UNIVERSITY OF DUNAÚJVÁROS

CURRICULUM
&
STUDY PROGRAM DESCRIPTION

COMPUTER SCIENCE ENGINEERING BSC

2024

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Description of the Degree Study Program

Computer Science Engineering BSc (Computer Network Engineering Specialization, Software Technology Specialization)	
The higher educational institution responsible for the study program	University of Dunaújváros
Identification number of higher educational institution	FI60345
Address of higher educational institution	Táncsics Mihály utca 1/A., 2400 Dunaújváros
Authorized head of the institution	Dr. István András, Rector
Responsible persons for the study program	
Responsible institute	Informatics Institute
Director of institute	Dr. Joós Antal, PhD
Programme leader	Dr. habil. József Katona, PhD
Specializations (majors) and responsible persons	
Computer Network Engineering	Dr. Ervin Burkus, PhD
Software Technology	Dr. István Kirchner, PhD
Main aspects of the study program	
Precondition of student application acceptance	• General Certificate of Education or a certificate of secondary school final exam, that certificate, which is required to start a higher educational study program in the home country of the student, • The level of the required English language knowledge to start bachelor studies: IELTS 5.5
Level of educational program	undergraduate
Level of qualification	bachelor (BSc)
Description of qualification in the diploma in Hungarian	mérnökinformatikus
Description of qualification in the diploma in English	Computer Science Engineer
Scheme of Study	7 semesters (3 and a half year) full-time program
Credit points to be acquired	210

The objectives of the training and the professional competencies to be acquired	The aim of the training is to train engineering IT specialists who are able to perform the design and development tasks of the data and program systems of technical IT and information infrastructure systems and services, as well as to solve their installation and operation tasks. They are prepared to continue their studies in a master's degree.
Prerequisites of specialization	The precondition for starting the chosen specialisation is the completion of the study and exam requirements of the the following subjects: • Introduction to Programming • Computer and Network Architectures • Database System • Windows Operating Systema
Condition(s) for starting a specialization and the order of classification	In the semester specified in the curriculum, at least one specialization will be launched, which most students choose. Starting more than one specialization is possible only if it has been selected by at least 15 people.
Practical internship	The practical internship is an internship organized in a professional internship place in the 7th (last) semester, lasting at least eight weeks. Credit value: 0 credit.
Preconditions of the issue of university leaving certificate	Successful passing of the examinations prescribed in the curriculum and, with the exception of passing the language exam and preparation of the dissertation (diploma thesis), the fulfilment of other study requirements and credit points assigned to the dissertation (diploma thesis). that the student has met the study and examination requirements specified in the curriculum in all respects. Nftv. § 50 (1): "… Has fulfilled the study and examination requirements prescribed in the curriculum and the prescribed professional practice - with the exception of passing the language exam, preparation of the dissertation, diploma thesis - and has obtained the prescribed credits and issues a final certificate (absolute)."
Thesis	The dissertation is a solution of an engineering informatics task or a research task arising in a specific field, which can be prepared in two semesters under the guidance of internal and external consultants by studying additional literature based on the knowledge acquired by the student. With the dissertation, the candidate proves that he / she has acquired sufficient skills in the practical application of the acquired knowledge, is able to perform the tasks of an engineering informatics and is also proficient in other literature beyond the curriculum, which he / she is able to apply in a value-

	creating way.
Prerequisites of final exam	The precondition for admission to the final exam is the obtaining of the final certificate (dissertation) and the dissertation accepted for review.
Final exam	The final exam is a test and assessment of the knowledge, skills and abilities required to obtain a diploma, during which the student must also demonstrate that he or she can apply the knowledge learned. The final exam consists of the defense of the dissertation and the oral exam of the subjects specified in the curriculum.
Final exam subjects	**FE1:** ISF-210 Database Systems ISF-213 Programming 1. ISR-118 Computer and Network Architectures **FE2:** **Computer Network Engineering specialization:** ISR-258 Computer Network Management 1. ISR-121 Network Operating Systems – Windows ISR-214 Network Operating Systems – Linux **Software Technology Specialization:** ISF-117 Software Development Technologies ISF-155 Programming 3. ISF-253 Web Programming
Average of certificate	The result of the diploma should be calculated as follows: (FEs + T + Cumulative GPA)/3. Arithmetic average of the marks of the final examination subject(s) (FEs), thesis (T) Grade of the final examination given by the Committee, the Cumulative Grade Point Average (GPA) of all credit points obtained during the entire study period, except for the preparation of the dissertation.
Qualification of certificate	excellent 4.51 – 5.00; good 3.51 – 4.50; satisfactory 2.51 – 3.50; adequate 2.00 – 2.50
Precondition of the issue of certificate	The precondition of the issue of certificate is to prove the completion of every study and exam requirement of the bachelor study program and to take a successful final exam.
The language of education	English
Mobility window	Ideally, students will take advantage of the mobility window during the 2nd and 3rd semester(s). As mobility is

	dependent on both the hosting capacity of the institution abroad and the student's travel possibilities, this window will be flexibly integrated into the curricular grid according to the principles set out in § 45 of the Student Requirements System Study and Examination Regulations. The designated staff member of the International Relations Directorate will assist in the selection of the host institution.
Physical education	In the first 1-4 semesters of the curriculum, 2 hours per week (full - time only)
Work schedule	Full-time (full-time)

Expected competencies

Knowledge:

- The student's knowledge of English reaches the level required for training, learning about the English language literature, understanding and processing the technical text, and performing professional tasks that can be provided with a professional qualification, as well as for continuous professional self-education.

The student

- knows the principles and methods of science (mathematics, physics, other natural sciences) necessary for cultivating his / her field of informatics.
- knows the operation of the hardware and software elements of IT systems, the technology of their implementation, how to solve the tasks arising from its operation, and the possibilities of connecting IT and other technical systems.
- has a basic knowledge and engineering approach to the processing of measured signals, modelling, simulation and control of systems and networks.
- knows the main programming paradigms, programming languages, development tools. His knowledge includes information systems modelling, database-based systems design, computer networking, operation and implementation, user interfaces and graphical applications, intelligent systems features, mobile application development features, advanced general-purpose operating systems management, and IT security aspects.
- knows important software development methodologies, notation of IT plans and documentation.
- has basic data security knowledge.
- knows the vocabulary and expressions of the IT and engineering profession in Hungarian and English, at least at a basic level.

Ability:

The student

- uses the principles and methods of natural sciences (mathematics, physics, other natural sciences) necessary for the cultivation of the field of informatics in his engineering work aimed at the development of informatics systems.

- uses the knowledge gained during his studies, he is able to install and configure computer and telecommunication networks, troubleshoot network problems, operate and improve networks.
- is able to develop applications, client-server and WEB, program mobile systems, create multiplatform systems.
- has got the ability to develop enterprise information systems and implement previous developments.
- is able to specify and implement embedded systems using the knowledge gained during his studies.
- is able to acquire deeper knowledge in a technical IT field, to process the literature, and then to solve IT problems related to the field, based on the acquired basic knowledge.
- is able to perform analysis, specification, design, development and operational tasks in his / her field, apply development methodologies, debugging, testing and quality assurance procedures.
- collaborates with IT and electrical engineers during group work, as well as with representatives of other disciplines in the development of requirements analysis and solution of the given problem.
  communicates professional issues in Hungarian and English and uses the formal language of informatics in a creative way.
- is constantly making efforts to train himself/ herself and keeping pace with the development of the IT profession.

Attitude:

The student

- authentically represents the professional principles of the engineering and IT fields.
- seeks to have an overview of the entire technical system beyond his/ her own area of work.
- is open to learning new skills, programming languages, procedures and their skill level.
  is open to learn about other fields using IT tools and to develop IT solutions in cooperation with experts in the field.
- makes its decision in full compliance with legal and ethical standards, even in decision-making situations requiring a complex approach.
- understands and feels the ethical principles and legal aspects of the profession.
- strives for efficient and quality work.
- keeps in mind and takes care of the security of the data and information of your employees and customers.

Autonomy and responsibility:

The student

- feels responsible for his / her independent and group IT systems analysis, development and operation.
- identifies the shortcomings of the applied technologies, the risks of the processes and initiates the measures to reduce them.
- has acquired the demanded expertise, he has a security-conscious attitude, keeps in mind the potential threats and attack possibilities, and prepares to prevent them.

Curriculum

Full time	Computer Science Engineering BSc																								
Subject code	Subject name	Credit	Requirement	Semester - Classes per week																					Prerequisite
				1			2			3			4			5			6			7			
				T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-IMA-100	Tutorial mathematics	0	S	0	2	0																			-
DUEN-IMA-152	Engineering Mathematics 1.	5	E	0	3	0																			-
DUEN-IMA-153	Basics of Computer Science 1.	5	M	1	0	2																			-
DUEN-ISF-111	Introduction to programming	5	M	1	0	2																			-
DUEN-ISR-118	Computer and Network Architectures	5	M	2	0	1																			-
DUEN-MUT-151	Engineering Physics	5	E	1	1	1																			-
DUEN-TKM-150	Legal Knowledge	5	E	3	0	0																			-
DUEN-IMA-212	Engineering Mathematics 2.	5	M				0	0	3																DUEN-IMA-152
DUEN-IMA-213	Basics of Computer Science 2.	5	M				2	0	1																DUEN-IMA-153
DUEN-ISF-010	Informatics	5	M				0	0	3																-
DUEN-ISF-210	Database systems	5	E				1	0	2																-
DUEN-ISF-213	Programming 1.	5	M				1	0	2																DUEN-ISF-111
DUEN-ISR-257	Windows operating system	5	E				1	0	2																-
DUEN-IMA-110	Mathematics 3.	5	M							0	3	0													DUEN-IMA-152
DUEN-ISF-112	Internet technologies	5	M							0	0	3													-
DUEN-ISF-113	Programming 2.	5	M							1	0	2													DUEN-ISF-213
DUEN-ISR-119	Electronic and digital systems	5	M							1	0	2													DUEN-MUT-151
DUEN-ISR-159	Linux Operating Systems	5	E							1	0	2													-
DUEN-TKT-151	Economics 1.	5	E							1	2	0													-
-	Optional course	5	-										-	-	-										-
-	Optional course	5	-										-	-	-										-
DUEN-ISF-250	Basics of AI	5	E										2	0	1										DUEN-ISF-111
DUEN-ISR-215	Embedded Systems	5	M										1	0	2										DUEN-ISR-119
DUEN-ISR-250	Computer Security	5	E										2	0	0										DUEN-ISR-118, DUEN-IMA-153
DUEN-ISR-258	Network management 1.	5	E										2	0	1										DUEN-ISR-118
-	Specialization	15	-													-	-	-							-
DUEN-TKM-128	Multimedia	5	M													2	0	2							-
DUEN-TVV-114	Management	5	M													1	2	0							-
DUEN-TVV-122	Entrepreneurship	5	M													1	2	0							-
-	Optional course	5	-																-	-	-				-
-	Specialization	15	-																-	-	-				-
DUEN-IMA-251	Numerical Methods	5	E																2	0	1				DUEN-IMA-110
DUEN-ISF-090	Thesis 1.	0	S																1	0	0				-
DUEN-ISR-157	Measurement and control	5	E																2	0	1				DUEN-IMA-110
-	Optional course	5	-																			-	-	-	-
-	Specialization	10	-																			-	-	-	-
DUEN-ISF-094	Thesis 2.	15	S																			0	9	0	DUEN-ISF-090
DUEN-ISF-097	Professional Internship	0	S																			0	0	0	
	Number of Theoretical/Practice/Lab classes per week			8	6	6	5	0	13	4	5	9	7	0	4	4	4	2	5	0	2	0	9	0	
	Total number of classes per week			**20**			**18**			**18**			**11**			**10**			**7**			**9**			
	Total credit points			.																					
COMPUTER NETWORK ENGINEERING																3	0	6	3	0	6	1	0	4	
																9			9			5			
				18			18			18			11			**19**			**16**			**14**			
SOFTWARE TECHNOLOGY																3	0	6	2	0	7	1	0	4	
																9			9			5			
				18			18			18			11			**19**			**16**			**14**			

E: exam, M: Midterm mark, S: Signature

SPECIALIZATION

COMPUTER NETWORK ENGINEERING

Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4			5			6			7			
				T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-ISR-116	Script languages	5	M													1	0	2							DUEN-ISF-111
DUEN-ISR-120	Network management 2.	5	M													1	0	2							DUEN-ISR-258
DUEN-ISR-121	Network operating systems – Windows	5	E													1	0	2							DUEN-ISR-257
DUEN-IMA-214	Operational research and Decision theory	5	E																1	0	2				DUEN-IMA-152
DUEN-ISF-217	Informatic project 1.	5	M																1	0	2				-
DUEN-ISR-214	Network operating systems – Linux	5	E																1	0	2				DUEN-ISR-159
DUEN-ISF-116	Informatic project 2.	5	M																			0	0	2	-
DUEN-ISR-164	Quality assurance and audit of critical systems	5	E																			1	0	2	-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	3	0	6	1	0	4	
	Total number of classes per week			0			0			0			0			**9**			**9**			**5**			
	Total credit points			**40**																					

E: exam, M: Midterm mark, S: Signature

SOFTWARE TECHNOLOGY

Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4			5			6			7			
				T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-ISF-117	Software development technologies	5	M													1	0	2							DUEN-ISF-113
DUEN-ISF-155	Programming 3.	5	E													1	0	2							DUEN-ISF-213
DUEN-ISR-116	Script languages	5	M													1	0	2							DUEN-ISF-111
DUEN-IMA-214	Operational research and Decision theory	5	E																1	0	2				DUEN-IMA-152
DUEN-ISF-217	Informatic project 1.	5	M																1	0	2				-
DUEN-ISF-253	Web Programming	5	E																0	0	3				DUEN-ISF-112
DUEN-ISF-116	Informatic project 2.	5	M																			0	0	2	-
DUEN-ISR-164	Quality assurance and audit of critical systems	5	E																			1	0	2	-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	2	0	7	1	0	4	
	Total number of classes per week			0			0			0			0			**9**			**9**			**5**			
	Total credit points			**40**																					

E: exam, M: Midterm mark, S: Signature

Description of the required subjects of Computer Science Engineering BSc

Tutorial mathematics

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Matematika felzárkóztató</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="4">Tutorial mathematics</td><td colspan="2">Subject code</td><td colspan="2">IMA-100</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="8">Institute of Informatics</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="6"></td><td colspan="2">Subject code</td><td colspan="2"></td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="4"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td colspan="2" rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td colspan="2">Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/26</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td rowspan="2">Signature</td><td rowspan="2">0</td><td colspan="2" rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per Semester</td><td>0</td><td>per Semester</td><td>10</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. Gordana Stankov</td><td colspan="2">Position</td><td colspan="2">assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="8">Educational goals, development objectives

Based on the preliminary knowledge assessment, this course is recommended for students studying in the bachelor courses in economics and management, materials engineering, mechanical engineering, business informatics, computer engineering, technical management, and in the higher vocational courses in engineering, economics and management. The aim is to acquire basic mathematical knowledge, to raise students' mathematical knowledge, skills and competences to a level appropriate for the preparation of higher education studies and for the completion of mathematics courses.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="7">-</td></tr>
<tr><td>Practice</td><td colspan="7">Classroom exercises, student-prepared papers, presentations, case studies.</td></tr>
<tr><td>Lab</td><td colspan="7">-</td></tr>
<tr><td>Misc.</td><td colspan="7">-</td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="8">Knowledge

Students know the methods and procedures needed to solve mathematical problems in their field. Possesses the knowledge and understanding of the mathematical, linear algebraic literacy required for the field of specialisation.</td></tr>
<tr><td colspan="8">Ability

Ability to apply the mathematical knowledge and activities learned. Ability to apply the problem-solving methods and procedures learned. Ability to develop and defend their own solution plans in discussions (argumentative debating skills) in relation to the mathematical concepts learnt. Ability to organise his/her own learning process effectively, to find and use different learning resources (print, electronic).</td></tr>
<tr><td colspan="8">Attitude

Open to learning about and embracing mathematically based, applied mathematical developments and innovations related to your qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="8">Autonomy and Responsibility

Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="8">The material for the intermediate mathematics exam.
Operations with complex numbers. Set theory, the concept of a function.
Number sequences, powers, roots, order of operations. Logarithm, solutions of linear and quadratic-equations. Solving problems in text. Exercise problems from the numeracy exercise in Engineering Mathematics 1.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="8">- Task solving with guidance 60 %
- Independent processing of tasks 40 %</td></tr>
</table>

Required reading and availability	• Lay, D. C.: Linear Algebra and its applications, 4th edition, Addison-Wesley, 2012. • Stewart, J.: Complex Numbers, Additional Topic to Essential Calculus, 2nd edition, 2013, pp. 1-11. • Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012.
Recommended readings and availability	Electronic content and learning material in Moodle and/or in Neptun systems.
Description of tasks/measurement procedures to be submitted	-
Description and schedule of the midterm tests	During the semester, full-time and correspondence students write 1 final examination in week 13. The final examination is assessed according to the TVR.

Introduction of Programming

Subject name	In Hungarian	Bevezetés a programozásba							Level	**BSc**	
	In English	**Introduction of Programming**							Subject code	**ISF-111**	
Responsible Educational unit name	**Institute of Informatics**										
Name of the required preliminary study									Subject code		
Type	Study load per week (in hours)							Requirement	Credit	Teaching language	
	Theoretical		Practice		Lab						
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader		Name	**Dr. Zoltán Király**						Position	**associate professor**	

Training course aims	**Educational goals, development objectives** The students will get to know the basics of structured programming. • Training history, development goals based on it. • The students gets acquainted with algorithmic thinking mainly in the framework of science subjects. In secondary school, simpler programs have already been written in C or Pascal languages. • The basic training method is followed, mastering the theory within the theoretical lessons. During the lab, students learn the skills of programming by writing short programs. • The subject provides theoretical and practical knowledge.	
Typical transfer methods	Theoretical	The lecture is provided to all students in a lecture room. The implementation of theoretical concepts in sample applications are explained and presented. Projectors and teacher's computers are used in every lecture.
	Practice	
	Lab	Different applications are implemented by the laboratory leader. The tasks are created on personal local storage using C#. Projectors and computers are used in every laboratory.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students will get to know the algorithm tools and the steps of the algorithm. know your programming environment. know the structured programming elements. know the algorithmic methods. know the basic data types and structures.	
	Ability The students will get to know the algorithm tools and the steps of the algorithm. know your programming environment. know the structured programming elements. know the algorithmic methods. learn to be able to specify short programs. be able to describe simple algorithms. learn to write easier C # programs in console mode. use Skill in the Visual Studio C # console panel be familiar with the basic data types and structures.	
	Attitude Interest in programming. Self-development using the available literature in English. The challenge of giving the solution (challenge).	
	Autonomy and Responsibility Independent thinking and problem solving. Assess, accept, or reject the difficulty of the task. Standalone specification capability.	
Short description of the subject content	Students become familiar with the basics of programming, the concepts of algorithm and software, and the basic tools needed for programming. During theoretical classes students	

	will be introduced to the basic principles of algorithmization, simple data structures and function creation.
Forms of student activity	Solving individual tasks (homework) outside the classroom. Finding solutions and implementing them for assigned tasks.
Required reading and availability	
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	One homework (compulsory application) • Topic: A programming task which fits to the material of theory and practice. • Date: The homework description is given on the 12th week. It must be finished until the last week of term-time. • It must be defended in front of a committee during last week of term-time which is appointed by the leader of practice. • It cannot be replaced! • In case of unsuccessful presentation (e. g.: if the student is not aware of the operation of the presented program or it is found that the program has been copied), the application will be rejected.
Description and schedule of the midterm tests	Two mid-term tests/exams. 1st mid-term test: it is recommended on the 6th week. 2nd mid-term test: the week before the last week during term-time. Replacement/Correction The material of the whole semester. Invalidate the previously mid-term tests. Deadline: last week during term-time. Final grade (lecture total min. 61% and practice total. min. 61%): <60%: Fail (1) 61-70%: Pass (2) 71-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5) Lecture: 1. test (50 points) + 2. test (50 points) = 100 point (each min. 51%, total min. 61%) Laboratory: 1. test (30 points) + 2. test (30 points) + Homework (40 points) = 100 points (each min. 51%, total min. 61%)

Computer and Network Architectures

Subject name		In Hungarian	Számítógép és hálózati architektúrák						Level	**BSc**	
		In English	**Computer and Network Architectures**						Subject code	**ISR-118**	
Responsible Educational unit name			**Institute of Informatics**								
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name	**Dr. Ervin Burkus**				Position	**assistant professor**	

Training course aims	**Educational goals, development objectives** The students should become familiar with computer architecture, hardware architectures, and network architectures, configuring subnets and network terminals. They should be able to replace computer components, install the Microsoft Windows operating system, and set up home, small business networking devices.	
Typical transfer methods	Theoretical	Lecture, in lecture hall, using tablet, computer and projector.
	Practice	
	Lab	Computer practice, projector and computer use in laboratories with appropriate software.
	Misc.	E-learning material in Moodle; Blended, hybrid learning.
Requirements (expressed study results)	**Knowledge** Student knows the general principles of how computers, operating systems, and networks work. Especially IBM PC compatible PCs and Cisco home and small-business devices.	
	Ability Student should be able to identify IBM PC-compatible PC components, build PCs, deploy Cisco home and small-business devices, and create a simple local area network.	
	Attitude The student is required to be open for learning about new operating systems and technologies used in them. He is interested in new operating systems and the technologies used in them. He/She seeks to implement lifelong learning, continuous professional training and self-education.	
	Autonomy and Responsibility The Student is responsible for the professional activity carried out independently and in the group. Students strive for quality work.	
Short description of the subject content	The study content of theoretical classes: The evolution of computers. The main components of computers and the integration process (cards -> ICs -> SoC). Structure of processors (CISC / RISC, cores, threads, cache levels). Bus systems and sockets role, type (BCLK and bandwidth on motherboards). RAM / ROM types, differences between data size and bus size, timings. Containers and their interfaces (differences between versions). Video outputs (GPUs, memories, interface types) and peripherals (connector types). Power supplies structure (connectors, voltage levels, power calculation). Networking (protocols, interfaces), LAN / MAN / WAN, ISO OSI, TCP / IP. IP and ICMP versions and traffic management in general. General basics about UDP, TCP. The study content of laboratory practical classes: PC parts replacement, UEFI settings, upgrade opportunities. Microsoft Windows installation, partitioning, file systems, permissions. Registry usage, tools, management of users and services. Schedule tasks. Folders, sharing printers. Event log, performance monitoring. PowerShell writing basic commands, scripts. Microsoft	

	Windows network configure. Network cable types, their preparation, testing. Home, access and configure small business ISRs.
Forms of student activity	- Processing heard text with notes. - Organize information. - Independent solution of tasks. - Solving tasks in groups.
Required reading and availability	- Tanenbaum, Andrew S.: Computer-architectures 2., edition, Panem Editor Co. Budapest, 2006. - Tanenbaum, Andrew S. – Woodhull, Albert S.: Operating systems; Planning and implementation, Panem Editor Co. Budapest, 2007 - Tanenbaum, Andrew S.: Computer networks (2. kiadás), edition, Panem Editor Co. Budapest, 2004
Recommended readings and availability	Electronic content and learning material in Moodle and/or in Neptun systems.
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	During the semester, there are two in-house dissertations in the labs, the first is evaluated in lab immediately, the second evaluation's files created will be uploaded to the Moodle system. It is possible to remedy these results in the last practical lesson (but you only have one time for all tasks then.) - 1. in-house evaluation exam: Main components and assembly of computers - 2. in-house evaluation exam: Task simulation in Cisco PacketTracer

Engineering Physics

Subject name		In Hungarian	Mérnöki Fizika								Level	**BSc**	
		In English	**Engineering Physics**								Subject code	**MUT-151**	
Responsible Educational unit name			**Institute of Engineering**										
Name of the required preliminary study											Subject code		
Type		Study load per week (in hours)							Requirement		Credit	Teaching language	
		Theoretical		Practice		Lab							
Full time	**150/39**	per Week	**1**	per Week	**1**	per Week	**1**		**Exam**		**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**5**	per Semester	**5**						
Course leader				Name		**Dr. Miklós Horváth**					Position	**c. professor**	

Training course aims	**Educational goals, development objectives** • To understand and learn the principles of particle mechanics, electricity, fluid and gas mechanics, thermodynamics, optics, quantum mechanics, • The preparation of the BSc level Physics and other related subjects.	
Typical transfer methods	Theoretical	In a classroom with the use of projector or computer in each lecture.
	Practice	Flipchart, blackboard and other multimedia equipment, group work for problem solving.
	Lab	Computer practice, projector and computer use in laboratories with appropriate software.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students will • Get acquainted with the principles of physics • Have practice for problem solving in physics problems • Have practice for measuring of basic physical quantities	
	Ability The students should be • Able to recognize the physical aspect of technical problems, • Able to solve and calculate physical problems, • Able to measure the physical parameters, able to use the instruments for measuring the basic physical parameters	
	Attitude The student should be open to learning about and to accepting knowledge related to physics, and should be interested in new methods and tools related to the field.	
	Autonomy and Responsibility Taking responsibility for one's own work and the work of others.	
Short description of the subject content	Kinematics, axioms of mechanics, basic equation of dynamics, work, energy, power, linear momentum, and collisions, oscillatory motion, simple harmonic motion, damped oscillation, forced oscillation, resonance. Basic phenomena of fluid dynamics, buoyant forces, Archimedes' principle, continuity equation, Bernoulli equation. Thermodynamics, thermal expansion, work and heat, specific heat, latent heat, calorimetry, thermodynamic processes, First Law of thermodynamics, kinetic theory of gases, Second Law of thermodynamics, entropy and disorder, energy conservation. Electricity electrostatics, electric current, resistance, Ohm's law, network analysis, magnetic field, electromagnetic induction, alternating current circuits. Optics, geometric optics, propagation of light. Interference of light, single-slit diffraction, diffraction grating, photometry. Laboratory practices.	
Forms of student activity	Individual work, frontal class work, problem solving. lab exercises in small groups.	
Required reading and availability	Materials on MOODLE Alvin Halpern: Beginning Physics I-II SHAUM OUTLINE SERIES McGraw- Hill, ISBN 0-07-025653-5)	

Recommended readings and availability	Daniel Oman- Robert Oman: Physics for the Utterly Confused (McGraw- Hill Companies, ISBN: 0-07-048262-4) Daniel Oman- Robert Oman: How to solve Physics Problems (McGraw- Hill Companies, ISBN: 0-07-048166-0)
Description of tasks/measurement procedures to be submitted	All together 5 measuring reports on the laboratory exercises.
Description and schedule of the midterm tests	Midterm tests on weeks 7th and 13th.

Legal Knowledge

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Jogi alapismeretek</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Legal Knowledge</td><td colspan="2">Subject code</td><td>TKM-150</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="5">Institute of Social Sciences
Department of Communication and Media</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="4"></td><td colspan="2">Subject code</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="2" rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td>Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>3</td><td>per Week 0</td><td>per Week 0</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>15</td><td>per Semester 0</td><td>per Semester 0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="2">Dr. habil Orsolya Fruzsina Falus</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

The goal of the course is to introduce the terminology of law and the rule of law in Hungary, in the European Union and from an international perspective, as well. Students will learn the principals of the Fundamental Law and the basics of public administration in Hungary, in the EU and the countries of the international community. They should be able to understand laws and apply the principle rules regulating business life. Students understand corruption as a criminal law concept, and know its forms, the United Nations Convention against Corruption, the EU anti-fraud policy, the OLAF (European Anti-Fraud Office) and its investigative powers. They are familiar with the policies aiming at the prevention of corruption.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">In a classroom with the use of projector or computer in each lecture.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5"></td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="6">Knowledge

Students know:
• the types, terminology and main principles of law,
• how to understand and apply rules,
• how public administration works,
• how legal entities are established and registered, the content of basic contracts.</td></tr>
<tr><td colspan="6">Ability

Students will be able to:
• find, understand and apply law,
• see the structure of law,
• establish and operate a legal entity, create basic contracts.</td></tr>
<tr><td colspan="6">Attitude

They should be open-minded, unprejudiced and creative to find the appropriate legal solution for certain cases.</td></tr>
<tr><td colspan="6">Autonomy and Responsibility

They should use legal jargon properly and be able to find and explain the appropriate law alone. They should recognize legal conflicts and exert a review concerning them with correct application of legal terms. They should understand the system of public administration and be aware of the importance of civic responsibility.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">The definition of law and the rule of law. The system of legal sources. Fundamental Law of Hungary. The National Assembly and the national referendum. The concept and principles of public administration. Bureaucracy. The concept of legal personality. The types of companies and company registration system. Basic types of economic contracts.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="6">• Frontal work: 30 %</td></tr>
</table>

	• Individual or group work: 35% • Test: 15% • Communication situation exercises: 20%
Required reading and availability	• The Fundamental Law of Hungary (25 April 2011) • (http://hunmedialaw.org/dokumentum/151/THE_FUNDAMENTAL_LAW_OF_HUNGARY.pdf) • Charles Szypszak: Understanding Law for Public Administration (http://samples.jbpub.com/9780763780111/80111_FMxx_Szypszak.pdf) • Materials on MOODLE
Recommended readings and availability	• Sources and Scope of European Law (http://www.europarl.europa.eu/ftu/pdf/enFTU_1.2.1.pdf) • Saylor Academy, 2012: Law for Entrepreneurs • https://saylordotorg.github.io/text_law-for-entrepreneurs/
Description of tasks/measurement procedures to be submitted	• On 7th week MIDTERM ESSAY, • On 13th week presentation.
Description and schedule of the midterm tests	According to the predetermined items.

Engineering Mathematics 1.

Subject name		In Hungarian	Mérnöki Matematika 1						Level	**BSc**	
		In English	**Engineering Mathematics 1**						Subject code	**IMA-152**	
Responsible Educational unit name			**Institute of Informatics**								
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**0**	per Week	**3**	per Week	**0**	**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**0**	per Semester	**15**	per Semester	**0**				
Course leader				Name		**Dr. Antal Joós**			Position	**associate professor**	

Training course aims	**Educational goals, development objectives** The students should get to know the basics of calculus and linear algebra which are required to the special subjects, as well as improvement of mathematical knowledge to study specialized literature. Student knows and understands the most remarkable relations, connections, and set of ideas.	
Typical transfer methods	Theoretical	
	Practice	Teaching in small groups, solving computational and applied exercises. Using projector, blackboard, calculator.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** The student should get to know methods and procedures required for solving of mathematical tasks from economic areas. Student has enough knowledge referring to mathematics, calculus, and linear algebra which are required by his/her special field.	
	Ability The student should be able to apply the studied mathematical knowledge and activity. The student is expected to be able to apply the studied methods and procedures. Student is able to create an own solving-plan and argue. Student is able to organize his/her own learning procedure as well as to find and use different learning sources.	
	Attitude Student should be willing to get acquainted with mathematical developments and innovations and their acceptance. Student is interested in new methods and means referring to his/her specialization.	
	Autonomy and Responsibility Students are expected to carry out their tasks by themselves, to think about different solutions and make suggestions. They take responsibility for their jobs.	
Short description of the subject content	• The basics of linear algebra. • The basics of calculus.	
Forms of student activity	• Directed learning of theoretical material 10 % • Independent learning of theoretical material 30 % • Directed exercise solving 30 % • Independent exercise solving 30 %	
Required reading and availability	• Lay, D. C.: Linear Algebra and its applications, 4th edition, Addison-Wesley, 2012. • Stewart, J.: Complex Numbers, Additional Topic to Essential Calculus, 2nd edition, 2013, pp. 1-11. • Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012.	
Recommended readings and availability		
Description of tasks/measurement procedures to be submitted		

Description and schedule of the midterm tests	Two tests will be written during the practice sessions: Test 1 on week 6 (20 points, 45 minutes), Test 2 on week 12 (20 points, 45 minutes). Make up Tests on the week 13. If the offered mark is not accepted, then the maximum scores of the written exam is 40. Conditions of final assessment from the 80 scores (40 test scores and 40 exam scores): 0-40 fail, 41-48 poor/pass, 49-56 satisfactory/fair, 57- good. If a student has at least 57 scores, then he/she can take an oral exam for the excellent mark.

Basics of Computer Sciences 1

Subject name		In Hungarian		Számítástudomány alapjai 1					Level		**BSc**
		In English		**Basics of Computer Sciences 1**					Subject code		**IMA-153**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. Györgyi Strauber**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The aim of the module is to introduce the essential mathematical basics to the special subjects of informatics. Students will learn the basics of discrete mathematics and basic algorithms that will serve as the basis for their subsequent programming knowledge.	
Typical transfer methods	Theoretical	With the participation of every student in the large lecture hall. Lecture with projector and blackboard or online course using Teams meeting.
	Practice	
	Lab	In classrooms with computer work-stations for every student. The teacher's computer is connected to projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students should • acquire such mathematical knowledge, which are necessary to understand additional IT subjects • understand the principle of operation of basic algorithms, knows the possible ways of describing them.	
	Ability The students should be • able to read and understand mathematical texts; • able to use mathematical knowledge in IT fields; • able to further develop the known basic algorithms and integrate them into more complex programs.	
	Attitude The students are required to have an open, inquisitive, constructive, efficient, and creative attitude to the course.	
	Autonomy and Responsibility Taking responsibility, making decisions and managing tasks independently in the given field.	
Short description of the subject content	Lecture: Sets, Set operations, Logic, Propositions, Relations and Their Properties, Representing Relations, Equivalence Relations, Partial Orderings, Functions, Properties of functions, Methods of Proof, Mathematical Induction, Algebraic structures, Information theory, Coding theory. Seminar: Numeral systems, number representation, basic algorithms.	
Forms of student activity	• Lecture: 50% • Self-dependent task solving: 50%	
Required reading and availability	K.H. Rosen: Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.	
Recommended readings and availability		
Description of tasks/measurement procedures to be submitted	Midterm tests	

Description and schedule of the midterm tests	• 1st midterm test: Week 5 • 2nd midterm test: Week 8 • 3rd midterm test: Week 12 • Make-up test: Week 13

Programming 1.

Subject name		In Hungarian		Programozás 1.							Level	**BSc**	
		In English		**Programming 1**							Subject code	**ISF-213**	
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study				Introduction to Programming							Subject code	ISF-111	
Type		Study load per week (in hours)								Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab							
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**			**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**						
Course leader				Name		**Dr. habil. Jozsef Katona**					Position	**associate professor**	

Training course aims	**Educational goals, development objectives** To know the basics of OOP programming, exception handling, attributes, reflections, delegates, events, collections, generic programming, serialization, LINQ and Unsafe codes. The subject provides both theoretical and practical knowledge. It lays the foundation of the knowledge the further software development subjects.	
Typical transfer methods	Theoretical	The lecture is provided to all students in a lecture room. The implementation of theoretical concepts in sample applications are explained and presented. Projectors and teacher's computers are used in every lecture.
	Practice	
	Lab	Different applications are implemented by the laboratory leader. The tasks are created on personal local storage using C#. Projectors and computers are used in every laboratory.
	Misc.	
Requirements (expressed study results)	**Knowledge** It is assured to know the advanced opportunities of C# (OOP, exception handling, reflection, delegates, events, collections, generic programming, serialization, LINQ and Unsafe codes) and students can design different UML static diagrams to write more efficient source codes.	
	Ability Students are able to implement/make C# based applications or solutions which require exception handling, attributes, reflection, delegates, events, collection, generics, LINQ and serialization technologies and technics using object-oriented elements. They are capable of solving complex tasks or problems completely (design and create algorithms, implement an application, testing, debugging and make documentation). They can read and modify static UML diagrams to C# source code. They can understand a complex application and work on it even in a team.	
	Attitude Students are motivated to programming. They are open-minded to discover new corporate solutions, accept to principles of an organizational work and find easily their place in a project team. In case of self-sufficient jobs, all phases are done with the best possible mode and results. In teamwork, they make an effort to do a high-quality job and observe deadlines.	
	Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.	
Short description of the subject content	• The basic stages of software development • Procedural vs. Object-Oriented Programming (OOP) • The basic terms and concepts of object-oriented paradigm	

	• UML
	  • class diagram (notations, camelCase, PascalCase, structure, access modifiers, examples)
	  • object diagram (notations, structure, examples)
	  • UML notations for stereotypes
	  • Association relationship
	  • Generic classes and the inheritance
	• Exception handling
	• Attributes, reflections
	• Delegates and events
	• Collections
	• Generics programming
	• Serialization
	• LINQ to Object, LINQ to XML
	• Unsafe code

Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• John Sharp, *Microsoft Visual C# Step by Step (9th Edition)*, Microsoft Press, 2018. • Troelsen and P. Japikse, *Pro C# 7: With .NET and .NET Core*. Berkeley, CA: Apress, 2017. • M. Seidl, M. Scholz, C. Huemer, and G. Kappel, *UML @ classroom an introduction to object-oriented modelling*. Cham: Springer, 2015. • Electronic curriculums are associated with C# available in the Moodle system.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Optionally, upon individual request, it is possible to prepare an assignment for an additional (bonus) 25 points: • Topic: That is, the solution of a programming task matching the materials of theory and practice. • Date: Everyone will receive the description of what is to be submitted in the 6th week. Its preparation is an extracurricular task for the last diligence week; • At the time designated by the supervisor of the exercise, but the deadline for its preparation is the last week of the diligence period, you must personally defend it in front of a committee. • Submitting the project work. The assignment cannot be replaced!
Description and schedule of the midterm tests	There are no conditions attached to obtaining the signature. Mid-term exams: Two mid-term exams from the theory and two mid-term exams from the lab. Date: 1. mid-term exam from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 6th week). 2. mid-term exams from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 11th week). Replacement mid-term exam/Repair mid-term exam: Each mid-term exam can be individually replaced or repaired during the diligence period. The first mid-term exam (lecture and lab) is expected in the 12th week, while the second mid-term exams are expected in the 13th week. Among the mid-term exams written more than once, the best result will be taken into account. Determination of merit: <=30 points: insufficient (1) 31-50 points: sufficient (2) 51-70 points: medium (3) 71-85: good (4)

	86-125 points: excellent (5) The final grade may differ from the one calculated in this way (plus/minus) by one mark, taking into account the mid-semester activity and attitude. Available points: Theory: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) = 50 points, Lab: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) + optional to be submitted (25 points) = 75 points (There is no minimum requirement for each location.) Examination period: As a make-up exam, the subject can be made up/corrected in closed places during the exam period. In this case too, the best result among the mid-term exams written more than once will be taken into account.

Windows Operating Systems

Subject name		In Hungarian		Windows operációs rendszer					Level		**BSc**
		In English		**Windows Operating Systems**					Subject code		**ISF-257**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. György Ágoston**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The aim of the course is to get acquainted with the specialities of the Windows operating systems, promote and support their application at beginner and advanced levels. Students should get acquainted with the most important applications under Windows, main attributes and possibilities. They will be able to create their own automated tasks and own scripts.	
Typical transfer methods	Theoretical	Presentation in a lecture hall using a projector.
	Practice	
	Lab	Computer lab, using a projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** • Knows the possibilities and tools of the IT field. • Has expertise and industry-specific knowledge of Windows. • Knows the methods and procedures needed to solve common problems/tasks in the ICT field. Has the knowledge of specialist-specific tools to perform tasks appropriate to the IT field.	
	Ability • Able to perform routine operational tasks in the ICT field, perform planned development tasks. • Apply learned problem-solving methods and procedures to perform his/her field tasks.	
	Attitude The student should • be interested in new methods and tools related to the field. • strive to maintain the level of knowledge about Windows systems and continuous professional training and self-education.	
	Autonomy and Responsibility • Capability for a managed IT job, in which he/she performs his/her job tasks independently. • Taking responsibility for his/her own work (for individual and team work, decisions, results). • Independently making decisions on the development of his own knowledge, plans and organizes it.	
Short description of the subject content	• History, development, general attributes, philosophy of Windows. Structure and characteristics of Windows file systems, overview of the directory hierarchy, structure and use of file and directory references. Process management, general characteristics of processes. • Processes, threads, address spaces, ports, memory management, paging, virtual memory, file systems. MS Windows: structure, authorization system, file system, registry, file system and registry privileges, tools, users, services, disk management, task scheduling, sharing folders and printers, event log, performance monitoring. • PowerShell basic commands, scripts.	
Forms of student activity	• Processing heard text with notes.	

	• Organize information, independent solution of tasks. • Solving tasks in teams.
Required reading and availability	Presentations used in lectures and during lab classes in PDF format in the Moodle.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Assignment to be submitted and presented from a topic on Windows. Preparation and presentation of two project tasks (for extra points).
Description and schedule of the midterm tests	Week 7, project assignment Week 11, project assignment Week 12, practical mid-term exam (task solution) Week 13, theoretical knowledge (test) Possibility of replacement and repair in the last week of the due diligence period.

Database Systems

Subject name		In Hungarian		Adatbáziskezelés							Level	**BSc**	
		In English		**Database Systems**							Subject code	**ISF-210**	
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study											Subject code		
Type		Study load per week (in hours)								Requirement	Credit	Teaching language	
		Theoretical		Practice			Lab						
Full time	**150/39**	per Week	**1**	per Week	**0**		per Week	**2**		**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**		per Semester	**10**					
Course leader				Name		**Dr. Mariann Váraljai**					Position	**associate professor**	

Training course aims	**Educational goals, development objectives** The majority of IT systems deal with data management. The main tool for that is the database management system. It is important, therefore, that the use of these is well known and practiced by an IT professional. The aim of the course is to introduce students to the tasks of database systems and the methods of solving tasks. Students will be able to model data, use relational and semi-structured databases. The prerequisite for effective study of the subject is the existence of basic programming skills and mathematical logic. Knowledge of the subject is expected in all other subjects dealing with complex programming, system design and implementation tasks.	
Typical transfer methods	Theoretical	Lecture, in lecture hall, using computer and projector. Online learning materials (handbooks, lecture presentations etc.) are available for the students.
	Practice	
	Lab	In classrooms with the use of projector and computer, students solve individual tasks on the computers, using programs, with teacher assistance. Computer based exercises, individual tasks.
	Misc.	
Requirements (expressed study results)	**Knowledge** • Students know the operation and use of database systems. • Students know database design methods, their capabilities and limitations.	
	Ability • Students can design and use databases independently. • Students are able to collaborate • Students are able to review, analyse and solve complex tasks	
	Attitude • Students should be open to explore and embrace new database systems and the technologies used in them. • They should be interested in new technologies related to databases. • They should strive for lifelong learning, continuous vocational training and self-training.	
	Autonomy and Responsibility • Students strive for efficient and quality work. • The students should take responsibility for the professional activities carried out independently.	
Short description of the subject content	Database design, modelling Overview of Data Modelling, ODL, E / R, UML. The relational data model. Transcribe ODL, E / R, and UML schema to relational schema. Functional dependencies, their rules. Closes an attribute set and calculates it. Polyvalent dependencies. Normal forms, steps of normalization. Relational algebra.	

	Use of SQL. Constraints, triggers. Embedded SQL, dynamic SQL. SQL injection and methods of defence. Transaction, atomicity, handling dirty data. Problems with simultaneous modifications, isolation levels. Implementation of database systems, the problems solution. Steps for query optimization. Error handling, logging methods. Semi-structured data management. Distributed database systems. Multi-database systems. Data warehouse, database association. OLAP, OLTP. Practice: Using database systems. Practice methods of normal use and methods of creating and correcting various error situations.
Forms of student activity	• Heard information processing by creating notes, • systematization of information has led by tasks, • self-processing (individual) tasks, • teamwork
Required reading and availability	• Jeffrey A. Hoffer – V. Ramesh – Heikki Topi: Modern Database Management, Pearson Education Inc., 2016 • Hans-Petter Halvorsen: Introduction to Database Systems 2017 • Hans-Petter Halvorsen: Structured Query Language 2017 • DBMS – Database Management System Tutorials Point(I) Pvt.Ltd, 2015 • w3schools References and Tutorial: https://www.w3schools.com/sql/default.asp
Recommended readings and availability	Electronic literature in Moodle or in Neptun, and examples on the Internet.
Description of tasks/measurement procedures to be submitted	Solving the assignments given by the supervisor. It is not compulsory, but rather for extra (bonus) points, the student has the opportunity to solve an assignment on a topic of his/her own choosing that is in line with the material of the semester, and the deadline for submitting it is the date of the last laboratory exercise at the end of the semester. The extra point will be included in the final grade. It is necessary to discuss the undertaken task with the internship supervisor. The task is to design and implement a database that meets the real needs and implement some queries.
Description and schedule of the midterm tests	Laboratory: During the semester, 2 mid-term exams from the course material processed up to that point. Sometimes there is a 10-minute mid-term test during the lab class.

Informatics

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Informatika</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="3">Informatics</td><td colspan="2">Subject code</td><td colspan="2">ISF-010</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="7">Institute of Informatics</td></tr>
<tr><td colspan="2">Name of the required preliminary study</td><td colspan="4"></td><td colspan="2">Subject code</td><td colspan="2"></td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="4">Study load per week (in hours)</td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td colspan="2" rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td colspan="2">Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>0</td><td>per Week</td><td>0</td><td>per Week</td><td>3</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td colspan="2" rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>0</td><td>per Semester</td><td>0</td><td>per Semester</td><td>15</td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="3">Dr. Mariann Váraljai</td><td>Position</td><td colspan="2">associate professor</td></tr>
<tr><td colspan="2">The educational purpose and justification of the course</td><td colspan="8">Educational goals, development objectives

In addition to the necessary basic information technology knowledge, students should acquire a higher level of knowledge in the given fields, which gives individuals the opportunity to develop the knowledge and skills necessary for the efficient, effective and professional use of the most common computer applications at work.
• Be able to safely manage a graphical operating system.
• Be able to browse the Internet, search for relevant information and conduct electronic correspondence. Learn about scientific search services and the general rules of etiquette for internet communication (NET etiquette)
• Be able to create any complex, multi-page text document with the word processing program, and be able to create professional digital text.
• Be able to create a table, manage data with the spreadsheet program, and be able to implement data visualization.
• Be able to make presentations and apply advanced presentation techniques.
• Be able to use artificial intelligence (AI) responsibly and safely, with particular attention to critical thinking when making decisions involving AI technology.
• Be able to develop an appropriate ethical attitude towards AI and data protection.
• Be able to use any innovative IT tools and applications independently and creatively.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td colspan="2">Theoretical</td><td colspan="6"></td></tr>
<tr><td colspan="2">Practice</td><td colspan="6"></td></tr>
<tr><td colspan="2">Lab</td><td colspan="6">In rooms with computers and projectors, students solve individual tasks with the help of teachers, and online course material is available to students.</td></tr>
<tr><td colspan="2">Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="3">Requirements (expressed study results)</td><td colspan="8">Knowledge

Students are required to be familiar with the general and specific mathematics, informatics principles, rules, relationships and procedures of the user programs in the field of information technology. They have adequate expertise in the IT field specialist knowledge of specific tools for selecting tools and to carry out its tasks.</td></tr>
<tr><td colspan="8">Ability

Students are able to perform partial activities independently during solving more complex system problems. They apply their studied problem solving methods and procedures efficiently in expertly tasks. Throughout the course, participants will learn to handle AI technology with critical thinking and make responsible decisions in source management.</td></tr>
<tr><td colspan="8">Attitude

Students are interested in new methods and tools related to IT section. Students consider their own professional competences and activities on reflective way. Open to understand and accommodate professional, technological development and</td></tr>
</table>

	innovation area. They apply technology in an ethical manner and in accordance with moral guidelines.
	Autonomy and Responsibility Students should strive for efficient and quality work. The responsible for the technical operations carried out independently.
Short description of the subject content	– Confident use of operating system: managing files and folders. – Goal-oriented use of the Internet, knowledge of NETiquette. Targeted search on the Internet. Use of email programs. – Word processing with MS Word word processor program: Basic text editing operations, creating tables, applying styles, creating a table of contents and other lists, and creating mail merges. – Spreadsheet management with MS Excel spreadsheet program: Creating, uploading and formatting tables, using cell references, formulas, functions, charts as data visualization, applying simple database operations, managing and visualizing data. – Making a presentation with MS PowerPoint or Prezi: basic slide editing and formatting operations, using the slide master, slide templates, applying styles, slideshow settings and presentation techniques. – They make independent, creative use of innovative information technology (e.g. AI) and tools.
Forms of student activity	Heard information processing by creating notes, systematization of information has led by tasks (40%) Self-processing (individual) tasks (60%)
Required reading and availability	[1] WORD 2010 All-In-One for Dummies by Doug Lowe with Ryan Williams, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) [2] EXCEL 2010 All-In-One for Dummies by Greg Harvey, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) [3] ACCESS 2010 All-In-One for Dummies by Margaret Levine Young, Alison Barrows, and Joseph C. Stockman, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) [4] POWER POINT 2010 All-In-One for Dummies by Doug Lowe, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) [5] The Internet for Dummies 12th edition by John R. Levine – Margaret Levine Young, Wiley Publishing Inc, Indiana (free pdf on Internet) [6] OFFICE 2010 All-in-one for Dummies by Peter Weverka, Wiley Publishing, Inc. Indiana (free pdf on Internet)
Recommended readings and availability	Electronic literature in Moodle or in Neptun. Microsoft Office Tutorial and examples (Internet).
Description of tasks/measurement procedures to be submitted	Compulsory assignment: Creating your own individual presentation using MS Power Point or the Prezi program based on the conditions set by the instructors. Deadline: until the 10th teaching week. (Upload to the Moodle system!) Not mandatory, but for extra (bonus) points: The student has the opportunity to solve a Word and Excel task on a topic of his or her own choosing that matches and is consistent with the material of the semester. The extra point will be included in the final grade. It is necessary to discuss the undertaken task with the internship supervisor. The task is to create a document, table, database that meets real needs with the help of Microsoft Office programs.
Description and schedule of the midterm tests	At the end of each topic, students write mid-term exams, typically: Week 5: Text editing mid-term exam Week 11: Table management mid-term exam In the case of any mid-term test thesis, the opportunity for replacement and correction is available in the last week of the diligence period (typically the 13th week) and during the exam period.

Engineering Mathematics 2

Subject name		In Hungarian		Mérnöki Matematika 2					Level		**BSc**
		In English		**Engineering Mathematics 2**					Subject code		**IMA-252**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. László Bognár**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The purpose of the course is to make the students familiar with analysing data using statistical methods and tools. Having covered this course students understand the objective of probability and statistics, they know the different ways of gathering data, analysing datasets with statistical software and they can make inferences for real world situations based on samples of data.	
Typical transfer methods	Theoretical	These formal lectures mostly aim at transferring information. Students are expected to take personal notes in addition to the course text, slides or transparencies.
	Practice	
	Lab	Students are expected to be actively involved. Whether it is about exercises, feedback on an assignment or practicing statistical data analysis with software package personal input will always be expected.
	Misc.	
Requirements (expressed study results)	• Students will have a solid foundation of analysing processes or phenomena described by quantitative data. • Students will demonstrate their ability to apply statistics in other fields at an appropriate level and demonstrate their ability to apply knowledge acquired from their major to real world models. • Students will demonstrate mastery of data analysis and statistical concepts by communicating critically reasoned analysis through written and oral presentations. • Students will acquire up-to-date skills and/or applications of computer use related to future career choices. • Students will be able to read, interpret, and critically analyse journal articles in the related field.	
Short description of the subject content	• During the course students will be engaged in the following topics: introduction, descriptive statistics, probability, random variable, method of estimation, test of hypotheses, simple linear regression.	
Forms of student activity	• Frontal work 30% • Individual or group work 50% • Testing 20%	
Required reading and availability	• James T. McClave, P. George Benson, Terry Sincich : Statistics for Business and Economics. Ed 12th. Pearson Education, Inc. 2014. • Douglas C. Montgomery George C. Runger : Applied Statistics and Probability for Engineers. Ed 5th. John Wiley & Sons Inc. 2011.	
Recommended readings and availability	1. http://onlinestatbook.com/2/index.html 2. STATISTICS FOR BUSINESS AND ECONOMICS TWELFTH EDITION James T. McClave Info Tech, Inc. University of Florida P. George Benson College of Charleston	

	Terry Sincich University of South Florida 3. STUDENT'S SOLUTIONS MANUAL Nancy S. Boudreau Bowling Green State University
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	Continuous evaluation in the form of midterm tests.

Basics of Computer Sciences 2

Subject name		In Hungarian		Számítástudomány alapjai 2					Level		**BSc**
		In English		**Basics of Computer Sciences 2**					Subject code		**IMA-213**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Basics of Computer Sciences 1					Subject code		IMA-153
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**2**	per Week	**0**	per Week	**1**	**Midterm Mark**	**5**		**English**
Part time	**150/15**	per Semester	**10**	per Semester	**0**	per Semester	**5**				
Course leader				Name		**Dr. Györgyi Strauber**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The aim of the module is to acquaint students with the basic data structures used in informatics and the algorithms that can be connected to them. At the end of the module, the student is expected to be able to see and create more complex algorithms consisting of several basic elements. Students will learn about the basics of syntactic analysis of programs, the theory of formal languages, and finite automata.	
Typical transfer methods	Theoretical	With the participation of every student in the large lecture hall. Lecture with projector and blackboard or online course using Teams meeting.
	Practice	
	Lab	In classrooms with computer work-stations for every student. The teacher' s computer is connected to projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students are required to - know the most common data structures. - understand the principle of operation of more complex algorithms, knows their application possibilities.	
	Ability The students of the course are required to - have algorithmic thinking, apply the acquired knowledge, solve tasks, use the learned procedures, methods and concepts - be able to further develop the known algorithms and integrate them into more complex programs.	
	Attitude The students should have an open, inquisitive, constructive, efficient, creative attitude.	
	Autonomy and Responsibility Taking responsibility, making decisions and managing tasks independently in the given field.	
Short description of the subject content	Data structures: queues, stacks, linked lists, graphs, trees Algorithms connected to the data structures, sorting algorithms, recursive algorithms. Formal languages and their operations, generative grammars and their classification, finite automata, Turing machines.	
Forms of student activity	Lecture: 50% Self-dependent task solving: 50%	
Required reading and availability	Géza Horváth, Benedek Nagy: Formal Languages and Automata Theory Typotex Publishing, www.typotex.hu, ISBN: 978-963-279-344-3 Seymour Lipschutz: Data Structures, Revised First Edition, McGraw Hill, 2014	
Recommended readings and availability		
Description of tasks/measurement procedures to be submitted	Midterm tests	

Description and schedule of the midterm tests	1st midterm test: Week 5 2nd midterm test: Week 8 3rd midterm test: Week 12 Make-up test: Week 13

Programming 2.

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Programozás 2.</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="4">Programming 2</td><td colspan="2">Subject code</td><td colspan="2">ISF-113</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="8">Institute of Informatics</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="4">Programming 1</td><td colspan="2">Subject code</td><td colspan="2">ISF-213</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="4"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td colspan="2">Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester</td><td>0</td><td>per Semester</td><td>10</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. habil. József Katona</td><td>Position</td><td colspan="2">associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="8">Educational goals, development objectives

The aim of the course is to present for students several aspects of visual and graphical programming basis. It provides high skills to create parallel or multi-threaded software and use the asynchronous opportunities of the given programming language. Further objective is to introduce students to the basics of network programming and to provide tools with which they will be able to implement and manage service applications. Eventually, transfer so knowledge that they will be able to create business applications, even implementing and using custom controls or building external libraries or components.

The subject provides both theoretical and practical knowledge. It lays the foundation of the knowledge the further software development subjects.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="7">The lecture is provided to all students in a lecture room.
The implementation of theoretical concepts in sample applications are explained and presented.

Projectors and teacher’s computers are used in every lecture.</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Lab</td><td colspan="7">Different applications are implemented by the laboratory leader.
The tasks are implemented on our own local repository of the university in C# language. The created and used databases are stored and accessed on remote servers.

Projectors and computers are used in every laboratory.</td></tr>
<tr><td>Misc.</td><td colspan="7"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="8">Knowledge

It is assured to know the advanced opportunities of C# (visual and graphical programming, multi-threading, parallelism, asynchronousness, network programming, service application development and management, business application implementation). Knowledge of OOP and using it with high efficiency is provided.</td></tr>
<tr><td colspan="8">Ability

Students can implement application using object-oriented elements that try to take advantage of the resources of processors with multiple cores and threads. They will be able to network programming, create and manage services as well implement business software.</td></tr>
<tr><td colspan="8">Attitude

Students are motivated to programming. They are open-minded to discover new corporate solutions, accept to principles of an organizational work and find easily their place in a project team. In case of self-sufficient jobs, all phases are done with the best possible mode and results. In teamwork, they make an effort to do a high-quality job and observe deadlines.</td></tr>
<tr><td colspan="8">Autonomy and Responsibility

Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.</td></tr>
</table>

Short description of the subject content	• Introduction to visual programming • Implement multithreading application • Possibilities of parallelization • Language-level asynchronousness • Network programming • Implementing and managing service applications • Basics of Graphic Programming • Implement business applications
Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• John Sharp, *Microsoft Visual C# Step by Step (9th Edition)*, Microsoft Press, 2018. • Troelsen and P. Japikse, *Pro C# 7: With .NET and .NET Core*. Berkeley, CA: Apress, 2017. • M. Seidl, M. Scholz, C. Huemer, and G. Kappel, *UML @ classroom an introduction to object-oriented modelling*. Cham: Springer, 2015. • Electronic curriculums are associated with C# available in the Moodle system.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Optionally, upon individual request, it is possible to prepare an assignment for an additional (bonus) 25 points: • Topic: That is, the solution of a programming task matching the materials of theory and practice. • Date: Everyone will receive the description of what is to be submitted in the 6th week. Its preparation is an extracurricular task for the last diligence week; • At the time designated by the supervisor of the exercise, but the deadline for its preparation is the last week of the diligence period, you must personally defend it in front of a committee. • Submitting the project work. The assignment cannot be replaced!
Description and schedule of the midterm tests	There are no conditions attached to obtaining the signature. Mid-term exams: Two mid-term exams from the theory and two mid-term exams from the lab. Date: 1. mid-term exam from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 6th week). 2. mid-term exams from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 11th week). Replacement mid-term exam/Repair mid-term exam: Each mid-term exam can be individually replaced or repaired during the diligence period. The first mid-term exam (lecture and lab) is expected in the 12th week, while the second mid-term exams are expected in the 13th week. Among the mid-term exams written more than once, the best result will be taken into account. Determination of merit: <=30 points: insufficient (1) 31-50 points: sufficient (2) 51-70 points: medium (3) 71-85: good (4) 86-125 points: excellent (5) The final grade may differ from the one calculated in this way (plus/minus) by one mark, taking into account the mid-semester activity and attitude. Available points:

	Theory: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) = 50 points, Lab: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) + optional to be submitted (25 points) = 75 points (There is no minimum requirement for each location.) Examination period: As a make-up exam, the subject can be made up/corrected in closed places during the exam period. In this case too, the best result among the mid-term exams written more than once will be taken into account.

Linux Operating Systems

Subject name		In Hungarian		Linux operációs rendszerek					Level		**BSc**
		In English		**Linux Operating Systems**					Subject code		**ISF-159**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. György Agoston**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The aim of the course is to get acquainted with the peculiarities of Unix / Linux operating systems, promote and support their application at the beginner and advanced level. Students should get acquainted with the most important applications running under Unix/Linux, main features and possibilities. Be able to create own work environment, automated tasks, own scripts. Be able to work, think, perform tasks in a Linux operating system. The subject is a compulsory subject for all students studying in the field of ICT. It is recommended to place it into the middle of the whole study period. What you learn in the subject will help you find a position in DEVOPS.	
Typical transfer methods	Theoretical	Presentation in a lecture hall using a projector.
	Practice	
	Lab	Computer lab, using a projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students are required to • get to know the possibilities and tools of the ICT field. • have a special and industry-specific knowledge of Unix/Linux systems. • get to knows the methods and procedures needed to solve frequently occurring problems/tasks in the ICT field. • acquire the knowledge of the ICT-specific tools to perform tasks.	
	Ability The students should • be able to perform routine operational tasks in the ICT field, perform development subtasks according to plans. • apply learned problem-solving methods and procedures to perform his/her field tasks.	
	Attitude The students are required to • be interested in new methods and tools related to the field. • strive to maintain the level of knowledge about Unix/Linux systems and continuous professional training and self-education.	
	Autonomy and Responsibility • Capability for a managed IT job, in which he/she performs his/her job tasks independently. • Taking responsibility for his/her own work (for individual and team work, decisions, results). • Making independently decisions on the development of his own knowledge, planing and organizing it.	
Short description of the subject content	History, development, general features, concepts and operating philosophy of Unix/Linux. Structure and characteristics of Linux file systems, overview of the directory hierarchy, structure and use of file and directory references. Use of the „basic” authorization system and POSIX ACLs, management and identification of users. I/O redirection and I/O scheduling. Use regular expressions. Linux kernel 2.6 and later and its capabilities. Process management, general characteristics of	

	processes. The Linux boot process. Linux network management. Structure and operation of the X Window System. The best known Linux distributions and their features. Significance, capabilities and scope of use of Linux.
Forms of student activity	• Processing heard text with notes. • Organize information, independent solution of tasks. • Solving tasks in teams.
Required reading and availability	Presentations used during lectures and during lab classes in PDF format in the Moodle.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Theoretical knowledge: oral answers based on a list-of-questions. Demonstration practical knowledge during lab classes by solving exercises.
Description and schedule of the midterm tests	1st midterm test: During 6th week, theories and exercises. 2nd midterm test: During 12th week, theories and exercises. Replacement and repair is possible in the last week of the due diligence period or at another agreed time.

Internet Technologies

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Internet technológiák</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Internet Technologies</td><td colspan="2">Subject code</td><td>ISF-112</td></tr>
<tr><td colspan="4">Responsible Educational unit name</td><td colspan="5">Institute of Informatics</td></tr>
<tr><td colspan="4">Name of the required preliminary study</td><td colspan="3"></td><td colspan="2">Subject code</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="3"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td>Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>0</td><td>per Week</td><td>0</td><td>per Week</td><td>3</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>0</td><td>per Semester</td><td>0</td><td>per Semester</td><td>15</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. Mariann Váraljai</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives

While acquiring the curriculum of Internet Technologies, students will acquire a thorough knowledge of website design. Students learn HTML and JavaScript language used in web design and are also acquainted with CSS technology. Students will be able to develop web pages.

The subject is an optional subject for all IT students.
The educational background of the subject: basic information technology and programming skills acquired in public education or during higher education studies</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Students solve individual tasks on the computers, using programs, with teacher assistance in classrooms with the use of projector and computer. Computer based exercises, individual tasks.
Online learning materials are also available during the learning process.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="7">Knowledge

• While acquiring the curriculum of Internet Technologies, students will acquire a thorough knowledge of website design.
• Students acquaint themselves with the HTML and JavaScript language used in web design and also learn CSS technology. Students will be able to develop web pages.</td></tr>
<tr><td colspan="7">Ability

• Students know the HTML language and CSS stylesheets to create websites. They have JavaScript programming skills to complete the tasks. They also know the technological background of up-to-date web-design.
• Students are able to create documents that can be interpreted for a web browser, to produce event-driven (dynamic) websites and web content. They are also able to apply the knowledge acquired during the course to a real web server environment.</td></tr>
<tr><td colspan="7">Attitude

• Students are interested in new methods for modern website design. They are opened to continually renewing HTML language and CSS technology, so therefore they strive for lifelong learning, continuous professional training, and general self-education.</td></tr>
<tr><td colspan="7">Autonomy and Responsibility

• Students will be independent web site designers and developers that carries out their own job tasks, thinking and developing professional questions independently. A student decides independently on the development of his own knowledge, plans and organizes it. A student is responsible for the preparation, proper appearance and operation of the website entrusted to it.</td></tr>
</table>

Short description of the subject content	The development of World Wide Web. The development of HTML language, its basic concepts, and the use of HTML5 language through the general description of the Internet. The structure of an HTML document and the HTML instructions. The concept and use of CSS. CSS3-based content formatting. Basics and application of JavaScript programming language. Accessing objects and their use with JavaScript. Use and possibilities of jQuery JavaScript library.
Forms of student activity	Heard information processing by creating notes, systematization of information has led by tasks (40%) Self-processing (individual) tasks (60%)
Required reading and availability	[1] Elizabeth Castro and Bruce Hyslop: HTML5 and CSS3, Seventh Edition: Visual QuickStart Guide Peachpit Press, 2012 [2] Microsoft Corporation: HTML5 Step-by-step, O'Reilly Media Inc, 2011 [3] Brian P. Hogan: HTML5 and CSS3 second edition – Level up with Today's Web Technologies, Dallas Texas, 2013 [4] Danny Goodman: JavaScript™Bible 4th Edition, Hungry Minds, Inc.New York, NY Cleveland, OH Indianapolis, IN, 2001 [5] Paul Wilton, Jeremy McPeak: Beginning Java Script 4th Edition, Wiley Publishing, Inc., 2010
Recommended readings and availability	Electronic literature in Moodle or in Neptun. Microsoft Office Tutorial and examples (Internet).
Description of tasks/measurement procedures to be submitted	The student has the option, not necessarily, but for extra (bonus) points.
Description and schedule of the midterm tests	Test time: Week 7., Week 12., Week 13 (re-take). During the semester, students take 2 tests: Test 1: HTML5, CSS3 Test 2: JavaScript Their time: at the end of the certain topic. In the case of any tests, the opportunity for replacement and correction is available in the last week of the school period (typically the 13th week) and during the exam period.

Electronics and Digital Techniques

Subject name		In Hungarian		Elektronika és digitális technika					Level	**BSc**	
		In English		**Electronics and Digital Techniques**					Subject code	**ISR-119**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Engineering physics					Subject code	MUT-151	
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. Péter Odry**			Position	**Prof. of College**	

Training course aims	**Educational goals, development objectives**	
	Acquiring the basic knowledge of electronic and digital technology, getting to know the basic elements that play a role in the operation and management of these systems, which is necessary for acquiring the knowledge that builds on it. Having the basic knowledge, in connection with the hardware knowledge of IT and mechatronic systems, he / she acquires the performance of tasks of average complexity related to the operation, development and design of these systems.	
Typical transfer methods	Theoretical	For all students in a large lecture, board lecture. Use of projector and teaching machine in all theoretical lessons. In addition to this, online video-based curriculum, notes and lecture slides are available for students. Additional consultation times were provided during the contact hours.
	Practice	
	Lab	In exercises, measurement and problem solving take place under the guidance of practice leaders. Using a projector and a teaching machine in a practical lesson. In addition, the development of laboratory tasks is carried out within the framework of contact hours and with the help of online simulator programs.
	Misc.	
Requirements (expressed study results)	**Knowledge** • He / she is familiar with the principles and methods of science required for cultivating his / her field of informatics. • He possesses a basic knowledge and engineering approach to the processing of measured signals, modeling, simulation and control of systems and networks. • The student is required to know the general and specific rules, contexts and procedures required for cultivating the technical field. • The student is required to know the conceptual system, the most important connections and theories related to his / her field. • He knows the methods of acquiring knowledge and problem solving of the main theories of his field. • He knows the operation of the hardware components of IT systems, the technology of their implementation, how to solve the tasks arising from its operation, and the possibilities of connecting IT and other technical systems. • It is fundamentally familiar with system design principles and methods, procedures, and operational processes. • At the application level, he / she knows the measurement procedures, their tools, instruments and measuring equipment. • Can interpret, characterize and model the structure and operation of the structural units and elements of the systems, the design and connection of the applied system elements.	
	Ability	

	• He uses the principles and methods of science necessary for the cultivation of his specialty in his engineering work. • He / she is able to perform a basic analysis of the disciplines that make up the knowledge system of the technical field, to formulate the connections synthetically and to perform adequate evaluation activities. • Is able to apply the most important terminologies, theories and procedures of the given technical field when performing the tasks related to them. • Able to plan, organize and conduct independent learning. • Able to identify routine professional problems, explore and formulate the theoretical and practical background needed to solve them, and solve them (using practical operations in practice). • Is able to understand and use the typical literature, computer technology and library resources of his / her field. • He / she is able to apply the acquired IT knowledge in solving the tasks arising in his / her field. • Able to create basic models of technical systems and processes. • Able to communicate orally and in writing in his / her mother tongue in a professionally adequate manner. • Able to diagnose failures, select remedial actions, solve repair technology tasks. • Based on the acquired basic knowledge, he / she is able to acquire deeper knowledge in a technical / IT field independently, to process the literature, and then to solve technical / IT problems related to the field. • Able to perform analysis, specification, design, development and operation tasks in his / her field, apply development methodologies and debugging procedures. • He collaborates with IT specialists and electrical engineers during the group work, as well as with representatives of other fields in the development of requirements analysis and solution of the given problem.
	Attitude • It undertakes and authentically represents the social role of its profession, its fundamental relationship with the world. • It is open to getting to know and accept professional, technological development and innovation in the technical field, and to mediate it authentically. • He strives to solve problems in collaboration with others as much as possible. • He has enough perseverance to perform practical activities. • Applying the acquired technical knowledge, he strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws. • In the course of its work, it observes and continues to comply with the relevant safety, health, environmental, and quality assurance and control requirements. • It authentically represents the professional principles of the engineering fields. • In addition to his own area of work, he strives to see the entire technical system. • Open to learning about new methods and procedures and mastering them at a skill level. • It is open to learn about other fields and to develop IT solutions in cooperation with experts in the field. • He understands and feels the ethical principles and legal aspects of the profession. • It strives for efficient and quality work.
	Autonomy and Responsibility • Even in unexpected decision-making situations, he / she independently considers and develops comprehensive, fundamental professional issues on the basis of specific sources. • In the course of his professional duties, he also cooperates with qualified specialists in other fields (primarily technical, as well as economic and legal). • She shares her experiences with her co-workers, thus helping them grow.

	• He / she is responsible for the consequences of his / her technical analyzes, his / her proposals and decisions. • He feels responsible for his independent and group-based IT systems analysis, development and operation. • It identifies the shortcomings of the applied technologies, the risks of the processes and initiates the measures to reduce them.
Short description of the subject content	Electronic and digital mechatronics systems. Signals of these systems, their classification, processing, signal shaping, digitization, analog-to-digital, digital-to-analog conversion. Measurement, measuring instruments. Understanding analog and digital basic circuits and their applications. Measurement of electrical signals, getting to know its measuring instruments, calculation of measurement error. Measurement of electrical quantities in direct current and alternating current networks. Measurement of electronic and digital basic circuits.
Forms of student activity	Processing of heard text with notes, directed and independent processing of theoretical curriculum, problem solving with guidance and independently. Collection, processing and systematization of information related to professional topics. Solving tasks, analyzing and processing case studies.
Required reading and availability	Kővári, Attila, Jeges, Zoltán, Haluska, János: Villamosságtan, Dunaújvárosi Főiskola Kiadói Hivatala, 2007. Kővári Attila, Jeges Zoltán, Haluska János: Tanulási Útmutató a „Villamosságtan” Című Tantárgyhoz. Dunaújvárosi Főiskola Kiadói Hivatala, 2008. Odry Péter, Haluska János, Kővári Attila: Digitális Technika. Dunaújvárosi Főiskola Kiadói Hivatala, 2007. Odry Péter, Haluska János, Kővári Attila, Farkas Imre: Tanulási Útmutató a „Digitális Technika” Című Tantárgyhoz. Dunaújvárosi Főiskola Kiadói Hivatala, 2008. J. Crowe Barrie Hayes-Gill: "Introduction to Digital Electronics", ISBN: 9780340645703
Recommended readings and availability	Puklus Zoltán: Elektronika gépészmérnököknek (http://jegyzet.sze.hu/index.php?felt=elektronika+g&fajl=keres) Hodossy László: Elektrotechnika (http://jegyzet.sze.hu/index.php?felt=elektr&fajl=keres)
Description of tasks/measurement procedures to be submitted	According to what was said at the first lecture. Preparation of a report on laboratory measurements according to the instructions of the laboratory manager.
Description and schedule of the midterm tests	As stated in the first lecture. During the lecture, there are two indoor dissertations during the year, during the last week of education there is a possibility of replacement.

Mathematics 3

Subject name		In Hungarian		Matematika 3					Level	**BSc**	
		In English		**Mathematics 3**					Subject code	**IMA-110**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**0**	per Week	**3**	per Week	**0**	**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**0**	per Semester	**15**	per Semester	**0**				
Course leader				Name		**Dr. Zoltán Papp**			Position	**assistant professor**	
Training course aims				**Educational goals, development objectives** To know the basics of calculus which are required to the special subjects, as well as improvement of mathematical knowledge to study specialized literature. Student knows and understands the most remarkable relations, connections, and set of ideas.							
Typical transfer methods				Theoretical							
				Practice		Teaching in small groups, solving computational and applied exercises. Using projector, blackboard, calculator.					
				Lab							
				Misc.							
Requirements (expressed study results)				**Knowledge** Student knows methods and procedures required for solving of mathematical tasks from economic areas. Student has enough knowledge referring to mathematics and calculus which are required by his/her special field.							
				Ability Student is able to apply the studied mathematical knowledge and activity. Student is able to apply the studied methods and procedures. Student is able to create an own solving-plan and argue it. Student is able to organize his/her own learning procedure as well as to find and use different learning sources.							
				Attitude Student is willing to get acquainted with mathematical developments and innovations and their acceptance. Student is interested in new methods and means referring to his/her specialization.							
				Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.							
Short description of the subject content				Special differentiation rules. Geometric applications of differential calculus. Area calculation. Volume and surface area of a rotating body. Arc length and center of gravity calculation. Multiple integrals. Numerical integration. Solving nonlinear equations. Examples of the application of differential equations (radioactive decay). Differential equations with separable variables and reducible to them. First-order and second-order linear differential equations. Incomplete second-order differential equations.							
Forms of student activity				Processing theoretical material with guidance. Independent processing of theoretical material. Task solution with control. Independent processing of tasks. Text interpretation. Processing of information individually and in groups. Conflicting opinions. Learning debating skills and argumentation techniques. Collaboration in a group.							
Required reading and availability				Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012.							
Recommended readings and availability											
Description of tasks/measurement procedures to be submitted											

Description and schedule of the midterm tests	Two tests will be during the practice sessions: Test 1 on week 6 (50 points, 45 minutes), Test 2 on week 12 (50 points, 45 minutes). Make up Tests on the week 13. 0-50 fail, 51-60 poor/pass, 61-70 satisfactory/fair, 71-80- good. 81- excellent.

Economics I

Subject name		In Hungarian		Közgazdaságtan I.					Level	**BSc**	
		In English		**Economics I**					Subject code	**TKT-151**	
Responsible Educational unit name				**Institute of Social Sciences** **Department of Economics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**2**	per Week	**0**	**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**10**	per Semester	**0**				
Course leader				Name		**Saleh Mohamad Dr.**			Position	**assistant professor**	

Training course aims	**Educational goals, development objectives** This course is an introduction to economic concepts and basic economic theory. The course is split between the study of microeconomics, which focuses on the decision making of individual consumers and firms, and macroeconomics, with focuses on aggregate level economic questions such as interest rates, government spending, among others. Perhaps most important, this course will introduce you to the "economic way of thinking," an approach to decision making that applies to personal decisions. It will: give you an idea of the range of behaviors that economists investigate, introduce you to the basic tools that we use to analyze the economy, and apply these tools to public policy issues.	
Typical transfer methods	Theoretical	In a classroom with the use of projector or computer in each lecture.
	Practice	In a classroom with the use of projector or computer in each seminar.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** Students as potential Economist know: • the types, terminology and main principles of Economics • basic concepts in Economics • the steps of analysis in Economics	
	Ability Students will be able to: • carry out basic analysis • formulate a synthetic relationship • carry out adequate evaluation activities	
	Attitude • Openness to authentic mediation and transmission of the overall mindset and the essential characteristics of practical operation of the profession. • Desire for continuous self-education in the field of economics.	
	Autonomy and Responsibility In professional questions, the students can play the role of a decision-maker and are able to solve problems alone. They can tackle problems as responsible persons, i.e. in a certain situation, they can decide if there is a need to cooperate with others.	
Short description of the subject content	The science of economics. Introduction to economic thinking. Macro- and microeconomics. Positive and normative approach to economics. The basic concepts of economics. Coordination mechanisms in the economy. The market and its basic concepts. The operation of the market and price mechanisms. The market balance. The agents of mixed economy. The motivations, income and expenditures of household. The management of business organizations. Production factors and their markets. The concept of national economic performance, its most important statistical indicators. The concepts, conditions and measurement of economic growth. Economic development and sustainable growth. The concept and functions of money. The basic categories of the labor market. The state and the market	

	economy. The role and functions of the government. Globalization, international trends and issues of the global economy.
Forms of student activity	• Guided learning 40% • Individual learning 30% • Guided task completion 20% • Individual task completion 10%
Required reading and availability	• Samuelson, Paul Anthony - Nordhaus, William D. Economics (2009) Mcgraw-Hill Publ.Comp. • Handouts from the lecturer • Materials on MOODLE
Recommended readings and availability	• Mankiw, Gregory Principles of Economics (2007) Sixth Edition, by Mason, Ohio: Thomson South-Western • Begg, D., S. Fischer and R. Dornbusch Economics (2002) -7th Edition- (McGraw- Hill) • Moffat, Mike: Online Microeconomics Textbook.
Description of tasks/measurement procedures to be submitted	Preparation and presentation of home assignments on pre-determined topics of micro and macroeconomics
Description and schedule of the midterm tests	The test usually lasts for one hour and covers everything taught up to the date of test. The question paper will consist of multiple choice questions and short essay questions.

Network Management 1

Subject name		In Hungarian		Hálózat menedzselés 1					Level	**BSc**	
		In English		**Network Management 1**					Subject code	**ISR-258**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Computer and network architectures					Subject code	ISR-118	
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**2**	per Week	**0**	per Week	**1**	**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**10**	per Semester	**0**	per Semester	**5**				
Course leader				Name		**Dr. Tibor Ujbányi**			Position	**assistant professor**	

Training course aims	**Educational goals, development objectives** The students completing the subject know the basic operation and algorithms of computer networks, they become able to handle and create basic communication networks. They are able to see and understand the processes from the operation of the communication media to the basic operation of the devices of computer networks. This course focuses primarily on the basic functions of the first three layers of the ISO OSI standard, while their more complex parts as well as the upper layers are described in Network Management 2.	
Typical transfer methods	Theoretical	Online study material (notes, lecture videos, lecture slides), test questions and consultations within the framework of a contact hour.
	Practice	
	Lab	Using computers with Wireshark and Cisco PacketTracer applications. The handover can take place in the framework of contact hours or with the help of on-line study material (notes, lecture videos, lecture slides, test questions), in the latter case supplemented by laboratory consultations held in the framework of contact hours.
	Misc.	
Requirements (expressed study results)	**Knowledge** Using computers with Wireshark and Cisco PacketTracer applications. The handover can take place in the framework of contact hours or with the help of on-line study material (notes, lecture videos, lecture slides, test questions), in the latter case supplemented by laboratory consultations held in the framework of contact hours.	
	Ability They can configure Cisco IOS-based network devices, configure interfaces, X.25 type foundations, statistics, and RIPV2 dynamic routing configuration. Configure DHCP and NAT services.	
	Attitude Open, inquisitive, constructive, efficient, creative.	
	Autonomy and Responsibility The student is required to take responsibility, making decisions and managing tasks independently in the given field.	
Short description of the subject content	Theory: Revival of ISO OSI and TCP / IP structure, parallelization. Tasks of each layer of the OSI model, typical procedures, their operation. Wired and wireless transmission media and their characteristics. Description and comparison of data connection methods. IP and ICMP versions, X.25 detail and multicast. Label allocation methods. Traffic management in general and static dynamic traffic management. Control algorithms, protocols. Networking address translation. Basic protocols for higher layers. Lab:	

	Prerequisite for reviving subject knowledge. Network device operating structure of your system, getting to know basic commands. Connection methods, addressing interfaces. Build an X.25 connection, default routing, practicing static traffic control. Dynamic exercise traffic management. DHCP and static address translation. Complex solving practice tasks.
Forms of student activity	Processing of heard text with notes Organizing information in a task-driven way Independent processing of tasks Solving a test task.
Required reading and availability	Tanenbaum, Andrew S .: Computer Networks (2nd edition) Coursework for the first two semesters of Cisco Certified Network Administrator training in Moodle. Moodle Electronic materials in Moodle or Neptun systems.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	During the semester, the course includes two in-house exams: one on theory and one on practice. Exams can be replaced 1 time separately.

Basics of Artificial Intelligence

Subject name		In Hungarian		Mesterséges intelligencia alapjai					Level		**BSc**
		In English		**Basics of Artificial Intelligence**					Subject code		**ISF-250**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Introduction to programming					Subject code		ISF-111
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**2**	per Week	**0**	per Week	**1**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**10**	per Semester	**0**	per Semester	**5**				
Course leader				Name		**Dr. Ákos Odry**			Position		**assistant professor**

Training course aims	**Educational goals, development objectives** The aim of the course is to present both the fundamental techniques of artificial intelligence (AI) and the problems that can be effectively handled with algorithms that constitute AI. The course presents the AI models and algorithms, moreover their application in software environment for different real-world problems. Throughout case studies the AI concepts, such as neural networks, fuzzy systems, genetic algorithms, and deep learning are demonstrated. These case studies foster the understanding of the techniques, moreover, hands-on experience is given about AI problems during the laboratory assignments. The subject provides both theoretical and practical knowledge.	
Typical transfer methods	Theoretical	The lecture is provided to all students in a lecture room. Additionally, online video-based lectures, lecture notes and presentation materials are available for the students. The implementation of theoretical concepts in sample applications are explained and presented. Projectors and teacher's computers are used in every lecture.
	Practice	
	Lab	Different applications are implemented by the laboratory leader. Each laboratory assignment addresses the concepts introduced during the lectures. Laboratory assignments describe the problem. The students are required to employ the AI techniques introduced in the lectures. Online simulation environment is also available for testing AI problems. Projectors and computers are used in every laboratory.
	Misc.	
Requirements (expressed study results)	**Knowledge** It is assured to know the basics of AI problems and algorithms, identify the AI/soft computing techniques to be used in specific tasks, and the fundamental mathematical relations in AI algorithms.	
	Ability Students are able to i) adapt fundamental techniques in AI problems ii) design and implement AI algorithms iii) establish learning mechanisms to mimic desired functionalities and approximate systems, iv) use soft computing tools to solve problems from heuristic point of view, and v) elaborate optimization tasks. They are capable of solving complex tasks or problems completely. They can understand a complex application and work on it even in a team.	
	Attitude Students are motivated to AI and soft computing-based concepts. They are open-minded to discover both new and fundamental solutions to realize intelligent AI-based systems. They make relevant engineering deductions based on the observations of the system. In teamwork, they make an effort to do a high-quality job.	

	Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.
Short description of the subject content	• The subject, origin, and relationship of artificial intelligence with other sciences • Machine learning, supervised learning, unsupervised learning, reinforcement, deep learning, SLP, MLP, backpropagation • Neural network (NN), convolutional NN, feedback NN • Fuzzy systems, fuzzy sets • Fuzzy logic, set operations, fuzzy inference, fuzzy logic controller • Genetic algorithms (GA) • GA/Fuzzy/NN implementation solutions • Deep learning-based models and methods • Presentation of artificial intelligence and deep learning software solutions • Presentation of adaptive solutions with case studies • Supplementing conventional solutions with artificial intelligence methods
Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• Electronic curriculums are associated with AI available in the Moodle system.
Recommended readings and availability	• Philip C. Jackson, *Introduction to Artificial Intelligence*, Dover Publications, 2013. • Patrick D. Smith, *Hands-On Artificial Intelligence for Beginners: An introduction to AI concepts, algorithms, and their implementation*, Packt Publishing, 2018. • Samir Roy, *Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms*, Pearson, 2013.
Description of tasks/measurement procedures to be submitted	One homework (optional, only for motivated students) • Topic: An AI task which fits to the material of theory and practice. • It must be finished until the last week of term-time. • It must be presented during last week of term-time which is appointed by the leader of practice.
Description and schedule of the midterm tests	As stated in the first lecture. Generally, two mid-term tests/exams. 1st mid-term test: it is recommended on the 6th week. 2nd mid-term test: the week before the last week during term-time. Retake: last week The administration details are always discussed and specified in the first lecture. Final grade <50%: Fail (1) 51-65%: Pass (2) 66-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5)

Information Security

<table>
<tr><td rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="6">Adatbiztonság, adatvédelem</td><td>Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="6">Information Security</td><td>Subject code</td><td colspan="2">ISR-250</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="9">Institute of Informatics</td></tr>
<tr><td colspan="2" rowspan="2">Name of the required preliminary study</td><td colspan="6">Computer and network architectures</td><td rowspan="2">Subject code</td><td>ISR-118</td></tr>
<tr><td colspan="6">Basics of Computer Science 1.</td><td>IMA-153</td></tr>
<tr><td rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="2"></td><td colspan="2"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td><td colspan="2">Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/26</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td>per Week</td><td>0</td><td rowspan="2">Exam</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per Semester</td><td>10</td><td>per Semester</td><td>0</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="2">Course leader</td><td colspan="3">Name</td><td colspan="3">Dr. Tibor Ujbányi</td><td>Position</td><td colspan="2">assistant professor</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="9">Educational goals, development objectives

The training goal of the course covers the technical, human and legal aspects of information security. Familiarity with the principles, rules, procedures, data management tools and methods for the collection, processing and use of personal data and the protection of data subjects. Overview of international and domestic regulations. Description of data protection IT solutions used in data management systems. Learn the principles of cryptography, both computer and network security technology, and security management, enterprise-level security solutions.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="8">On-line study material (notes, lecture videos, lecture slides), test questions and consultations within the framework of a contact hour.</td></tr>
<tr><td>Practice</td><td colspan="8"></td></tr>
<tr><td>Lab</td><td colspan="8"></td></tr>
<tr><td>Misc.</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="3">Requirements (expressed study results)</td><td colspan="9">Knowledge

He has basic data security knowledge. Knows the conceptual system, the most important connections and theories related to his / her field. He knows the methods of acquiring knowledge and problem solving of the main theories of his field. It is fundamentally familiar with system design principles and methods, procedures, and operational processes.</td></tr>
<tr><td colspan="9">Ability

The student should be able to develop security systems for enterprise information systems and implement previous developments. The student should be able to perform analysis, specification, design, development and operational tasks in his / her field, apply development methodologies, debugging, testing and quality assurance procedures. He should be able to plan, organize and conduct independent learning. Is able to understand and use the typical literature, computer technology and library resources of his / her field. He / she is able to apply the acquired knowledge in solving tasks arising in his / her field. The student is required to be able to communicate orally and in writing in his / her mother tongue in a professionally adequate manner. Able to perform analysis, specification, design, development and operation tasks in his / her field, apply development methodologies and debugging procedures. He collaborates with IT specialists and electrical engineers during the group work, as well as with representatives of other fields in the development of requirements analysis and solution of the given problem. He is constantly training himself and keeping pace with the development of the IT profession.</td></tr>
<tr><td colspan="9">Attitude

It strives to solve problems in collaboration with others as much as possible. Applying the acquired technical knowledge, he strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws. Open to learning about new methods and procedures and mastering them at a skill level. It is open to learn about other fields and to develop IT solutions in cooperation with experts in the field. He / she understands and feels the ethical principles and</td></tr>
</table>

	legal aspects of the profession. It strives for efficient and quality work. He is constantly training himself and keeping pace with the development of the IT profession.
	Autonomy and Responsibility With the expertise, he has a security-conscious attitude, keeps in mind potential threats and attack opportunities, and prepares to defend against them. In the course of his professional duties, he also cooperates with qualified specialists in other fields (primarily technical, as well as economic and legal). He / she is responsible for the consequences of his / her technical analyzes, his / her proposals and decisions. He feels responsible for his independent and group-based IT systems analysis, development and operation. It identifies the shortcomings of the applied technologies, the risks of the processes and initiates the measures to reduce them.
Short description of the subject content	Overview of cryptographic algorithms (simple, redundancy, freshness, symmetric, asymmetric, hash, PGP). Electronic signature and security issues. Operating system security, authentication, access protection, Windows and UNIX based operating system security. Application security. Network security. Pests. IT security development. Social engineering methods, defense options. Information security regulatory issues.
Forms of student activity	Processing of heard text with notes, directed and independent processing of theoretical curriculum, problem solving with guidance and independently. Collecting, processing and organizing information related to a professional topic. Solving tasks, analyzing and processing case studies.
Required reading and availability	Moodle Electronic materials in Moodle or Neptun systems.
Recommended readings and availability	Stallings W., Brown L.: Computer Security, Prentice Hall, 2008
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	During the semester, the course includes two in-house exams: one on theory and one on practice. Exams can be replaced 1 time separately.

Embedded Systems

Subject name		In Hungarian		Beágyazott rendszerek					Level		**BSc**
		In English		**Embedded Systems**					Subject code		**ISR-215**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Electronics and digital techniques					Subject code		ISR-119
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. Péter Odry**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The aim of the course is to present the basics of microcontrollers and their peripherals, moreover, to introduce basic methods needed for the development of intelligent embedded systems. The course gives an extensive knowledge to design and realize the hardware components of microcontroller-based systems and implement the associated embedded software system. Design phases, realization procedures and implementation methods are demonstrated with case studies. The subject provides both theoretical and practical knowledge.	
Typical transfer methods	Theoretical	The lecture is provided to all students in a lecture room. Additionally, online video-based lectures, lecture notes and presentation materials are available for the students. The implementation of theoretical concepts in sample applications are explained and presented. Projectors and teacher's computers are used in every lecture.
	Practice	
	Lab	Different applications are implemented by the laboratory leader. Each laboratory assignment addresses the concepts introduced during the lecture. Hardware components and Arduino development boards are given to the students. Laboratory assignments describe problem. The students are required to realize the hardware and develop embedded software codes. Online simulation environment is also available for testing the constructed embedded environment. Projectors and computers are used in every laboratory.
	Misc.	
Requirements (expressed study results)	**Knowledge** It is assured to know the architecture of microcontrollers, the design and implementation procedures of embedded systems and the embedded software solutions for intelligent systems.	
	Ability Students are able to i) select microcontrollers for dedicated autonomous tasks, ii) equip the system with sensors and actuators, iii) measure physical quantities and process data in embedded system, iv) implement algorithms that operates autonomously an embedded system. They are capable of solving complex tasks or problems completely (design and realize hardware, create software for data acquisition, implement intelligent algorithms, testing, debugging and make documentation). They can understand a complex application and work on it even in a team.	
	Attitude Students are motivated to hardware development and programming. They are open-minded to discover both new and fundamental solutions in embedded systems. They make relevant engineering deductions based on the observations of the system. In teamwork, they make an effort to do a high-quality job.	

	Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.
Short description of the subject content	• Main characteristics and areas of application of embedded systems (microcontroller-based systems). • Construction of general-purpose processors, microcontrollers (MCU), signal processing processors (DSP) • Getting to know the basics, programming, and areas of use of software development for embedded systems. Embedded software development. • Digital inputs/outputs • Signal matching, signal conditioning, AD and DA converters. Matching some sensor types. • Communication interfaces (UART, I2C, SPI). • PWM and motor control with transistor, H-bridge. • Management of interruptions (position measurement with incremental transmitters) • Implementation of digital filter algorithms • Implementation of PID position and speed control • Use of a real-time operating system • Realization of case studies, complex systems.
Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• Electronic curriculums are associated with both Arduino and embedded systems available in the Moodle system.
Recommended readings and availability	• Jeremy Blum, *Exploring Arduino: Tools and Techniques for Engineering Wizardry*, Wiley, 2019. • David Russell, Mitchell Thornton, *Introduction to Embedded Systems: Using ANSI C and the Arduino Development Environment,* Morgan and Claypool Publishers, 2010. • Simon Monk, *Programming Arduino: Getting Started with Sketches,* McGraw-Hill Education Tab, 2011.
Description of tasks/measurement procedures to be submitted	One homework (optional, only for motivated students) • Topic: An embedded systems task which fits to the material of theory and practice. • It must be finished until the last week of term-time. • It must be presented during last week of term-time which is appointed by the leader of practice.
Description and schedule of the midterm tests	As stated in the first lecture. Generally, two mid-term tests/exams. 1st mid-term test: it is recommended on the 6th week. 2nd mid-term test: the week before the last week during term-time. Retake: last week The administration details are always discussed and specified in the first lecture. Final grade <50%: Fail (1) 51-65%: Pass (2) 66-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5)

Entrepreneurship

Subject name		In Hungarian		Vállalkozástan					Level		**BSc**
		In English		**Entrepreneurship**					Subject code		**TVV-122**
Responsible Educational unit name				**Institute of Social Sciences** **Department of Management and Enterprise Sciences**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**2**	per Week	**0**	**Midterm Mark**	**5**		**English**
Part time	**150/15**	per Semester	**5**	per Semester	**10**	per Semester	**0**				
Course leader				Name		**Dr. Andrea Keszi-Szeremlei**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** The curriculum provides a comprehensive knowledge of entrepreneurship, including the creation, operation, transformation, liquidation, financial management and the management of assets and liabilities. The student will be familiar with the means of preventing corruption. The student will be able to review the essence and the conduct of corporate management and to understand and apply corporate (business) law and regulations. They will be familiar with the economic, financial, human, material and property characteristics and components of companies, the risks inherent in the activities of companies and their types, the characteristics of international and domestic corporate cooperation and will be able to apply these at a skill level. In addition to theoretical knowledge, practical features will also be explored.	
Typical transfer methods	Theoretical	In a classroom with the use of projector or computer in each lecture.
	Practice	Flipchart, blackboard and other multimedia equipment in smaller seminar rooms suitable for group work
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** Students will • know the basic terms of entrepreneurship, • understand the effect mechanisms of operating firms, • know the legal background of companies, their internal and external environments, • know the economic systems, aims and strategies of firms.	
	Ability Students will be able • to use terms of this field professionally, • to identify and determine the resources of companies, • to understand the steps of company aims and strategies • to understand and use the relevant literature.	
	Attitude They are open and willing to discuss all points of the cases, as well as express their opinion, but without disclosing any important information about the circumstances of their own company. They have sensibility to find potentials for development.	
	Autonomy and Responsibility Students feel responsibility for both their development and environment. They cooperate with each other. They have sensibility to find possible resolving opportunities for problems.	
Short description of the subject content	The emergence of companies, their concept, the legal background of their operation. The macro and micro, external and internal environment of the company. Anti-corruption in entrepreneurial practice (Forms of corruption, means of prevention) The company as an economic system, characteristics of economic systems, basic concepts of their operation. The corporate purpose, objectives,	

	strategy. Economic decisions of companies. Description of the resources and activity system of a company. Assets and liabilities of the company, financing of the company. Organisation and management of companies. Resource management of companies. Introduction to corporate production, services, material processes. Internal and external logistics of the company. Human resource management in the company. Sources and role of corporate information. Corporate innovation. Corporate revenue and cost management. The concept of quality, total quality management and control (TQM). Corporate strategy, strategic guiding principles, strategic management, strategy development, implementation and control. Controlling. The role of business planning, presentation. Corporate ethics, responsibility, culture in the operation of companies. Outsourcing, its development, types, ways of implementation. Corporate partnerships.
Forms of student activity	Case study analysis, Presentations, Individual work, Frontal class work, Essay writing
Required reading and availability	• William D. Bygrave - Andrew Zacharakis (2014): Entrepreneurship, 3rd Edition, John Wiley & Sons, DUE Library • Materials on MOODLE
Recommended readings and availability	• Jerome Katz, Richard Green (2014) Entrepreneurial Small Business. 4th ed. McGraw-Hill International Ed., ISBN: 978-0078029424, DUE Library
Description of tasks/measurement procedures to be submitted	• Processing and analysis of 1 chosen case study (On week 8th)
Description and schedule of the midterm tests	Midterm tests on weeks 7th and 12th. Supplementary test on week 13th.

Multimedia

<table>
<tr><td rowspan="2">Subject name</td><td colspan="2">In Hungarian</td><td colspan="5">Multimédia</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">In English</td><td colspan="5">Multimedia</td><td>Subject code</td><td>TKM-128</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="7">Institute of Social Sciences
Department of Communication and Media</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="5"></td><td>Subject code</td><td></td></tr>
<tr><td rowspan="2">Type</td><td colspan="2" rowspan="2">Study load per week (in hours)</td><td colspan="2" rowspan="2">Practice</td><td colspan="2" rowspan="2">Lab</td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td></tr>
<tr><td>Full time</td><td>150/52</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/20</td><td>per Semester</td><td>10</td><td>per Semester</td><td>0</td><td>per Semester</td><td>10</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr Péter Ludik</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives

Getting to know the definition and characteristic properties of multimedia. Getting to know the basic properties of media and the possibilities of their application.

Own design and production of media elements. Creating a standalone multimedia program.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">Lecture in a boardroom, using a projector and a computer, 34% of the hours.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Independent task solution in a computer lab in 66% of the hours.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="7">Knowledge

The student should get to know:
• the definition and characteristics of multimedia;
• the building blocks of multimedia and their relationship to each other: text, image, graphics, illustration, sound, moving image: animation, film, virtual reality elements;
• a multimedia production of tools,
• the basics of multimedia development programs</td></tr>
<tr><td colspan="7">Ability

The student should be able to define the parameters and services of software tools required for the production and editing of source materials (text, sound, moving and still images, graphics). Digitizes an image, creates and edits vector and raster graphics. Digitizes and edits audio and video material. Creates an animation.

The student should be able to plan an own program and select the means necessary for its implementation, to implement their own idea.</td></tr>
<tr><td colspan="7">Attitude

The student is required to be open to learning about the use of computer media, its theoretical foundations, methods, new results and innovations.

Critical, creative and imaginative.</td></tr>
<tr><td colspan="7">Autonomy and Responsibility

Capability to form an independent opinion, planning the appropriate proportion of multimedia elements.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Definition and characteristics of multimedia. The building blocks of multimedia and their relationship to each other: text, image, graphics, illustration, sound, motion picture: animation, film, virtual reality elements. Tools for creating multimedia. Create a stand-alone interactive multimedia application with optimal use of media elements.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="7">Processing of heard text with notes 20%
Organizing information with a task 20%
Independent processing of tasks 60%</td></tr>
</table>

Required reading and availability	*Tay Vaughan: Multimedia: Making It Work; McGrawHill 2011* Materials on MOODLE
Recommended readings and availability	Student guide for using Neobook 5.0 / www.neosoft.com Authorware 7 - User Knowledge / www.adobe.com
Description of tasks/measurement procedures to be submitted	Entering hourly tasks continuously max: 30 points Independent program development with any topic max: 30 points
Description and schedule of the midterm tests	Written test from the material of the lesson (12 pieces) continuously max 20 points Written summary test from the theoretical parts max: 20 points

Management

<table>
<tr><td rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="6">Menedzsment</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="6">Management</td><td>Subject code</td><td>TVV-114</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="7">Institute of Social Sciences
Department of Management and Enterprise Sciences</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="6"></td><td>Subject code</td><td></td></tr>
<tr><td rowspan="2">Type</td><td colspan="2" rowspan="2">Study load per week (in hours)</td><td colspan="2" rowspan="2">Practice</td><td colspan="2" rowspan="2">Lab</td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td rowspan="2">Midterm Mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester</td><td>10</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. habil Mónika Rajcsányi-Molnár</td><td>Position</td><td>c. professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Goals, development objective

The module provides a comprehensive understanding of management and human behavior in organizations for undergraduate students. The aim of the course is to enable students to attain the competencies needed to become effective members of organizations, or even managers.

It is hard to imagine living in modern society without participating in or interacting with organizations. The variability of organizations implies complexity in the organizational settings and challenges we regularly face.

The course introduces special management dimensions and techniques to help students gain expertise in management. Through this course, students will consider cases describing various organizational and management struggles. Students will see, how we can make sense of organizations and the challenges they face, and develop means of managing them in desired directions. Through this course, students will learn different organizational theories and interpret concrete organizational situations.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">Theory with examples from the practice (video lectures).</td></tr>
<tr><td>Practice</td><td colspan="6">Individual work (quizzes, cases, readings)</td></tr>
<tr><td>Lab</td><td colspan="6"></td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3">Requirements (expressed study results)</td><td colspan="7">On completion of the course, students will be able to
• systematically identify important features of an organization and the events transforming it
• understand and manage organisational processes
• manage leadership tasks effectively
• analyze real-life management situations and problems, and
• present alternative solutions to deal with them</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7"></td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="7"></td></tr>
<tr><td colspan="3">Required reading and availability</td><td colspan="7">• https://moodle.uniduna.hu: Management– DUEN-TVV-114-EN – 2020-2021-1
• Textbook.pdf: Daniel A. McFarland – Charles J. Gomez (2013): Organizational Analysis. Stanford University
• Mullins, L.J. (2008): Management and Organisational Behaviour; 8th ed. New Jersey: Prentice Hall. ISBN 978-0-273-70888-9. /Library code: 650 M93/</td></tr>
<tr><td colspan="3">Recommended readings and availability</td><td colspan="7">• Robbins, S.P. (2005): Organizational Behavior; 12th ed. New Jersey: Prentice Hall. ISBN 0-13-164224-3. /Library code: 658 R76/
• Champoux, J.E. (2001): Organizational Behavior - Using Film to Visualize Principles and Practices, 1st ed. South-Western College Publishing. ISBN: 0324048564 /Library code: 650 C15/
• Champoux, J.E. (2006): Organizational Behavior: Integrating Individuals, Groups and Organizations, 3rd ed. Thomson Publishing. ISBN-10: 0324048505, ISBN-13: 9780324048506. /Library code: 658 C15/
• McShane, S.L. – Von Glinow, M.A. (2006): Organizational Behavior. 4th ed.</td></tr>
</table>

Description of tasks/measurement procedures to be submitted	Turn it in exercise: Deadline: week 12 For more detail, see the description of the assignment!
Description and schedule of the midterm tests	Turn it in exercise 20 points 20% Topic quizzes (completion of each topic's quizzes in Moodle) 20 points 20% Final Exam (quiz: multiple choice questions) 60 points 60% Evaluation and Grades (according to the percentage given): 0 – 60 % 1 (Fail) 61 – 70 % 2 (Pass) 71 – 80 % 3 (Average) 81 – 90 % 4 (Good) 91 – 100 % 5 (Excellent) Attendance and make ups: according to the University's Rules and regulations (TVSz).

Measurement and Control

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Mérés- és irányítástechnika</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Measurement and Control</td><td colspan="2">Subject code</td><td>ISR-260</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="2">Name of the required preliminary study</td><td colspan="4">Mathematics 3</td><td>Subject code</td><td>IMA-110</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td>Study load per week (in hours)</td><td colspan="2"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td>Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>2</td><td>per Week 0</td><td>per Week 1</td><td>Exam</td><td>5</td><td>English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>10</td><td>per Semester 0</td><td>per Semester 5</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="2">Dr. Ákos Odry</td><td>Position</td><td>assistant professor</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="6">Educational goals, development objectives

The aim of the course is to present the basics of measurement and control of electromechanical systems. The first part of the subject covers the measurement concepts (e.g., the characterization of electrical systems, instruments, measurement methods, measurement errors, signal processing in analog and digital domain) that enable engineers to both establish mathematical models of systems and elaborate system identification approaches. The second part of the subject aims to introduce the fundamental control synthesis tools that allow engineers to design intelligent closed-loop system architectures. The course gives an extensive knowledge to both design and realize control algorithms, moreover, the implementation and validation of such control approaches are demonstrated throughout the course program. Design phases, realization procedures and implementation methods are demonstrated with case studies.

The subject provides both theoretical and practical knowledge.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">The lecture is provided to all students in a lecture room. Additionally, online video-based lectures, lecture notes and presentation materials are available for the students.

The implementation of theoretical concepts in sample applications are explained and presented.

Projectors and teacher’s computers are used in every lecture.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">Different applications are implemented by the laboratory leader.

Each laboratory assignment addresses the concepts introduced during the lectures. Laboratory assignments describe problem. The students are required to employ the measurement and control synthesis techniques introduced in the lectures. Online simulation environment is also available for testing of closed-loop systems.

Projectors and computers are used in every laboratory.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="3">Requirements (expressed study results)</td><td colspan="6">Knowledge

It is assured to know the basics of measurement techniques, the relationship between measurement and control problems and the fundamental mathematical relations in dynamical systems for controlling plants in closed loop.</td></tr>
<tr><td colspan="6">Ability

Students are able to i) measure physical quantities and interpret measurements, errors and noise sources, ii) understand signal components in analog and digital domain and outline signal processing iii) derive and analyze mathematical models in time and frequency domain, iv) design feedback loops to operate systems in desired set points, iv) implement algorithms that operate autonomously dynamical system. They are capable of solving complex tasks or problems completely. They can understand a complex application and work on it even in a team.</td></tr>
<tr><td colspan="6">Attitude</td></tr>
</table>

	Students are motivated to measurement and control concepts. They are open-minded to discover both new and fundamental solutions to measure and control dynamical systems. They make relevant engineering deductions based on the observations of the system. In teamwork, they make an effort to do a high-quality job.
	Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.
Short description of the subject content	• Basic concepts of measurement technology, measurement errors. • Basic concepts of signal and system technology, their classification, continuous and discrete time signals, their characteristics • Analog to digital converter, sampling and holding, some more important signals. • Description and examination of continuous-time and discrete-time systems (Fourier, Laplace, z-transformation). • Transfer functions, mathematical models, dynamic systems • Signal processing, basic filters • Defining the basic concepts of control technology. The operating mechanism of control and regulation and their comparison, basic elements. • The section to be controlled as a process, signal transmission. Examination of regulatory framework, concept of stability, examination methods. Quality characteristics of regulation. • PID control • Analysis of controls and design solutions (root curve, frequency response and state space based solutions) • Computer (microcontroller-based) controls, implementation solutions • Introduction of MATLAB-based controller design • Designing model-based and predictive controls • Adaptive controls and their importance in practical regulation
Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• Electronic curriculums are associated with measurement and control available in the Moodle system
Recommended readings and availability	• Gene F. Franklin. J. Davis Powell. Abbas F. Emami-Naeini, *Feedback Control of Dynamic Systems*, Pearson, 2019. • William C. Dunn, *Fundamentals of Industrial Instrumentation and Process Control*, McGraw-Hill Education, 2018. • Thomas A. Hughes, *Measurement and Control Basics*, ISA Press, 2002
Description of tasks/measurement procedures to be submitted	One homework (optional, only for motivated students) • Topic: A feedback control task which fits to the material of theory and practice. • It must be finished until the last week of term-time. • It must be presented during last week of term-time which is appointed by the leader of practice.
Description and schedule of the midterm tests	As stated in the first lecture. Generally, two mid-term tests/exams. 1st mid-term test: it is recommended on the 6th week. 2nd mid-term test: the week before the last week during term-time. Retake: last week The administration details are always discussed and specified in the first lecture. Final grade <50%: Fail (1) 51-65%: Pass (2) 66-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5)

Numerical Methods

Subject name		In Hungarian		Numerikus módszerek					Level	**BSc**	
		In English		**Measurement and Control**					Subject code	**IMA-251**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Mathematics 3					Subject code	IMA-110	
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**2**	per Week	**0**	per Week	**1**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**10**	per Semester	**0**	per Semester	**5**				
Course leader				Name		**Dr. habil. Bálint Nagy**			Position	**c. professor**	

Training course aims	**Educational goals, development objectives** The aim of the module is to acquaint students with the basic numerical methods.	
Typical transfer methods	Theoretical	With the participation of every student in the large lecture hall. Lecture with projector and blackboard or online course using Teams meeting.
	Practice	
	Lab	In classrooms with computer work-stations for every student. The teacher' s computer is connected to projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** The student is required - to know the most common numerical methods. - to be able to develop programs using numerical methods.	
	Ability The student should - have algorithmic thinking, apply the acquired knowledge, solve tasks, use the learned numerical methods - be able to further develop the known algorithms and integrate them into more complex programs.	
	Attitude An open, inquisitive, constructive, efficient and creative attitude is required from the student.	
	Autonomy and Responsibility Takes responsibility, decides and manages independently in the given field.	
Short description of the subject content	• Solving of linear equation systems: Gauss-elimination, iterative methods (Jacobi, Gauss-Seidel) • Interpolation: Lagrange interpolation, Hermite interpolation, Trigonometric interpolation • Initial value problem, Euler Method • Boundary value problem, Finite differences, Finite difference method	
Forms of student activity	• Lecture: 50% • Self-dependent task solving: 50%	
Required reading and availability	• Won Young Yang Chung-Ang University, Korea Wenwu Cao Pennsylvania State University Tae-Sang Chung Chung-Ang University, Korea John Morris The University of Auckland, New Zealand: • Applied Numerical Methods Using Matlab • JohnWiley & Sons, Inc., 2005	
Recommended readings and availability	• Numerical Methods with Applications • Autar K Kaw, University of South Florida, Egwu Eric Kalu, Florida A&M University	
Description of tasks/measurement procedures to be submitted	Midterm tests.	
Description and schedule of the midterm tests	1st midterm test: Week 6 2nd midterm test: Week 12 Make-up test: Week 13	

Thesis Research 1. –Methodology Computer Science BSc

Subject name		In Hungarian		Szakdolgozat 1.- Módszertan INF							Level		**BSc**
		In English		**Thesis Research 1. –Methodology Computer Science BSc**							Subject code		**ISF-090**
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study											Subject code		
Type		Study load per week (in hours)								Requirement	Credit		Teaching language
		Theoretical		Practice		Lab							
Full time	**150/13**	per Week	**1**	per Week	**0**	per Week	**0**			**No Grade**	**0**		**English**
Part time	**150/5**	per Semester	**5**	per Semester	**0**	per Semester	**0**						
Course leader				Name		**Dr. Antal Joós**					Position		**associate professor**
Training course aims				**Educational goals, development objectives** The aim of the course is to prepare prospective IT professionals for IT decisions and the use of the results in practice.									
Typical transfer methods				Theoretical	Using a projector								
				Practice									
				Lab									
				Misc.									
Requirements (expressed study results)				**Knowledge** He/she knows the most important contexts and theories of the IT field and the terminology and applications that make them up.									
				Ability The student should be able to synthetically formulate, evaluate and apply the knowledge system and connections of the IT field. The student should be able to use, understand the typical literature of the field of informatics, search for related sources.									
				Attitude The student is required to authentically convey and transfer the comprehensive way of thinking and the basic features of the practical operation of his open profession. It is characterized by the need for continuous self-education.									
				Autonomy and Responsibility He/she conducts his/her own reflection on the basis of comprehensive, foundational issues and the given sources. It is characterized by cooperation and responsibility with qualified professionals in the given field.									
Short description of the subject content				Methods of processing the literature. Presentation of the general rules, basic concepts, methods and tools of engineering and research work. Data analysis, preparation of field plans, summary of research									
Forms of student activity				• Text interpretation • Processing information individually and in groups • Acquisition of discussion skills and argumentation techniques									
Required reading and availability				• Lengyelné Molnár Tünde (2013): Kutatástervezés, Eger, 168. http://mek.oszk.hu/14400/14492/pdf/14492.pdf • MAJOROS Pál (2011): A kutatásmódszertan alapjai: tanácsok, tippek, trükkök: nem csak szakdolgozat-íróknak [Budapest], Perfekt. 250 p.ISBN 9789633945841 • Guide to writing a thesis (MOODLE system)									
Recommended readings and availability													
Description of tasks/measurement procedures to be submitted													

Description and schedule of the midterm tests	

Thesis Research 2. – Computer Science BSc

Subject name		In Hungarian		Szakdolgozat 2. – MINFBSC							Level	**BSc**	
		In English		**Thesis Research 2. – Computer Science BSc**							Subject code	**ISF-094**	
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study				Thesis Research 1. –Methodology Computer Science BSc							Subject code	ISF-090	
Type		Study load per week (in hours)							Requirement		Credit	Teaching language	
		Theoretical		Practice		Lab							
Full time	**150/117**	per Week	**0**	per Week	**9**	per Week	**0**		**No Grade**		**15**	**English**	
Part time	**150/45**	per Semester	**0**	per Semester	**45**	per Semester	**0**						
Course leader				Name		**Dr. habil. József Katona**					Position	**associate professor**	
Training course aims				**Educational goals, development objectives** For independent professional activity and written presentation of its results, ie for the preparation of the dissertation: - to identify and identify problems, to select the problem to be solved, - to solve and solve the problem, to collect and systematize knowledge, to synthesize it - development of a solution proposal - implementation, testing - evaluation									
Typical transfer methods				Theoretical									
				Practice		Using a projector							
				Lab									
				Misc.									
Requirements (expressed study results)				**Knowledge** He/she knows the most important contexts and theories of the IT field and the terminology and applications that make them up.									
				Ability The students completing the course will be able to synthetically formulate, evaluate and apply the knowledge system and connections of the IT field. They will be able to use, understand the typical literature of the field of informatics, search for related sources.									
				Attitude The students are required to authentically convey and convey the comprehensive way of thinking and the basic features of its practical operation of its open profession. It is characterized by the need for continuous self-education.									
				Autonomy and Responsibility He/she conducts his / her own reflection on the basis of comprehensive, foundational issues and the given sources. It is characterized by cooperation and responsibility with qualified professionals in the given field.									
Short description of the subject content				Presentation of the problem solving and acquaintance with the relevant regulations of the university college.									
Forms of student activity													
Required reading and availability				Thesis preparation guide (Moodle system)									
Recommended readings and availability													
Description of tasks/measurement procedures to be submitted				Recording thesis data in the Thesis system. Submitting a thesis.									
Description and schedule of the midterm tests													

Field Practice – Computer Science BSc

Subject name		In Hungarian		Szakmai gyakorlat - MINFBSC							Level	**BSc**	
		In English		**Thesis Research 2. – Computer Science BSc**							Subject code	**ISF-097**	
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study											Subject code		
Type		Study load per week (in hours)						Requirement			Credit	Teaching language	
		Theoretical		Practice		Lab							
Full time	**150/0**	per Week	**0**	per Week	**0**	per Week	**0**	**No Grade**			**0**	**English**	
Part time	**150/0**	per Semester	**0**	per Semester	**0**	per Semester	**0**						
Course leader				Name		**Dr. habil. József Katona**					Position	**associate professor**	
Training course aims				**Educational goals, development objectives** By the end of the internship, the student will be able to plan his / her work, to take the necessary measures, to evaluate his / her results, - to complete his / her tasks on time, - to recognize and to solve the problems of work organizations – to apply what has been learned professionally. Communicate effectively with professionals, - perform tasks in individual and team work, - report on the practice / dissertation process - report on your work, report in writing and orally, supported by a presentation, in the style of an economist, - explore errors and omissions in the work process, to eliminate.									
Typical transfer methods				Theoretical									
				Practice									
				Lab									
				Misc.									
Requirements (expressed study results)				**Knowledge** The student completing the course will become familiar with the most important contexts and theories of the IT field and the terminology that makes them up. They will know the basic methods of acquiring knowledge and problem solving in the field of informatics.									
				Ability He / she is able to formulate the knowledge system and connections of the IT field synthetically and to perform adequate evaluation activities. He has the skills to work independently; he is required to be able to cooperate with others; he is required to be able to manage a variety of resources. The student will be able to use his / her professional knowledge according to the different professional expectations of a given job.									
				Attitude The student is required to authentically convey and transfer the comprehensive way of thinking and the basic features of the practical operation of his open profession. It is characterized by the need for continuous self-education in the field of economics									
				Autonomy and Responsibility He/she is required to take into consideration the comprehensive, foundation technical issues and think over the given sources. It is characterized by cooperation and responsibility with qualified professionals in the given field. It takes responsibility for the views that underpin the profession.									
Short description of the subject content				The student completes the internship prescribed in the curriculum in an environment that meets the professional needs of the major and the specialization.									

	The student's practical professional work is assisted by the appointment of an internship supervisor, the provision of data collection, literature research and consultation.
Forms of student activity	Individual and social problem solving and work in the professional internship place.
Required reading and availability	
Recommended readings and availability	Reading (at least 10) domestic and foreign literature related to the topic of our specialization and the dissertation, getting to know it, synthesizing it, solving IT problems.
Description of tasks/measurement procedures to be submitted	Internship report.
Description and schedule of the midterm tests	

Description of the required subjects of Computer Science Engineering BSc specialization

Network Management 2

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Hálózat menedzselés 2.</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Network Management 2</td><td colspan="2">Subject code</td><td>ISR-120</td></tr>
<tr><td colspan="4">Responsible Educational unit name</td><td colspan="5">Institute of Informatics</td></tr>
<tr><td colspan="4">Name of the required preliminary study</td><td colspan="3">Network Management 1.</td><td>Subject code</td><td>ISR-258</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="2"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td><td>Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week 0</td><td>per Week 2</td><td rowspan="2">Midterm mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester 0</td><td>per Semester 10</td></tr>
<tr><td colspan="4">Course leader</td><td>Name</td><td colspan="2">Dr. Tibor Ujbányi</td><td>Position</td><td>assistant professor</td></tr>
<tr><td colspan="4">Training course aims</td><td colspan="5">Educational goals, development objectives

The students completing the subject know the basic operation and algorithms of computer networks, they become able to handle and create basic communication networks. They are able to see and understand the processes from the operation of the communication media to the basic operation of the devices of computer networks. The course covers knowledge of the more complex parts of the layers of the ISO OSI standard.</td></tr>
<tr><td colspan="4" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="4">Online study material (notes, lecture videos, lecture slides), test questions and consultations within the framework of a contact hour.</td></tr>
<tr><td>Practice</td><td colspan="4"></td></tr>
<tr><td>Lab</td><td colspan="4">Using computers with Wireshark and Cisco PacketTracer applications. The handover can take place in the framework of contact hours or with the help of on-line study material (notes, lecture videos, lecture slides, test questions), in the latter case supplemented by laboratory consultations held in the framework of contact hours.</td></tr>
<tr><td>Misc.</td><td colspan="4"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed study results)</td><td colspan="5">Knowledge

Students completing the course are going to be familiar with ISO OSI and TCP / IP models, its layers and functions, and the operation of basic procedures. Characteristics of wired and wireless transmission media, modulation methods used. The essential differences between the different switching modes, the X.25 protocol and the operation of the IPv4 and IPv6 protocols (and their ICMP protocols), the address allocation options.

The purpose and method of traffic control, as well as the operation and configuration of the RIPv2 dynamic control protocol. IP-based address translation.</td></tr>
<tr><td colspan="5">Ability

They can configure Cisco IOS-based network devices, configure interfaces, X.25 type foundations, statistics, and RIPV2 dynamic routing configuration. Configure DHCP and NAT services.</td></tr>
<tr><td colspan="5">Attitude

Open, inquisitive, constructive, efficient, creative.</td></tr>
<tr><td colspan="5">Autonomy and Responsibility

He takes responsibility, decides and manages independently in the given field.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="5">Lecture:
ISO OSI and TCP / IP structure, reviving certain layer tasks, typical procedures and their operation of the OSI model. Spanning tree protocol. Virtual LANs, trunk connections, VTP. OSPF traffic management protocol. Dynamic address</td></tr>
</table>

	translation. Relationship and typical functions and applications of the display layer. Firewalls and authentication (802.1x, Radius, TACACS). Graphic management interfaces use. Operation of DNS, VPN, SNMP, MIB, CIM, VoIP protocols. Lab: Revival of previous studies. PPP configuration and spanning tree protocol. Configuring VLANs and trunks, subinterfaces. Port security, control of VLANs on trunks, VTP. Dynamic NAT and PAT, OSPF configuration. Creating ACLs. Graphical interface and SSH configuration.
Forms of student activity	Processing of heard text with notes Organizing information in a task-driven way Independent processing of tasks Solving a test task.
Required reading and availability	Tanenbaum, Andrew S .: Computer Networks (2nd edition) Coursework for the last two (3rd and 4th) semesters of Cisco Certified Network Administrator training in Moodle. Moodle Electronic materials in Moodle or Neptun systems.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	During the semester, the course includes two in-house exams: one on theory and one on practice. Exams can be replaced 1 time separately.

Network Operating Systems – Windows

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Hálózati operációs rendszerek – Windows</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Network Operating Systems – Windows</td><td>Subject code</td><td>ISR-121</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="4">Windows operating system</td><td>Subject code</td><td>ISR-257</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="3"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td colspan="2">Practice</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td rowspan="2">Exam</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester</td><td>0</td><td>per Semester</td><td>10</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. György Agoston</td><td>Position</td><td>c. professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

The aim of the course is to get acquainted with Windows Server operating systems and related technologies. During the semester, students can learn the terminology related to the operation of domain systems, learn about the most important Active Directory services. They are able to create a domain environment, centrally control Windows systems through the management and configuration of AD objects, group policies, server roles, and services.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">Computer lab, using a projector.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">Computer lab, using a projector.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="6">Knowledge
The student should
• get to know the possibilities and tools of the IT field.
• have expertise and industry-specific knowledge of Windows Server.
• get to know the methods and procedures needed to solve common problems / tasks in the ICT field.
• have the knowledge of specialist-specific tools to perform tasks appropriate to the IT field.</td></tr>
<tr><td colspan="6">Ability
The student should
• be able to perform routine operational tasks in the ICT field, perform planned development tasks.
• apply learned problem-solving methods and procedures to perform his/her field tasks.</td></tr>
<tr><td colspan="6">Attitude
The student is required to
• be interested in new methods and tools related to the field.
• strive to maintain the level of knowledge about Windows Servers and continuous professional training and self-education.</td></tr>
<tr><td colspan="6">Autonomy and Responsibility

• Capability for a managed IT job, in which he/she performs his/her job tasks independently.
• Taking responsibility for his/her own work (for individual and team work, decisions, results).
• Making decisions independently on the development of his own knowledge, plans and organizes it.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Understanding the basic concepts related to network operating systems, ways of virtualization (server, application, desktop, storage, display). Get to know the basic concepts of cloud computing related to the topic (Software as a Service, Platform as a Service, Infrastructure as a Service, Storege as a Service). The main features of the current edition of Windows Server, installation methods, installation. Post-installation steps, local server settings. Features and structure of Active Directory directory service. AD database, operational levels. Naming and identifying AD objects, object classes. Global catalog, directory partitions. Functionality levels. Commissioning a domain controller, using AD Administrative Tools. Creating AD objects, group management. Features of Storage Spaces service, Creation and</td></tr>
</table>

	management of Storage Pool, creation of fault-tolerant storage volume. Authentication (DAP, LDAP, IWA, NTLM, Kerberos) and access control (ACE, ACL). User rights and privileges, delegation of control. Group Policies, management templates. Group Policies vs. Local policies. Inheritance, factors influencing inheritance. Evaluate group policies, order of implementation, update. Group Policy levels. Starter GPO. Validate the creation of Group Policies. Run scheduled tasks, scripts (PowerShell, Batch) from Group Policy. Shares. Sharing and file system level permissions. Resulting rights. Disk quotas, local quota configuration. Quota configuration policies. Use a shared library as a drive with central quota management. The process of name resolution under Windows. DNA records, zone types, zone characteristics. AD integrated DNA. DNA search zones. Deployment of DNS role, important DNS server features. Creation of DNA search zone, management of DNS records. DHCP service operation, basic concepts. DHCP address allocation process, DHCP lease renewal process. DHCP Scope types. DHCP Failover Cluster, Multi-site DHCP. Creating a DHCP Scope. IIS, WSUS, WDS services and basic concepts.
Forms of student activity	Guided and independent processing of theoretical curriculum, Problem solving with guidance and independently. Collection and processing of information related to a professional topic.
Required reading and availability	Presentation and other teaching materials in the Moodle. Microsoft TechNet (online) Microsoft Docs (online)
Recommended readings and availability	William Panek: MCSA Windows Server 2016 Complete Study Guide: Exam 70-740, Exam 70-741, Exam 70-742 and Composite Upgrade Exam 70-743
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	Only one midterm test, during the 12th week (contains theoretical and practical part). Possibility of retake tests during the last (13th) week and during Exam period.

Script Language

<table>
<tr><td rowspan="2">Subject name</td><td colspan="2">In Hungarian</td><td colspan="4">Szkript nyelvek</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">In English</td><td colspan="4">Script Language</td><td>Subject code</td><td>ISR-116</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="4">Introduction to programming</td><td>Subject code</td><td>ISF-111</td></tr>
<tr><td rowspan="2">Type</td><td colspan="2" rowspan="2">Study load per week (in hours)</td><td colspan="4" rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td>Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>0</td><td>per Week</td><td>3</td><td>per Week</td><td>0</td><td rowspan="2">Midterm mark</td><td rowspan="2">5</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>0</td><td>per Semester</td><td>15</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Kálmán Hadarics</td><td>Position</td><td>teacher of master</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

The subject imparts theoretical and practical knowledge. Using the Linux operating system, it demonstrates how it is possible to use the advanced features of various commonly used scripting languages. By creating script files, it enables the student to develop general-purpose scripts. The purpose of the Script languages course is for students to acquire theoretical and practical knowledge in the use of a widely used Script language and to be able to perform development tasks in the most common areas of application of the language. Script languages are used for dealing with everyday problems as well as for nuclear solutions that apply high security standards, and their importance is increasingly prominent. In the course, we chose the Python language as a basis.
The subject imparts theoretical and practical knowledge. The student will be able to use the Python scripting language, get to know the PyCharm development environment, handle exceptions that arise during the script's execution, as well as files and databases.
Among the interfaces used by development groups that support joint work, task sharing, version tracking and source code management, you will get to know the application and possibilities of GitHub.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">Presentation in a large lecture hall, using a projector in all theory classes.
Theoretical concepts are presented at the lecture, using practical examples.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">In a computer lab, using a projector in every lab class.
Independent task solving under the guidance of laboratory managers in sub-laboratories. Development and execution of scripts in the Linux operating system and individual task solutions.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed study results)</td><td colspan="6">Knowledge

• Learn scripting at an advanced level. Knowledge of Python language elements.
• Knowledge of PyCharm development environments.
• Knowledge of GitHub version tracking.
• Knowledge of commonly used Python modules.
• Knowledge of an individually chosen Python module.</td></tr>
<tr><td colspan="6">Ability

• Setting up the PyCharm runtime.
• GitHub application for development and sharing.
• Can write simpler Python programs.
• You can choose the right module/modules for the given problem.
• Use of the Python language in other topics of interest.</td></tr>
<tr><td colspan="6">Attitude

To solve specific problems, you think about solving them in Python.</td></tr>
</table>

	Consider the implementation steps and the advantages/disadvantages resulting from them.
	Autonomy and Responsibility • Independent thinking and problem solving. • Assessing the difficulty of the task, accepting or rejecting it.
Short description of the subject content	Basics of the Python language, development and runtime environment, frequently used Python modules, application areas of the Python language (mathematics, machine learning, web development, 3D, signal processing, etc.), use of the Python function library. Integration and application of the PyCharm development environment and GitHub version tracking.
Forms of student activity	Text interpretation Information, information processing individually Learning a logical, logical way of thinking. Development of problem solving skills Systematization of learned knowledge Solving independent tasks.
Required reading and availability	Perl online documentation (perldoc.perl.org) Ruby online documentation (ruby-doc.org)
Recommended readings and availability	Kevin C. Baird: The Ruby programming language, Kiskapu, 2008Gérard Swinnen: Let's learn to program in Python Mark Summerfield: Python 3 Guido Van Rossum: Python tutorial (https://docs.python.org/3/tutorial/) Using the PyCharm development environment (https://www.jetbrains.com/help/pycharm/quick-start-guide.html) GitHub User Guide (https://github.com/PovertyAction/github-training)
Description of tasks/measurement procedures to be submitted	The task to be submitted is to solve a problem related to a topic of your choice. The submitted project must be defended orally. Theoretical knowledge is assessed by completing a test. Assessment of practical knowledge in laboratory classes by solving computer problems.
Description and schedule of the midterm tests	Theory test week 7. Defense of project assignments in weeks 11 and 12. replacement option: 13th week

Network Operating Systems – Linux

Subject name		In Hungarian		Hálózati operációs rendszerek – Linux					Level	**BSc**	
		In English		**Network Operating Systems – Linux**					Subject code	**ISR-214**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Linux operating system					Subject code	ISR-159	
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Exam**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Kálmán Hadarics**			Position	**teacher of master**	

Training course aims	**Educational goals, development objectives** The aim of the course is to acquaint the student with the installation process and configuration of the Linux operating system. The student should be able to install applications, both from source and through pre-built packages. Be involved in managing the operating system and network connection, installing, monitoring, and tuning network services. What you learn in the subject will help you find a position as a Network System Engineer.	
Typical transfer methods	Theoretical	Lecture in lecture hall, using a projector in each theoretical lesson. The lecture introduces theoretical concepts using practical examples.
	Practice	
	Lab	In a computer lab, using a projector during every lab class. Independent task solution under the guidance of laboratory teachers. Install, use, and configure the Linux operating system.
	Misc.	
Requirements (expressed study results)	**Knowledge** The student is required to • learn the steps to install the Linux operating system. • learn common Linux administration commands. • learn how to administer key network services in Linux.	
	Ability The student should • be able to install a Linux operating system. • be able to manage users on a Linux operating system, control user rights. • be able to install and configure applications.	
	Attitude • Interest in Linux system administration. • Self-development using the available English literature (sources). • The compulsion to give a solution (challenge).	
	Autonomy and Responsibility • Independent thinking and problem solving. • Assess, accept or reject the difficulty of the task.	
Short description of the subject content	Installing Linux, creating partitions and file systems. Using RAID and LVM, mounting file systems. Software package management. Manage users and control their permissions. Linux kernel capabilities and administration of the Linux boot process. Network configuration, network communication filtering. Install and configure key Linux networking features.	
Forms of student activity	Guided and independent processing of theoretical curriculum, Problem solving with guidance and independently. Collection and processing of information related to a professional topic.	
Required reading and availability	Teaching materials in the Moodle.	
Recommended readings and availability		

Description of tasks/measurement procedures to be submitted	Assessment of theoretical knowledge with oral answers based on a series of items. Assessment of practical knowledge in lab classes, by solving computer problems or preparing reports related to assigned tasks.
Description and schedule of the midterm tests	1st mid-term exam: 6th week of practice 2nd mid-term exam: 12th week of practice Replacement and repair is possible in the last week of the due diligence period or at another agreed time.

IT Project 1

Subject name		In Hungarian		Informatika projekt 1.							Level	**BSc**	
		In English		**IT Project 1**							Subject code	**ISF-217**	
Responsible Educational unit name				**Institute of Informatics**									
Name of the required preliminary study											Subject code		
Type		Study load per week (in hours)							Requirement		Credit	Teaching language	
		Theoretical		Practice		Lab							
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**		**Midterm Mark**		**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**						
Course leader				Name		**Dr. Györgyi Strauber**					Position	**c. professor**	

Training course aims	**Educational goals, development objectives** Providing technical and methodological knowledge that is necessary for the successful implementation of an IT project. Introducing project management and execution procedures to the students, within the framework of an IT project of 3-5 people, realized with group work (for example, supporting sustainable development, increasing energy efficiency, and being used in the nuclear industry).	
Typical transfer methods	Theoretical	With the participation of every student in the large lecture hall. Lecture with projector and blackboard or online course using Teams meeting.
	Practice	
	Lab	In classrooms with computer work-stations for every student. The teacher's computer is connected to projector.
	Misc.	
Requirements (expressed study results)	**Knowledge** • The student should acquire such technical and methodological knowledge, which are necessary to complete and manage an informatical project successfully.	
	Ability The student should be • able to take an independent role in a project, • able to manage a small project, • able to use the project management tools and technics	
	Attitude The student is required to be • interested in new methods and tools related to the field. • open, inquisitive, constructive, efficient, creative.	
	Autonomy and Responsibility He takes responsibility, decides and manages independently in the given field	
Short description of the subject content	The implementation process of informatical projects: the informatical strategy, the feasibility study, the project definition plan, contract types, tendering, project control, evaluation. The life-cycle of the development. Project phases. Project planning. Resource handling in the projects. Resource allocation. Project realisation organisational forms. Cost handling of projects. Project analysis. Risk handling: risk types, risk handling methods and techniques. The documentation of the project. Handling quality in the informational projects. Project management methodologies (PRINCE 2, PMI). Softwares supporting the project management (MS Project). Making a project in the laboratory in team-work.	
Forms of student activity	Lecture: 30% Self-dependent task solving: 30% Teamwork: 40%	
Required reading and availability	Gary R. Heerkens: Project Managenet, McGraw-Hill Companies USA, 2002, Microsoft Project 2010; Step by Step, Microsoft Press, Redmond, Washington, 2010	

Recommended readings and availability	Guidelines for Managing Projects; Department for Business, Innovation and Skills, London UK, 2010 Adrienne Watt: Project Management; The Open University of Hong Kong, 2012 Wouter Baars: Project Management Handbook, Data Archiving and Networked Services, The Hague, 2006
Description of tasks/measurement procedures to be submitted	Preparation of project tasks, group work: software development (whether nuclear industry or steel industry), networking, data analysis, dealing with "smart" solutions that support sustainable development, increase energy efficiency, can be used in the nuclear industry, etc. IT topics can be chosen to solve the semester project task.
Description and schedule of the midterm tests	The midterm ticket consists of 3 parts: 1. Theoretical mid-term tests from the lecture material, weeks 6 and 12, max. 30 points 2. Computer mid-term tests: knowledge of MS Project or software with similar functionality, 10th week, max. 20 points 3. Presentation of project group work: • Week 5: presentation of project establishment documents in groups • Week 7, 9: submission of project status reports • End of week 10: submission of project assignment • Presentation of the activities carried out in the 11th, 12th week project, project closing, project evaluation in groups Max. 50 points with the following additions: due to non-scheduled progress, the exercise leader may deduct -5, -5 points from the entire group in the 5th and 10th weeks, and the group leaders can distribute a total of 10 reward points within their group in the 12th week distributed in proportion to the work done. The mid-semester ticket requires at least 50% completion of all three parts.

Operations Research and Decision Making

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Operációkutatás és döntéselmélet</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Operations Research and Decision Making</td><td>Subject code</td><td>IMA-214</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="5">Institute of Informatics</td></tr>
<tr><td colspan="3">Name of the required preliminary study</td><td colspan="4">Mathematics 1 or Engineering Mathematics 1</td><td>Subject code</td><td>IMA-152</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="3"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td><td colspan="2">Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week</td><td>0</td><td>per Week 2</td><td>Exam</td><td>5</td><td>English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester</td><td>0</td><td>per Semester 10</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. habil. Bálint Nagy</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

Basic aim of the Operations Research and Decision Making course is to familiarize the students with the most important methods of mathematical modeling and simulation techniques to assist and improve the managerial decisions. The subject provides both theoretical and practical knowledge.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">The lecture is provided to all students in a lecture room.

The implementation of theoretical concepts in sample applications are explained and presented.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">Different applications are implemented by the laboratory leader.

The tasks are created on personal local storage using Excel Solver.

Projectors and computers are used in every laboratory.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed study results)</td><td colspan="6">Knowledge

The subject ensures to provide knowledge about the different modelling techniques used to assist the modern managerial decisions. The students can develop the suitable mathematical models to quantitatively describe the arising problems in different kind of decision problems.</td></tr>
<tr><td colspan="6">Ability

Students are able to use specific tools implemented in the Excel called Solver. These tools are a very effective component of the Excel to solve linear programming problems. With this ability the student can create optimal decisions arising in different area of manufacturing, economical and transportation problems.</td></tr>
<tr><td colspan="6">Attitude

Students are motivated to logical and constructive thinking what is inevitably important to successful managerial decision making. They are open-minded to discover new solutions. In teamwork, they make an effort to do a high-quality job and observe deadlines.

Autonomy and Responsibility

Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">• The basic concept of decision making
• Introduction to linear programming (LP) models
• Main components of linear programming models
• The basic terms and concepts of mathematical modelling
• Most important mathematical tools of LP modelling.
• Linear space, vector space, linear independency
• Concept of vector base, elementary base transformation
• Application of base transformations to vectors and matrices.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="6">• Processing the heard text and writing notes: 10%
• Organize information supported by tasks: 20%</td></tr>
</table>

	• Own tasks solutions: 70%
Required reading and availability	Saul J. Gass, Linear Programming, Methods and Applications
Recommended readings and availability	• Michael W. Carter, Camille C. Price, Ghaith Rabadi, Operations Research: A Practical Introduction • Gerald Lieberman, Frederick S Hillier, Introduction to Operations Research • E. W. Martin, Jr, Mathematics for Decision Making • Thomas L. Saatz, , Mathematical Principles of Decision Making
Description of tasks/measurement procedures to be submitted	One homework (compulsory application) • Topic: A linear programming task which fits to the material of theory and practice. • Date: The homework description is given on the 7th week. It must be finished until the last week of term-time. • In case of unsuccessful presentation (e. g.: if the student is not aware of the operation of the presented program or it is found that the program has been copied), the application will be rejected.
Description and schedule of the midterm tests	Two mid-term tests/exams. mid-term test: the last week during term-time. Replacement/Correction The material of the whole semester. Invalidate the previously mid-term tests. Deadline: last week during term-time. Final grade (lecture total min. 61% and practice total. min. 61%): <50%: Fail (1) 51-60%: Pass (2) 61-70%: Satisfactory (3) 71-80%: Good (4) 81-100%: Excellent (5) Lecture: test: 100 point (min. 51%)

IT Project 2

Subject name		In Hungarian		Informatika projekt 2.					Level	**BSc**	
		In English		**IT Project 2**					Subject code	**ISF-116**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/26**	per Week	**0**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/10**	per Semester	**0**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. Mariann Váraljai**			Position	**associate professor**	

Training course aims	**Educational goals, development objectives** The purpose of the subject is to prepare the student to write a thesis as a conclusion of his higher education studies. In this context, the goals and areas to be developed are: The student should be able to choose a thesis topic appropriate to his field of study and level, which matches those determined by the training and output requirements. The student should be able to assess his possibilities from both a professional and academic point of view, and to the best of his knowledge, choose the field in which he can write a thesis that meets the expectations. The student should be able to explore the subject area of the chosen topic in advance, collect the necessary information, The student should be able to determine and evaluate the relevance of the collected information. The student should be able to explore the relevant literature, compare them and evaluate them objectively. The student should be able to interpret the professional scientific text. The student should be able to explore connections and think logically. The student should be able to base the outline of his own topic based on the acquired previous and new information. The student should be able to plan and organize his thesis writing process, and within that to start preparing the necessary plans for his topic. The student should be able to prepare the research/development plan of the planned thesis topic with sufficient thoroughness (approx. 10 pages). The student should be able to create professional scientific contents. The student should be able to communicate his/her professional and scientific results and defend his/her research/development work. The student should be able to express himself in scientific circles and participate in scientific conferences.	
Typical transfer methods	Theoretical	
	Practice	
	Lab	In classrooms with computers for every student and a projector, individually or in groups with teacher's guidance; Furthermore online learning materials are also available.
	Misc.	
Requirements (expressed study results)	**Knowledge** • To know the general IT professional principles, rules, relationships, procedures necessary for the cultivation of the IT field, as well as the fundamental theories and connections of the field, and their terminology. • To have thorough knowledge in the narrower scientific field related to student's thesis, so (s)he can think in a system and explore connections. • To know and understand the modern technologies used and is aware of the basic legislation.	
	Ability • The student should be able to independently perform sub-activities in solving complex system tasks.	

	• The student applies the learned problem-solving methods and procedures efficiently and professionally to your specialist tasks. • During the development of his task, the student uses various sources of knowledge effectively. Based on source research, he performs comparative analyzes in areas related to the topic of his thesis. • The student is able to plan his own researcher/developer's work and is able to create plans for the task to be implemented.
	Attitude The student is required to • be interested in new methods and tools related to the field, and is constantly expanding his knowledge by acquiring knowledge. • look at his own professional competences and activities in a reflective manner. • open to learning about and accepting professional, technological development and innovation related to his qualifications and field of expertise. • cooperate with the instructor during the expansion of knowledge and strives for accurate, error-free task solutions, considering the principles of economy and sustainability, and applying modern solutions.
	Autonomy and Responsibility The student strives for efficient and quality work and be able to apply modern techniques and technologies independently. The student is responsible for his independent professional activities. He thinks logically and strives to explore connections, he uses the systematic approach in his thinking.
Short description of the subject content	• Collection of information and resources in the form of professional and scientific publications. Carrying out professionally and scientifically sound research work, discarding non-professional, non-scientific and irrelevant content. • Effective and sufficiently thorough source management in printed and electronic form. • Applying a design process that meets engineering expectations, creating high-quality plans for both the thesis writing workflow and the topic of the thesis to be completed. • Knowing the concept of plagiarism, taking appropriate measures regarding one's own work, observing laws and regulations. • Cultivating scientific text/content comprehension: reading and processing as many professional scientific publications as possible, both in English or other foreign and mother languages too. • Cultivation of academic text creation (thorough knowledge and observance of Hungarian spelling rules, use of adequate vocabulary and sentence structure, well-understood and properly interpreted self-expression both professionally and academically. • High-level word processing with a word processing program: managing multi-page documents, applying templates, making references, lists, and following formal requirements. • Making a presentation with the PowerPoint program: using a template, creating an efficient and goal-oriented, well-planned, and properly organized presentation. • Knowing and complying with the content and form requirements of thesis preparation. • Participation in at least one scientific conference: behaving in accordance with the event, objective and subjective evaluation of the professional scientific lectures listened to, forming an opinion, formulating it factually.
Forms of student activity	• Processing heard text, create notes; • Task-guided organization of information (30%) ; • Independent processing of tasks (70%)
Required reading and availability	Literature of subjects related to the topic of the project task
Recommended readings and availability	• David Evans, Paul Gruba, Justin Zobel: How to Write a Better Thesis, Springer International Publishing Switzerland, 2014

	• Kate L, Turabian: A Manual for Writers of Research Papers, Theses and Dissertations, The University of Chicago Press, 2007 • Don Shiach: How to Write Essays, Spring Hill House, Oxford UK 2007
Description of tasks/measurement procedures to be submitted	The individual project work preparing the thesis and the preparation of the specified tasks by the deadline set by the instructor based on the conditions set by the instructor, (See the details below, in the weekly breakdown of the topic.) Uploading the assignment solutions to the Moodle system is mandatory
Description and schedule of the midterm tests	The TESTS are replaced by mandatory individual task solutions. The Informatics project 2. subject is intended to help with the preparation of the thesis, so the work to be done is continuous, homework supported by tutor guidance and consultations.

Quality and Auditing of IT Critical Systems

Subject name		In Hungarian		Informatikai rendszerek minőségbiztosítása és auditja					Level		**BSc**
		In English		**Quality and Auditing of IT Systems**					Subject code		**ISR-164**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**2**	per Week	**1**	per Week	**0**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**10**	per Semester	**5**	per Semester	**0**				
Course leader				Name		**Dr. Tibor Ujbányi**			Position		**assistant professor**

Training course aims	**Educational goals, development objectives** The student should be able to evaluate the effectiveness of control solutions and the realistic risks associated with the use of IT. Students should get acquainted with the risks of computer applications, the basic goals and tasks of quality assurance and audit of IT systems. Get acquainted with the control and testing tasks of system development.	
Typical transfer methods	Theoretical	Online study material (notes, lecture videos, lecture slides), test questions and consultations within the framework of a contact hour.
	Practice	The handover can take place in the framework of contact hours or with the help of on-line study material (notes, lecture videos, lecture slides, test questions), in the latter case supplemented by laboratory consultations held in the framework of contact hours.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** The student should gain knowledge about security-critical systems. He knows the risks of computer applications, the basic goals and tasks of quality assurance and audit of IT systems. He should be familiar with the control and testing tasks of system development.	
	Ability The student is required to be able to assess risks. Able to participate in the quality assurance and audit of IT systems. Able to perform basic software testing tasks.	
	Attitude Open, inquisitive, constructive, efficient, creative.	
	Autonomy and Responsibility He takes responsibility, decides and manages independently in the given field.	
Short description of the subject content	Software quality assurance, security critical systems. IT system audit. IT systems testing, software testing. testing strategies. Case studies.	
Forms of student activity	Processing of heard text with notes, directed and independent processing of theoretical curriculum, problem solving with guidance and independently. Collecting, processing and organizing information related to a professional topic. Solving tasks, analyzing and processing case studies.	
Required reading and availability	Moodle Electronic materials in Moodle or Neptun systems.	
Recommended readings and availability		
Description of tasks/measurement procedures to be submitted	According to subject requirement. During the course, an assignment must be completed from the practical part (testing of IT systems).	
Description and schedule of the midterm tests	During the semester, the course includes one in-house exam, which can be replaced 1 time separately.	

Software Development Technologies

Subject name		In Hungarian		Szoftverfejlesztési technológiák					Level	**BSc**	
		In English		**Software Development Technologies**					Subject code	**ISF-117**	
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Programming 2					Subject code	ISF-113	
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**1**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**5**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr. habil. József Katona**			Position	**associate professor**	

Training course aims	**Educational goals, development objectives** The aim of the course is to acquaint the student with the basics of Windows Presentation Foundation (WPF) and Xamarin.Forms programming, among others, as well as to be able to effectively design and build graphical application architecture (MVC, MVP and MVVM), apply SOLID principles and be a web service for communication. Another goal is to introduce the student to the whole process of software development, methods, models, and to introduce them to UML diagrams that will enable requirement specification and object-oriented design, including structure modelling, state management, and execution modelling. In addition to specification and requirements management and design, be familiar with implementation techniques, configuration management, verification and validation, software evolution, and effective unit testing based on Test-Driven Development (TDD). Ultimately, it is the transfer of knowledge that will enable you to see the entire software development lifecycle and solve the tasks of each phase in a team or even on your own, using the techniques, technologies, paradigms and opportunities learned within the subject. The course also imparts theoretical and practical knowledge that will form the basis for further programming-related subjects.	
Typical transfer methods	Theoretical	The lecture is provided to all students in a lecture room. The implementation of theoretical concepts in sample applications are explained and presented. Projectors and teacher's computers are used in every lecture.
	Practice	
	Lab	Different applications are implemented by the laboratory leader. The tasks are implemented on our own local repository of the university in C# language. The created and used databases are stored and accessed on remote servers. Projectors and computers are used in every laboratory.
	Misc.	
Requirements (expressed study results)	**Knowledge** The student is required to gain knowledge of C # language Windows Presentation Foundation (WPF) and Xamarin.Forms capabilities (design patterns, S.O.L.I.D. principles, web service, platform-dependent and independent implementation, test control development, and unit testing). He has knowledge of UML views and applies the models with high efficiency.	
	Ability The student should be able to see the entire software development lifecycle and solve the tasks of each phase in a team or even independently, using the techniques, technologies, paradigms and opportunities learned within the framework of the subject.	

	Attitude Students are motivated to programming. They are open-minded to discover new corporate solutions, accept to principles of an organizational work and find easily their place in a project team. In case of self-sufficient jobs, all phases are done with the best possible mode and results. In teamwork, they make an effort to do a high-quality job and observe deadlines.
	Autonomy and Responsibility Students carry out their tasks by themselves, think about different solutions and make suggestions. They take responsibility for their jobs.
Short description of the subject content	• Software development process, methods and models • Specification and requirement management • Structural modelling • Object-oriented design: state management • Object-oriented design: implementation • Design of software systems • Windows Presentation Foundation (WPF) basics • WPF resource management • Architecture of graphical interface and WPF applications • Xamarin basics • Development of a platform-independent and platform-specific application • Use of Web Services • The S.O.L.I.D. principles • Implementation • Configuration management • Verification and validation • Software evolution • Test-Driven Development TDD, unit testing
Forms of student activity	• Processing the heard text and writing notes: 20% • Organize information supported by tasks: 30% • Own tasks processing: 50%
Required reading and availability	• Matthew MacDonald, *Pro WPF 4.5 in C#: Windows Presentation Foundation in .NET 4.5 4th edition*. Apress, 2012. • Arnaud Weil, *Learn WPF MVVM - XAML*, C# and the MVVM pattern, 2017. • Richard Murch, *The Software Development Lifecycle*. 2012. • M. Seidl, M. Scholz, C. Huemer, G. Kappel, *UML @ Classroom: An Introduction to Object-Oriented Modeling*. Springer International Publishing, 2015. • Hermes Dan, Mazloumi Nima, *Building Xamarin.Forms Mobile Apps Using XAML*. Apress, 2019. • Arnaud Weil, *Xamarin Mobile Application Development: Cross-Platform C# and Xamarin.Forms Fundamentals*, Apress, 2015. • Electronic curriculums are associated with C# available in the Moodle system.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Optionally, upon individual request, it is possible to prepare an assignment for an additional (bonus) 25 points: • Topic: That is, the solution of a programming task matching the materials of theory and practice. • Date: Everyone will receive the description of what is to be submitted in the 6th week. Its preparation is an extracurricular task for the last diligence week; • At the time designated by the supervisor of the exercise, but the deadline for its preparation is the last week of the diligence period, you must personally defend it in front of a committee. • Submitting the project work. • The assignment cannot be replaced!
Description and schedule of the midterm tests	There are no conditions attached to obtaining the signature.

	Mid-term exams: Two mid-term exams from the theory and two mid-term exams from the lab. Date: 1. mid-term exam from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 6th week). 2. mid-term exams from theory and laboratory: at the scheduled time agreed with the lecturer/exercise leaders (in lecture or laboratory) during the diligence period (expected in the 11th week). Replacement mid-term exam/Repair mid-term exam: Each mid-term exam can be individually replaced or repaired during the diligence period. The first mid-term exam (lecture and lab) is expected in the 12th week, while the second mid-term exams are expected in the 13th week. Among the mid-term exams written more than once, the best result will be taken into account. Determination of merit: <=30 points: insufficient (1) 31-50 points: sufficient (2) 51-70 points: medium (3) 71-85: good (4) 86-125 points: excellent (5) The final grade may differ from the one calculated in this way (plus/minus) by one mark, taking into account the mid-semester activity and attitude. Available points: Theory: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) = 50 points, Lab: 1st mid-term exam (25 points) + 2nd mid-term exam (25 points) + optional to be submitted (25 points) = 75 points (There is no minimum requirement for each location.) Examination period: As a make-up exam, the subject can be made up/corrected in closed places during the exam period. In this case too, the best result among the mid-term exams written more than once will be taken into account.

Programming 3.

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Programozás 3.</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Programming 3</td><td colspan="2">Subject code</td><td>ISF-155</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="2">Name of the required preliminary study</td><td colspan="4">Programming 1</td><td colspan="2">Subject code</td><td>ISF-213</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="2">Study load per week (in hours)</td><td colspan="2" rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Teaching language</td></tr>
<tr><td>Theoretical</td><td>Practice</td><td>Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>1</td><td>per Week 0</td><td>per Week 2</td><td>Exam</td><td>5</td><td>English</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per Semester</td><td>5</td><td>per Semester 0</td><td>per Semester 10</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="2">Dr. habil. József Katona</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="6">Educational goals, development objectives

The aim of the course is to present for students several aspects of visual and graphical programming basis. It provides high skills to create parallel or multithreaded software and use the asynchronous opportunities of the Java programming language. Further objective is to introduce students to the basics of network programming and to provide tools with which they will be able to implement and manage service applications. Eventually, transfer so knowledge that they will be able to create business applications, even implementing and using custom controls or building external libraries or components.

The subject provides both theoretical and practical knowledge. It lays the foundation of the knowledge the further software development subjects.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">The lecture is provided to all students in a lecture room.

The implementation of theoretical concepts in sample applications are explained and presented.

Projectors and teacher’s computers are used in every lecture.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">Different applications are implemented by the laboratory leader.

The tasks are implemented on our own local repository of the university in Java language. The created and used databases are stored and accessed on remote servers.

Projectors and computers are used in every laboratory.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="2">Requirements (expressed study results)</td><td colspan="6">Knowledge

The students are required to learns about advanced Java language elements, version control techniques, JUnit testing techniques, and complete project development. (Java Syntax, OOP Overview, Lambda Expressions, Data Structures, Collection Framework, GIT

Versioning, Using GITHUB, JUnit Tests, Database Management, Serialization, Java Patterns, Knowledge of Graphical User Interface, Bug Management). The subject is about designing and implementing complex software. The student applies the knowledge of the previous subjects.</td></tr>
<tr><td colspan="6">Ability

The students should be capable of implement a complex software development in Java programming language, using object-oriented and functional programming techniques.

He should be capable of completing a software development project (specification, design, UML, Use-Case diagrams, database design, screen design, implementation, task writing in Java, testing, debugging and handling, documentation). Effective in designing, reading and converting static UML diagrams to Java. Understands the operation of a more sophisticated Java program and is able to work effectively in teams on a complex task solution.</td></tr>
</table>

	Attitude Motivated towards programming. He is open to new software development solutions, accepts the principles of teamwork and finds his place in the project team. In the case of self-employment, perform all phases of the work to the best of your ability. He also strives for quality work and meeting deadlines during teamwork.
	Autonomy and Responsibility He / she independently solves the tasks assigned to him / her, thinks about possible solutions and develops proposals. He takes responsibility for his project work.
Short description of the subject content	• Java technology, JRE • Java program development, JDK, NetBeans • Java syntax, OOP, functionality, lamda expressions • Data structures, collection framework • SWING, Creating a graphical user interface, using graphical objects • Java DB, database management • Use version control management, GIT, GITHUB throughout the project • JUnit, creating and running tests • Error handling, repair process • Project planning and implementation
Forms of student activity	• Processing of heard text with notes 20% • Systematisation of information 30% • Self-processing of tasks 50%
Required reading and availability	• Java Design Patterns: A Hands-On Experience with Real-World Examples ISBN-13: 978-1484240779 • Java-based electronic learning materials produced and compiled by educators. Access via Moodle. • Effecitive Java. ISBN-13: 978-0134685991
Recommended readings and availability	• Version Control with Git: Powerful tools and techniques for colLaboratoryative software development. ISBN-13: 978-0596520120 • Effecitive Java. ISBN-13: 978-0134685991. • The Definitive Guide to Java Swing, ISBN-13: 978-1590594476 • Database Programming with JDBC and Java, ISBN-13: 978-1565922709 • Pragmatic Unit Testing in Java 8 with JUnit, ISBN -13: 978-1941222591
Description of tasks/measurement procedures to be submitted	Software project developed in teamwork (Required Program) • Topic: Solving programming problems that fit theory and Seminar. • Timeline: Everyone will receive a description of what to submit in Week 2. Preparing for the final week is an extracurricular task; • You must personally present in front of a committee at a time determined by the supervisor, but during the final week of the term. • Submitting project work cannot be make up for! • In case of unsuccessful presentation (if the student is not aware of the functioning of the submitted program or it turns out that the program has been copied), the project work will be rejected.
Description and schedule of the midterm tests	Two mid-term tests/exams. 1st mid-term test: at a time agreed with the practice leaders. 2nd mid-term test: the week before the last week during term-time. Replacement/Correction The material of the whole semester. Invalidate the previously mid-term tests. Deadline: last week during term-time. Final grade (lecture total min. 61% and practice total. min. 61%): <60%: Fail (1) 61-70%: Pass (2) 71-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5) Lecture: 1. test (25 points) + 2. test (25 points) = 50 point (each min. 51%)

	Laboratory: Project Task (50 points). 100 points (each min. 51%)

Web Programming

Subject name		In Hungarian		Web programozás					Level		**BSc**
		In English		**Web Programming**					Subject code		**ISF-253**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit		Teaching language
		Theoretical		Practice		Lab					
Full time	**150/39**	per Week	**0**	per Week	**0**	per Week	**3**	**Exam**	**5**		**English**
Part time	**150/15**	per Semester	**0**	per Semester	**0**	per Semester	**15**				
Course leader				Name		**Dr. Zoltán Király**			Position		**associate professor**

Training course aims	**Educational goals, development objectives** The student will know the elements of web-based server-side programming and become familiar with a poorly typed language. Use and integrate previously familiar user-based scripting languages and databases into a PHP program. The student will know the elements of web-based server-side programming and become familiar with a poorly typed language. Use and integrate previously familiar user-based scripting languages and databases into a PHP program.	
Typical transfer methods	Theoretical	
	Practice	
	Lab	Exercises solving exercises during exercises. Tasks are implemented in PHP, on the University web server. Use of a projector and a teacher's machine in every class.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students completing the course will - know the basic PHP instructions. - learn how to use PHP's built-in functions. - know the basics of PHP OOP. - learn the PHP database management capabilities with MySQL and XML data. Learn basic PHP security steps.	
	Ability The students should - be able to specify complex programs. - be able to encode complex programs in PHP, HTML, JavaScript. - be able to use databases with PHP. - be able to implement dynamic websites / portals based on a specific specification.	
	Attitude Interest in programming. Self-development using the available literature in Hungarian and English. The challenge of giving the solution (challenge).	
	Autonomy and Responsibility Independent thinking and problem solving. Assess, accept, or reject the difficulty of the task. Standalone specification capability.	
Short description of the subject content	Students become familiar with the server-side PHP programming language, learn how to build complete websites / portals based on the specification, and use their experience in programming, database management, and networking technology. The course includes short and major programs. Students are required to make	

	projects. In the theoretical classes they learn the rules of web development and in practice they learn how to create dynamic web pages.
Forms of student activity	Solving individual tasks (homeworks) outside the classroom. Finding solutions and implementing them for assigned tasks.
Required reading and availability	w3cschool.com • https://www.w3schools.com/php/default.asp
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	One homework (compulsory application) • Topic: A programming task which fits to the material of theory and practice. • Date: The homework description is given on the 12th week. It must be finished until the last week of term-time. • It must be defended in front of a committee during last week of term-time which is appointed by the leader of practice. • It cannot be replaced! • In case of unsuccessful presentation (e. g.: if the student is not aware of the operation of the presented program or it is found that the program has been copied), the application will be rejected.
Description and schedule of the midterm tests	Two mid-term tests/exams. 1st mid-term test: it is recommended on the 6th week. 2nd mid-term test: the week before the last week during term-time. Replacement/Correction The material of the whole semester. Invalidate the previously mid-term tests. Deadline: last week during term-time. Final grade (lecture total min. 61% and practice total. min. 61%): <60%: Fail (1) 61-70%: Pass (2) 71-80%: Satisfactory (3) 81-90%: Good (4) 91-100%: Excellent (5) Lecture: 1. test (50 points) + 2. test (50 points) = 100 point (each min. 51%, total min. 61%) Laboratory: 1. test (30 points) + 2. test (30 points) + Homework (40 points) = 100 points (each min. 51%, total min. 61%)