior theory is to find the ayer full-information	ur of agents the equilibria, on combinatorial
(players) of a certain co which are the states of t games, was by Conway otherwise incompatible	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game of the game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-place. Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The the	udies the behavion the theory is to find the ayer full-information to evaluate gare arid most importan	ur of agents the equilibria, on combinatorial mes such that nt step is the
(players) of a certain co which are the states of t games, was by Conway otherwise incompatible work of Beck, who estal	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game the game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl. Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force	udies the behavion the theory is to find the ayer full-information is to evaluate gare arried most important the traversal of the g	ur of agents the equilibria, on combinatorial mes such that nt step is the name tree, which
(players) of a certain co which are the states of t games, was by Conway otherwise incompatible work of Beck, who estal is no efficient. Beck intro	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game he game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl. Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The the plished the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force oduced the "false probabilistic method", which aims to tackhle this problem. In this course we build the foundation of the theory	udies the behavion theory is to find ayer full-information is to evaluate gare hird most importate traversal of the ground of combinatoria	ur of agents the equilibria, on combinatorial mes such that nt step is the name tree, which and positional
(players) of a certain co which are the states of t games, was by Conway otherwise incompatible work of Beck, who estal is no efficient. Beck intro games. We focus on the	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game he game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl. Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The the blished the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force additional transportance of the study combinatorial games and building the theory, not on the programming aspects of game solving algorithms. The course	udies the behavion theory is to find ayer full-information is to evaluate gare ird most importate traversal of the gray of combinatoria requires independe	ur of agents the equilibria, on combinatorial mes such that nt step is the ame tree, which all and positional dent work, ability
(players) of a certain co which are the states of t games, was by Conway otherwise incompatible work of Beck, who estal is no efficient. Beck intro games. We focus on the to mathematically analy	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game he game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl. Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The tolished the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force additional transportant of the strategies of games and building the theory, not on the programming aspects of game solving algorithms. The course see, think and proof. The course is also suitable for bachelors student in the third year, who attended introduction to graph the	udies the behavion theory is to find ayer full-information is to evaluate gare ird most importate traversal of the gray of combinatoria requires independe	ur of agents the equilibria, on combinatorial mes such that nt step is the ame tree, which all and positional dent work, ability
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	Neural Language Models	Z	5
	vill learn the technical foundations of the Transformer architecture as well as the practical aspects of using language models.	1	-
,	guage models to solve problems, make informed risk assessments, and work critically with the scientific literature.		
	New media in art and design	ZK	3
l l	rivew media in art and design tudents to the issue of using new media in artistic and design work. Key topics are moving image, internet, computer game a	1 1	
			-
	ith the largest possible range of creative approaches in new media. The subject emphasizes dialogue with students, especia	ally in lectures devi	oted to specific
art projects.			
	Computer arithmetic	Z,ZK	4
Students will learn variou	us data representations used in digital devices and will be able to design arithmetic operations implementation units.		
NI-PG1	Computer Grafics 1	ZK	4
The course builds on gra	phic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge	e. The course is de	signed for those
interested in advanced of	omputer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of t	the course is the st	tudy of scientific
articles and their subseq	uent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and	d topics of comput	ter graphics.
NI-EDW	Enterprise Data Warehouse Systems	Z,ZK	5
	rehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods		-
•	rehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to		- 1
visualization.		o 11.0 11.01 01.10po.	ing and data
	Advanced Virtual Deality	V7	
ı	Advanced Virtual Reality	KZ	4
	dvanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mo		·
=	ents to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will a		
- ·	mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the	e knowledge gaine	ed in this subject
	ly create a complex game for VR.		
NI-IOS	Advanced techniques in iOS applications	KZ	4
Students will learn the la	test trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all th	ne basics from the	beginners class
BI-IOS.			
NI-APT	Advanced Program Testing	Z,ZK	5
	ential to ensure that a program respects its specification, that changes do not introduce regressions or security issues. The	1 ' 1	-
	g techniques, beyond writing unit tests, especially fuzzing and symbolic execution.	g	
	Advanced embedded systems	Z,ZK	4
			- 1
	n ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advar	•	
<del>-</del>	ge devices, motor control, system control and industrial communication. The students obtain both theoretical and also practi	icai experiences w	ith embedded
systems.			
	Advanced .NET	Z,ZK	4
	overview of platform .NET and will gain knowledge about technologies ASP.NET Core, Entity Framework Core, .NET MAUI		
get notions of Azure Dev	Ops and GIT. Students will get practical experience in semestral work where they will create a client-server application utiliz	zing technologies A	ASP.NET Core,
Entity Framework Core a	and (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.		
	ind (blazor, .ive r iviaor or vir r ) and also azure bevops and orr.		
NI-PYT		KZ	4
	Advanced Python		-
The goal of this course is	Advanced Python s to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Pyth	non (BI-PYT) left of	f. The course is
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NI-SZ1	Knowledge Engineering Seminar Master I	Z	4
	present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research		
• • •	n how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top ma well as FIT's own Summer Research Program (VyLet).	icnine learning and	Al conferences
	Knowledge Engineering Seminar Master II	Z	4
	present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research		•
	n how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top ma		
and summer schools, as	well as FIT's own Summer Research Program (VyLet).		
PI-SCN	Seminars on Digital Design	ZK	4
	problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description	-	- 1
	on algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial parties in Described.		
NI-MLP	Machine Learning in Practice  g methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to	Z,ZK	5
	ents through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practic	=	
<del>-</del>	rn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and unc	-	
NI-SEP	World Economy and Business	Z,ZK	4
This course is presented	I in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students of	of technical univer	sity to the
	does that predominantly by comparing individual countries and key regions of world economy. Students get to know about of	-	
	ness in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needec e on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course	•	
NI-TVR	Virtual Reality Technology	Z,ZK	3
	ed to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of co	. , ,	-
	eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways c	-	
reality will be presented.		· ·	J
NI-TS1	Theoretical Seminar Master I	Z	4
	tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		
=	nd concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scie	ntific papers and
· · · · · · · · · · · · · · · · · · ·	The capacity is limited by the the potentials of the teachers of the seminar.	- I	
NI-TS2	Theoretical Seminar Master II tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	Z Z	In The students
	nd concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is		•
=	The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TS3	Theoretical Seminar Master III	Z	4
Theoretical seminar is in	tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	ssical reading gro	up. The students
=	nd concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	s a work with scie	ntific papers and
	The capacity is limited by the the potentials of the teachers of the seminar.	<del>-</del> -	
NI-TS4	Theoretical Seminar Master IV	Z	4
NI-TS4 Theoretical seminar is in	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class	ssical reading gro	up. The students
NI-TS4 Theoretical seminar is in are treated individually a	Theoretical Seminar Master IV	ssical reading gro	up. The students
NI-TS4 Theoretical seminar is in are treated individually a	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	ssical reading gro	up. The students
NI-TS4 Theoretical seminar is in are treated individually a other scholarly literature NI-TKA	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class nd concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is. The capacity is limited by the the potentials of the teachers of the seminar.  Category Theory	ssical reading gro	up. The students
NI-TS4 Theoretical seminar is in are treated individually a other scholarly literature NI-TKA NI-TNN	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class nd concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is . The capacity is limited by the the potentials of the teachers of the seminar.	ssical reading groups a work with scient Z,ZK Z,ZK	up. The students ntific papers and 4
NI-TS4 Theoretical seminar is in are treated individually a other scholarly literature NI-TKA NI-TNN In this course, we study pertaining to artificial ne	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a The capacity is limited by the the potentials of the teachers of the seminar.  Category Theory Theory of Neural Networks neural networks from the point of view of the theory of function approximation and from the point of view of probability theory and Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission.	ssical reading gross a work with scient Z,ZK Z,ZK y. At first, we recalon, network topological reading growth and the scient section is a second section of the scient second section is a second section of the scient sec	up. The students tiffic papers and 4 5 l basic concepts pgy, somatic and
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NI-TS4 Theoretical seminar is in are treated individually a other scholarly literature NI-TKA NI-TNN In this course, we study pertaining to artificial ne synaptic mappings, netwand in connection with s	Theoretical Seminar Master IV tended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a The capacity is limited by the the potentials of the teachers of the seminar.  Category Theory Theory of Neural Networks neural networks from the point of view of the theory of function approximation and from the point of view of probability theory and Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission fork training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transformatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with transformatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with transformatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with transformatic and synaptic mappings.	ssical reading gross a work with scient in a work to pole in a work with a work	up. The students on tiffic papers and 4 5 I basic concepts ogy, somatic and onical topology, ention to the
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NI-ZS20	Master internship abroad for 20 credits	Z	20
Each student can of	nce within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institt	ution. Before the inte	ernship the
Dean of the FIT, or	he vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and o	extent of the internsl	nip. Auxiliary
courses MI-ZS10,	II-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 wee	ks of full-time emplo	yment 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 i	f the internship exce	eds the
academic year's de	ad-line.		
NI-ZS30	Master internship abroad for 30 credits	Z	30
The course is prez	ented in chzech language. Each student can once within his / her master's degree have a foreign internship at a foreign university o	r other foreign scier	tific 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 prov	vide 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 K	OS. Every 10 credits	correspond
to 4 weeks of full-ti	ne employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This a	mount can be divide	ed into two
subjects if the inter	nship exceeds the academic year's dead-line.		
	List of courses of this pass.		
	List of courses of this pass:		
Code	Name of the course		
ANI-VGA		Completion	Credits
	Video Games Architecture	Completion Z.ZK	Credits 5
		Z,ZK	5
philosophical point	Video Games Architecture a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior view. In the lectures, students will be guided through the history of development, the structure of game engines, component and	Z,ZK iew, but also from a	5 design and
	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vi	Z,ZK iew, but also from a functional architectu	5 design and ire typical of
	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior view. In the lectures, students will be guided through the history of development, the structure of game engines, component and	Z,ZK iew, but also from a functional architectu	5 design and ire typical of
	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail,	Z,ZK iew, but also from a functional architectu	5 design and ire typical of
game development	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing	Z,ZK iew, but also from a functional architectuincluding ways of ir	5 design and ire typical of aplementing
game development BI-3DT.1 BI-A2L	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.	Z,ZK iew, but also from a functional architecturincluding ways of in	5 design and the typical of applementing  4 2
BI-3DT.1 BI-A2L The content of the	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam	Z,ZK iew, but also from a functional architecturincluding ways of in  KZ Z t - students are due	5 design and the typical of applementing  4 2 to: -Take an
BI-3DT.1 BI-A2L The content of the active part in the	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement	Z,ZK iew, but also from a functional architecture including ways of in KZ Z t - students are due the midterm and the	5 design and are typical of applementing  4 2 to: -Take an application of the final term
BI-3DT.1 BI-A2L The content of the active part in the	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement anguage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both	Z,ZK iew, but also from a functional architecture including ways of in KZ Z t - students are due the midterm and the	5 design and are typical of applementing  4 2 to: -Take an application of the final term
BI-3DT.1 BI-A2L The content of the active part in the	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam  course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement anguage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both ss rate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by incomplete the state of the properties o	Z,ZK iew, but also from a functional architecture including ways of in KZ Z t - students are due the midterm and the	5 design and are typical of applementing  4 2 to: -Take an application of the final term
BI-3DT.1 BI-A2L The content of the active part in the tests with the succession.	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam  course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement anguage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both ss rate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by inclass of the term.	Z,ZK iew, but also from a functional architectu including ways of ir  KZ Z t - students are due the midterm and the dividual teachers du	5 design and are typical of applementing  4 2 to: -Take an a final term ring the first
BI-3DT.1 BI-A2L The content of the active part in the tests with the succession.	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam  course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement anguage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both ss rate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by inclass of the term.  Programming Practices 1	Z,ZK iew, but also from a functional architectu including ways of ir  KZ Z t - students are due the midterm and the dividual teachers du	5 design and are typical of applementing  4 2 to: -Take an a final term ring the first
BI-3DT.1 BI-A2L The content of the active part in the tests with the succession.	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vior of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, some game mechanics, in the form of practical demonstrations.  3D Printing  English language, preparation for the B2 level exam  course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement anguage instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both as rate set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by inclass of the term.  Programming Practices 1  This is a selective course for preparing talented student for representation in international programming contests.	Z,ZK iew, but also from a functional architectu including ways of ir  KZ Z t - students are due the midterm and the dividual teachers du	5 design and are typical of explementing  4 2 to: -Take an explementing the first

BI-ACM	Programming Practices 1	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.		1
BI-ACM2	Programming Practices 2	KZ	5
	This is a selective course for preparing talented student for representation in international programming contests.		
BI-ACM3	Programming Practices 3	KZ	5
	This is a selective course for preparing talented student for representation in international programming contests.		
BI-ACM4	Programming Practices 4	KZ	5
,	This is a selective course for preparing talented student for representation in international programming contests.		
BI-ADW.1	Windows Administration	Z,ZK	4
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).		
BI-ALO	Algebra and Logic	Z,ZK	4
,	The course extends and deepens the study of topics touched upon in the basic course in logic.		
BI-AND.21	Programming for the Android Operating System	KZ	4
	This course is presented in Czech.		
BI-ANGK	English language, contact preparation for the B2 level exam	Z	2
he content of the cours	e corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement -	students are due	to: -Take
active part in the langua	age instructionMeet the requirements for writing assignments - Summary, Abstract, Argumentation PaperSucceed in both th	ie midterm and the	final te
	te set at 70%80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by indi	vidual teachers du	rina the
ests with the success ra	class of the term.		3

The subject is designed for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple applications for modern programmable kits and control varied peripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded systems, i.e. to see the results not only on display of a PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefore is suitable even for Web and Software Engineering students.

BI-AVI.21 Algorithms visually Z,ZK 4

The course complements other algorithm courses at FIT. It brings knowledge about particular important algorithms from different fields of the computer science that extend substantially knowledge presented in BI-AG1 and BI-AG2. A wide scope of covered subject is made possible due to using visualization bz Algovision (www.algovision.org<http://www.algovision.org&gt;) that make understanding the principles of algorithms easy.

BI-BLE Blender Z,ZK 4

The course extends knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those interested in 3D graphics and animation. It offers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphics applications) course.

BI-CCN Compiler Construction Z,ZK 5
This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to

understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.

BI-CS1 Programming in C# KZ 4

The goal of the course is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental construction, types of variables, operators, arrays, loops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class definition and class instancing, constructors, methods, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugging and exception processing, as well as work with files are emphasized.

BI-CS2			
The C# lengueses	C# language and data access	KZ	4
	and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Micros	•	
	ts used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current techr rying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL (L	_	
	). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data u	-	
	f the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Model		•
, ,	(XML description).		11 0
BI-CS3	Language C# - design of web applications	KZ	4
The students will be	introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview of	of the development	possibilities
	on thisplatform. They will learn to create WebAPI and to use it by client programs.		
BI-EHD	Introduction to European Economic History	Z,ZK	3
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).		_
BI-EJK	Enterprise Java and Kotlin	Z,ZK	4
The course is on a	dvanced technologies in the Java and Kotlin programming languages. The focus is on technologies for developing enterprise informat	ion systems with n	nicroservice
DI EDA OA	architecture, that can be deployed to the cloud.	KZ	4
BI-EP1.24	Effective programming 1  The course is taught in Czech.	NΔ	4
BI-EP2	Efficient Programming 2	KZ	4
	fficient Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving individ		1
	with the aim to choose the best one and avoid implementation errors.	,	,
BI-HAM	HW accelerated network traffic monitoring	KZ	4
This course intro	duces students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring. The	e monitoring and a	analysis of
	mandatory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as a security analysts).		
for analysis). The g	loals of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network traffi	c on a hardware a	ınd software
511146	level and to develop their practical abilities in this field.	7.71	
BI-HAS	Human Aspects in Cryptography and Security	Z,ZK	5
This course is ion	students interested not only in technical scope of computer science, but also in making products usable - for users and for developers use their gained knowledge to design, plan and analyse their own projects in the context of human-centered security.	s. Students of this	course can
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
DI-I IIVII	This course is presented in Czech.	Ζ,ΖΚ	3
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad	KZ	4
500	This course is presented in Czech.		
BI-KOT	Programing in Kotlin	Z,ZK	4
	n, statically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of advan		nstructions.
The language is fu	illy Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of a r	-	nctional way
	with minimum of boiler-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages)	<u> </u>	
BI-KSA	Cultural and Social Anthropology	ZK	2
			_
	course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity		amples from
	search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health		amples from
anthropological res	search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health shown. The course is presented in Czech.	n, history, death, e	amples from etc) will be
anthropological res	search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health shown. The course is presented in Czech.  Mikrotik technologies	n, history, death, e	amples from etc) will be
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	ge. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VMN might be an advantage. No previous knowledge of physics is assumed.	1 and experience wi	ith Python
BI-QUA	Quality Assurance	KZ	4
This course introd	duces students to the fundamentals of testing and quality management. Students will learn what the role of a tester is in the context		software
	rill experience hands-on application testing using both manual and automated testing. At the end of the semester, the student should na set of test scenarios, prepare test data, automate an appropriate portion of the scenarios, and prepare a report on the bugs found		
BI-SCE1	Computer Engineering Seminar 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		
	dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the rofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	=	
artiolog aria otrior p	semester.	io. The topico are no	ow for odorr
BI-SCE2	Computer Engineering Seminar 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		
	dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the rofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	-	
articles and other p	semester.	is. The topics are no	SW IOI Cacii
BI-SEP	World Economy and Business	Z,ZK	4
This course is pres	sented in Czech. The course introduces students of technical university to the international business. It does that predominantly by c	omparing individual	countries
· -	world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as		
corruption and ecor	nomic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of di readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.	iscussions based or	n individuai
BI-SKJ.21	Scripting Languages	Z,ZK	4
	eneral overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In additi		per insight
51.001.1	into shell and some other particular scripting languages and will get practical experience with shell script programming.		
BI-SQL.1	Language SQL, advanced knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In page 1.0 page	KZ	4
	puries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization from the point of the course is dedicated to practical database optimization database o		
	exes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan ar	•	
will be discussed	d. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle	acle DBMS and part	tially on
	PostgreSQL.		
BI-ST1	Network Technology 1		3
The subject is on	iented to providing the students basic information and practical skills from the area of digital and IP networks. The subject is acredite CCNA1 - R&S Introduction to Networks.	u under the Cisco N	ieiacau -
BI-ST2	Network Technology 2	Z	3
	This course is presented in Czech.		
BI-ST3	Network Technology 3	Z	3
	r enhance their knowledge acquired from previous BI-ST1 and BI-ST2 courses. Principles of routing and switching presented during E		
	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictions and the course is a start fine-tune protocols.		
	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.		
BI-ST4 Students will further	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4 er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching	z presented during B	beyond a  3 sI-ST1 and
BI-ST4 Students will further BI-ST2 courses go	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased effici	Z presented during B ency, predictability,	3 SI-ST1 and extension
BI-ST4 Students will furthe BI-ST2 courses go beyond a simple	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficitopology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely	Z presented during B ency, predictability, other type of netwo	3 SI-ST1 and extension ork (Non
BI-ST4 Students will furthe BI-ST2 courses go beyond a simple Broadcast Multiple	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased effici	Z presented during B ency, predictability, vother type of network firmware, perform	3 II-ST1 and extension ork (Non password
BI-ST4 Students will furthe BI-ST2 courses go beyond a simple Broadcast Multiple	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficitopology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely expected by the Access of the configure of	Z presented during B ency, predictability, vother type of network firmware, perform	3 II-ST1 and extension ork (Non password
BI-ST4 Students will furthe BI-ST2 courses go beyond a simple Broadcast Multiple recoveries, and em	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, pred simple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficitopology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely expects Access) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switch nergency procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigation network running.  TeX and Typography	Z presented during B ency, predictability, other type of netwo infirmware, perform on ways while main:	3 II-ST1 and extension ork (Non password taining the
BI-ST4 Students will furthe BI-ST2 courses go beyond a simple Broadcast Multiple recoveries, and em	ded in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predisciple topology, security, etc.  Network Technology 4  er enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching of further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficitopology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely expects Access) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switch nergency procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigation network running.  TeX and Typography  ented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the	Z presented during B ency, predictability, other type of netwo infirmware, perform on ways while main:	3 II-ST1 and extension ork (Non password taining the
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will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools. BI-VMM Selected Mathematical Methods Z.ZK 4 The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples. BI-VR1 Virtual reality I K7 Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of virtual worlds communication. The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds. It improves computational thinking, empathy and shared social activities. Virtual reality II ΚZ 3 Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objective is to develop applications for computer science and gamification in various social metaverse and desktop engines. BI-ZIVS Intelligent Embedded System Fundamentals ΚZ 4 Intelligent embedded system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim of the course is to teach students modern humanoid robot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to get practical experience with these technologies. Process engineering Students will learn fundamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles of process modelling and they will learn basics of the used notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of business processes using modern CASE tools. The role of process engineering for information systems development is discussed as well as its importance in the overall context of information and business strategy of an enterprise. Bachelor internship abroad for 10 credits BI-ZS10 10 Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship, Auxiliary courses BI-7S10, BI-7S20, BI-7S30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. BI-ZS20 Bachelor internship abroad for 20 credits Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. BI-ZS30 Bachelor internship abroad for 30 credits Each student can once within his / her bachelor's study programme have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary courses BI-ZS10, BI-ZS20, BI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line. BI-ZWU Z,ZK Introduction to Web and User Interfaces 4 This course is presented in Czech. Windows Administration BIE-ADW.1 Z,ZK 4 Students understand the architecture and internals of the Windows OS and acquire the skills to administrate the Windows OS. They are able use the standard administration and security tools and apply advanced ActiveDirectory administration methods. They are able to solve problems by applying appropriate troubleshooting methods and administrate heterogeneous systems. Students are able to effectively configure centralised administration of a computer network. **BIE-CCN** Compiler Construction Z.ZK 5 This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class. Introduction to Computer Science This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before. Czech Language for Foreigners BIE-CZ0 K7 2 Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family. BIE-CZ1.21 Czech Language for Foreigners II 2 The course is intended for Students of English programmes who have completed BIE-CZ0 course or have basic knowledge of the Czech language. The course further expands the basic vocabulary and clarifies the structure of the Czech language structure with regard to the practical needs of Students residing in the Czech Republic. **BIE-DIF** Differential equations Z,ZK This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs. **BIE-EHD** Introduction to European Economic History Z,ZK 3 The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course

	tailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and of meetings will consist of a mixture of lecture and discussion.	organizations in his	tory. Class
BIE-EPR	Economic project	Z	1
This course is an ex	xtension of the course Introduction to European Economic History (BIE-EHD). There is no fixed schedule for BIE-EPR. A teacher will	contact you before	the start of
DIE ETD 4	the semester.	7.71/	-
BIE-FTR.1	Financial Markets has been deeply transformed in the recent years, which led to a development of structured financial products, a new point of view or	Z,ZK	5 risk and
	rket activities. The need to use and properly apply mathematical and technical tools is emphasized. To manage their financial activities		
	ools who have sufficient knowledge ICT and mathematics, and who have at the same time an understanding of the functioning of fin		
	e thus englobes both a description of financial markets and related economic theories, and an overview of mathematical and statistic		
BIE-HAS	Human Factors in Cryptography and Security students interested not only in technical scope of computer science, but also in making products usable - for users and for developer	Z,ZK	5
This course is ion s	use their gained knowledge to design, plan and analyse their own projects in the context of human-centered security.	s. Students of this	course can
BIE-IMA2	Introduction to Mathematics 2	Z	2
	nd extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are	able to apply them	in particular
	examples.		
BIE-PJV	Programming in Java	Z,ZK	4
The course Program	mming in Java will introduce students to the object oriented programming in Java programming language. Beside of basics of Java la will also be presented, especially data structures, files, GUI, networking, databases and concurrent APIs.	anguage the fundar	nentai APIS
BIE-PKM	Preparatory Mathematics	Z	4
512 1 1 tim	The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics	1	·
BIE-PRR.21	Project management	Z,ZK	5
	urse is to introduce students into the basic concepts and principles of project management, i.e. methods of planning, teamwork, ana	-	
	cation, argumentation and meeting management. Students will practice project management techniques (e.g. SWOT analysis, risk as		
	ource schedule, resource balancing, network graphs) and creation of project documentation. The course is designed especially for st nowledge outside IT, consider starting their own company, or have ambitions to work in middle or senior management positions in la		
deepering their ki	also suitable for all those who will develop software or hardware in the form of team projects.	rge companies. The	, 000130 13
BIE-PS2	Programming in shell 2	Z,ZK	4
	eral overview of scripting languages, introduction into syntax, semantics, programming style, data structures, pros and cons. In addit		1
_	shell and some other particular scripting languages and will get practical experience with shell script programming. Note to Erasmus st		
	vide even very basic Bourne shell usage. Depending on actual knowledge of the students, orientation in user filesystem tools (cp, In, s (cut, tr, sort, uniq) can be provided. The advantage of this module is that we do not stop at this point - we will show you also a sei		
data intering took	techniques used in practice.	icolion of advanced	i scripting
BIE-SCE1	Computer Engineering Seminar 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		
	dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the	e subject is work wi	th scientific
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articles and other p	rofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teache semester.	rs. The topics are n	ew for each
	semester.	rs. The topics are n	ew for each
BIE-SCE2		Z	4
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BIE-SCE2 The Seminar of Cor are approached incarticles and other p  BIE-SEG This is an introduct to understand procunderstand the counderstand the counderstand trock of scripting languages of scripting languages.  BIE-ST1 The course is footbased on the scripting languages of scripting languages of scripting languages.  BIE-TUR.21 Students gain a baccommunicate with the scripting languages of scripting languages.  BIE-VAK.21 The course aims to ssue from applications and other processing scripting languages.	Computer Engineering Seminar II  mputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the rofessional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teache semester.  Systems Engineering  ory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of essor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what co parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication.  World Economy and Business  Loses students of technical university to the international business. It does that predominantly by comparing individual countries and know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedor have needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual countries and take bachelor level of this course BIE-SEP as a prerequisite.  Scripting Languages  To the world of scripted programming. Together, we will unveil the power of Bourne Again shell and PERL as proven industry standars assing utilities (AWK, sed), with some basic UNIX system tools, in many real-world situations like processing web feeds or logs. We verse and introduction into their pros and cons and students get practical experience with shell script programming. We will touch also into how your code documentation can be implemented. And if you know UNIX system-level scriptinaged, we can show you advert	Z o failures and attack e subject is work with the class, students incurrency is, as operating systems the class, students incurrency is, as operating systems of world in the class, students incurrency is, as operating in the class, students incurrency is, as operating in the class, students in th	4 ss. Students th scientific lew for each  Offor students are able to posed to  4 deconomy. It is advised to advised to advised to a safe and  3 R&S  5 Jucts do not lethods that  3 approach the urthermore,

will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools. BIE-VMM Selected Mathematical Methods Z.ZK 4 The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples. BIE-VR1.21 Virtual reality I K7 4 Introduction to Virtual Reality (VR), virtual reality operations, metaverse, and creation. Rules and requirements for virtual worlds communication. The course focuses on the ways of creating virtual reality worlds and interactive activities in 3D worlds. It improves computational thinking, empathy, and shared social activities. BIF-ZRS **Basics of Systems Control** Optional subject Basics of System Control is designed for anyone interested in applied computer science in bachelor studies. A brief introduction to the field of automatic control will be definitely evaluated by our graduates in the industrial practice. Students will gain knowledge in this rapidly evolving field of great future. We will focus our attention particularly on control of engineering and physical systems. We will provide basic information from the feedback control of linear dynamical SISO systems. We will teach you description methods of system models, basic linear dynamic systems analysis and design verification, simple PID feedback, PSD and fuzzy controllers. This is a survey course in which students will learn the methods of creating a description of the system model, the basic linear dynamic systems analysis and design verification and simple PID feedback, PSD and fuzzy controllers. Attention is also given to sensors and actuators in control loops, issues of stability in control systems, single and continuous adjustment of the controller parameters and certain aspects of the industrial implementation of continuous and digital controllers and PLC control. The themes of lectures are accompanied by a number of useful examples and practical industrial implementations. FI-TOP Academic writing Publishing is an important and required part of research activity. It is not only about obtaining research results but also about applying them in the form of publication. Writing scientific publications can be useful for students not only in their own publishing activities but also in the preparation of a bachelor's or master's thesis. In the course, students will learn how to write a scientific article, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an article and reviewing someone else's article. The course will be taught in blocks, with one lecture at the beginning of the semester and one practicum in the middle of the semester. Dates will be determined based on the availability of enrolled students. NI-AFP Applied Functional Programming K7 This course is presented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice. NI-AML 5 Advanced machine learning 7.7K 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. Completing a professional event The subject is participation in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drafting a report, etc. Such an event must be approved in advance by the vice-dean for pedagogical activities or the vice-dean for science and research and is presented within the FIT through a website, infomail, etc. NI-APH Architecture of computer games Z.ZK Students will gain a basic understanding of the various issues in the field of computer games development, especially from a technical point of view, but also from design and philosophical perspective. They will get a grasp of component-oriented and functional-oriented architecture, game mechanics, decision-making processes and base components that form an integral part of most games. They will also understand the basics of pathfinding, networking and scripting and apply them in practical exercises (labs). An important part of the course is an implementation of a simple game, with a strong focus on nontrivial game mechanics. NI-APT **Advanced Program Testing** Z.ZK 5 Testing a program is essential to ensure that a program respects its specification, that changes do not introduce regressions or security issues. The goal of the course is to present advanced program testing techniques, beyond writing unit tests, especially fuzzing and symbolic execution. NI-ARI Computer arithmetic Z.ZK Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units. NI-ATH AlgorithmicTheories of Games Traditional game theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory studies the behaviour of agents (players) of a certain competitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game theory is to find the equilibria, which are the states of the game where no player wants to deviate from his strategy. Due to the recent development of computers, internet, social networks, online auctions, advertising, multiagent systems and other concepts the algorithmic point of view is gaining attention. In addition to existential questions we study the problems of efficient computation of various solution concepts. In this course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods of their computation. Wireless Computer Networks Students will learn about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad-hoc networks, multicast and broadcast mechanisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowledge of security mechanisms for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools. 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-CPX Complexity Theory Z,ZK 5 Students will learn about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the theory concerning practical (in)tractability of difficult problems. NI-CTF Capture The Flag ΚZ 4 The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber security. NI-DDM Distributed Data Mining ΚZ 4 Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language. NI-DID Digital drawing 7 2 The course will introduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspective and color theory, which they will practically apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is fit for anyone who wants to practice or learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gained knowledge.

NI-DNP	Advanced .NET	Z,ZK	4
	re an overview of platform .NET and will gain knowledge about technologies ASP.NET Core, Entity Framework Core, .NET MAUI (WI		
get notions of Azur	re DevOps and GIT. Students will get practical experience in semestral work where they will create a client-server application utilizing Entity Framework Core and (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.	technologies ASP.	NET Core,
NI-DPH	Game Design	Z,ZK	5
	ments the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on game of		
•	er knowledge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics d	_	
development cycle.	The students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation of the students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation of the students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation of the students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation of the students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation of the students o	mentation applied to	o semestral
	projects.		
NI-DSP	Database Systems in Practes	Z,ZK	4
NI DOW	This course is presented in Czech.	7	2
NI-DSW   Students will work o	Design Sprint on projects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to valida	. – .	
	Idents will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting with		1
	testing the prototypes (plus final presentation).		
NI-DVG	Introduction to Discrete and Computational Geometry	Z,ZK	5
The course intends	to introduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar with	the most fundame	ntal notions
NI DZO	of this discipline, and to be able to solve simple algorithmic problems with a geometric component.	7.71/	
NI-DZO This course presen	Digital Image Processing nts a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical alg	Z,ZK	4 oth easy to
	e an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is al		
of digital image p	processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR	compression, de-b	lurring in
	abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conv		
	gid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, as		
NI-EDW The Enterprise Date	Enterprise Data Warehouse Systems ta Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and	Z,ZK	5 knowledge
=	ing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the		- 1
, ,	visualization.		<b>´</b>
NI-ESC	Experimental Project Course	KZ	8
	ct course offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles, n	_	
	logy-driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design pro Ito integrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their skills	-	- 1
experts, and learn	user experience evaluation, as well as gain experience working in a team to design and prototype a functional solution."	in user-centered d	esign and
NI-FMT	Finite model theory	Z,ZK	4
	se is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of	1	of database
systems. Since its ir	nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as de-	scriptive complexity	theory, the
NII OL D	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.	7.71	
NI-GLR	Games and reinforcement learning cement learning coment learning coment learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelliger	Z,ZK	4
THE HEIG OF TERMORE	give you both theoretical and practical background so you can participate in related research activities. Presented in Englis		interface to
NI-GNN	Graph Neural Networks	Z,ZK	4
	oduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural r		- 1
representations of	f nodes, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last p		so covers
NI COL	graph generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and pro	KZ	
NI-GOL NI-GRI	Programming of distributed systems in GO Grid Computing	Z,ZK	5 5
MI-GKI	Grid computing and gain knowledge about the world-wide network and computing infrastructure.	Z,ZR	5
NI-HCM	Mind Hacking	ZK	5
	is an emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks, infe	1	
-	nitive security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive secur		
the context of inform	nation warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Internet	environment have r	eal societal
NI-HMI2	impacts such as disruption of social cohesion, threats to democracy or war.  History of Mathematics and Informatics	ZK	3
	esented in Czech. Selected topics {Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithm		
,	functions, eliptic curves, etc.) note on possibilities of applications of some mathematical methods in informatics and its develop		
NI-HSC	Side-Channel Analysis in Hardware	Z,ZK	4
	dicated to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical attac	-	
	de channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and	-	-
NI-IAM	hey also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel  Internet and Multimedia	Z,ZK	e. 4
	e is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acq		
	signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical u	-	
	nissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the eff	-	
the quality and later	ncy of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording th	e scene up to the p	resentation
NI-IBE	for audience.	ZK	2
l l	Information Security rmation and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internation	1	
	d methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g.		- 1
NI-IKM	Internet and Classification Methods	Z,ZK	4
	students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering		- 1
in malware detection	on systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving	these four kinds of	problems.

NI-IOS	t of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle w During the exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult		
	Advanced techniques in iOS applications	KZ	4
	the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the base		
NUIOT	BI-IOS.	7 71/	4
NI-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 (Gl		ivaliable
NI-IVS	Intelligent embedded systems	KZ	4
-	led 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 programm	•	
development. Lectu	ures 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 techniques.	-	applications
NII IZTLI	combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web techn		4
NI-KTH	Combinatorial Theories of Games theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory study	Z,ZK	of agents
_	ain competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game the		- 1
	s of the game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-player	' <del>-</del>	
	onway, Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea is		II.
-	patible games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The thir	_	
-	established the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force tra	· ·	
is no efficient. Beck	k introduced the "false probabilistic method", which aims to tackhle this problem. In this course we build the foundation of the theory o	f combinatorial and	d positional
games. We focus o	n theoretical analysis of games and building the theory, not on the programming aspects of game solving algorithms. The course requ	uires independent v	work, ability
to mathematically	analyse, think and proof. The course is also suitable for bachelors student in the third year, who attended introduction to graph theory	, as well as for Phi	O students
	looking for research topics.		
NI-KYB	Cybernality	ZK	5
Students get acqu	uainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the	classification of at	tacks and
have an overview o	f systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activ	rities and behavior.	The course
V	vill also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CE		
NI-LOM	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 optin		
	scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelli	-	
issues from econor	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
	in linear programming.		
NI-LSM	Statistical Modelling Lab	KZ	5
	ented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is p		
avaliable information	on and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and 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	-	properties.
NI-LSM2		3).	
		<b>K</b> 7	
	Statistical Modelling Lab	KZ	5
	is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the presen	ce of clutter, or vid	-
The topic of LSM2	is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the presen We aim at the state-of-the-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli)	ce of clutter, or vid filters.	eo tracking.
The topic of LSM2	is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the present We aim at the state-of-the-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli)  Machine Learning in Practice	ce of clutter, or vid filters. Z,ZK	eo tracking.
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NI-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 necess but We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one	•	•
	inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponen		
and polynomially i	n the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial tir	me preprocessing o	of the input,
•	sible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution		
plethora of param	neterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (pro- will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation		t exist. We
NI-PDD	Data Preprocessing	Z,ZK	5
	prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data s		-
	and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteris		-
	pages.		
NI-PG1	Computer Grafics 1	ZK	4
	on graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. Th need computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the o	-	
	r subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and	-	
NI-PLS1	Programming Language Seminar	Z	2
The Programmin	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	we discuss scienti	fic papers
about programmin	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		ading group
NI DI CO	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language	s. Z	2
NI-PLS2	Programming Language Seminar g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	_	
	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		
	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language	S.	
NI-PLS3	Programming Language Seminar	Z	2
-	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which		
about programmin	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language		ading group
NI-PLS4	Programming Language Seminar	о.   Z	2
_	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which		
about programmin	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		ading group
DOD	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language		
NI-PSD	Public Services Design roduce students to specifics of UX, Service design and development for public sector. We will look into the design and development produce students to specifics of UX, Service design and development for public sector.	KZ	4
	and designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration	· · · · · · · · · · · · · · · · · · ·	-
	Course is aimed at students-designers as well as clients.		
NI-PSL	Programming in Scala	Z.ZK	4
The second of the total		l ' l	-
	luces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language feature	es - e.g.pattern ma	tching and
	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and	es - e.g.pattern ma	tching and
advance standard	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.	es - e.g.pattern ma I libraries e.g. Play,	tching and
advance standard NI-PVR	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and	es - e.g.pattern ma I libraries e.g. Play,	tching and Cassandra,
NI-PVR The course introduce:	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.  Advanced Virtual Reality  Ices advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D models students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also	es - e.g.pattern ma d libraries e.g. Play, KZ s in Blender, and a deal with creating a	tching and Cassandra,  4 mong other applications
NI-PVR The course introduce:	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.  Advanced Virtual Reality uces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D models students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also gines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kn	es - e.g.pattern ma d libraries e.g. Play, KZ s in Blender, and a deal with creating a	tching and Cassandra,  4 mong other applications
NI-PVR The course introduce: n available 3D eng	library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and Scalaz, etc.  Advanced Virtual Reality  Ices advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D model is students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also gines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kn in virtual reality, or directly create a complex game for VR.	es - e.g.pattern ma d libraries e.g. Play, KZ s in Blender, and a deal with creating a lowledge gained in	tching and Cassandra,  4 mong other applications this subject
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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. NI-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. Parsing and Compilers The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing. NI-SZ1 Knowledge Engineering Seminar Master I Z 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). NI-SZ2 Knowledge Engineering Seminar Master II 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). NI-TKA **Category Theory** Z,ZK 4 Theory of Neural Networks NI-TNN Z.ZK 5 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. Ζ NI-TS1 Theoretical Seminar Master I Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. NI-TS2 Theoretical Seminar Master II 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. NI-TS3 Theoretical Seminar Master III Ζ 4 Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. NI-TS4 Theoretical Seminar Master IV Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar. NI-TSP Testing and Reliability Z,ZK 5 Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits. NI-TVR Virtual Reality Technology Z,ZK Students will be introduced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD, ...) and the possibilities of controlling virtual avatars (position tracking, hand tracking, eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways of using virtual and augmented reality will be presented. NI-VCC Virtualization and Cloud Computing Z,ZK Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development). NI-VOL Elections Z,ZK 5 We will cover the basics of (committee) elections and, in general, opinion aggregation. NI-VPR Research Project Z 5 Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en. NI-VYC Z,ZK 4 Computability Classical theory of recursive functions and effective computability.

NI-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. NI-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. NI-ZS30 Master internship abroad for 30 credits 30 The course is prezented in chzech language. 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. NIE-AM2 Middleware Architectures 2 5 Students will learn new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application architectures, concepts and technologies for microservices, distrubuted cache and databases, smart contracts, realtime communication and web security NIE-ARI Computer arithmetic 7.7K 4 Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementation units. NIE-BLO Blockchain 5 Students will understand the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain platforms. They will be able to design, code and deploy a secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course places an increased emphasis on the relationship between blockchains and information security. It is concluded with a defense of a research or applied semester project, which prepares the students for implementing or supervising implementation of blockchain-based solutions in both academia and business. NIE-BPS Wireless Computer Networks 7 7K Students will learn about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad-hoc networks, multicast and broadcast mechanisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowledge of security mechanisms for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools **NIE-CPX** Complexity Theory 5 Students will learn about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the theory concerning practical (in)tractability of difficult problems. NIF-DDW Web Data Mining 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, 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. NIE-DVG Introduction to Discrete and Computational Geometry The course intends to introduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar with the most fundamental notions of this discipline, and to be able to solve simple algorithmic problems with a geometric component. NIE-EVY Efficient Text Pattern Matching Z,ZK 5 Students get knowledge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both access time and memory complexity. They will be able to use the knowledge in design of applications that utilize pattern matching. NIE-HMI History of Mathematics and Informatics Z,ZK 3 The course focuses on selected topics from calculus, general algebra, number theory, numerical mathematics and logic - useful for today computer science The topics are selected for finding some relations between computer science and mathematical methods. Some examples of applications of mathematics to computer sciences will be showed. NIF-HSC Side-Channel Analysis in Hardware 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. Computational Intelligence Methods Students will understand the basic methods and techniques of computational intelligence, which are based on traditional artificial intelligence, are parallel in nature and are applicable to solving a wide range of problems. The subject is also devoted to modern neural networks and the ways in which they learn and neuroevolution. Students will learn how these methods work and how to apply them to problems related to data extraction, management, intelligence in games and optimisation, etc. Parameterized Algorithms There are many optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessary to solve these problems exactly in practice. We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one can find a common property (parameter) of the inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponentially in this (small) parameter and polynomially in the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time preprocessing of the input, which is not possible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution method. We will present a plethora of parameterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (presumably) does not exist. We will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation schemes. NIE-PDL Practical Deep Learning ΚZ This course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine learning framework. Throughout the course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such as computer vision and natural language processing. NIE-PML Personalized Machine Learning Z,ZK Personalized machine learning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteristics and behaviors of individual entities. While PML is commonly used in applications such as recommender systems, which recommend items to users based on their personal interests, its principles can be applied to a wide range of other fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from theoretical, algorithmic, and practical perspectives. Specifically, we will focus on cutting-edge models that are of interest to both the research and commercial communities. NIF-ROZ Pattern Recognition Z.ZK 5 The aim of the module is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the statistical approach to pattern recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects. Computer Engineering Seminar Master I The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. NIE-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 resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. NIE-SEP World Economy and Business Z,ZK 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. Semantic Web and Knowledge Graphs **NIE-SWE** The students will learn the most recent concepts and technologies of the Semantic Web. The course will provide an overview of the Semantic Web technologies, methods and best practices for modelling, integration, publishing, querying and consumption of semantic data. The students will also gain skills in creation of knowledge graphs and their systematic quality assurance. NIE-SYP Parsing and Compilers The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing. **NIE-VPR** Research Project Ζ 5 1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the IS based on the confirmation of the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester. NIE-VYC Computability Z,ZK 4 Classical theory of recursive functions and effective computability. 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 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 TV1 Physical Education Ζ 0 TV2 Physical Education Ζ 0 TVK1 Z Physical Education 1 **TVKLV** Physical Education Course 7 0 Z **TVKZV** Physical Education Course 0 TVV Physical education Ζ 0 TVV0 Physical education 7 0 UKCJ7 Czech Language 7 for Ukrainian refugees ZK 10 Course Czech for foreigners offers the basic topics of conversation: Introductions, Orientation, Shopping, Work / Study, Travel, Time, Family.

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For updated information see <a href="http://bilakniha.cvut.cz/en/FF.html">http://bilakniha.cvut.cz/en/FF.html</a> Generated: day 2025-04-26, time 07:59.

**UKCJP** 

UKMAT

UKR-PKM

Czech language for advanced An advanced Czech course for Ukrainian students with refugee status. The exam will confirm knowledge of Czech at B2 level with validity for CTU.

Mathematics UK

Preparatory Mathematics for Ukrainian refugees

The purpose of Preparatory Mathematics is to help students revise the most important topics of high-school mathematics.