2026

Computer Science Engineering BSc

STUDY PROGRAM

UNIVERSITY OF DUNAÚJVÁROS

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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. habil. 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.
Prerequisite(s) for starting the internship	There are no mandatory academic prerequisites for starting the internship. It is recommended that the internship be completed in the last semester of the program, when students already have the necessary professional foundations, but the internship can also be completed earlier in the program if the student finds a suitable place to do it and the conditions are right.
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.
The earliest date and conditions for acceptance of internship based on work experience	The acceptance of professional experience as work experience can be requested in the last semester of the training. The conditions for the acceptance of work experience as professional experience are: proof of employment lasting at least six months, corresponding to the professional profile of the training, which corresponds to approximately 1,000 working hours. The documents to be submitted include a certificate issued by the employer and a job description detailing the position held and the tasks performed. The practical internship course must be taken when registering for courses.

Preconditions of the issue of university leaving certificate	The university leaving certificate certifies the successful completion of the exam requirements in accordance with the curriculum and the completion of the other study requirements (e.g. physical education) and the collection of the required number of credit points defined in the study and output requirements. This certificate is a proof without qualification and evaluation that the student has fulfilled all the study and exam requirements defined in the curriculum.
Prerequisite(s) for thesis writing	A prerequisite for starting to write a thesis is the completion of the Thesis 1 - Methodology course, which is announced in the penultimate semester of the program. As part of this, students are required to submit a thesis topic proposal and prepare and submit a literature review related to the thesis topic. The Thesis 2 course involves the actual preparation of the thesis, which must be completed in the final semester of the program. The thesis is written in this semester based on the previously approved topic and in accordance with the formal and content requirements. The prerequisite for this course is the completion of Thesis 1.
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 prerequisites of the final exam are the receipt of the university leaving certificate and the thesis accepted for evaluation.
Final exam	The final exam is to check and evaluate the professional knowledge, skills and abilities, which is required to grant the degree certificate. In the final exam the student has to prove that he is able to apply the acquired knowledge in practice. The final exam includes defending the thesis and an oral exam of the subjects appointed in the curriculum. (FE1 and FE2)
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 the certificate	The average of the certificate should be calculated in the following way: (FE1 + FE2 + D + SA)/4: (FE1) the mark for the first final exam subject, (FE2) the mark for the second final exam subject, (D) is the mark awarded for the thesis by the final exam committee, which is structured as follows: - Mark received for the evaluation 1/3 - Presentation 1/3 - Debating skills, answers to questions 1/3 (SA) is the cumulative average of the study marks weighted with the credits points obtained by the student.
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 to prove the completion of higher educational studies is the 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.
Sport	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-TKK-915	Introduction to the use of artifical intelligence	0	S	5*	5*	0																								-
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	25	-																			-	-	-							-
	Sport (recommended semester)	0	S																												
	Number of Theoretical/Practice/Lab classes per week			8,4	6,4	6	5	0	13	4	5	9	7	0	4	4	4	2	5	0	2	0	0	0							
	Total number of classes per week			**20,8**			**18**			**18**			**11**			**10**			**7**			**0**									
	Total credit points																														
COMPUTER NETWORK ENGINEERING																3	0	6	3	0	6	1	9	4							
																9			9			14									
				18,8			18			18			11			**19**			**16**			**14**									
SOFTWARE TECHNOLOGY																3	0	6	2	0	7	1	9	4							
																9			9			14									
				18,8			18			18			11			**19**			**16**			**14**									

** (total number per semester)*

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-ISF-217
DUEN-ISR-164	Quality assurance and audit of critical systems	5	E																			1	0	2	-
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			0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	3	0	6	1	9	4	
	Total number of classes per week			0			0			0			0			**9**			**9**			**14**			
	Total credit points			**55**																					

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-ISF-217
DUEN-ISR-164	Quality assurance and audit of critical systems	5	E																			1	0	2	-
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			0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	2	0	7	1	9	4	
	Total number of classes per week			0			0			0			0			**9**			**9**			**14**			
	Total credit points			**55**																					

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

Description of the required subjects of Computer Science Engineering BSc

Introduction to the use of Artifical Intelligence

Title of the subject	Hungarian			**Bevezetés a mesterséges intelligencia használatába**					Level	compulsory	
	English			**Introduction to the use of artificial intelligence**					Code	DUEN(L) -TKK- 915	
Responsible Academic Unit				Teacher Training Centre							
Compulsory prerequisite subject:				none							
Type		Lecture		Seminar		Lab		Requirements	Credit	Language of instruction	
Full time		Per semester	5	Per semester	5		0	F	**0**	Hungarian	
Part time		Per semester	5	Per semester	5		0				
Person responsible for the subject:				name:		Dr. Tibor Fauszt			position:	associate professor	
Lecturer:				name:					position:		

Course objectives and justification (content, learning outcomes, place in curriculum)

Objectives and development goals

The rapid development of artificial intelligence and its integration into everyday life is fundamentally transforming access to knowledge, learning methods, and educational and workplace environments. As a result, there is a growing demand for targeted, short-term training courses that provide comprehensive yet practical knowledge about artificial intelligence. The primary goal of the 10-hour artificial intelligence training course is to provide participants with meaningful, systematic, and applicable knowledge, while laying the foundation for a critical and responsible approach to the technology.

The general aim of the training is to provide participants with a comprehensive overview of the basic concepts, operating principles, and key areas of application of artificial intelligence, and to enable them to use AI tools in a conscious and goal-oriented manner in their own learning or professional environment. The training does not aim to impart in-depth technical or programming knowledge but rather to develop participants' competencies based on the three pillars of understanding, applicability and reflection.

The training also aims to help students understand the basic principles of AI including the role of data and how algorithms work. The training includes a brief overview of the historical development of AI, which helps students understand the current state of technology and future possibilities.

The 10-hour time frame provides participants with the opportunity to gain practical experience in using simple, widely available AI-based tools. Within this framework the aim of the training is to teach participants the principles of effective instruction i.e. prompting and to enable them to use these tools for various purposes such as information retrieval and content creation. Another important goal is for participants to be able to critically evaluate AI-generated content, recognizing its inaccuracies, biases and limitations.

One of the main goals of artificial intelligence education is to encourage participants to adopt an open yet critical approach to AI technologies. The training helps participants become aware of the role of human decision-making, creativity and responsibility in the use of AI. A key objective is to provide a basic understanding of ethical, legal and data protection issues, with a particular focus on their application in an educational environment.

<table>
<tr><td rowspan="4">Typical lesson types:</td><td>Lecture</td><td>For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams</td></tr>
<tr><td>Seminar</td><td>By providing access to appropriate IT equipment and web-based AI tools in the computer room.</td></tr>
<tr><td>Lab</td><td></td></tr>
<tr><td>Other</td><td></td></tr>
<tr><td rowspan="4">Requirements
(in learning outcomes)</td><td colspan="2">Knowledge
During the lectures students will learn about artificial intelligence, its basic concepts, and theoretical frameworks. The lectures will cover the basic principles of artificial intelligence and its main areas of application. In order to apply new technologies, they will understand and comprehend the data protection, ethical, and social implications of using artificial intelligence-based systems and learn about the factors that influence the reliability of AI systems.</td></tr>
<tr><td colspan="2">Skills
After completing the training, participants will be able to consciously use simple AI-based tools (e.g. text, image or presentation generators), create and apply well-formulated prompts for their purposes. They will recognize the advantages and limitations of using AI. In line with conscious application students will be able to critically evaluate AI-generated content, integrate it into learning or teaching processes, and design application scenarios in their own areas of interest and expertise.</td></tr>
<tr><td colspan="2">Attitude
The training helps participants become open to learning about and trying out AI-based solutions, while also recognizing whether a given problem is suitable for an AI solution. After completing the course students will be able to critically evaluate information obtained through AI and use AI tools responsibly and ethically. They will strive for continuous professional development and keep up with the latest AI innovations, recognizing the importance of lifelong learning in the long term.</td></tr>
<tr><td colspan="2">Autonomy and responsibility
The student is able to independently select and apply AI tools when solving a given problem. They take responsibility for the accuracy, reliability and ethical use of the outputs they produce. They recognize their own limits of competence in AI-based analysis tasks.</td></tr>
<tr><td>Short description of subject content</td><td colspan="2">The aim of the 10-hour artificial intelligence (AI) training course is to provide participants with a comprehensive yet practical overview of the basic concepts, operating principles and potential applications of AI. The introductory section of the course clarifies the concept of artificial intelligence and current technological trends. After that, the focus gradually shifts to practical applications.
Students learn about generative AI tools (such as text, image and study material generation). An important part of the course is discussing ethical, legal and data protection issues, with a special focus on responsible AI use in education.
By the end of the course participants will be able to use AI-based tools critically and reflectively, recognize their pedagogical added value and make informed decisions about their application. The 10-hour course does not provide in-depth programming knowledge, but develops digital and pedagogical competencies that lay the foundation for the informed, responsible, and effective use of AI.</td></tr>
<tr><td>Forms of student activity</td><td colspan="2">Assessment of listening comprehension with note-taking – 50%
Individual practical assignments – 50%</td></tr>
<tr><td>Required reading and resources</td><td colspan="2">• National AI Strategy (Hungary)
• AI-MI-tools: Elicit, Scite.ai, ChatGPT, Consensus, ScholarAI, Semantic Scholar, ResearchRabbit</td></tr>
<tr><td>Recommended reading and resources</td><td colspan="2">• UNESCO (2023): AI in Science and Research Ethics Guidelines
• OECD (2024): Responsible AI for Research and Innovation
• Elsevier & Springer AI policy for authors
• Peter Norvig, Stuart J. Russell: Artificial Intelligence Volume I – A Modern Approach</td></tr>
</table>

	• Malcolm Show-Enczi Zoltán: Artificial Intelligence for beginners – Learn how artificial intelligence can be your best colleague and helper! • Stuart J. Russell: Artificial Intelligence: A Modern Approach • Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson. • Alpaydin, E. (2020). *Introduction to Machine Learning* (4th ed.). MIT Press. • Mitchell, T. M. (1997). *Machine Learning.* McGraw-Hill. • Christian, B. (2020). *The Alignment Problem: Machine Learning and Human Values.* Norton & Company.
Assignments	Preparation of individual project tasks/case studies using AI-based tools in line with the number of measurement points specified in the TVR.
Description and schedule of exams	There is no midterm test.
Framework and rules for the use of artificial intelligence	Given the nature of the course content the use of artificial intelligence is permitted in all situations.

Tutorial mathematics

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Matematika felzárkóztató</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Tutorial mathematics</td><td>Subject code</td><td>DUEN(L) - IMA-100</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="3"></td><td>Subject code</td><td></td></tr>
<tr><td rowspan="2">Type</td><td colspan="2" rowspan="2"></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>150/26</td><td>per Week</td><td>0</td><td>per Week 2</td><td>per Week 0</td><td rowspan="2">Signature</td><td rowspan="2">0</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per Semester</td><td>0</td><td>per Semester 10</td><td>per Semester 0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. Gordana Stankov</td><td>Position</td><td>assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

This course is recommended, based on a preliminary assessment of prior knowledge, for students enrolled in the Bachelor's programmes in Business Administration and Management, Materials Engineering, Mechanical Engineering, Business Informatics, Computer Engineering, and Technical Management, as well as in higher-level vocational programmes in technical and business-related fields.
The primary objective of the course is to provide students with the fundamental mathematical knowledge required for higher education studies. It aims to strengthen and systematize students' mathematical knowledge, skills, and competencies in order to establish an appropriate foundation for successfully completing university-level mathematics courses.
The course builds on the mathematical knowledge acquired in secondary education.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">-</td></tr>
<tr><td>Practice</td><td colspan="5">Classroom exercises, student-prepared papers, presentations, case studies.</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

The student has knowledge of the methods and procedures necessary for solving mathematical problems related to their field of study.
They possess the fundamental mathematical background required for their discipline, including knowledge of functions and linear algebra.</td></tr>
<tr><td colspan="6">Ability

The student is able to apply the acquired mathematical knowledge and related activities in practice. They apply the learned problem-solving methods and procedures in solving mathematical tasks. They are able to develop their own solution strategies and defend them in discussions by using appropriate mathematical reasoning and argumentation. They are capable of organizing their own learning process effectively and of identifying and using various learning resources (printed and electronic).</td></tr>
<tr><td colspan="6">Attitude

The student is open to understanding and adopting developments and innovations in mathematics and applied mathematics related to their qualification and field of study. They show interest in new methods and tools relevant to their discipline.
Their attitude towards solving technical problems is strengthened and further developed.</td></tr>
<tr><td colspan="6">Autonomy and Responsibility

Students take responsibility for their own work.</td></tr>
</table>

Short description of the subject content	The course covers the content of the intermediate-level mathematics matriculation exam. Operations with complex numbers. Set theory concepts and the notion of functions. Number sequences, exponentiation, root extraction, and order of operations. Logarithms, solutions of linear and quadratic equations. Solving word problems.
Forms of student activity	Guided problem-solving: 60% Independent problem-solving: 40%
Required reading and availability	• OpenStax. (2021). Precalculus 2e. Houston, TX: OpenStax. ISBN 978-1-951693-40-4. • Abramson, J. (Ed.). (2021). Algebra and Trigonometry 2e. Houston, TX: OpenStax. ISBN 978-1-951693-40-4.
Recommended readings and availability	• OpenStax. (2021). College Algebra (2e). Houston, TX: OpenStax. ISBN 978 1 951693 41 1. • OpenStax. (2022). Contemporary Mathematics. Houston, TX: OpenStax. ISBN 978-1-951693-56-5.
Description of tasks/measurement procedures to be submitted	-
Description and schedule of the midterm tests	During the semester, full-time and part-time students will take one midterm test in week 13. Students who achieve at least 50% on the midterm will receive a graded signature.
Framework and rules for the use of artificial intelligence	Artificial intelligence may be used during classwork; however, it is not permitted for solving tests.

Introduction of Programming

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="5">Bevezetés a programozásba</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="5">Introduction of Programming</td><td colspan="2">Subject code</td><td>DUEN(L) -ISF-111</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="5"></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="4"></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>150/39</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="4">Dr. Zoltán Király</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="8">Educational goals, development objectives
The students will get to know the basics of structured programming.

The student should be familiar with fundamental definitions such as information, data, syntax, semantics, implementation, compiler, interpreter, source program, object program, and machine code program. Furthermore, the student should be able to specify problems, design algorithms, and confidently use algorithm-description tools (e.g., structured text description, pseudocode, flowcharts, Jackson diagrams, and Nassi–Shneiderman diagrams). The student should know the programming environment and be able to implement a designed program using a programming language. The student should understand the basics and elements of imperative and procedural programming based on the top-down principle.

The educational methodology is based on acquiring theoretical knowledge during lectures.

The course provides both theoretical and practical knowledge and establishes the foundation for further programming studies.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="7">Lectures delivered to all students in a large lecture hall.
Sample problems presented during lectures to demonstrate theoretical concepts.
Use of projector and instructor’s computer during every lecture.
Online learning materials (notes, lecture videos, slides), test questions, and consultations during contact hours.</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Lab</td><td colspan="7">In laboratory sessions, problem-solving and implementation of programming exercises are carried out under the supervision of instructors.
Use of projector and instructor’s computer during every practical session.
Teaching may take place during contact hours or through online materials (notes, lecture videos, slides, test questions), supplemented by laboratory consultations during contact hours.</td></tr>
<tr><td>Misc.</td><td colspan="7"></td></tr>
<tr><td colspan="3" rowspan="2">Requirements (expressed study results)</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">Ability</td></tr>
</table>

	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	• Processing spoken material through note-taking: 20% • Task-guided organization of information: 30% • Independent completion of tasks: 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	Any written or online professional literature related to the C# language.
Description of tasks/measurement procedures to be submitted	As announced during the first class.
Description and schedule of the midterm tests	As announced during the first class.
Framework and rules for the use of artificial intelligence	Partial permission: AI may be used for certain tasks (e.g., classwork, assignments) but is prohibited in others (e.g., midterm exams).

Computer and Network Architectures

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Számítógép és hálózati architektúrák</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Computer and Network Architectures</td><td>Subject code</td><td>DUEN(L) -ISR-118</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"></td><td>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>1</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td>Midterm Mark</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</td><td>10</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. Ervin Burkus</td><td>Position</td><td colspan="2">assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives

Students will become familiar with the fundamentals of computers and networks and will be able to perform basic hardware and system configuration tasks.

Students will gain an understanding of computer architecture, hardware structures, and network architectures, as well as the configuration of subnets and network end devices.

They will be able to replace computer components, install the Microsoft Windows operating system, and configure networking devices for home and small business environments.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">Lectures in a lecture hall, blackboard presentation, projector or online using MS Teams</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Conducted in laboratories equipped with appropriate software, using computers and projectors. In online sessions, Microsoft Teams is used.</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="7">Knowledge

Understands the general principles of computer, operating system, and network operations, with particular emphasis on IBM PC-compatible computers and Cisco devices for home and small business environments.</td></tr>
<tr><td colspan="7">Ability

Able to identify components of IBM PC-compatible personal computers, assemble a computer, and set up Cisco home and small business devices to create simple local networks.</td></tr>
<tr><td colspan="7">Attitude

Open to learning about new operating systems and the technologies they employ.
Interested in exploring new operating systems and related technologies.
Strives for lifelong learning through continuous professional development and self-education.</td></tr>
<tr><td colspan="7">Autonomy and Responsibility

Responsible for professional tasks carried out independently and within a team.
Committed to performing work to a high standard.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Theory: The evolution of computers. Main components of computers and the integration process (cards → ICs → SoCs). Structure of processors (CISC/RISC, cores, threads, cache levels). Role and types of bus systems and sockets (BCLK and bandwidth on motherboards). RAM and ROM types, differences between data width and bus width, and timings. Storage devices and their interfaces (differences between</td></tr>
</table>

	versions). Video outputs (GPUs, memory types, interface standards) and peripherals (connector types). Power supply design (connectors, voltage levels, power calculation). Evolution of networks (protocols, interfaces), LAN/MAN/WAN, ISO/OSI, TCP/IP. IP and ICMP versions, and basics of routing. Fundamental knowledge of UDP and TCP. Laboratory: Replacing PC components, configuring UEFI settings, and applying updates. Installing Microsoft Windows, partitioning drives, managing file systems and permissions. Using the Registry, managing devices, users, and services. Scheduling tasks. Sharing folders and printers. Event log and performance monitoring. Basic PowerShell commands and script writing. Configuring Microsoft Windows networking. Network cable types, creating and testing cables. Accessing and configuring home and small business ISR devices. Calculating and designing subnets.
Forms of student activity	- Processing heard text with notes. - Organize information. - Independent solution of tasks. - Solving tasks in groups.
Required reading and availability	- Andrew S. Tanenbaum, Nick Feamster, David Wetherall: Computer Networks, Sixth Edition; Pearson Education Limited, ISBN: 1-292-37406-3, 978-1-292-37406-2, 2021 - Kevin Wilson: Essential Computer Hardware; O'Reilly Media, ISBN: 9781836646419, 2024
Recommended readings and availability	- Ata Elahi: Computer Systems; Springer, ISBN: 978-3-319-66774-4, 978-3-319-66775-1, 2022
Description of tasks/measurement procedures to be submitted	According to what was presented in the first class.
Description and schedule of the midterm tests	According to what was presented in the first class.
Framework and rules for the use of artificial intelligence	Partial Permission: Artificial intelligence is allowed for certain types of tasks (e.g., in-class exercises, assignments) but prohibited in other cases (e.g., midterm or closed-book exams).

Engineering Physics

Subject name		In Hungarian		Mérnöki Fizika							Level	**BSc**	
		In English		**Engineering Physics**							Subject code	DUEN(L) - 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.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted for preparing for a paper or exam. In case of working from home, (preparing assignments to be submitted), the use of artificial intelligence-based tools is permitted for language and form correction, information collection, and systematization, provided that the student indicates the use and checks the results. In these cases, the responsibility for the submitted work is the student's responsibility. The use of artificial intelligence in all activities during assessments (written and oral assessments) is prohibited: In the first lesson the teacher must provide a detailed information about these rules.

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>DUEN(L) - TKM-150</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="6">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 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>150/39</td><td>per Week</td><td>3</td><td>per Week</td><td>0</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>15</td><td>per Semester</td><td>0</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="3">Course leader</td><td colspan="2">Name</td><td colspan="3">Dr. habil Orsolya Fruzsina Falus</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">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="6">In a classroom with the use of projector or computer in each lecture.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6"></td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed study results)</td><td colspan="7">Knowledge

• Knows the basics of the legal branches related to his/her field of expertise;
• Is aware of the basic principles and methods for establishing organizations and institutions, developing and changing their structure and organizational behavior. Has legal knowledge regarding the establishment and operation of small and medium-sized enterprises.
• Has knowledge regarding the regulation of corruption crimes that frequently occur in his/her field of expertise, the legal norms established for their prevention, as well as international and European conventions and the institutional system.</td></tr>
<tr><td colspan="7">Ability

• Follows and interprets changes in relevant legislation and their effects in the field, and takes these into account in his/her analyses, proposals and decisions;
• Is capable of substantive professional cooperation with lawyers working in his/her field;
• Knows and correctly applies legal terminology related to his/her field in English;
• Recognizes situations suspected of corruption and consciously applies the relevant legislation in force in order to avoid and prevent them.</td></tr>
<tr><td colspan="7">Attitude

• Open to changes in the broader legal environment of the given job, work organization, and enterprise, and strives to follow and understand the changes;</td></tr>
</table>

	• Acceptable to the opinions of others, to sectoral, regional, national, and European values; • Convincedly defends the enforcement of human rights in their work; • Follows and interprets changes in domestic, EU, and International Legal norms. Within this, they pay special attention to following and complying with changes in social, environmental, and ecological-sustainability legal sources.
	Autonomy and Responsibility • Takes responsibility for complying with legal and ethical norms and rules related to work and behaviour; • Using his/her knowledge of Contractual Law and Company Law, he independently leads, organizes and manages an organizational unit, work group, or enterprise, a smaller economic organization in a business organization, taking responsibility for the organization and its employees; • Based on his/her basic legal knowledge covering several branches of law, he/she performs the tasks assigned to him as a member of projects, group work, and organizational units independently and with legal responsibility.
Short description of the subject content	The definition of Law and the Rule of Law. The system of legal sources. Human rights. The Fundamental Law of Hungary. The National Assembly and the national referendum. Legal competency - legal capacity and forms of representation. Legal entity. Establishment and termination of firms. Contracts. Introduction to criminal law. International law and EU law. Legal case studies. • Corruption: 1. Corruption as a criminal law concept. 2. Corruption offences. 3. United Nations Convention against Corruption. 4. EU anti-fraud policy; OLAF (European Anti-Fraud Office) and its investigative powers. Preventing corruption.
Forms of student activity	• Frontal work: 50 % • Individual or group work: 15% • Test: 15% • Communication situation exercises: 20%
Required reading and availability	• Falus, Orsolya (2021), DIGITAL LEGAL KNOWLEDGE TEXTBOOK FOR INTERNATIONAL STUDENTS. Dunaújváros: DUE Press. ISBN 978-615-6142-12-2 (available: Moodle) • United Nations Convention against Corruption (UNCAC) is the only legally binding universal anti-corruption instrument. It was drafted and negotiated in Vienna, Austria in 2002-2003 and subsequently adopted by the United Nations General Assembly on 31 October 2003. • https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XVIII-14&chapter=18#EndDec • UNCAC: https://www.unodc.org/corruption/en/learn/what-is-uncac/prevention.html • https://www.unodc.org/corruption/en/learn/what-is-corruption.html • https://www.unodc.org/corruption/en/uncac/index.html • OLAF: https://anti-fraud.ec.europa.eu/index_en • Prevention: https://corruptionprevention.gov.hu/index
Recommended readings and availability	• The Universal Declaration of Human Rights (available: https://www.un.org/en/sections/issues-depth/human-rights/) • The European Convention on Human rights (available: https://www.coe.int/en/web/human-rights-convention) • The Fundamental Law of Hungary (available: http://hunmedialaw.org/dokumentum/151/THE_FUNDAMENTAL_LAW_OF_HUNGARY.pdf) • Elizabeth Wolfenden: How to Evaluate an Oral Presentation • (available: https://www.theclassroom.com/evaluate-oral-presentation-2661.html)
Description of tasks/measurement procedures to be submitted	• O n 7th week midterm test (legal cases) • On 13th week final test (legal cases)
Description and schedule of the midterm tests	Formation of the test grade: 0-50% insufficient

	51-60% sufficient 61-70% average 71-80% good 81%- excellent
Framework and rules for the use of artificial intelligence	The use of Artificial Intelligence is partially permitted: • during class work, for data collection for assignments, for orientation, • during preparation for presentations. The use of all AI tools is prohibited during knowledge assessments and writing tests.

Engineering Mathematics 1.

Subject name		In Hungarian	Mérnöki Matematika 1						Level	**BSc**	
		In English	**Engineering Mathematics 1**						Subject code	DUEN(L) - **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. habil. Antal Joós**			Position	**associate professor**	

Training course aims	**Educational goals, development objective**s Acquiring the mathematical foundations necessary for further studies. Training background: knowledge and skills acquired in public education. Related subjects: Engineering Mathematics 2, Mathematics 3, Operations Research and Decision Theory. Related objectives: learning the concepts and relationships of linear algebra, probability theory, and statistics that are essential for working in the field.	
Typical transfer methods	Theoretical	
	Practice	Classroom practice, student-written posts, presentations, case study analysis
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** Knows the methods and procedures necessary for solving mathematical problems in their field of expertise. Possesses the knowledge and skills in mathematics, function theory, and linear algebra necessary for their field of expertise.	
	Ability Is able to apply the mathematical knowledge and skills they have learned. Applies the problem-solving methods and procedures learned. Is able to prepare their own solution plan and defend it in discussions (argumentative debate skills) in relation to the mathematical concepts learned. Is able to organize their own learning process effectively, find and use various learning resources (printed, electronic).	
	Attitude Is open to learning about and accepting mathematics-based, applied mathematical developments and innovations related to their qualification and field of expertise. Is interested in new methods and tools related to their field of expertise.	
	Autonomy and Responsibility Responsibility for their own work and that of their colleagues.	
Short description of the subject content	Linear equation systems. Matrices, operations with matrices. Matrix determinant, inverse, rank. Vectors, operations with vectors. Basis transformation. Space elements, metric tasks. Eigenvalues, eigenvectors. Operations with complex numbers. Set theory, the concept of a function. Limits of sequences, convergence criteria. Basic properties of single-variable real functions, limits, continuity. Interpretation of the differential quotient of single-variable real functions, the relationship between differentiability and continuity, the derivative function, the differential of a differentiable function. General differentiation rules, differentiation of elementary functions. Mean value theorems of differential calculus, higher-order derivatives, L'Hospital's rule, function discussion. The concept of the Riemann	

	integral, conditions for integrability, properties of definite integrals, mean value theorem of integral calculus, Newton-Leibniz formula. Primitive functions, indefinite integrals and some of their properties, basic integrals. Integration methods. Improper integrals. Basic properties of real functions of several variables, differential calculus, calculation of extreme values. Tasks related to nuclear energy and green energy.
Forms of student activity	Learning theoretical material with guidance and independently. Solving tasks with guidance and independently. Learning theoretical material with guidance: 10% Learning theoretical material independently: 30% Solving tasks with guidance: 30% Solving tasks independently: 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	As stated in the first lesson.
Description and schedule of the midterm tests	As stated in the first lesson.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted. Artificial intelligence is permitted for checking homework assignments, accelerating the learning process, and generating sample examples to facilitate understanding of concepts, but its use is prohibited in closed-book exams.

Basics of Computer Sciences 1

Subject name		In Hungarian	Számítástudomány alapjai 1						Level	**BSc**	
		In English	**Basics of Computer Sciences 1**						Subject code	DUEN(L) - **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	For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams
	Practice	Individually completed problem solving.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** • Is familiar with the fundamental concepts, theorems, and relationships of discrete mathematics. • Knows the notation, terminology, and proof methods used in informatics and mathematics. • Understands the operating principles of fundamental algorithms and is familiar with the possible ways of describing them.	
	Ability • Able to apply acquired mathematical knowledge to solve problems and to use the learned methods and concepts when acquiring further informatics knowledge. • Able to further develop the learned fundamental algorithms and integrate them into more complex programs. • Able to read and understand mathematical texts.	
	Attitude • Able to apply acquired mathematical knowledge to solve problems and to use the learned methods and concepts when acquiring further informatics knowledge. • Able to further develop the learned fundamental algorithms and integrate them into more complex programs. • Able to read and understand mathematical texts. • Open to acquiring mathematical knowledge, independent problem solving, logical thinking, and applying acquired knowledge when solving more complex tasks.	
	Autonomy and Responsibility Independently completes assigned tasks and carefully considers possible solutions. Takes responsibility for their work.	

Short description of the subject content	Theory: Basic operations on sets. Fundamentals of mathematical logic: propositional calculus, logical operations, disjunctive and conjunctive normal forms. Relations: binary relations, equivalence relations, total and partial order relations. Mathematical induction. Infinite cardinalities: equivalence of sets, countably infinite and continuum cardinality. Algebraic structures, Boolean algebra. Fundamentals of information theory, measurement of information content. Average information content, entropy. Coding theory: information channel, symbol-by-symbol encoding, optimal codes, error-correcting codes, linear codes, Hamming codes. Practice: Number systems, fundamentals of algorithms. Application of the following programming patterns in complex tasks: summation, minimum–maximum search, counting, linear and logarithmic search. Simple sorting algorithms: bubble sort, insertion sort, direct selection sort. Determining the intersection and union of two sets. Merge algorithm. Description in pseudocode and flowcharts.
Forms of student activity	• Processing spoken and written texts with note-taking • Independent problem solving • Writing written assignments/tests
Required reading and availability	Strauber Gy. , Sóti Lné.: A számítástudomány alapjai I, DF, Dunaújváros, 2009. Strauber Gy. , Sóti Lné.: A számítástudomány alapjai I, Gyakorlati feladatok gyűjteménye, DF, Dunaújváros, 2009. Strauber Gy. , Sóti Lné., Johanné Dukai Klára: A számítástudomány alapjai II, Gyakorlati feladatok gyűjteménye, DF, Dunaújváros, 2010. Moodle keretrendszerben elérhető.
Recommended readings and availability	Demetrovics J. , Denev, J. , Pavlov, R.: A számítástudomány matematikai alapjai. Nemzeti Tankönyvkiadó, Budapest, 1999. 374 p. (4. kiad.)
Description of tasks/measurement procedures to be submitted	None.
Description and schedule of the midterm tests	Midterm tests. Schedule according to the arrangements agreed upon during the first class.
Framework and rules for the use of artificial intelligence	For practice assignments and during classes, the use of artificial intelligence–based tools is permitted and may be used to support the learning process; however, their use is prohibited during in-class tests.

Programming 1.

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Programozás 1.</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Programming 1</td><td colspan="2">Subject code</td><td>DUEN(L) -ISF-213</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 colspan="2">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="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>Theoretical</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. Jozsef Katona</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">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="6"></td></tr>
<tr><td>Lab</td><td colspan="6">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.</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

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.</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">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="7">Autonomy and Responsibility</td></tr>
</table>

	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.
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Windows Operating Systems

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Windows operációs rendszer</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Windows Operating Systems</td><td>Subject code</td><td>DUEN(L) -ISF-257</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"></td><td>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"></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>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 Ágoston</td><td>Position</td><td>c. professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

Students understand the general operating principles of operating systems.
Students identify the specific characteristics of Windows operating systems.
Students use key applications running under Windows at a basic operational level.
Students configure and personalize their own Windows working environment.
Students create and execute simple command files (scripts).
Students automate basic tasks using PowerShell or batch scripts.

The aim of the course is, in addition to presenting the general operating principles of operating systems, to introduce the specific characteristics of Windows operating systems and to support the development of practical, skill-level application.
Students of the course should become familiar with the major applications running under Windows operating systems, including their main features and capabilities. They should be able to create their own working environment and automate tasks using their own command files (scripts).</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">Lecture in a large lecture hall using a projector</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</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

• Knows the possibilities and tools of the field of informatics.
• Possesses field-specific and profession-specific knowledge related to Windows systems.
• Knows the methods and sources of procedures required to solve common problems/tasks in the field of informatics.
• Has knowledge of specialized tools necessary to perform tasks in the relevant subfield of informatics.</td></tr>
<tr><td colspan="6">Ability

• Able to perform routine operational tasks in the field of informatics and carry out partial development tasks based on plans.
• Applies learned problem-solving methods and procedures to perform professional tasks.</td></tr>
<tr><td colspan="6">Attitude

• Shows interest in new methods and tools related to the field.
• Strives to maintain and continuously develop professional knowledge related to Windows systems through further training and self-education.</td></tr>
<tr><td colspan="6">Autonomy and Responsibility

• Suitable for working in a supervised IT position, where tasks are performed independently.</td></tr>
</table>

	• Takes responsibility for own work (both individual and group work, decisions, and results). • Independently decides on the development of own knowledge and plans and organizes this development.
Short description of the subject content	• History and development of Windows, general characteristics, operational philosophy. • Structure and characteristics of Windows file systems, overview of 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: development, structure, permission system, file system, registry, file system and registry permissions, devices, users, services, disk management, task scheduling, folder and printer sharing, event logging, performance monitoring. • Basic PowerShell commands and scripts.
Forms of student activity	• Processing heard material with note-taking • Collecting and organizing information • Solving tasks individually • Solving tasks in groups
Required reading and availability	Presentations used in lectures and laboratory sessions in PDF format available in Moodle or Teams.
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	Submission and presentation of an individual or group assignment from a Windows-related topic. Preparation and presentation of a project task.
Description and schedule of the midterm tests	Presentation by week 5 (at a scheduled time) Tests in weeks 3, 5, 7, and 9 Week 12: practical midterm (test and problem-solving) Retake and improvement opportunity in the last week of the semester.
Framework and rules for the use of artificial intelligence	For submitted assignments, the use of artificial intelligence–based tools is permitted; however, the student must clearly indicate how they were used, critically evaluate any AI-generated content, and bears full professional responsibility for the submitted work. During classes, AI tools may be used to support the learning process; however, their use is prohibited during in-class tests.

Database Systems

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Adatbáziskezelés</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Database Systems</td><td>Subject code</td><td>DUEN(L) -ISF-210</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"></td><td>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"></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>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. Mariann Váraljai</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 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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">Lecture, in lecture hall, using computer and projector.
Online learning materials (handbooks, lecture presentations etc.) are available for the students.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">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.</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 operation and use of database systems.
• Students know database design methods, their capabilities and limitations.</td></tr>
<tr><td colspan="6">Ability

• Students can design and use databases independently.
• Students are able to collaborate
• Students are able to review, analyse and solve complex tasks</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">Autonomy and Responsibility

• Students strive for efficient and quality work.
• The students should take responsibility for the professional activities carried out independently.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Database design, modelling</td></tr>
</table>

	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	• Electronic literature in Moodle or in Neptun, and examples on the Internet. • Jeffrey A. Hoffer – V. Ramesh – Heikki Topi: Modern Database Management, Pearson Education Inc., 2016
Recommended readings and availability	• 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 • MySQL online reference: https://dev.mysql.com/doc/refman/8.0/en/ • w3schools References: https://www.w3schools.com/sql/default.asp
Description of tasks/measurement procedures to be submitted	Not mandatory, but for extra (bonus) points, the student can solve a task on a topic of his or her own choosing that matches and is consistent with the material of the semester, the deadline for submission of which 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 teacher. 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	Practical classes: Two midterm tests during the semester about the learning material covered up to that point. Sometimes there is a 10-minute quick tests during the lab class.
The framework and rules for the use of artificial intelligence	Complete prohibition (ban) on AI: Given that the course conveys fundamental knowledge, its use is prohibited in all educational situations and in all midterm tests.

Informatics

Subject name		In Hungarian	Informatika						Level	**BSc**	
		In English	**Informatics**						Subject code	DUEN(L) -**ISF-010**	
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**	**Midterm Mark**	**5**	**English**	
Part time	**150/15**	per Semester	**0**	per Semester	**0**	per Semester	**15**				
Course leader				Name		**Dr. Mariann Váraljai**			Position	**associate professor**	

The educational purpose and justification of the course	**Educational goals, development objectives** In addition to the necessary basic IT knowledge, students should acquire a higher level of knowledge in the given areas that will enable individuals to develop the knowledge and skills necessary for the efficient, effective and professional use of the most common computer applications in the workplace. • Be able to confidently 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 (NETiquette) • Be able to create any complex, multi-page text document with a word processing program, and be able to create professional digital text. • Be able to create tables, manage data with a spreadsheet program, and be able to implement data visualization. • Be able to create 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 independently creatively use any innovative IT tools and applications.	
Typical transfer methods	Theoretical	
	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 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.	
	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.	
	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 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 and learning materials in Moodle or in Neptun. – MS Office Tutorial and examples (Internet).
Description of tasks/measurement procedures to be submitted	Compulsory assignment: Create an own individual presentation using MS Power Point or Prezi program based on the conditions set by the instructors. Deadline: until Week 10! (Upload to the Moodle system!) Not mandatory, but for extra (bonus) points: The student has the opportunity to solve a Word and Excel tasks on a topic of his or her own choice that match and are consistent with the learning materials of the semester. The extra point will be included in the final grade. It is necessary to discuss the undertaken tasks with the teacher in advance. The tasks are to create a document, table, database that meet real needs with the help of Microsoft Office programs.
Description and schedule of the midterm tests	At the end of each topic, students write closed papers, typically: – Week 5: Word processing computer-based test – Week 11: Spreadsheet management computer-based test In case of any computer-based tests, the opportunity for improving grades is available in the last week of the school period (typically in Week 13) and during the exam period.
Framework and rules for the use of artificial intelligence	– Partial authorization of artificial intelligence: For classwork and individual assignments. – Prohibition of artificial intelligence: For the two midterm exams and the make-up midterm exams.

Engineering Mathematics 2

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Mérnöki Matematika 2</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Engineering Mathematics 2</td><td>Subject code</td><td>DUEN(L) - IMA-252</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"></td><td>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>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. László Bognár</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 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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">These formal lectures mostly aim at transferring information. Students are expected to take personal notes in addition to the course text, slides or transparencies.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">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.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3">Requirements (expressed study results)</td><td colspan="6">• 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.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">• 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.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="6">• Frontal work 30%
• Individual or group work 50%
• Testing 20%</td></tr>
<tr><td colspan="3">Required reading and availability</td><td colspan="6">• 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.</td></tr>
<tr><td colspan="3">Recommended readings and availability</td><td colspan="6">1.
http://onlinestatbook.com/2/index.html

2.
STATISTICS FOR BUSINESS AND ECONOMICS
TWELFTH EDITION</td></tr>
</table>

	James T. McClave Info Tech, Inc. University of Florida P. George Benson College of Charleston Terry Sincich University of South Florida Copyright © 2014, 2011, 2008 Pearson Education, Inc. Publishing as Pearson, 75 Arlington Street, Boston, MA 02116. 3. STUDENT'S SOLUTIONS MANUAL Nancy S. Boudreau Bowling Green State University Copyright © 2014, 2011, 2008 Pearson Education, Inc. Publishing as Pearson, 75 Arlington Street, Boston, MA 02116.
Description of tasks/measurement procedures to be submitted	
Description and schedule of the midterm tests	Continuous evaluation in the form of midterm tests.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted. Artificial intelligence is permitted for checking homework assignments, accelerating the learning process, and generating sample examples to facilitate understanding of concepts, but its use is prohibited in closed-book exams.

Basics of Computer Sciences 2

Subject name		In Hungarian		Számítástudomány alapjai 2					Level	**BSc**	
		In English		**Basics of Computer Sciences 2**					Subject code	DUEN(L) - **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 course is to introduce students to the fundamental data structures used in informatics and the algorithms associated with them. By the end of the module, students are expected to be able to understand and implement more complex algorithms composed of multiple basic components. Students will become familiar with the basics of syntactic analysis of programs, as well as the theory of formal languages and finite automata.	
Typical transfer methods	Theoretical	For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams
	Practice	Individually completed problem solving.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** Is familiar with the structure and properties of the most commonly used data structures in informatics. Understands the operating principles of more complex algorithms and knows their possible applications.	
	Ability Able to think algorithmically, apply acquired knowledge, solve problems, and use the learned procedures, methods, and concepts when acquiring further informatics knowledge. Able to further develop the learned algorithms and integrate them into more complex programs.	
	Attitude Open to independent problem solving, logical and algorithmic thinking, and to applying acquired knowledge when solving more complex tasks.	
	Autonomy and Responsibility Independently completes assigned tasks and carefully considers possible solutions. Takes responsibility for their work.	
Short description of the subject content	Theory: Heap sort, tournament tree, quicksort, merge sort, searching and data modification. Recursive algorithms: backtracking algorithms, Towers of Hanoi. Implementation of data structures: composite list data model, tree data model, graph data model. Graph theory and graph algorithms: traversal of binary trees, graph traversal, shortest path problem, topological sorting of graphs. Formal languages and automata: formal languages and their operations, generative grammars and their classification, recognizers of regular languages — deterministic and nondeterministic finite automata; transducers of regular languages — Mealy and Moore machines; context-free languages, pushdown automata. Turing machines: the concept of the Turing machine, the universal Turing machine.	

	Practice: Sequential and linked lists. Implementation of data structures using sequential and linked lists. Formulation of the learned algorithms (sorting, searching, traversals) in pseudocode.
Forms of student activity	Processing spoken and written texts with note-taking Independent problem solving Writing written assignments/tests
Required reading and availability	Strauber Gy. , Sóti Lné.: A számítástudomány alapjai II, DF, Dunaújváros, 2010. Strauber Gy. , Sóti Lné. , Johanné Dukai K.: A számítástudomány alapjai II, Programozási feladatok, feladatsorok, megoldások, DF, Dunaújváros, 2010. Moodle keretrendszerben elérhető.
Recommended readings and availability	Demetrovics J. , Denev, J. , Pavlov, R.: A számítástudomány matematikai alapjai. Nemzeti Tankönyvkiadó, Budapest, 1999. 374 p. (4. kiad.) Lipschutz, S.: Adatszerkezetek. Panem, Budapest, 1993. 357 p. Wirth, N.: Algoritmusok + adatstruktúrák. Műszaki Könyvkiadó, Budapest, 1982. 345 p.
Description of tasks/measurement procedures to be submitted	None.
Description and schedule of the midterm tests	Midterm tests. Schedule according to the arrangements agreed upon during the first class.
Framework and rules for the use of artificial intelligence	For practice assignments and during classes, the use of artificial intelligence–based tools is permitted and may be used to support the learning process; however, their use is prohibited during in-class tests.

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>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Programming 2</td><td colspan="2">Subject code</td><td>DUEN(L) -ISF-113</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">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"></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>150/39</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>associate professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">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="6">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="6"></td></tr>
<tr><td>Lab</td><td colspan="6">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="6"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed study results)</td><td colspan="7">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="7">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="7">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>
</table>

	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	• 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.
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Linux Operating Systems

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Linux operációs rendszerek</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="3">Linux Operating Systems</td><td colspan="2">Subject code</td><td colspan="2">DUEN(L) -ISF-159</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="8">Institute of Informatics</td></tr>
<tr><td colspan="2">Name of the required preliminary study</td><td colspan="5"></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="3"></td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td colspan="2" rowspan="2">Teaching language</td></tr>
<tr><td colspan="2">Theoretical</td><td colspan="3">Practice 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</td><td>2</td><td rowspan="2">Exam</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>5</td><td>per Semester 0</td><td>per Semester</td><td>10</td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="3">Dr. György Agoston</td><td>Position</td><td colspan="2">c. professor</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="8">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.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="7">For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Lab</td><td colspan="7">Computer lab, using a projector.</td></tr>
<tr><td>Misc.</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed study results)</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

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	• William Shotts: The Linux Command Line, No Starch Press, 2026 • William Shotts: Adventures with the Linux Command Line, LinuxCommand.org • Bash Notes for Professionals, goalkicker.com
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.
Framework and rules for the use of artificial intelligence	Full prohibition: the use of artificial intelligence is prohibited in all educational situations and forms of assessment.

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>DUEN(L) -ISF-112</td></tr>
<tr><td colspan="4">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="4">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"></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 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 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="4">Course leader</td><td>Name</td><td colspan="3">Dr. Mariann Váraljai</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="4">Training course aims</td><td colspan="6">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 history of training is the basic IT and programming skills acquired in public education or in higher education.</td></tr>
<tr><td colspan="4" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5"></td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">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.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed study results)</td><td colspan="6">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="6">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="6">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="6">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</td></tr>
</table>

	own knowledge, plans and organizes it. A student is responsible for the preparation, proper appearance and operation of the website entrusted to it.
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 • Self-processing (individual) tasks
Required reading and availability	• Electronic literature and learning materials in Moodle or in Neptun. • HTML Referencia: https://www.w3schools.com/tags/default.asp • CSS Referencia: https://www.w3schools.com/cssref/index.php • JavaScript Referencia: https://www.w3schools.com/jsref/default.asp
Recommended readings and availability	• Elizabeth Castro and Bruce Hyslop: HTML5 and CSS3, Seventh Edition: Visual QuickStart Guide Peachpit Press, 2012 • Microsoft Corporation: HTML5 Step-by-step, O'Reilly Media Inc, 2011 • Brian P. Hogan: HTML5 and CSS3 second edition – Level up with Today's Web Technologies, Dallas Texas, 2013 • Danny Goodman: JavaScript™Bible 4th Edition, Hungry Minds, Inc.New York, NY Cleveland, OH Indianapolis, IN, 2001 • Paul Wilton, Jeremy McPeak: Beginning Java Script 4th Edition, Wiley Publishing, Inc., 2010
Description of tasks/measurement procedures to be submitted	Not mandatory, but for extra (bonus) points, the student has the opportunity to solve a task on a topic of his or her own choosing that matches and is consistent with the material of the semester, the deadline for submission of which is the date of the last practical class 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 teacher. The task is to create a website that meets real needs using knowledge of HTML5, CSS3, JavaScript and jQuery, or using other innovative solutions agreed with the instructor.
Description and schedule of the midterm tests	During the semester, the students write tests 2 times from the material of the practical classes. • 1st test: HTML5, CSS3 • 2nd test: JavaScript Time: at the end of each topic. In the case of any tests, the opportunity for improving the grades is available in the last week of the school period (typically week 13) and during the exam period.
Framework and rules for the use of artificial intelligence	Complete prohibition (ban) on AI: Given that the course conveys fundamental knowledge, its use is prohibited in all educational situations and in all midterm tests.

Electronics and Digital Techniques

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Elektronika és digitális technika</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Electronics and Digital Techniques</td><td>Subject code</td><td>DUEN(L)-ISR-119</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">Engineering physics</td><td>Subject code</td><td>MUT-151</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 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 5</td><td>per Semester 0</td><td>per Semester 10</td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="2">Dr. Péter Odry</td><td>Position</td><td>Prof. of College</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="6">Educational goals, development objectives

The goal is to train professionals with introductory knowledge in the fields of electricity, electronics and digital technology. Who will have knowledge, especially in the field of digital technology, that can act as a negotiator with electrical engineers when solving more complex tasks.

Physics training lays the foundation for following the subject.

In terms of the content of the subject, at the beginning it briefly repeats and summarizes the basics of electricity. In the second part it summarizes the basics of electronics, listing the main electronic components, and deals in more detail with operational amplifiers and oscillators. At the end it reviews digital technology, starting with combinational networks and then sequential networks, using these circuits as computer "components". An important part is the introduction of FPGA technology, this is an important area for a computer scientist who is approaching, because the solution of the task can be handled by writing a program within a project task. If you can understand the task, you can also handle the given task as a programming task under the guidance of an electrical engineer.

In terms of curriculum, the subject provides a solid foundation for a closer understanding of computer structure. You will specifically understand better how a processor structure works.

The goal is to provide a level of electronics knowledge that enables students to learn about systems using microelectronic devices based on technical descriptions and operating equipment, to design simpler circuits, and to perform functional testing, primarily in a working group with mixed qualifications.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">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.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">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.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="2">Requirements (expressed study results)</td><td colspan="6">Knowledge

• He / she is familiar with the principles and methods of science required for cultivating his / her field of informatics.</td></tr>
</table>

	• 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	The first 10% of the course is a review of the basics of electrical engineering. The second 20% of the course is an introduction to electronics. The remaining part is digital technology. In the first half, combinational networks are introduced, then sequential networks are introduced, and various applications are presented through various tasks. In the second half, the programmable digital circuits of digital technology are reviewed and programming techniques are introduced. Finally, programming tasks are solved, which can be solved without hardware elements because simulators are powerful enough for initial tasks.
Forms of student activity	Processing heard text by taking notes 50% Task-guided organization of information 30% Independent processing of tasks 20%
Required reading and availability	Electronics and digital technology – DUE notes J. Crowe Barrie Hayes-Gill: "Introduction to Digital Electronics", ISBN: 9780340645703
Recommended readings and availability	Tokheim, Roger L.: Digital Electronics (Basic Skills in Electricity and Electronics) – Softcover, Glencoe/McGraw-Hill School Pub Co
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.
Framework and rules for the use of artificial intelligence	Total ban: the use of artificial intelligence is prohibited in all educational situations and forms of assessment.

Mathematics 3

Subject name		In Hungarian		Matematika 3					Level		**BSc**
		In English		**Mathematics 3**					Subject code		**DUEN(L)-IMA-110**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Engineering mathematics 1					Subject code		IMA-152
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		**associate professor**

Training course aims	**Educational goals, development objectives** The aim of the course is to acquire and deepen the mathematical and function-theoretic foundations that are essential for understanding and applying the professional subjects. Students broaden their mathematical knowledge for the independent study of the literature, and they become familiar with the key relationships and conceptual frameworks necessary for working in the field. The course also develops applied mathematical thinking. The course builds on the foundations of analysis and function theory: limits, continuity, differentiation, basic integration methods, as well as fundamental function types and their analysis. Students are expected to be familiar with basic mathematical notation, computational techniques, and elementary problem-solving steps. The aim of the course is to deepen and extend students' mathematical knowledge toward analytical and differential-equation methods needed for understanding and applying algorithms, modelling tasks, data processing, and engineering computations. It develops students' abstract thinking, modelling skills, and problem-solving abilities, with particular emphasis on the applications of multivariable functions, numerical procedures, and differential equations in computer science. The course supports independent learning and the development of students' analytical thinking, which are indispensable for later professional subjects.	
Typical transfer methods	Theoretical	
	Practice	Instruction is conducted entirely in practical sessions, involving guided problem-solving, small-group or pair-based activities, and collective solution analysis. The emphasis is placed on the application of methods, the articulation and refinement of problem-solving strategies, and the provision of immediate feedback.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** The student possesses the theoretical foundations and methodological tools of differential and integral calculus, as well as differential equations, that are required for the mathematical modelling and analysis of engineering problems. They have a clear understanding of the essential concepts, relationships, and computational techniques associated with multivariable functions, numerical procedures, and geometrical applications. They command a comprehensive system of theoretical and practical knowledge related to the topics of the course, forming a solid basis for algorithmic thinking, engineering computations, and the acquisition of subsequent technical subjects. The student understands the engineering applications of the methods studied, such as numerical solution techniques, model construction, and the mathematical description of processes, and recognizes their role in problem-solving and data-processing workflows.	

	Ability The student is able to apply differential and integral calculus, as well as numerical methods, in the modelling and analysis of engineering problems. They employ techniques of multivariable analysis, numerical integration, and the solution of differential equations in algorithmic reasoning, data-processing tasks, and simulation workflows. They are capable of identifying and selecting the appropriate mathematical method in accordance with the nature of a given engineering problem (e.g., optimization, approximation, process modelling); they develop problem-solving strategies independently and are able to justify their choices with sound professional reasoning. The student is proficient in the use of mathematical and computational tools (e.g., computer algebra systems, numerical computing environments) throughout the problem-solving process, and they can compare and evaluate the efficiency and applicability conditions of different solution methods.
	Attitude The student is open to methodological innovations and developments in mathematics and engineering, and demonstrates a willingness to engage with modern analytical and numerical techniques. They strive for precise, logical, and transparent reasoning, as well as for the consistent use of formal mathematical notation. The student shows an active interest in the connections between mathematical modelling and engineering sciences. They maintain a positive attitude toward collaboration, joint problem-solving, and professional dialogue. Furthermore, they appreciate the role of mathematical methods in ensuring the reliability, optimisability, and efficient operation of engineering systems.
	Autonomy and Responsibility The student selects mathematical methods and tools responsibly, in accordance with the nature of the given task. They carry out mathematical analyses, model construction, and computational work independently, interpret the obtained results, and verify their reliability. They assume responsibility for the accuracy of their own work, including the identification and correction of errors. The student is capable of making professionally grounded decisions and justifying them through mathematical reasoning. They collaborate effectively in an information-technology project environment with peers and professionals, particularly in tasks that involve developments based on mathematical analysis or modelling.
Short description of the subject content	Special differentiation rules. Geometric applications of differential calculus. Area calculation. Volume and surface area of solids of revolution. Arc-length and centroid calculations. Multiple integrals. Numerical integration. Solution of nonlinear equations. Separable and reducible differential equations. First-order and second-order linear differential equations. Reduced (incomplete) second-order differential equations.
Forms of student activity	Guided processing of theoretical material. Independent study of theoretical content. Guided problem-solving. Independent completion of problem-solving tasks. Text comprehension. Individual and group-based information processing. Articulation and discussion of differing viewpoints. Development of debating skills and argumentation techniques. Collaboration within a group.
Required reading and availability	Frank Ayres JR., Elliott Mendelson: Theory and Problems of Differential and Integral Calculus, McGraw-Hill, 1990, ISBN: 0-07-002662-9 Robert C. Wrede, Murray Spiegel: Theory and Problems of Advanced Calculus, Schaumn's Outline Series, McGraw-Hill, 2002
Recommended readings and availability	Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012

Description of tasks/measurement procedures to be submitted	As discussed during the first session.
Description and schedule of the midterm tests	Full-time students are required to complete four in-class assessments, administered in Weeks 3, 6, 9, and 12. Each assessment carries a maximum of 25 points. The tests consist of theoretical questions and problem-solving tasks. Students must achieve at least 50% of the available points on each individual assessment, and the combined score of the two assessments must reach at least 51% of the total possible points. Part-time students are required to complete two in-class assessments. Each assessment carries a maximum of 50 points. Students must achieve at least 50% of the available points on each individual assessment, and the combined score of the two assessments must reach at least 51% of the total possible points.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence (AI) is partially permitted in this course. Students may use AI-based tools exclusively for the purpose of understanding the course material, independently processing theoretical content, and practising problem-solving techniques. This includes requesting explanations, visualizations, supporting examples, or alternative solution approaches. Permitted uses of AI include: – supporting the comprehension of theoretical material (explanations, supplementary examples); – checking practice exercises and exploring possible solution approaches; – assisting autonomous learning processes (e.g., conceptual clarification, visualization). Prohibited uses of AI: AI may not be used in any context that affects the evaluation of semester performance. It is strictly forbidden to: – use AI during in-class assessments, make-up tests, or retakes; – generate or revise homework, assignments, or any work submitted for evaluation using AI; – substitute in-class problem-solving with AI assistance; – automatically generate solutions or solution plans using AI tools.

Economics I

Subject name		In Hungarian		Közgazdaságtan I.					Level	**BSc**	
		In English		**Economics I**					Subject code	**DUEN(L)-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** The course provides an introduction to economic concepts and basic economic theories. The course is divided into two parts: microeconomics, which focuses on the decision-making of individual consumers and firms, and macroeconomics, which focuses on economic issues at the aggregate level.The goal is for students who complete the course to understand the connections between micro- and macroeconomic phenomena, the economic relationships and the drivers of economic actions. They should understand the basic decision-making and substitution possibilities arising from the limitation of resources, the functioning of economies and markets, the place and role of actors in them, as well as the costs and benefits of economic interactions.							
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				Economics as a science. Introduction to economic thinking. Macro- and microeconomics. Positive and normative economic approach. The subject of economics, basic concepts. Economic systems. Coordination mechanisms in the economy. The market mechanism. The functioning of the market and the price mechanism. Demand and supply. Demand and supply function/curve. Market							

	equilibrium and imbalance. Actors of the mixed economy. Motivations, income, and expenses of the household. Management of business organizations. Costs, income, and profit concepts. Market forms and market structures. The concept of national economic performance, the most important statistical indicators. Basic concepts, conditions, and measurement of economic growth. The concept and functions of money. The modern banking system and the money supply. Money market and inflation processes. Basic categories of the labor market. Labor market imbalances, unemployment. The role of the state in a market 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.
Recommended readings and availability	• N. Gregory Mankiw (2020) Principles of Economics. 9. kiadás. Cengage Learning Inc. ISBN-13: 978-0357038314 • Moffat, M. ((2020) Online Microeconomics Textbook https://www.thoughtco.com/online-microeconomics-textbook-1147732 • Moffat, M. ((2020) Online Macroeconomics Textbook Resources https://www.thoughtco.com/online-macroeconomics-textbook-resources-1147693 • Thomas Sowell (2014) Basic Economics. Basic Books ISBN-13: 978-0465060733 • Begg, D., S. Fischer and R. Dornbusch Economics 12e (2020) McGraw- Hill 800p ISBN 978-1526847393 • The Economy 2.0 CORE Econ. https://books.core-econ.org/the-economy/index.html
Description of tasks/measurement procedures to be submitted	Preparation and presentation of home assignments on predetermined 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. With the possibility of making up/correction in the last week of study.
Frameworks and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: • during class work, for data collection and orientation for assignments • for data collection for certain homework assignments • during preparation for a closed-class paper The use of all AI tools is prohibited during knowledge assessments and writing closed-door papers.

Network Management 1

Subject name		In Hungarian	Hálózat menedzselés 1						Level	**BSc**	
		In English	**Network Management 1**						Subject code	**DUEN(L)-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** Students will know the basic operation and algorithms of computer networks and will be able to manage and create computer networks. Students will be able to see and understand processes ranging from the operation of communication media to the basic operation of computer network devices. The course focuses primarily on building wired and wireless networks and on techniques that can be configured on CISCO routers (with a narrower network security perspective). Switching techniques can be learned within Network Management 2 course.	
Typical transfer methods	Theoretical	Online learning materials (notes, lecture videos, slides, supporting materials)
	Practice	
	Lab	Solving tasks in virtual environment
	Misc.	
Requirements (expressed study results)	**Knowledge** • Possess professional and domain-specific knowledge of computer networks. • Know the terminology, key concepts, and theoretical foundations of the field. • Are familiar with commonly used methods and procedures necessary for solving typical problems. • Have basic knowledge of system design principles, methods, procedures, and operational processes.	
	Ability • Perform routine operational IT tasks. • Implement developments based on plans. • Apply learned problem-solving methods in professional tasks. • Perform analysis, specification, design, development, and operation tasks. • Apply development methodologies, troubleshooting, testing, and quality assurance procedures. • Plan and conduct independent learning. • Understand and use professional literature and IT/library resources. • Apply acquired knowledge to professional problem-solving. • Communicate professionally and appropriately in their native language, both orally and in writing. • Cooperate with IT professionals, electrical engineers, and other specialists in team-based work and requirement analysis.	
	Attitude • Strive to solve problems collaboratively when necessary. • Aim to thoroughly understand and explain observed phenomena using their technical knowledge. • Are open to learning and mastering new methods and procedures.	

	• Are open to interdisciplinary cooperation. • Understand and accept professional ethical and legal principles. • Strive for efficient and high-quality work. • Keep up with developments in IT and continuously improve their computer networking knowledge.
	Autonomy and Responsibility • Follow a systems approach and ensure continuous availability of computer networks. • Cooperate with professionals from technical, economic, and legal fields. • Take responsibility for their analyses, proposals, and decisions. • Take responsibility for individual and team-based IT system analysis, development, and operation activities. • Identify technological shortcomings and process risks and initiate corrective actions.
Short description of the subject content	Review of ISO OSI and TCP/IP structure. Wired and wireless transmission media and their characteristics. Description and comparison of data connection modes. IP and ICMP versions, X.25 in detail and multicast. Address allocation modes. LAN and WLAN network configuration methods. Hot Standby Router Protocol (HSRP). Authentication (PPP, CHAP). Static and dynamic traffic routing. Routing algorithms, protocols (RIP, RIPv2, IGRP, EIGRP, OSPF). Dynamic IP address assignment (DHCP) and application of DHCP Relay. Network Address Translation (NAT) and types (static, dynamic, PAT).
Forms of student activity	• Processing lectures with note-taking • Guided and independent study of theoretical materials • Guided and independent problem-solving • Collecting, processing, and organizing professional information • Case study analysis, including project-based work
Required reading and availability	Learning materials in Moodle or Neptun systems and on Teams channel.
Recommended readings and availability	CISCO Press: CCNA 200-301 Official Cert Guide, Volume 1 CISCO Press: CCNA 200-301 Official Cert Guide, Volume 2 CISCO Learning Network (https://learningnetwork.cisco.com/s/article/200-301-ccna-study-materials) Andrew S. Tanenbaum Wetherall, Davidj: Computer Networks (5th Edition), 2010.
Description of tasks/measurement procedures to be submitted	As stated in the first lesson.
Description and schedule of the midterm tests	As stated in the first lesson.
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (it can be used to get ideas and search during project work), but is prohibited in other cases (e.g. tests).

Basics of Artificial Intelligence

Subject name		In Hungarian		Mesterséges intelligencia alapjai					Level		**BSc**
		In English		**Basics of Artificial Intelligence**					Subject code		**DUEN(L)-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 provide an overview of the main topics of Artificial Intelligence (AI), including its fundamental problem types, core concepts, and methodological approaches. Students will study models and algorithms developed to solve problems arising in various AI application domains. The course enables students to recognize AI-related problems and to apply modern computational tools and software frameworks for their solution. As a result, students will be capable of developing and implementing basic AI models and algorithms. Furthermore, the course provides a solid foundation for advanced studies in specific AI fields such as expert systems, data science, data mining, deep learning, and robotics. The course builds upon students' previously acquired knowledge in mathematics, computer science, and engineering, particularly in probability theory and statistics, linear algebra, algorithm theory, and programming. Prior knowledge in data management, data visualization, and basic software development is also expected. The development objective of the course is to provide students with a comprehensive understanding of the fundamental methods and application possibilities of Artificial Intelligence. Students will develop the ability to identify, formally define, and solve AI-based problems. In addition, the course aims to strengthen data-driven thinking, modeling skills, and algorithmic problem-solving competencies through the use of modern computational tools.	
Typical transfer methods	Theoretical	All students attend lectures held in a large lecture hall using a traditional blackboard-based teaching format or online using MS Teams. A projector and the instructor's computer are used during all theoretical lectures. In addition, online video-based learning materials, lecture notes, and presentation slides are available to students. Further consultation hours are also provided during contact sessions.
	Practice	
	Lab	Laboratory assignments are completed during scheduled contact hours using computers or online using MS Teams. Online laboratory guides are supplemented with in-person lab consultations.
	Misc.	
Requirements (expressed study results)	**Knowledge** Has knowledge of the main fields of Artificial Intelligence. Understands methods of intelligent behavior and knowledge representation. Is familiar with the fundamentals of applying Artificial Intelligence methods.	
	Ability	

	Is able to develop effective methods for solving computational problems. Is able to recognize the applicability of Artificial Intelligence methods and tools in tasks arising in their professional work. Is capable of contributing to the introduction and application of Artificial Intelligence methods. Is able to apply Artificial Intelligence methods to solve specific problems. Applies Artificial Intelligence methods required in their field of informatics in engineering work aimed at the design and development of IT systems. Is capable of independently acquiring deeper knowledge in specific technical or informatics domains based on foundational knowledge, processing relevant scientific literature, and solving domain-specific IT problems. Is able to cooperate with computer scientists and electrical engineers in teamwork, and with professionals from other disciplines in requirement analysis and solution development. Continuously develops their professional knowledge and keeps up with advancements in the field of informatics.
	Attitude Is open to acquiring new knowledge. Strives to understand the entire technical system beyond their own specific field of work. Is open to learning and mastering new methods and procedures at a practical level. Is open to understanding other disciplines that apply IT tools and to developing IT-based solutions in collaboration with domain experts.
	Autonomy and Responsibility Takes responsibility for independent and team-based activities related to the analysis, development, and operation of IT systems. Identifies deficiencies in applied technologies and risks in processes, and initiates measures to mitigate them.
Short description of the subject content	• The subject, origins, and interdisciplinary relations of Artificial Intelligence • Machine learning: supervised learning, unsupervised learning, reinforcement learning, deep learning; Single-Layer Perceptron (SLP), Multi-Layer Perceptron (MLP), backpropagation • Neural networks (NN), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) • Fuzzy systems, fuzzy sets • Fuzzy logic, set operations, fuzzy inference, fuzzy logic controllers • Genetic Algorithms (GA) • Implementation approaches for GA/Fuzzy/NN-based systems • Deep learning–based models and methods • Overview of software solutions for Artificial Intelligence and deep learning • Presentation of adaptive solutions through case studies • Enhancement of conventional solutions using Artificial Intelligence methods
Forms of student activity	• Processing of spoken material with note-taking; guided and independent study of theoretical course material; problem-solving both under supervision and independently. • Collection, processing, and systematic organization of information related to professional topics. • Completion of assignments, as well as analysis and evaluation of case studies.
Required reading and availability	• Ross, T.J. : Fuzzy Logic with Engineering Applications, 4th Edition, Wiley 2016, ISBN: 9781119235866 • Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2020, ISBN: 978-0134610993 • Richard E. Neapolitan, Xia Jiang, Artificial Intelligence • With an Introduction to Machine Learning, Chapman & Hall, 2018, ISBN: 978-0367571641

Recommended readings and availability	• Albert Chun-Chen Liu, Oscar Ming Kin Law, Iain Law, Understanding Artificial Intelligence: Fundamentals and Applications, Wiley-IEEE Press, 2022, ISBN: 978-1119858331Alpaydin, E. (2020). Introduction to Machine Learning (4th ed.). MIT Press.
Description of tasks/measurement procedures to be submitted	As specified during the first lecture.
Description and schedule of the midterm tests	As specified during the first lecture.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence–based tools is permitted during practice assignments and in class, and they may be used to support the learning process; however, their use is prohibited during exams.

Information Security

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Adatbiztonság, adatvédelem</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Information Security</td><td>Subject code</td><td>DUEN(L)-ISR-250</td></tr>
<tr><td colspan="2">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="2" rowspan="2">Name of the required preliminary study</td><td colspan="4">Computer and network architectures</td><td rowspan="2">Subject code</td><td>ISR-118</td></tr>
<tr><td colspan="4">Basics of Computer Science 1.</td><td>IMA-153</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>150/26</td><td>per Week</td><td>2</td><td>per Week 0</td><td>per Week 0</td><td>Exam</td><td>5</td><td>English</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per Semester</td><td>10</td><td>per Semester 0</td><td>per Semester 0</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="2">Dr. Tibor Ujbányi</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 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="5">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="5"></td></tr>
<tr><td>Lab</td><td colspan="5"></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

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="6">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="6">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.</td></tr>
</table>

	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 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	Electronic materials in Moodle or Neptun systems.
Recommended readings and availability	William Stallings, Lawrie Brown: Computer Security – Principles and Practice (5th Edition), Pearson / Addison-Wesley, 2024. ISBN: 978-0-13-809167-5 Stallings W., Brown L.: Computer Security, Prentice Hall, 2008
Description of tasks/measurement procedures to be submitted	As stated in the first lesson.
Description and schedule of the midterm tests	As stated in the first lesson.
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Embedded Systems

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Beágyazott rendszerek</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Embedded Systems</td><td colspan="2">Subject code</td><td>DUEN(L)-ISR-215</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">Electronics and digital techniques</td><td colspan="2">Subject code</td><td>ISR-119</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>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>Midterm Mark</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="3">Course leader</td><td>Name</td><td colspan="3">Dr. Ákos Odry</td><td>Position</td><td>c. professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives

The course introduces microcontroller-based systems, covering the architecture of microcontrollers and the operation of various peripherals, ranging from digital inputs and outputs to analog inputs, PWM techniques, and I2C/SPI communication. The course also addresses microcontroller programming and the development of intelligent embedded systems. All topics are introduced through case studies to facilitate easier understanding and structured insight into the problem domains. The course further covers autonomous microcontroller-based solutions, signal interfacing and processing in embedded software environments, and the development of communication solutions for intelligent systems.

The course builds upon students' previously acquired foundational knowledge, particularly in electronics, digital systems, and programming. Prerequisites include the fundamentals of analog and digital circuits, basic algorithmic thinking, and introductory software development skills. The development objective of the course is to enable students to independently design, implement, and test microcontroller-based systems aligned with industrial and research applications. Furthermore, the course aims to develop students' problem-solving abilities, systems-level thinking, and practice-oriented engineering mindset.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">All students attend lectures held in a large lecture hall using a traditional blackboard-based teaching format or online using MS Teams.

A projector and the instructor's computer are used during all theoretical lectures.

In addition, online video-based learning materials, lecture notes, and presentation slides are available to students.

Further consultation hours are also provided during contact sessions.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Laboratory assignments are completed during scheduled contact hours using computers or online using MS Teams.

Online laboratory guides are supplemented with in-person lab consultations.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3">Requirements (expressed study results)</td><td colspan="7">Knowledge
Through lectures, students become familiar with the hardware and software architecture of embedded systems, including microcontroller architectures, peripherals, and the operating principles of embedded software.

The course material covers the design and implementation processes of embedded systems, the fundamentals of hardware–software co-design, and the understanding of interfaces and interconnections between system components. In this way, the course contributes to the acquisition of the defined professional knowledge.</td></tr>
</table>

	Ability Through practical sessions and laboratory assignments, students develop their abilities by solving concrete microcontroller-based tasks, requiring the selection, integration, and programming of appropriate hardware and software components. Independent and guided assignments provide opportunities for students to synthesize hardware and software solutions using a systems-oriented approach, and to design, implement, and commission simple autonomous embedded systems.
	Attitude Practical work, programming tasks, and measurement assignments performed within the course encourage precision, reliability, and properly documented engineering practice. During task completion, students become open to adopting and applying new technological solutions, and develop a demand for the critical evaluation and continuous improvement of operational systems.
	Autonomy and Responsibility Through independent development and laboratory tasks, students progressively learn to recognize and evaluate the consequences of their own design and implementation decisions. The course contributes to the development of responsibility for the operation, reliability, and documentation of the embedded systems they develop.
Short description of the subject content	• Main characteristics and application areas of embedded systems (microcontroller-based systems) • Architecture of general-purpose processors, microcontrollers (MCUs), and digital signal processors (DSPs) • Fundamentals of software development and programming for embedded systems, and their application areas; embedded software development • Digital inputs and outputs • Signal interfacing and signal conditioning; A/D and D/A converters; interfacing selected sensor types • Communication interfaces (UART, I2C, SPI) • PWM and motor control using transistors and H-bridge circuits • Interrupt handling (e.g., position measurement using incremental encoders) • Implementation of digital filter algorithms • Implementation of PID position and velocity control • Use of real-time operating systems (RTOS) in embedded systems • Case studies and realization of complex systems
Forms of student activity	Note-taking during lectures; performing measurement, system assembly, and testing tasks in laboratory sessions, as well as preparing laboratory reports.
Required reading and availability	• Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley, 2019. ISBN: 978-1-119-40530-6 • Tianhong Pan, Yi Zhu, Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Springer Singapore, 2018. ISBN: 978-981-13-5131-0
Recommended readings and availability	• Cornel M Amariei, Arduino Development Cookbook, Packt Publishing, 2015. ISBN: 9781783982943 • Kakoty Nayan M., Goswami Rupam, Vinjamuri Ramana, Introduction to Embedded Systems and Robotics, Springer Nature Switzerland, 2024. ISBN: 978-3-031-73100-6
Description of tasks/measurement procedures to be submitted	As specified during the first lecture.
Description and schedule of the midterm tests	As specified during the first lecture.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence–based tools is permitted during practice assignments and in class, and they may be used to support the learning process; however, their use is prohibited during exams.

Entrepreneurship

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Vállalkozástan</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="4">Entrepreneurship</td><td colspan="2">Subject code</td><td colspan="2">DUEN(L)-TVV-122</td></tr>
<tr><td colspan="3">Responsible Educational unit name</td><td colspan="8">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 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 colspan="2">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>2</td><td>per Week</td><td>0</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>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 colspan="2">Name</td><td colspan="3">Dr. Andrea Keszi-Szeremlei</td><td>Position</td><td colspan="2">c. professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="8">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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="7">In a classroom with the use of projector or computer in each lecture.</td></tr>
<tr><td>Practice</td><td colspan="7">Flipchart, blackboard and other multimedia equipment in smaller seminar rooms suitable for group work</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

• Understands the conceptual framework of business management.
• Is familiar with the mechanisms of corporate operations.
• Is familiar with the legal background and internal and external environment of companies.
• Is familiar with the management systems, objectives, and strategies of companies.</td></tr>
<tr><td colspan="8">Ability

• Able to use the concepts of the field professionally.
• Able to identify and define the resources of companies.
• Able to implement the basics of corporate management.
• Able to understand corporate goals and strategic steps.
• Able to understand and use relevant literature.</td></tr>
<tr><td colspan="8">Attitude

• Open to actively interpreting changing communication communities and social situations.
• Sensitive to solving problems arising from the functioning of relationships.
• Receptive to exploiting opportunities for development.</td></tr>
<tr><td colspan="8">Autonomy and Responsibility</td></tr>
</table>

	• Takes responsibility for their own development. • Cooperates with others and seeks solutions to problems. • Feels responsible for the development of their work environment.
Short description of the subject content	The formation of companies, their concept, and the legal background of their operation. The macro and micro, external and internal environment of companies. Anti-corruption in business practice (forms of corruption, means of prevention). Companies as economic systems, characteristics of economic systems, basic concepts of their operation. Company goals, goal systems, strategy. Economic decisions of companies. Description of corporate resources and activity systems. Company assets and resources, company financing. Organization and management of companies. Resource management in companies. Presentation of corporate production, services, and material processes. Internal and external logistics of companies. Human resource management in companies. 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 principles, strategic management, strategy development, implementation, and control. Controlling. The role and presentation of business planning. Corporate ethics, responsibility, and culture in the operation of companies. Outsourcing, its development, types, and implementation possibilities.
Forms of student activity	Corporate cooperation. Individual and group activities: participation in individual and small group tasks, participation in guided corporate role-playing, analysis of case studies, examination of complex corporate simulations.
Required reading and availability	• William D. Bygrave - Andrew Zacharakis (2014): Entrepreneurship, 3rd Edition, John Wiley & Sons, DUE Library • Dollinger, Marc J. (2008): Entrepreneurship, Marsh Publications, Letölthető: https://shorturl.at/R1ydn - egyes részei • 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	Presentation and analysis of the business activities of a company selected by the student in week 14, using the knowledge acquired so far. Short presentation on a predetermined company-related topic.
Description and schedule of the midterm tests	Midterm tests on weeks 7th and 12th. Supplementary test on week 13th.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: - during class work, for data collection and information gathering for assignments - for data collection for certain HF assignments - during preparation for ZH The use of any AI tools is prohibited during knowledge assessment and closed book exams.

Multimedia

Subject name		In Hungarian		Multimédia					Level	**BSc**	
		In English		**Multimedia**					Subject code	**DUEN(L)-TKM-128**	
Responsible Educational unit name				**Institute of Social Sciences** **Department of Communication and Media**							
Name of the required preliminary study									Subject code		
Type		Study load per week (in hours)						Requirement	Credit	Teaching language	
		Theoretical		Practice		Lab					
Full time	**150/52**	per Week	**2**	per Week	**0**	per Week	**2**	**Midterm Mark**	**5**	**English**	
Part time	**150/20**	per Semester	**10**	per Semester	**0**	per Semester	**10**				
Course leader				Name		**Dr Péter Ludik**			Position	**associate professor**	
Training course aims				**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.							
Typical transfer methods				Theoretical	Lecture in a boardroom, using a projector and a computer, 34% of the hours.						
				Practice							
				Lab	Independent task solution in a computer lab in 66% of the hours.						
				Misc.	Application of e-learning curriculum						
Requirements (expressed study results)				**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, motion picture: animation, film, virtual reality elements; • multimedia creation tools. • Acquire a basic understanding of audiovisual tools in the field of motion picture and media.							
				Ability • The student should be able to determine the software tools necessary for the production and editing of source materials (text, sound, moving and still images, graphics) parameters and services. • It digitizes images, creates and edits vector and raster graphic images. • He digitizes and edits audio and video material. • It creates animation. • Be able to make independent decisions taking into account technical applications and their intended use.							
				Attitude • Open to learning about the use, theoretical foundations, methods, new results and innovations of computer media. • He is inquisitive, critical, creative, imaginative.							
				Autonomy and Responsibility • He/she is able to form an independent opinion and plans the appropriate proportions of the elements of the multimedia.							
Short description of the subject content				Definition of multimedia, its characteristic properties. 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.
Forms of student activity	Processing of heard text with notes 20% Organizing information with a task 20% Independent processing of tasks 60%
Required reading and availability	• Online learning material in the Moodle system
Recommended readings and availability	• Steinmetz, Ralf: Multimedia: Introduction and Basics. 2nd edition Spinger , 1998 • Tay Vaughan: Multimedia: Making It Work; McGrawHill 2011
Description of tasks/measurement procedures to be submitted	Independent multimedia programme (week 13)30 points Continuous submission of tasks 20 points Multimedia Development Systems Assignment (Weeks 5 and 10) 10 points
Description and schedule of the midterm tests	Electronic test of the watch material (12 pieces) continuously max 20 points Summary test of the theoretical parts of the material week 13 max.: 20 points
Frameworks and rules of the use of artificial intelligence	Artificial Intelligence is partially enabled: • during class work, for data collection and information for tasks, • manipulation of media elements • Collecting material during the creation of a multimedia program The use of all AI tools is prohibited during tests and the writing of the final exam.

Management

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Menedzsment</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Management</td><td colspan="2">Subject code</td><td>DUEN(L)-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="5"></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="4"></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>150/39</td><td>per Week</td><td>1</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td>Midterm Mark</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>10</td><td>per Semester</td><td>0</td><td></td><td></td><td></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 colspan="2">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">In a classroom with the use of projector or computer in each lecture.</td></tr>
<tr><td>Practice</td><td colspan="6">In a classroom with the use of projector or computer in each seminar.</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">Knowledge
Students as potential manager:
• Familiar with the fundamental aspects of science organization, the most important concepts, requirements, relationships and procedures.
• It learns supply management tasks, theoretical and methodological foundations of the exercise of the functions.
• Familiar with the planning, organization and management frequently used procedures and methods.
• Familiar with the leadership style models and understand their role in effective leadership behavior.picture and media.

Ability
Students will be able to:
• analyse and develop the management and decision making mechanisms of work organizations
• effectively organize individual and team work
• identify and solve problems
• integrate knowledge
• recognize and evaluate alternatives
• handle operative planning tasks
• work in groups
• accept divergent views
• manage time</td></tr>
</table>

	• select and focus on various tasks • identify, understand and apply different leadership styles • understand and manage organizational processes lications and their intended use. **Attitude** • Open to accommodate new innovative approaches. • Avoids the stereotypes. • Not think schemas. • Susceptible development opportunities for exploitation. • Good, future-oriented bargainers respect their counterpart, are trustworthy and not aggressive. • They are open and willing to discuss all points of the negotiation process, as well as express their opinion, but without disclosing any important information about the circumstances of their own company. **Autonomy and Responsibility** • In professional questions negotiators can play the role of a decision-maker and are able to solve problems alone. They can tackle problems as responsible persons, i.e. can decide if it is a need in a certain negotiation phase or situation to cooperate with others.
Short description of the subject content	Interpretation and origin of management. The role and importance of management in the governance of companies. Historical overview of management studies: concepts, schools, trends; similarities and differences. Practicing management functions: - Planning: vision of the future, goal hierarchy, short term and operative planning, planning methods. - Organizing: changing the structure, processes, defining organizations, division of labor, developing processes and organizational structures, structural differences of organizations, organization types and characteristics. - Control: changing conditions, exercise authority, define norms, measurement, evaluation and adjusting, managing everyday problems. - Coordinating: harmonizing goals-processes-organization, coordination tools, operation control, task-authority-responsibility fit, control processes of organizations: rules of organization and operation, professional rules and regulations, job description. - Leadership: leadership effectiveness, leadership styles: characteristics, decision making theories, behavioral theories, contingency-approach. Organizational culture and strategy. Components and dimensions of culture. Understanding and analyzing cultural differences. Managing corporate culture.
Forms of student activity	Frontal work: 30 % Individual presentation 20% Group work: 35% Test: 15%
Required reading and availability	• Louis A. Allen and Keith Davis (2013) Management and Organization : McGraw-Hill Series in Management • Williams-DuBrin-Sisk (1995):Management & Organization, South-Western Publishing Co. Cincinnati, Ohio, USA • Materials on Moodle
Recommended readings and availability	• Chelsom-Payne-Reavill (2005): Management for Engineers, Scientists and Technologists, John Wiley& sons, Ltd, England
Description of tasks/measurement procedures to be submitted	Case study analysis Group work Individual presentation: An organization working goal, process and organizational structure. These tasks cannot be replaced during the exams.
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).
Framework and rules for the use of artificial intelligence	The use of artificial intelligence–based tools is permitted during practice assignments and in class, and they may be used to support the learning process; however, their use is prohibited during exams.

Measurement and Control

<table>
<tr><td colspan="3" 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>DUEN(L)-ISR-260</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">Mathematics 3</td><td colspan="2">Subject code</td><td>DUEN(L)-IMA-110</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 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 colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per Week</td><td>2</td><td>per Week</td><td>0</td><td>per Week</td><td>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</td><td>0</td><td>per Semester</td><td>5</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Course leader</td><td colspan="2">Name</td><td colspan="3">Dr. Ákos Odry</td><td>Position</td><td>assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives

The course provides fundamental knowledge in systems theory and electrical measurement engineering, introduces the operation and handling of electrical measuring instruments, and enables students to apply this knowledge in the design and implementation of control systems. It establishes foundational concepts in signal and system theory, including mathematical modeling and methods for analyzing signals and systems. The course covers the measurement of electrical signals, measurement principles, electrical measuring instruments, and the measurement of various physical quantities using transducers. The theoretical foundations of control and regulation are introduced, with emphasis on the application of system-theoretic descriptions in the design of control systems. Students learn to design, simulate, and implement control algorithms on real systems. All topics are introduced through case studies to facilitate a clear understanding and structured overview of the problem domains.

The course builds upon students' previously acquired knowledge in mathematics, physics, and engineering, particularly differential and integral calculus, linear algebra, fundamental electrical circuit theory, and electronics. Basic programming and computer simulation skills are also required as prior knowledge. The development objective of the course is to equip students with a comprehensive systems-theoretic and measurement-oriented perspective, enabling them to model, analyze, and control complex technical systems. Furthermore, the course aims to develop competencies in interpreting measurement data, handling measurement uncertainty, and selecting and applying appropriate measurement systems correctly.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">All students attend lectures held in a large lecture hall using a traditional blackboard-based teaching format or online using MS Teams.

A projector and the instructor's computer are used during all theoretical lectures.

In addition, online video-based learning materials, lecture notes, and presentation slides are available to students.

Further consultation hours are also provided during contact sessions.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Laboratory assignments are completed during scheduled contact hours using computers or online using MS Teams.

Online laboratory guides are supplemented with in-person lab consultations.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
</table>

Requirements (expressed study results)	**Knowledge** Through lectures and practical sessions, students become familiar with the fundamental concepts, methods, and interrelationships of systems theory, as well as measurement and control engineering. During the study of the course material, emphasis is placed on understanding measurement principles, measurement errors, system modeling, feedback systems, and basic control structures. In this way, the course contributes to the acquisition of the defined theoretical knowledge.
	Ability Through theoretical and laboratory assignments, students develop their analytical and problem-solving skills by processing measurement data, constructing system models, and solving basic measurement and control engineering problems. Computational, simulation, and interpretation tasks provide opportunities for students to apply theoretical knowledge in practical contexts and to develop solutions based on systems-oriented thinking.
	Attitude Measurement tasks, report writing, and independent problem-solving performed within the course promote precision and a commitment to high-quality engineering work. The course fosters interest in technical problem-solving and encourages students to actively engage with the course material and critically evaluate results.
	Autonomy and Responsibility Through independently structured sub-tasks and various assessment methods (e.g., problem-solving assignments, laboratory reports, written tests), students progressively learn to recognize and evaluate the professional consequences of their decisions. The course contributes to the development of responsibility for the quality and outcomes of their own work.
Short description of the subject content	• Fundamental concepts of measurement engineering, measurement errors • Basic concepts of signal and system theory, their classification; continuous-time and discrete-time signals and their characteristics • Analog-to-digital conversion, sampling and holding, important signal types • Description and analysis of continuous-time and discrete-time systems (Fourier, Laplace, and z-transforms) • Transfer functions, mathematical models, dynamic systems • Signal processing, basic filters • Definition of the fundamental concepts of control engineering; operating principles and comparison of open-loop control and closed-loop control; basic control elements • The controlled plant as a process, signal transmission; analysis of control loops; concept of stability and methods of stability analysis; quality characteristics of control systems • PID control • Analysis and design methods in control engineering (root locus, frequency response, and state-space–based approaches) • Computer-based (microcontroller-based) control systems and implementation solutions • Introduction to MATLAB-based controller design • Design of model-based and predictive control systems • Adaptive control and its significance in practical control applications
Forms of student activity	Note-taking during lectures; performing measurement, system assembly, and testing tasks in laboratory sessions, as well as preparing laboratory reports.
Required reading and availability	• Alessandro Ferrero, Dario Petri, Paolo Carbone, Marcantonio Catelani, Modern Measurements: Fundamentals and Applications, Wiley-IEEE Press, 2015, ISBN: 978-1118171318

	• Gene F. Franklin. J. Davis Powell. Abbas F. Emami-Naeini, Feedback Control of Dynamic Systems, Pearson, 2019, ISBN: 978-1292068909 • Anders Andersson, Measurement Technology for Process Automation, CRC Press, 2017, ISBN: 9781315267913
Recommended readings and availability	• Kamran Iqbal, A First Course in Control System Design, River Publishers, 2020, ISBN: 9781003336907
Description of tasks/measurement procedures to be submitted	As specified during the first lecture.
Description and schedule of the midterm tests	As specified during the first lecture.
Framework and rules for the use of artificial intelligence	Partial authorization: the use of Artificial Intelligence is permitted for certain types of tasks (e.g., in-class activities, take-home assignments), while it is prohibited in other cases (e.g., written midterm examinations).

Numerical Methods

Subject name		In Hungarian		Numerikus módszerek					Level		**BSc**
		In English		**Measurement and Control**					Subject code		**DUEN(L)-IMA-251**
Responsible Educational unit name				**Institute of Informatics**							
Name of the required preliminary study				Mathematics 3					Subject code		**DUEN(L)-**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. Györgyi Strauber**			Position		**c. professor**

Training course aims	**Educational goals, development objectives** Acquisition of the fundamental algorithms of numerical methods, acquisition of related programming knowledge, and the programming of numerical methods.	
Typical transfer methods	Theoretical	For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams
	Practice	By providing access to appropriate IT equipment and web-based AI tools in the computer room.
	Lab	
	Misc.	
Requirements (expressed study results)	**Knowledge** Programming of numerical computational algorithms. Has knowledge of the algorithmic and numerical principles and methods required for the field of informatics. Possesses basic knowledge and an engineering approach related to information processing, system modelling, and simulation. Is familiar with the vocabulary and terminology of informatics and engineering in both Hungarian and English, at least at a basic level.	
	Ability Able to apply numerical methods to solve informatics problems. Applies the scientific, algorithmic, and numerical methods and principles required in the field of informatics in engineering work aimed at designing and developing IT systems. Able to build on acquired fundamental knowledge to independently gain deeper expertise in a specific technical informatics area, process professional literature, and solve related IT problems. Continuously develops professional skills and keeps up with the advancement of the informatics profession.	
	Attitude Authentically represents the professional principles of the engineering and informatics fields. Strives to understand the entire technical system beyond their own area of work. Open to learning new methods, programming languages, and procedures, and to mastering them at a practical level. Open to exploring other disciplines that use informatics tools and to developing IT solutions in cooperation with professionals of the given field.	
	Autonomy and Responsibility Takes responsibility for informatics activities carried out both independently and in a team.	

	Identifies the shortcomings of applied technologies and the risks of processes, and initiates measures to reduce them
Short description of the subject content	• Linear systems of equations: Gaussian elimination; iterative solution of linear systems: Jacobi iteration, Gauss–Seidel iteration. • Interpolation: Lagrange interpolation, Hermite interpolation, trigonometric interpolation. • Numerical differentiation. • Ordinary differential equations: initial value problems, boundary value problems. • Partial differential equations. • Programming of the above methods.
Forms of student activity	• Computer-based exercises, programming, problem solving.
Required reading and availability	• StoyanGisbert: Numerikus matematika Mérnököknek és programozóknak, Typotex, Budapest, 2007
Recommended readings and availability	• Development of an independent program implementing one of the learned algorithms.
Description of tasks/measurement procedures to be submitted	Development of an independent program implementing one of the learned algorithms.
Description and schedule of the midterm tests	Midterm test. Schedule according to the arrangements agreed upon during the first class.
Framework and rules for the use of artificial intelligence	For practice assignments and during classes, the use of artificial intelligence–based tools is permitted and may be used to support the learning process; however, their use is prohibited during in-class tests.

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	**DUEN(L)-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		**Anita Mihálovicsné Kollár**			Position	**teacher of master**	

Training course aims	**Educational goals, development objectives** The aim of the course is to prepare students to begin and lay the foundations for their thesis work. Within this framework, students learn about the criteria for selecting a thesis topic, methods for researching and processing literature related to their field of expertise, and the basic principles of planning independent engineering work. The course develops students' problem-recognition, analytical, and organizational skills, and prepares them for the preparation of their thesis in the Thesis 2 course.	
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	Lectures and consultation-based teaching, guided independent student work. The course includes a methodological overview to support the selection of thesis topics and the processing of specialist literature, as well as individual task completion accompanied by instructor guidance.	

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 • Boncz Imre (szerk.): Kutatásmódszertani alapismeretek Pécsi Tudományegyetem, Pécs, 2015. ISBN: 978-963-642-825-9 • Körtvélyesi Zsolt (2018): Bevezetés a tudományos szöveg írásába (ELTE online jegyzet) ISBN 978-963-489-049-2 • Umberto Eco (1996): Hogyan írjunk szakdolgozatot? Budapest: Kairosz Kiadó, ISBN: 963-913-753-7 • Guide to writing a thesis (MOODLE system)
Recommended readings and availability	
Description of tasks/measurement procedures to be submitted	The requirements for completing the course are the submission of a thesis topic proposal by the end of the eighth week of the study period at the latest, and the submission of a literature review of at least 10 pages completed by the end of the study period. The course will be graded based on the written work submitted.
Description and schedule of the midterm tests	
Framework and rules for the use of artificial intelligence	Partial authorization of artificial intelligence: Authorization in preliminary work: • generating research ideas, • preliminary literature search with appropriate source criticism, Complete prohibition in the substantive part of scientific work. Permission in post-production: • rewriting text, • creating illustrative figures, linguistic and stylistic checking.

Thesis Research 2. – Computer Science BSc

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Szakdolgozat 2. – MINFBSC</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Thesis Research 2. – Computer Science BSc</td><td colspan="2">Subject code</td><td>DUEN(L)-ISF-094</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="3">Thesis Research 1. –Methodology Computer Science BSc</td><td colspan="2">Subject code</td><td>DUEN(L)-ISF-090</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>150/117</td><td>per Week 0</td><td>per Week 9</td><td>per Week 0</td><td rowspan="2">No Grade</td><td rowspan="2">15</td><td rowspan="2">English</td></tr>
<tr><td>Part time</td><td>150/45</td><td>per Semester 0</td><td>per Semester 45</td><td>per Semester 0</td></tr>
<tr><td colspan="2">Course leader</td><td>Name</td><td colspan="3">Anita Mihálovicsné Kollár</td><td>Position</td><td>teacher of master</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="6">Educational goals, development objectives

The aim of the course is for students to carry out independent engineering work based on their previously selected and approved thesis topics and to prepare a thesis that meets the formal and content requirements. Within the framework of the course, students apply the theoretical and practical knowledge acquired during their training, demonstrate their problem-solving and design skills, and prove their ability to work independently. The course concludes with the completion and submission of the thesis by the deadline, which is one of the conditions for admission to the final exam.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5"></td></tr>
<tr><td>Practice</td><td colspan="5">Using a projector</td></tr>
<tr><td>Lab</td><td colspan="5"></td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed study results)</td><td colspan="6">Knowledge

He/she knows the most important contexts and theories of the IT field and the terminology and applications that make them up.</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="6">Presentation of the problem solving and acquaintance with the relevant regulations of the university college.</td></tr>
<tr><td colspan="2">Forms of student activity</td><td colspan="6"></td></tr>
<tr><td colspan="2">Required reading and availability</td><td colspan="6">Eco, U. (2015). How to write a thesis (C. Farina & G. Farina, Trans.). Cambridge, MA: MIT Press. (Original work published 1977)</td></tr>
</table>

	Evans, D., Gruba, P., & Zobel, J. (2014). How to write a better thesis (3rd ed.). Cham, Switzerland: Springer. 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	
Framework and rules for the use of artificial intelligence	Partiat authorization of artificial intelligence: Authorization in preliminary work: - generating research ideas, - preliminary literature search with appropriate source criticism, Complete prohibition in the substantive part of scientific work. Permission in post-production: - rewriting text, - creating illustrative figures, - linguistic and stylistic checking.
Framework and rules for the use of artificial intelligence	Partial authorization of artificial intelligence: Authorization in preliminary work: - generating research ideas, - preliminary literature search with appropriate source criticism, Complete prohibition in the substantive part of scientific work. Permission in post-production: - rewriting text, - creating illustrative figures, linguistic and stylistic checking.

Field Practice – Computer Science BSc

Subject name			In Hungarian		Szakmai gyakorlat - MINFBSC						Level		**BSc**
			In English		**Thesis Research 2. – Computer Science BSc**						Subject code		**DUEN(L)-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		**Anita Mihálovicsné Kollár**				Position		**teacher of master**

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	
Framework and rules for the use of artificial intelligence	Enabling artificial intelligence: based on the regulations of the host organization.

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="4">Hálózat menedzselés 2.</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Network Management 2</td><td>Subject code</td><td>DUEN(L)-ISR-120</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">Network Management 1.</td><td>Subject code</td><td>DUEN(L)-ISR-258</td></tr>
<tr><td rowspan="2">Type</td><td colspan="2" rowspan="2"></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>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>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. Tibor Ujbányi</td><td>Position</td><td>assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="6">Educational goals, development objectives

Students will know the basic operation and algorithms of computer networks, and will be able to manage and create communication networks in a basic way. They will be able to see and understand processes ranging from the operation of communication media to the basic operation of computer network devices. The course focuses on the construction of wired and wireless networks, as well as on techniques that can be configured on CISCO switches (with a narrower network security perspective).</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5">Online learning materials (notes, lecture videos, slides, supporting materials)</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">Solving tasks in virtual environment</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="2">Requirements (expressed study results)</td><td colspan="6">Knowledge

• Possess professional and domain-specific knowledge of computer networks.
• Know the terminology, key concepts, and theoretical foundations of the field.
• Are familiar with commonly used methods and procedures necessary for solving typical problems.
• Have basic knowledge of system design principles, methods, procedures, and operational processes.</td></tr>
<tr><td colspan="6">Ability

• Perform routine operational IT tasks.
• Implement developments based on plans.
• Apply learned problem-solving methods in professional tasks.
• Perform analysis, specification, design, development, and operation tasks.
• Apply development methodologies, troubleshooting, testing, and quality assurance procedures.
• Plan and conduct independent learning.
• Understand and use professional literature and IT/library resources.
• Apply acquired knowledge to professional problem-solving.
• Communicate professionally and appropriately in their native language, both orally and in writing.
• Cooperate with IT professionals, electrical engineers, and other specialists in team-based work and requirement analysis.</td></tr>
</table>

	Attitude • Strive to solve problems collaboratively when necessary. • Aim to thoroughly understand and explain observed phenomena using their technical knowledge. • Are open to learning and mastering new methods and procedures. • Are open to interdisciplinary cooperation. • Understand and accept professional ethical and legal principles. • Strive for efficient and high-quality work. • Keep up with developments in IT and continuously improve their computer networking knowledge.
	Autonomy and Responsibility • Follow a systems approach and ensure continuous availability of computer networks. • Cooperate with professionals from technical, economic, and legal fields. • Take responsibility for their analyses, proposals, and decisions. • Take responsibility for individual and team-based IT system analysis, development, and operation activities. • Identify technological shortcomings and process risks and initiate corrective actions.
Short description of the subject content	Review of ISO OSI and TCP/IP structures. Virtal LAN, Trunk connections. Spanning Tree Protocol (STP). Firewalls and authentication (802.1x, Radius, TACACS). VLAN Trunking Protocol (VTP). ACL (standard, extended). Telnet and SSH connections. LACP, PAgP. Switch Port Security (static, dynamic, sticky).
Forms of student activity	• Processing lectures with note-taking • Guided and independent study of theoretical materials • Guided and independent problem-solving • Collecting, processing, and organizing professional information • Case study analysis, including project-based work
Required reading and availability	Learning materials in Moodle or Neptun systems and on Teams channel.
Recommended readings and availability	CISCO Press: CCNA 200-301 Official Cert Guide, Volume 1 CISCO Press: CCNA 200-301 Official Cert Guide, Volume 2 CISCO Learning Network (https://learningnetwork.cisco.com/s/article/200-301-ccna-study-materials) Andrew S. Tanenbaum Wetherall, Davidj: Computer Networks (5th Edition), 2010.
Description of tasks/measurement procedures to be submitted	As stated in the first lesson.
Description and schedule of the midterm tests	As stated in the first lesson.
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (it can be used to get ideas and search during project work), but is prohibited in other cases (e.g. tests).

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 colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="4">Network Operating Systems – Windows</td><td>Subject code</td><td colspan="2">DUEN(L)-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 colspan="2">DUEN(L)-ISR-257</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 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>150/39</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. Tibor Ujbányi</td><td>Position</td><td colspan="2">assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">Educational goals, development objectives
The aim of the course is to introduce the Windows Server operating system and its related technologies. During the semester, students acquire terminology related to the operation of domain-based systems and become familiar with key Active Directory services.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">Online learning materials (notes, lecture videos, slides, supporting materials)</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">Solving tasks in virtual environment</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed study results)</td><td colspan="7">Knowledge
• Possess professional and domain-specific knowledge of Windows Server systems.
• Know the terminology, key concepts, and theoretical foundations of the field.
• Are familiar with commonly used methods and procedures necessary for solving typical problems.
• Have basic knowledge of system design principles, methods, procedures, and operational processes.</td></tr>
<tr><td colspan="7">Ability
• Perform routine operational IT tasks.
• Implement developments based on plans.
• Apply learned problem-solving methods in professional tasks.
• Perform analysis, specification, design, development, and operation tasks.
• Apply development methodologies, troubleshooting, testing, and quality assurance procedures.
• Plan and conduct independent learning.
• Understand and use professional literature and IT/library resources.
• Apply acquired knowledge to professional problem-solving.
• Communicate professionally and appropriately in their native language, both orally and in writing.
• Cooperate with IT professionals, electrical engineers, and other specialists in team-based work and requirement analysis.</td></tr>
<tr><td colspan="7">Attitude
• Strive to solve problems collaboratively when necessary.
• Aim to thoroughly understand and explain observed phenomena using their technical knowledge.
• Are open to learning and mastering new methods and procedures.
• Are open to interdisciplinary cooperation.
• Understand and accept professional ethical and legal principles.
• Strive for efficient and high-quality work.
• Keep up with developments in IT and continuously improve their Windows Server knowledge.</td></tr>
</table>

	Autonomy and Responsibility • Follow a systems approach and ensure continuous availability of system services. • Cooperate with professionals from technical, economic, and legal fields. • Take responsibility for their analyses, proposals, and decisions. • Take responsibility for individual and team-based IT system analysis, development, and operation activities. • Identify technological shortcomings and process risks and initiate corrective actions.
Short description of the subject content	Basic concepts of networking operating systems Types of virtualization (server, desktop, application, network, storage) Cloud Computing fundamentals (SaaS, PaaS, IaaS), hybrid infrastructure, Entra (formerly Azure) overview Main features and installation methods of the current Windows Server edition Post-installation steps, local server configuration Active Directory (AD) directory service features and structure AD database and functional levels Naming and identification of AD objects, object classes Global catalog, directory partitions Domain controller deployment and AD Administrative Tools Creating AD objects, group management Storage Spaces, Storage Pool creation and management, disk mirroring Authentication methods (DAP, LDAP, IWA, NTLM, Kerberos) Access control (ACE, ACL) User rights and permissions, delegate control Group Policy (GPO), administrative templates Group vs. local policies, inheritance and influencing factors GPO evaluation, processing order, updates, Starter GPO Creating and enforcing Group Policies Scheduled tasks and scripts (PowerShell, Batch) via Group Policy Share and NTFS permissions, effective permissions Disk quotas, local and centralized quota configuration Using shared folders as mapped drives with centralized quota management Domain name resolution in Windows AD-integrated DNS, zone types, records, DNS search zones DNS role installation and configuration DHCP service operation, addressing process, lease renewal DHCP scope types DHCP Failover Cluster, Multi-site DHCP IIS, WSUS, WDS services and fundamentals
Forms of student activity	• Processing lectures with note-taking • Guided and independent study of theoretical materials • Guided and independent problem-solving • Collecting, processing, and organizing professional information • Case study analysis, including project-based work
Required reading and availability	Learning materials in Moodle or Neptun systems and on Teams channel.
Recommended readings and availability	Windows Server documentation (https://learn.microsoft.com/en-us/windows-server/) William Panek: MCSA Windows Server 2016 Study Guide (Exams 70-740/741/742) William Panek: MCA Windows Server Hybrid Administrator Complete Study Guide (Exams AZ-800/801)
Description of tasks/measurement procedures to be submitted	As stated in the first lesson
Description and schedule of the midterm tests	As stated in the first lesson
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (it can be used to get ideas and search during project work), but is prohibited in other cases (e.g. tests).

Script Language

Subject name		In Hungarian	Szkript nyelvek						Level	**BSc**	
		In English	**Script Language**						Subject code	**DUEN(L)-ISR-116**	
Responsible Educational unit name			**Institute of Informatics**								
Name of the required preliminary study			Introduction to programming						Subject code	**DUEN(L)-**ISF-111	
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**	**Midterm mark**	**5**	**English**	
Part time	**150/15**	per Semester	**0**	per Semester	**15**	per Semester	**0**				
Course leader				Name		**Kálmán Hadarics**			Position	**teacher of master**	

Training course aims	**Educational goals, development objectives** The aim of the Script Languages course is to provide students with theoretical and practical knowledge in the use of a widely used script language and to enable them to perform development tasks in the most common areas of application of the language. Scripting languages are used in everything from everyday problem solving to nuclear solutions with high security requirements, and their importance is growing. We have chosen Python as the basis for this course. The course provides theoretical and practical knowledge. Students will be able to use the Python scripting language, learn about the PyCharm/VSCode development environment, handle exceptions that occur during script execution, and manage files and databases. Among the interfaces used by development teams to support collaboration, task sharing, version tracking, and source code management, students will learn about the GitHub application and its capabilities.	
Typical transfer methods	Theoretical	For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams
	Practice	
	Lab	Individual task completion under the supervision of lab supervisors in computer labs
	Misc.	
Requirements (expressed study results)	**Knowledge** • Knowledge of Python language elements. • Knowledge of PyCharm/VSCode development environments. • Knowledge of GitHub version control. • Knowledge of frequently used Python modules. • Knowledge of individually selected Python modules.	
	Ability • Setting up the PyCharm/VSCode runtime environment. • Using GitHub for development and sharing. • Writing simple Python programs. • Selecting the appropriate module(s) for a given problem. • Using the Python language in other areas of interest.	
	Attitude Considers solutions to specific problems using the Python language. Considers the steps involved in implementation and the resulting advantages/disadvantages.	
	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	Python documentation: https://docs.python.org
Recommended readings and availability	• Gérard Swinnen: Learning to program with Python • Mark Summerfield: Python 3 • Guido Van Rossum: Python tutorial (https://docs.python.org/3/tutorial/) • Using PyCharm IDE (https://www.jetbrains.com/help/pycharm/quick-start-guide.html) • Using VSCode IDE (https://code.visualstudio.com/docs/languages/python) • GitHub User Guide (https://github.com/PovertyAction/github-training)
Description of tasks/measurement procedures to be submitted	The assignment is to solve a problem related to a freely chosen topic. The submitted project must be defended orally. Theoretical knowledge is assessed by completing tests. Practical knowledge is assessed during laboratory classes by solving computer tasks.
Description and schedule of the midterm tests	7. week – Theoretical quiz 11. and 12. weeks – Presentation and defense of project assignment. 13. week – Retake option
Framework and rules for the use of artificial intelligence	Full authorization: the use of artificial intelligence is permitted in all situations for the given subject. The student must understand every line of source code generated by artificial intelligence and be able to justify its use.

Network Operating Systems – Linux

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Hálózati operációs rendszerek – Linux</td><td colspan="2">Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="3">Network Operating Systems – Linux</td><td colspan="2">Subject code</td><td colspan="2">DUEN(L)-ISR-214</td></tr>
<tr><td colspan="4">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="4">Name of the required preliminary study</td><td colspan="3">Linux operating system</td><td colspan="2">Subject code</td><td colspan="2">DUEN(L)-ISR-159</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 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>150/39</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="4">Course leader</td><td>Name</td><td colspan="3">Kálmán Hadarics</td><td>Position</td><td colspan="2">teacher of master</td></tr>
<tr><td colspan="4">Training course aims</td><td colspan="7">Educational goals, development objectives

The aim of the course is to familiarize students with the installation and configuration of the Linux operating system. Students should be able to install applications from source code and use pre-built packages. They should be proficient in managing the operating system and network connections, as well as installing, monitoring, and tuning network services.

The subjects studied will help you find employment as a network systems engineer.</td></tr>
<tr><td colspan="4" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams

The lectures introduce theoretical concepts using practical examples.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">In the computer lab, using a projector in every lab session.

Independent task completion under the guidance of lab instructors. Installation, use, and configuration of the Linux operating system.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed study results)</td><td colspan="7">Knowledge

• Be familiar with the steps involved in installing the Linux operating system.
• Be familiar with common Linux administration commands.
• Be familiar with the administration of important network services in the Linux operating system.</td></tr>
<tr><td colspan="7">Ability

• 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.</td></tr>
<tr><td colspan="7">Attitude

• Interest in Linux system administration.
• Self-development using the available English literature (sources).
• The compulsion to give a solution (challenge).</td></tr>
<tr><td colspan="7">Autonomy and Responsibility

• Independent thinking and problem solving.
• Assess, accept or reject the difficulty of the task.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">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</td></tr>
</table>

	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	• Debian GNU/Linux Installation Guide
Recommended readings and availability	• Fred Butzen, C. Hilton: The Linux Network, IDG Books, 1998 • Evi Nemeth and others: Linux Administration Handbook, Prentice Hall, 2006 • Brian Ward: How Linux Works: What Every Superuser Should Know, No Starch Press, 2021
Description of tasks/measurement procedures to be submitted	Theoretical knowledge is assessed through oral examinations based on a list of topics. Practical knowledge is assessed during laboratory classes, through the completion of computer-based tasks and the preparation of reports related to assigned tasks.
Description and schedule of the midterm tests	6. week – Practical exam until 12. week one task/week, upload reports to Moodle 13. week – Retake option
Framework and rules for the use of artificial intelligence	Partial authorization: the use of artificial intelligence is permitted when preparing reports but prohibited in other cases (computer task solving). In the case of reports, source references must be used for any parts that were created by artificial intelligence.

IT Project 1

Subject name		In Hungarian		Informatika projekt 1.							Level	**BSc**	
		In English		**IT Project 1**							Subject code	**DUEN(L)-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 necessary for the successful execution of an IT project. Introducing students to project management and implementation procedures through a project carried out in teams of 4–5 participants.									
Typical transfer methods				Theoretical	For all students, in a large lecture hall, blackboard presentation, projector or online using MS Teams								
				Practice	Individually completed problem solving and team work.								
				Lab									
				Misc.									
Requirements (expressed study results)				**Knowledge** Understands the fundamental concepts and toolset of project management and is able to apply them during the development of IT projects. Has an overview of the main phases of the project lifecycle, as well as the basic principles of planning, risk management, and resource management. Is familiar with the key characteristics of agile and traditional project management methodologies, and with the operation of digital tools that support teamwork. Understands the role of requirements management, scheduling, and quality assurance in the successful implementation of IT projects.									
				Ability Is able to perform fundamental planning and organizational tasks in IT projects, create a simple project plan and schedule, and prioritize tasks. Can collaborate effectively in a team, communicate efficiently with project stakeholders, and use digital project management tools to track tasks. Is capable of identifying project risks, analyzing problems, and developing basic solution proposals. Applies feedback and iterative development methods during project work.									
				Attitude Open to structured problem-solving and collaboration-based work. Strives for precise documentation, transparent communication, and a quality-oriented mindset. Accepts the natural presence of change in IT projects and responds constructively to feedback. Is motivated to learn about and apply new project management methods and digital tools.									
				Autonomy and Responsibility Takes responsibility for completing assigned subtasks on time and for supporting project objectives. Is able to organize simpler project tasks independently, while recognizing the importance of teamwork and asking for help when necessary. Adheres to professional and ethical standards and takes into account data protection and security aspects in IT projects.									
Short description of the subject content				Theory:									

	The course provides an overview of the fundamentals of planning and managing IT projects. It presents the stages of the project lifecycle from definition to project closure, including methods of goal setting, requirements analysis, scheduling, and resource planning. It addresses both traditional and agile project management approaches, as well as the role of risk management, quality assurance, and communication, and the basic principles of project documentation in IT projects. Practice: Students become familiar with the importance of teamwork and project roles, and apply digital project management tools through practical tasks. Working in small teams (3–5 members), they complete a complex project assignment.
Forms of student activity	Lecture: 30% Individual assignment: 20% Group assignment: 50%
Required reading and availability	Eric Verzuh: Projektmenedzsment HVG Kiadó, Budapest 2006 Szentirmai Róbert: Projektirányítás Microsoft Office Project 2007 segítségével J.O.S. Kiadó, Budapest 2007
Recommended readings and availability	Görög M. - Ternyik L.: Informatikai projektek vezetése Kossuth Kiadó, Budapest 2001 Raffai M.: Információrendszerek fejlesztése és menedzselése Novadat Kiadó, Budapest 2003 Keith Lockyer - James Gordon: Projektmenedzsment és hálós tervezési technikák Kossuth Kiadó, Budapest 2000 Görög Mihály: Általános projektmenedzsment Aula Kiadó, Budapest 1996 Roland Garies: Projekt - Örömmel! HVG Kiadó, Budapest 2007 PMI: Projektmenedzsment útmutató PMBOK Guide Akadémiai Kiadó, Budapest 2006
Description of tasks/measurement procedures to be submitted	Preparation of a project assignment, teamwork.
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.
Framework and rules for the use of artificial intelligence	For submitted assignments, the use of artificial intelligence–based tools is permitted; however, the student must clearly indicate how they were used, critically evaluate any AI-generated content, and bears full professional responsibility for the submitted work. During classes, AI tools may be used to support the learning process; however, their use is prohibited during in-class tests.

Operational 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">Operational Research and Decision Making</td><td>Subject code</td><td>DUEN(L)-IMA-214</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 1 or Engineering Mathematics 1</td><td>Subject code</td><td>DUEN(L)-IMA-151 OR DUEN(L)-IMA-152</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="3">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 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 0</td><td>per Semester 10</td></tr>
<tr><td colspan="2">Course leader</td><td colspan="2">Name</td><td colspan="3">Dr. Zoltán Papp</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="2">Training course aims</td><td colspan="7">Educational goals, development objectives

The aim of the course is to introduce students to the methods of scientific analysis and optimisation used to address decision-making problems arising in complex systems. The course focuses on constructing models that support rational choice among decision alternatives, on the fundamental techniques of linear and integer programming, and on the application of network-planning and capacity-optimisation procedures. Students will develop the ability to formalise real economic and engineering decision situations, to translate them into mathematical models, and to solve them using computational tools.

The aim of the course is to enable students to master the methods of mathematical modelling for decision-making problems arising in complex economic, logistical, and engineering systems, as well as the operations research techniques that support optimal decision-making. The course develops students' ability to formulate and interpret linear and integer programming models and to solve network-planning and capacity-optimisation problems.
Students will acquire the ability to: formalise decision-making problems and identify relevant variables and constraints; formulate various optimisation models (linear, integer, and network-based) grounded in real examples from informatics and business practice; solve models using both manual computations and computational optimisation software; interpret results and formulate decision-support recommendations.
A further key objective of the course is the development of logical and system-level reasoning, structured problem-solving, and modelling competencies, all of which are essential in the fields of business informatics and engineering informatics—for example in corporate process optimisation, the design of logistics systems, resource allocation, scheduling problems, and the development of decision-support systems.</td></tr>
<tr><td colspan="2" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">The lecture is supported by multimedia tools.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Lab</td><td colspan="6">During the computer-based laboratory sessions, students construct and solve various optimisation models. An essential part of the learning process is small-group collaboration, joint problem-solving, and the development of project-based tasks, as well as the regular use of digital learning materials and online learning-support tools.</td></tr>
<tr><td>Misc.</td><td colspan="6"></td></tr>
<tr><td colspan="2">Requirements (expressed study results)</td><td colspan="7">Knowledge

The student has knowledge of the theoretical foundations of operations research, the methods of mathematically modelling decision-making problems, and the families of models that support rational decision-making. They understand the conceptual framework of linear programming, the steps of model formulation, the</td></tr>
</table>

	role of the objective function and constraints, as well as the structure of special linear and network models. They are familiar with the major optimisation techniques, including the graphical solution method, the basic principles of the simplex method, basis and pivot structures, and the fundamentals of sensitivity analysis. The student understands the theoretical principles of integer and binary programming and is acquainted with classical discrete optimisation problems such as assignment problems and the basic formulation of the travelling salesman problem. They possess knowledge of the theoretical foundations of network planning (CPM networks, critical paths, project durations, slack times) and their relevance in project management and scheduling problems. They have an understanding of the mathematical relationships underlying capacity planning, resource allocation, cost optimisation, and logistical processes. The student is familiar with the operating principles and application domains of computer-based optimisation tools, including software for modelling and solving linear and integer programming problems.
	Ability Students are able to use specific tools implemented in the Excel called Solver. The student is capable of formally formulating economic, informatics, and engineering decision-making problems, identifying the relevant variables, constraints, and objective functions. They can apply the mathematical models of linear and integer programming to real-world tasks and are able to verify and interpret the correctness of the models. They are capable of solving linear programming problems using manual techniques (graphical solution methods, manual execution of simplex steps) and of comparing these results with computer-generated solutions. The student confidently applies network-planning techniques (CPM), determines critical paths, computes project durations and slack times, and prepares project and scheduling analyses independently. They are able to construct their own optimisation models for logistics, scheduling, production-management, or information-system problems and select appropriate solution strategies. The student can use computer-based optimisation software (linear and integer solvers), interpret the obtained results from a professional perspective, compare them critically, and formulate decision-support conclusions. They develop a systems-level, model-based problem-solving approach essential for the analysis, development, and optimisation of economic and informatics processes. The student is capable of justifying their own solution plan with well-founded professional reasoning and presenting the solution process clearly and logically to others.
	Attitude The student is open to learning the mathematical-modelling and optimisation methods of operations research and decision theory, with particular attention to their applications in informatics, management, and engineering. They strive for systems-level, logical, and evidence-based reasoning, which is essential for the accurate understanding and proper formalisation of decision-making problems. The student shows receptiveness and interest in modern decision-support techniques, computer-based optimisation tools, and analytical methods, and is open to exploring their potential applications. They demonstrate a positive attitude toward structured problem-solving processes, model construction, analytical evaluation, and the comparison of alternative solution approaches. The student values the role of collaboration in complex decision-making tasks and participates constructively in group work, project assignments, and joint modelling activities. They are committed to responsible, professionally grounded decision-making and regard transparency, accuracy, and objective reasoning as fundamental values.
	Autonomy and Responsibility

	The student is able to independently identify decision-making problems, formalise them mathematically, and select the modelling and optimisation methods required for their solution. They assume responsibility for the correctness of the models they construct, for the solution procedures they apply, and for the professional interpretation of the results obtained. The student can independently verify the accuracy of calculations and computer-based optimisation processes, and, when necessary, modify the structure or parameterisation of the model. They are capable of making autonomous decisions when choosing among alternative solution strategies and can justify their choices with well-founded professional reasoning. They work responsibly in project and group assignments, completing their allocated tasks accurately and on time. The student consciously applies model-based thinking and objective, data-driven reasoning in their own professional and academic decision-making processes.
Short description of the subject content	Modelling and problem-solving by hand and with computational tools (formulation of linear programming models based on practical examples; graphical solution methods for two-variable problems; manual execution of simplex steps). Use of computer-based applications (solving linear and integer programming models with optimisation software; modelling and optimising transportation problems in practical contexts). Project and network-planning exercises (drawing and analysing networks; determining the critical path; calculating project durations and slack times; scheduling activities). Integer-programming exercises (modelling binary optimisation problems; solving assignment problems using the Hungarian method; working with small-scale instances of the travelling salesman problem).
Forms of student activity	Guided processing of theoretical material. Independent study of theoretical material. Guided problem-solving. Independent completion of problem-solving tasks. Text comprehension. Individual and group-based information processing. Articulation and discussion of differing viewpoints. Development of debating skills and argumentation techniques. Collaboration and teamwork within a group setting.
Required reading and availability	P. Rama Murthy: Operations Research, New Age International Publishers, 2007, ISBN: 978-81-224-2944-2 G. Srinivasan: Operations Research – Principles and Applications, PHI Learning, Private Limited, 2010, ISBN-978-81-203-4208-8
Recommended readings and availability	Saul J. Gass, Linear Programming, Methods and Applications, Dover Publications, Inc., Mineola, New York, 2003, ISBN: 0-486-43284-X
Description of tasks/measurement procedures to be submitted	As discussed during the first session.
Description and schedule of the midterm tests	Full-time students are required to complete two in-class assessments (in Weeks 6 and 11). Each assessment carries a maximum of 30 points. During the examination period, students take a final written exam worth 40 points (40%). Students must obtain at least 50% of the available points on each assessment, and the combined score of the two assessments must reach at least 51% of the total possible points. Part-time students are required to complete one in-class assessment, which carries a maximum of 40 points. During the examination period, students take a final written exam worth 60 points (60%). Students must achieve at least 50% of the available points on each assessment, and the total score must reach at least 51% of the possible points. The final grade is determined on the basis of the combined results of the in-class assessments and the written exam, as specified below. To obtain a passing grade, students must achieve at least 51% (51 points) of the maximum total score. A student who fails to complete all required in-class assessments during the semester receives a ‘Not Completed’ (Fail) entry.

	During the examination period, grades may be earned in accordance with the provisions of the Study and Examination Regulations. A comprehensive retake covering the entire course content is available during the examination period. The final grade is assigned according to the following scale: Score: 0 - 50 Grade: Fail (1); Score: 51 - 60 Grade: Pass (2); Score: 61 - 80 Grade: Satisfactory (3); Score: 81 - 90 Good (4); Score: 91 - 100 Grade: Excellent (5)
Framework and rules for the use of artificial intelligence	The use of artificial intelligence (AI) is partially permitted in this course. Students may use AI-based tools exclusively for the purpose of understanding the course material, independently processing theoretical content, and practising problem-solving techniques. This includes requesting explanations, visualizations, supporting examples, or alternative solution approaches. Permitted uses of AI include: – supporting the comprehension of theoretical material (explanations, supplementary examples); – checking practice exercises and exploring possible solution approaches; – assisting autonomous learning processes (e.g., conceptual clarification, visualization). Prohibited uses of AI: AI may not be used in any context that affects the evaluation of semester performance. It is strictly forbidden to: – use AI during in-class assessments, make-up tests, or retakes; – generate or revise homework, assignments, or any work submitted for evaluation using AI; – substitute in-class problem-solving with AI assistance; – automatically generate solutions or solution plans using AI tools.

IT Project 2

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Informatika projekt 2.</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">IT Project 2</td><td>Subject code</td><td>DUEN(L)-ISF-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">IT Project 1</td><td>Subject code</td><td>DUEN(L)-ISF-217</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>150/26</td><td>per Week</td><td>0</td><td>per Week</td><td>0</td><td>per Week</td><td>2</td><td>Midterm Mark</td><td>5</td><td>English</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per Semester</td><td>0</td><td>per Semester</td><td>0</td><td>per Semester</td><td>10</td><td></td><td></td><td></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="6">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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="5"></td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Lab</td><td colspan="5">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.</td></tr>
<tr><td>Misc.</td><td colspan="5"></td></tr>
<tr><td colspan="3">Requirements (expressed study results)</td><td colspan="6">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.</td></tr>
</table>

	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.
Framework and rules for the use of artificial intelligence	Partial authorization of artificial intelligence: Permission in preliminary work: - Generating research ideas, - Preliminary literature search with appropriate source criticism, Complete prohibition in the substantive part of scientific work. Permission in post-production: - rewriting text, - creating illustrative figures, - linguistic and stylistic checking.

Quality and Auditing of IT Critical Systems

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Informatikai rendszerek minőségbiztosítása és auditja</td><td>Level</td><td colspan="2">BSc</td></tr>
<tr><td>In English</td><td colspan="4">Quality and Auditing of IT Systems</td><td>Subject code</td><td colspan="2">DUEN(L)-ISR-164</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"></td><td>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 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>2</td><td>per Week</td><td>1</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>150/15</td><td>per Semester</td><td>10</td><td>per Semester</td><td>5</td><td>per Semester</td><td>0</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="3">Dr. Tibor Ujbányi</td><td>Position</td><td colspan="2">assistant professor</td></tr>
<tr><td colspan="3">Training course aims</td><td colspan="7">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.</td></tr>
<tr><td colspan="3" rowspan="4">Typical transfer methods</td><td>Theoretical</td><td colspan="6">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="6"></td></tr>
<tr><td>Lab</td><td colspan="6">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="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed study results)</td><td colspan="7">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.</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">Attitude

Open, inquisitive, constructive, efficient, creative.</td></tr>
<tr><td colspan="7">Autonomy and Responsibility

He takes responsibility, decides and manages independently in the given field.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Software quality assurance, security critical systems. IT system audit. IT systems testing, software testing. testing strategies. Case studies.</td></tr>
<tr><td colspan="3">Forms of student activity</td><td colspan="7">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.</td></tr>
<tr><td colspan="3">Required reading and availability</td><td colspan="7">Electronic materials in Moodle or Neptun systems.
Jerald Savin: IT Auditing – The Practitioner’s Guide to Reliable Information Automation, Routledge, 2025, ISBN: 978-1-032-67866-5</td></tr>
<tr><td colspan="3">Recommended readings and availability</td><td colspan="7"></td></tr>
<tr><td colspan="3">Description of tasks/measurement procedures to be submitted</td><td colspan="7">Project report based on the information provided in the first lesson.</td></tr>
</table>

Description and schedule of the midterm tests	Writing tests during the semester, with the possibility of retake, and a project report at the times specified in the first class.
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Software Development Technologies

<table>
<tr><td colspan="3" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="3">Szoftverfejlesztési technológiák</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="3">Software Development Technologies</td><td colspan="2">Subject code</td><td>DUEN(L)-ISF-117</td></tr>
<tr><td colspan="4">Responsible Educational unit name</td><td colspan="6">Institute of Informatics</td></tr>
<tr><td colspan="4">Name of the required preliminary study</td><td colspan="3">Programming 2</td><td colspan="2">Subject code</td><td>DUEN(L)-ISF-113</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 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 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 10</td></tr>
<tr><td colspan="4">Course leader</td><td>Name</td><td colspan="3">Dr. habil. József Katona</td><td>Position</td><td>associate professor</td></tr>
<tr><td colspan="4">Training course aims</td><td colspan="6">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.</td></tr>
<tr><td colspan="4" 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 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="5"></td></tr>
<tr><td colspan="4" rowspan="2">Requirements (expressed study results)</td><td colspan="6">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.</td></tr>
<tr><td colspan="6">Ability</td></tr>
</table>

	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.
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Programming 3.

<table>
<tr><td colspan="2" rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Programozás 3.</td><td>Level</td><td>BSc</td></tr>
<tr><td>In English</td><td colspan="4">Programming 3</td><td>Subject code</td><td>DUEN(L)-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>Subject code</td><td>DUEN(L)-ISF-213</td></tr>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="3">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 rowspan="2">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>5</td><td>English</td></tr>
<tr><td colspan="3">Course leader</td><td>Name</td><td colspan="2">Dr. habil. József Katona</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 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="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.

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="3" 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,</td></tr>
</table>

	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.
	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%)
Framework and rules for the use of artificial intelligence	During work carried out at home, the use of artificial intelligence tools is permitted for idea generation, planning, language and formatting support, as well as programming or technical assistance, provided that the student transparently discloses such use, critically reviews the output, and retains full academic responsibility for the submitted work, whereas the use of such tools is prohibited for all activities during class; the detailed requirements are explained by the instructor in the first class.

Web Programming

Subject name		In Hungarian		Web programozás						Level		**BSc**	
		In English		**Web Programming**						Subject code		**DUEN(L)-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** - Short objective: what students will be able to do and why it is important: The student should understand the elements of web-based server-side programming and become familiar with a weakly typed language. They should use and integrate previously learned client-side scripting languages and databases into a PHP program. - Prerequisites and related development objectives Students have primarily developed algorithmic thinking skills within the framework of scientific subjects. Previously, they have written structured and object-oriented programs in C-based languages and have become familiar with client-side markup and scripting languages, which enable them to create static web pages. In addition, they have acquired the fundamental knowledge of SQL and database management. - The educational methodology follows theoretical instruction in lectures. In laboratory sessions, students learn PHP by writing short programs. The course provides both theoretical and practical knowledge.	
Typical transfer methods	Theoretical	
	Practice	
	Lab	Problem-solving under the supervision of instructors during practice sessions. Assignments are implemented in PHP on the University's web server. The projector and instructor computer are used in every practical session.
	Misc.	
Requirements (expressed study results)	**Knowledge** The students completing the course will - Know the basic PHP statements. - Know how to use PHP built-in functions. - Know the basics and possibilities of PHP OOP. - Know the fundamental security measures in PHP.	
	Ability - 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	2 homework assignments
Description and schedule of the midterm tests	6, 12 week retake midterm: 13. week
Framework and rules for the use of artificial intelligence	Partial permission: the use of artificial intelligence is permitted for certain types of tasks (e.g., in-class work, assignments), but prohibited in other cases (e.g., midterm examinations).