2026

Mechanical Engineering MSc

STUDY PROGRAM

UNIVERSITY OF DUNAÚJVÁROS

Content

COURSE DESCRIPTION

Mechanical Engineering Master's Course (Mechanical Engineering)	
Institution responsible for education	University of Dunaújváros
ID of institution	FI60345
Address	2400 Dunaújváros, Táncsics Mihály utca 1/A
Responsible leader	István András, Dr. habil. Rector
Leaders responsible for education	
Institution responsible for course	Technical Institute
Director of institute	Róbert Sánta Dr. habil.
Responsible for course	Andras Nagy Dr. PhD
Specialisations	
Lifetime management specialization	Andras Nagy Dr. PhD
Modern material structure and technology specialization	Judit Pazman Dr. PhD
Parameters of education	
Level of education	Master education
Educational level	Master's degree (MSc)
Qualification indicated in the diploma in Hungarian	okleveles gépészmérnök
Qualification indicated in the diploma in English	Mechanical Engineer
Time of education	4 semesters
Number of credit scores to be acquired	120 credit

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Condition for admission	
a) To be considered for full credit: bachelor's degree in mechanical engineering.	
b) To be admitted to the master's programme, you must have obtained at least 40 credits (including at least 12 credits in mathematics, at least 5 credits in physics and at least 20 credits in professional studies) out of the 70 credits listed below: - 20 credits in basic sciences (mathematics, physics, mechanics, materials science, thermodynamics); - 10 credits in economic and human sciences (economics, management, environment, quality assurance, occupational health and safety, social sciences); - 40 credits in the field of professional knowledge (general engineering, machine and product design, structural engineering, materials science and technology, information technology, measurement and signal processing, control engineering, safety engineering, energy technology, machinery and processes, production technology, production automation, quality assurance, logistics, vehicles and mobile machinery, chemical and environmental processes, electrical engineering and electrical engineering). In the master's programme, the missing credits in the listed areas must be acquired in accordance with the study and examination regulations of the higher education institution.	
c) To the input b. The input can be primarily counted by completing the credits specified in b: from the engineering field of study, materials engineering, safety engineering, military and security engineering, light industrial engineering, civil engineering, engineering geology, engineering management, chemical engineering, environmental engineering, energy engineering, industrial product and design engineering, transport engineering, automotive engineering, mechatronics engineering, electrical engineering, and agricultural engineering in the field of agricultural engineering.	
Professional practice	The professional practice shall take at least 4 weeks
Prerequisite(s) for starting the internship	The prerequisite for starting the internship is 1 completed semester and a minimum of 20 credit points.
The earliest date and conditions for acceptance of internship based on work experience.	The recognition of the internship based on professional work experience may be requested if the student can demonstrate that their previous or current employment is professionally aligned with the learning outcomes and competency requirements of the program. The student may initiate the request for recognition after enrolling in the internship course by contacting the course coordinator.
Conditions for issuing the Final certificate (absolutorium)	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.
Diploma work	The diploma work consists in the solution of a mechanical engineering task or elaboration of a research task arising in a specific professional field that, relying on the knowledge acquired by the student during his/her studies, can be completed during a semester by means of studying additional special literature and under the management of internal and industrial consultants. By means of the

	diploma work, the candidate certifies that he/she obtained adequate skill in the practical application of the knowledge acquired, is capable of performing mechanical engineering tasks and, in addition to the curriculum, is also familiar with and capable of applying other professional literature in a value crating way. Formal requirements: the size of diploma work shall be 50 to 70 pages.
Prerequisites of the 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)
Operation of Industrial Systems specialization	DUEN(L)-MUG-150 Lifetime management DUEN(L)-MUG-255 Maintenance strategies DUEN(L)-MGT-261 Machine and Structural Health Monitoring
Modern material structure and technology specialization	DUEL-MGT-110 Information technology in materials science DUEL-MUA-111 Material and Structure Analysis DUEL-MGT-011 Innovative applications of polymers and composites
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 diploma	excellent 4.51 – 5.00; good 3.51 – 4.50; average 2.51 – 3.50; acceptable 2.00 – 2.50
Conditions for issuing a diploma	The precondition of the issue of certificate to prove the completion of higher educational studies is the successful final exam.
Work order	Full-time (regular)

Required engineering competences

Knowledge:

- Know the general and specific mathematics, natural and social sciences principles, rules, relationships and procedures for the technical field of agriculture.
- Comprehensive understanding of global social and economic developments. - Do you know the theories, and the relationship between them make up the terminology is essential in technical areas.
- Know and understand the technical field of activities for knowledge and basic facts, and the limits of the expected directions of progress and development.
- Knowledge and understanding related to the technical area and the occupation of a key importance in other areas (mainly in logistics, management, environmental protection, quality control, information technology, legal, economic, labor and fire protection, safety areas) terminology, the main specifications and criteria.
- In-depth knowledge and understanding of knowledge acquisition, data collection methods in the technical field, their ethical constraints and problem-solving techniques.
- A comprehensive overview of important structural properties of materials used in mechanical and areas of application.
- Details of the rules of the technical documentation created. Familiar productivity tools and methods necessary for the occupation specialty legislation related to driving.
- Provides a related engineering field measurement and test theoretical knowledge. - Do you know a related engineering field of information and communication technologies.
- Know and understand the related computer modeling and simulation engineering skill of the art tools and methods.
- Wide range of theoretical and practical preparedness, methodological and practical knowledge of complex engineering systems and processes for the design, production, modeling, operation and management.
- Comprehensive knowledge of Mechanical design of machines, systems and process design methods.

Skills:

- Technical problems solving in field gained the ability to apply general and specific mathematics, natural and social sciences principles, rules, relationships and processes.
- Ability of the relevant technical field theories and related terminology when applied to solve problems in innovative ways.
- Ability to specific problems in the field of professional and versatile interdisciplinary approach to solve.
- The ability to organize in cooperation with experts from the related disciplines in problem solving.
- The use of modern methods of data acquisition to knowledge and innovative ways to be able to solve specific technical problems arising in the art.
- Can information and communication technologies and methods used to solve technical problems.
- Are you ready to trade territory, language and conduct at least one foreign language publications, presentations and business negotiations.
- After due practice is able to perform managerial tasks.
- Laboratory testing and analysis, evaluation and documentation of test results Able materials used in the engineering field.
- Are you ready to process and organize information gathered during the operation of engineering systems and processes to analyze, draw conclusions.
- Ability to original ideas to enrich the knowledge base of engineering sciences.

- Ability to apply integrated knowledge of machinery, mechanical equipment, systems and processes in engineering materials and technologies, and related areas of electronics and information technology professionals.
- Ability Based on a system-oriented, process-oriented way of thinking global design complex systems to learn.
- Ability to plan and manage complex technical, economic, environmental, and human resource utilization.
- Ability to design engineering systems and processes, used for organizing and operating procedures, models, their application and further development of information technologies.
- Ready for mechanical systems, technologies and processes, quality assurance, metrology, and process control for solving tasks you.
- Ability to deal with problems in creative and flexible to solve complex tasks, as well as lifelong learning and commitment to diversity and value-based side.

Attitude:

- An open and receptive to learn and adopt credible mediation of the technical field in a professional, technological development and innovation.
- It takes a professional and ethical values related to the technical area.
- Seek technical areas related to the development of new methods and tools to collaborate. Mind profound vocation.
- Striving to both its own staff and continuous self-knowledge and training to develop.
- Endeavor to respect the work and organizational culture of ethical principles are complied with.
- Strives to comply with the quality requirements are complied with.
- Strives for environmental awareness, according to health awareness and sustainability expectations organize and carry out tasks.
- Seek a broad, comprehensive literacy acquisition.
- Shall be guided by the requirements of sustainability and energy efficiency.
- Seek professional work individually or in groups to plan and execute the tasks at a high level.
- Striving to perform the work of a complex approach based on system-based and process-oriented way of thinking.
- Examining the possibility of setting the research, development and innovation objectives in its work and seek to implement them.
- Work towards the application of acquired technical knowledge of observable phenomena thorough knowledge of, the laws of the description, to explain.
- Committed to high standards, quality work toward, shows an example of staff for the purposes of this approach.
- Committed to the expansion of new areas of mechanical engineering knowledge with scientific evidence.
- Mechanical power turn-themed research and development projects, to achieve this goal, in cooperation with members of the development team will mobilize theoretical and practical knowledge and skills.
- Committed to the health and safety culture towards health promotion.

Autonomy and responsibility

- Knowledge and experience acquired in formal, non-formal and informal sharing of information reporting forms specializes in cultivating.

- Evaluate the work of his subordinates, critical comments of sharing promotes professional development.
- Independently be able to solve engineering problems.
- Assume a proactive role in solving technical problems.
- Take responsibility for part of the process taking place under his command.
- Working independently in the field to professional decisions.
- Responsible colleagues and subordinates and encourage ethical profession.
- Work in solving problems independently and proactively occurs.
- Bears responsibility for sustainability, occupational health and safety culture and awareness towards the environment.
- The decisions carefully, to other areas of expertise (mainly legal, economic, energy and environmental) in consultation with representatives be autonomous, assume any liability.
- In making its decision takes account of environmental protection, quality management, consumer protection, product liability, the principle and application of equal access, occupational health and safety, technical, economic and legal regulations, as well as engineering ethics basic specifications.

DAYTIME MECHANICAL ENGINEERING MASTERS COURSE

Full time	Mechanical Engineering MSc															
Subject code	**Subject name**	**Credit**	**Requirement**	**Semesters - Classes per week**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
–	Specialisation	5	–	–	–	–										–
DUEN-IMA-150	Mathematics (M) 1.	5	E	2	1	0										–
DUEN-MGT-250	Energetics and Environmental Politics	5	E	2	1	0										–
DUEN-MUA-152	Up-to-date Material and Production Technologies	5	E	2	0	1										–
DUEN-MUG-116	Measuring Technologies and Signal Processing	5	M	1	0	2										–
DUEN-MUG-154	Mechanics	5	E	2	2	0										–
–	Specialisation	10	E				–	–	–							–
DUEN-MUT-152	Engineering Heat and Fluid Dynamics	5	E				2	0	1							–
DUEN-MUA-254	The Damage of Engineering Materials	5	E				2	1	0							–
DUEN-MUT-150	Physics	5	E				1	1	1							–
DUEN-TVV-252	Management Skills	5	E				2	1	0							–
–	Specialisation	5	M							–	–	–				–
DUEN-MUG-095	Project Tasks	5	S							0	5	0				–
DUEN-MUG-096	Degree Planning 1.	10	M							0	4	0				–
DUEN-MGT-159	Automated industrial systems	5	E							2	0	1				–
–	Optimal corse - specialization	5	–							–	–	–				–
DUEN-MGT-223	Industrial Energy Systems	5	E										2	1	1	–
–	Specialisation	5	–										–	–	–	–
DUEN-MGT-000	Internship (4 weeks)	0	S										0	0	0	–
DUEN-MUG-097	Degree Planning 2.	20	M										0	12	0	–
	Number of Theoretical/Practice/Lab classes per week			9	4	3	7	4	2	2	9	1	2	13	1	
	Total number of classes per week			**16**			**13**			**12**			**16**			
	Total credit points			**120**												
OPERATION OF INDUSTRIAL SYSTEMS				2	1	0	4	1	1	0	0	0	2	0	1	
				3			**6**			**0**			**3**			
				19			**19**			**12**			**19**			
MODERN MATERIALS SCIENCE AND TECHNOLOGIES				2	1	0	4	0	2	0	0	0	2	0	1	
				3			**6**			**0**			**3**			
				19			**19**			**12**			**19**			

OPERATION OF INDUSTRIAL SYSTEMS																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MUG-150	Lifetime management	5	E	2	1	0										-
DUEN-MUA-256	Assembly and Repairment Technologies	5	E				2	0	1							-
DUEN-MGT-158	Building energy	5	E				2	1	0							-
-	Specializációs szabadon választható	5	-							-	-	-				-
DUEN-MGT-261	Machine and Structural Health Monitoring	5	E										2	0	1	DUEN-MUG-116
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	1	1	0	0	0	2	0	1	
	Total number of classes per week			**3**			**6**			**0**			**3**			
	Total credit points			**25**												

MODERN MATERIALS SCIENCE AND TECHNOLOGIES																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MGT-110	Information technology in materials science	5	M	2	1	0										-
DUEN-MST-214	Computer Image Analysis and Measurement Techniques	5	M				2	0	1							-
DUEN-MUA-111	Material and Structure Analysis	5	M				2	0	1							-
-	Specializációs szabadon választható	5	-							-	-	-				-
DUEN-MGT-011	Innovative application of polymers and composites	5	M										2	0	1	-
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	0	2	0	0	0	2	0	1	
	Total number of classes per week			**3**			**6**			**0**			**3**			
	Total credit points			**25**												

OPERATION OF INDUSTRIAL SYSTEMS - Optimal corse - specialization																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MUA-112	Weldability	5	M							2	0	1				-
DUEN-MUA-115	Special Materials and Technologies	5	M							2	0	1				-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0	
	Total number of classes per week			**0**			**0**			**6**			**0**			
	Total credit points			**10**												

MODERN MATERIALS SCIENCE AND TECHNOLOGIES - Optimal corse - specialization																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MGT-224	Physical simulation in materials science	5	M							2	0	1				-
DUEN-MST-110	Nanotechnology	5	M							2	0	1				-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0	
	Total number of classes per week			**0**			**0**			**6**			**0**			
	Total credit points			**10**												

Optimal corse - master																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MST-213	Experimental Design in Mechanical Testing	5	M										2	1	0	-
DUEN-MUG-220	Computer and modelling simulation	5	M										1	0	2	-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	3	1	2	
	Total number of classes per week			**0**			**0**			**0**			**6**			
	Total credit points			**10**												

Full time	Mechanical Engineering MSc															
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
–	Specialisation	5	–	–	–	–										–
DUEL-IMA-150	Mathematics (M) 1.	5	E	0	0	0										–
DUEL-MGT-250	Energetics and Environmental Politics	5	E	0	0	0										–
DUEL-MUA-152	Up-to-date Material and Production Technologies	5	E	0	0	0										–
DUEL-MUG-116	Measuring Technologies and Signal Processing	5	M	0	0	0										–
DUEL-MUG-154	Mechanics	5	E	0	0	0										–
–	Specialisation	10	E				–	–	–							–
DUEL-MUT-152	Engineering Heat and Fluid Dynamics	5	E				0	0	0							–
DUEL-MUA-254	The Damage of Engineering Materials	5	E				0	0	0							–
DUEL-MUT-150	Physics	5	E				0	0	0							–
DUEL-TVV-252	Management Skills	5	E				0	0	0							–
–	Specialisation	5	M							–	–	–				–
DUEL-MUG-095	Project Tasks	5	S							0	5	0				–
DUEL-MUG-096	Degree Planning 1.	10	M							0	4	0				–
DUEL-MGT-159	Automated industrial systems	5	E							2	0	1				–
–	Optimal corse - specialization	5	–							–	–	–				–
DUEL-MGT-223	Industrial Energy Systems	5	E										2	1	1	–
–	Specialisation	5	–										–	–	–	–
DUEL-MGT-000	Internship (4 weeks)	0	S										0	0	0	–
DUEL-MUG-097	Degree Planning 2.	20	M										0	12	0	–
	Number of Theoretical/Practice/Lab classes per week			9	4	3	7	4	2	2	9	1	2	13	1	
	Total number of classes per week			**16**			**13**			**12**			**16**			
	Total credit points			**120**												
OPERATION OF INDUSTRIAL SYSTEMS				2	1	0	4	1	1	0	0	0	2	0	1	
				3			**6**			**0**			**3**			
				19			**19**			**12**			**19**			
MODERN MATERIALS SCIENCE AND TECHNOLOGIES				2	1	0	4	0	2	0	0	0	2	0	1	
				3			**6**			**0**			**3**			
				19			**19**			**12**			**19**			

OPERATION OF INDUSTRIAL SYSTEMS																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MUG-150	Lifetime management	5	E	2	1	0										−
DUEL-MUA-256	Assembly and Repairment Technologies	5	E				2	0	1							−
DUEL-MGT-158	Building energy	5	E				2	1	0							−
−	Specializációs szabadon választható	5	−							−	−	−				−
DUEL-MGT-261	Machine and Structural Health Monitoring	5	E										2	0	1	DUEN-MUG-116
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	1	1	0	0	0	2	0	1	
	Total number of classes per week			3			6			0			3			
	Total credit points			25												

MODERN MATERIALS SCIENCE AND TECHNOLOGIES																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MGT-110	Information technology in materials science	5	M	2	1	0										−
DUEL-MST-214	Computer Image Analysis and Measurement Techniques	5	M				2	0	1							−
DUEL-MUA-111	Material and Structure Analysis	5	M				2	0	1							−
−	Specializációs szabadon választható	5	−							−	−	−				−
DUEL-MGT-011	Innovative application of polymers and composites	5	M										2	0	1	−
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	0	2	0	0	0	2	0	1	
	Total number of classes per week			3			6			0			3			
	Total credit points			25												

OPERATION OF INDUSTRIAL SYSTEMS - Optimal corse - specialization																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MUA-112	Weldability	5	M							2	0	1				−
DUEL-MUA-115	Special Materials and Technologies	5	M							2	0	1				−
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0	
	Total number of classes per week			0			0			6			0			
	Total credit points			10												

MODERN MATERIALS SCIENCE AND TECHNOLOGIES - Optimal corse - specialization																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MGT-224	Physical simulation in materials science	5	M							2	0	1				−
DUEL-MST-110	Nanotechnology	5	M							2	0	1				−
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0	
	Total number of classes per week			0			0			6			0			
	Total credit points			10												

Optimal corse - master																
Subject code	Subject name	Credit	Requirement	Semesters - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MST-213	Experimental Design in Mechanical Testing	5	M										2	1	0	−
DUEL-MUG-220	Computer and modelling simulation	5	M										1	0	2	−
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	3	1	2	
	Total number of classes per week			0			0			0			6			
	Total credit points			10												

SUBJECT MATTER PROGRAMS, DESCRIPTIONS OF SUBJECTS MATTERS

Mathematics (M) 1.3

<table>
<tr><td rowspan="2">Title of the subject</td><td colspan="2">Hungarian</td><td colspan="4">Matematika (M) 1.</td><td>Level</td><td colspan="2">MSc</td></tr>
<tr><td colspan="2">English</td><td colspan="4">Mathematics (M) 1.3</td><td>Code</td><td colspan="2">DUEN(L) -IMA- 150</td></tr>
<tr><td colspan="3">Responsible Academic Unit</td><td colspan="7">Institute of Information Technology</td></tr>
<tr><td colspan="3">Compulsory prerequisite subject:</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Lecture</td><td colspan="2">Seminar</td><td colspan="2">Lab</td><td>Requirements</td><td>Credit</td><td>Language of instruction</td></tr>
<tr><td>Full time</td><td>150/39</td><td>Per semester</td><td>30</td><td>Per semester</td><td>15</td><td></td><td>0</td><td>Exam</td><td>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></td><td>0</td><td></td><td></td></tr>
<tr><td colspan="3">Person responsible for the subject:</td><td>name:</td><td colspan="3">Zoltán Papp, Dr.</td><td>position:</td><td colspan="2">Associate professor</td></tr>
<tr><td colspan="3">Lecturer:</td><td>name:</td><td colspan="3">Zoltán Papp, Dr.</td><td>position:</td><td colspan="2">Associate professor</td></tr>
<tr><td colspan="3">Course objectives and justification (content, learning outcomes, place in curriculum)</td><td colspan="7">Objectives and development goals
The aim of the course is to provide students with an advanced set of mathematical tools for the analytical and computational solution of engineering problems. The course deepens students' knowledge of complex function theory, differential equations, the Laplace transform, and Fourier analysis, and demonstrates their applications in modelling and computational tasks arising in mechanical engineering practice.

The course builds upon the mathematical knowledge acquired in the undergraduate mechanical engineering curriculum, with particular emphasis on analysis, linear algebra, differential and integral calculus, and the basic concepts of probability theory. Students are expected to have prior familiarity with the fundamentals of mathematical modelling of engineering problems, the elementary application of function analysis and differential equations, as well as the consistent use of computational techniques.
The aim of the course is to deepen students' mathematical proficiency in ways that enable the advanced analytical and numerical treatment of contemporary mechanical engineering problems. The course develops students' ability to apply differentiation and integration methods for complex-valued functions, to solve special differential equations and boundary-value problems, and to employ Laplace- and Fourier-based techniques effectively in the modelling of engineering systems. It also enhances students' competence in using statistical and probabilistic tools for engineering data analysis.
A central objective of the course is to equip students with robust and comprehensive mathematical foundations, empowering them to describe, model, and analyse complex mechanical phenomena, and to apply the mathematical toolkit at the MSc level effectively in both research and engineering development tasks.</td></tr>
<tr><td colspan="3" rowspan="4">Typical lesson types:</td><td>Lecture</td><td colspan="6">During the explanatory lectures held in the large lecture hall, students are introduced to the theoretical foundations of the subject. The instructor employs board demonstrations and multimedia tools (projector) to present complex mathematical concepts, theorems, and methods in a clear and structured manner. The focus is on the systematic exposition of concepts, relationships, and procedures.</td></tr>
<tr><td>Seminar</td><td colspan="6">The practical sessions are conducted in small-group classroom settings, where students reinforce and deepen the methods introduced in the lectures through guided and independent problem-solving. The emphasis is placed on mastering computational techniques, developing step-by-step problem-solving procedures, and understanding the key ideas behind proofs and solution strategies.</td></tr>
<tr><td>Lab</td><td colspan="6">-</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="3">Requirements</td><td colspan="7">Knowledge</td></tr>
</table>

(in learning outcomes)	The student is familiar with the fundamental concepts and definitions related to complex-valued functions, as well as their differentiation and integration rules. They understand the significance of the Cauchy–Riemann equations and the properties of analytic, harmonic, and meromorphic functions. The student possesses knowledge of the theory of complex integration, including Cauchy's integral theorem, integral formulas, the methods of Taylor and Laurent series expansions, and the residue theorem together with its applications. They understand the role and use of conformal mappings in applied mathematics, particularly with respect to transformations and the preservation of geometric properties. The student has comprehensive knowledge of the theory and properties of the Laplace transform, as well as its practical application in solving linear differential equations. They are familiar with the probability distributions most commonly encountered in engineering applications, the methods of estimating distribution parameters, the techniques used for approximating distributions, and the application of these concepts in engineering problem-solving.
	Skills The student is able to apply the concepts, definitions, and properties related to complex-valued functions. They can carry out complex differentiation and integration tasks and make use of Cauchy-type theorems and series expansions in solving practical problems. The student is capable of applying residue calculus, evaluating complex integrals, and utilising these methods in engineering contexts. They are able to solve linear differential equations using the Laplace transform. The student can apply their knowledge of probability distributions and parameter-estimation techniques in engineering data analysis, modelling, and verification tasks.
	Attitude The student is open to acquiring advanced mathematical methods, techniques, and theoretical results, particularly their practical engineering applications in complex function theory, differential equations, and probability theory. They strive for a deeper understanding of modern applied mathematical tools and special functions, and are committed to applying these in the solution of engineering problems. The student values precise, logical, and systematic modes of reasoning, which form the foundation of engineering modelling and computational tasks.
	Autonomy and responsibility The student independently performs the analysis of complex mathematical problems, selects appropriate methods, and designs the solution process, even in unexpected or novel engineering situations. They assume responsibility for the accuracy of their calculations, analyses, and mathematically grounded professional conclusions, as well as for the implications of their application in engineering decisions. The student is capable of autonomous professional decision-making, particularly when applying concepts from complex function theory, differential equations, Laplace-based methods, and probabilistic techniques. They consistently verify and validate their own solutions, identify and correct errors, and, when necessary, adopt alternative solution strategies.
Short description of subject content	Probability Theory: notable probability distributions occurring in engineering practice and their applications. Elementary complex functions: limits and continuity. Differentiability of complex functions: Cauchy–Riemann equations, harmonic functions, analytic functions, Taylor series. Integration of complex functions: Cauchy's integral theorem, Cauchy integral formulas, Liouville's theorem; meromorphic functions, Laurent series, residue theorem and its applications. Conformal mappings. Laplace transform: convolution. Solution of linear differential equations using the Laplace transform.
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 context.
Required reading and resources	Dean G. Duffy: Advanced Engineering Mathematics, CRC Press, 1998, ISBN: 0-8493-7854-0 Douglas C. Montgomery, George C. Runger: Applied Statistics and Probabaility for

	Engineers, 2003, John Wiley and Sons, Inc., ISBN 0-471-20454-4
Recommended reading and resources	Lars V. Ahlfors: Complex Analysis – An Introduction to the Theory of Analytic Functions of One Complex Variable, 1979, McGraw-Hill, Inc., ISBN 0-07-000657-1
Assignments	As discussed during the first session.
Description and schedule of exams	Full-time students are required to complete two in-class assessments (in Weeks 6 and 12). Each assessment carries a maximum of 25 points. During the examination period, students take a final written exam worth 50 points (50%). 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 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.
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.

Energetics and Environmental Policy

Subject name	In Hungarian	Energetika és környezetpolitika	Level	MSc
	In English	Energetics and Environmental Policy	Code	DUEN(L)-MGT-250
2026/2027 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	1	Per week	0	E	5	English
Part time	150/15	Per semester	10	Per semester	5	Per semester	0			

Person responsible for the subject:	name	Petrovickijné, Ildikó Angerer, PhD	position	associate professor

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to understand the fundamentals of energy, its impact on the environment, and how to align corporate environmental policy objectives to help solve global environmental problems.	
	Objectives and development goals	
	The aim of the course is to familiarize the student with the problems of environmental protection related to energy management, environmental management systems and environmental policy.	
Typical delivery methods	Lecture	For all students in a large lecture hall or on-line with MS PowerPoint presentation. Use of projector or MS Teams programme.
	Seminar	For all students in a lecture room with projector or on-line by MS Teams programme.
	Lab	-
	Other	-
Requirements (in learning outcomes)	**Knowledge**	
	A comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering and economics. Knowledge of the general and specific rules, contexts and procedures necessary for the operation of the field of engineering. Comprehensive knowledge of the main theories and problem-solving methods in the field. Has an applied knowledge of the measurement procedures used, their tools, instruments and measuring equipment. Understand, characterise and model the structure and function of the structural units and elements of systems, the design and interrelationship of the system elements used. The student will learn about energetics, environmental management systems and environmental policy.The student will understand what it means to balance needs and environmental opportunities; The student will recognise the links between natural resources and the economy-society.	
	Ability The student can to consider environmental or social, economic energy choices and their consequences through examples; The student can explore the systemic relationships between nature, his/her own life and the environment. The student is able to analyse at a basic level the disciplines that make up the knowledge base of technical and economic disciplines, to synthesise interrelationships and to make appropriate evaluations. The student is able to apply the most important terminologies, theories and procedures of the technical discipline in the performance of related tasks. The student is able to plan, organise and conduct independent learning. The student is able to	

	identify routine technical problems and to identify, formulate and solve (by the practical application of standard operations) the theoretical and practical background required to solve them. The student is able to understand and use literature, computer and library resources specific to the field. The student is able to apply the acquired IT knowledge to the solution of problems in the field. The student is able to construct basic models of systems and processes. The student is able to communicate orally and in writing in his/her mother tongue in a professionally appropriate manner in his/her field of specialisation.
	Attitude By the end of the course, students should be committed to the preservation of environmental values and the environmentally responsible use of energy. The student will take responsibility for the preservation of his/her own activities and the natural environment, and for cooperation with the social environment. The student assumes and authentically represents the social role of its profession and its fundamental relationship with the world. Open to learning about, accepting and authentically communicating professional and technological developments and innovations in the field of engineering. Seeks to solve problems, preferably in cooperation with others. Have the stamina and tolerance of monotony to carry out practical activities. Applies his/her acquired technical knowledge to gain a thorough understanding of observable phenomena, to describe and explain their laws. complies with and observes the relevant safety, health, environmental, quality assurance and control requirements.
	Autonomy and responsibility The student can make independent decisions; take responsibility. Independently thinks through and develops comprehensive, well-founded professional questions based on given sources, even in unexpected decision-making situations. In the performance of his/her professional duties, he/she will also cooperate with qualified professionals from other disciplines (primarily technical, economic and legal). He/she will share his/her experience with his/her colleagues, thus contributing to their development. He/she is responsible for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes.
Short description of subject content	Basic energy production processes and their environmental impact. Introduction to and comparison of fossil, renewable and nuclear energy production. Introduction to environmental management. Introduction to the basic principles of environmental policy. The relationship between environmental audits and environmental policy. Life cycle analysis and its use.
Types of student activity	Presentation: Processing of heard text with notes 40%, independent processing of theoretical material 20%, Exercise: 40%. Listen to lectures, give small presentations, discuss. Preparation at home.
Required reading and resources	Endre Kiss: Environmental protection and energy management (electronic note) Petrovickijné, Ildikó Angerer Handbook and lecture notes: Moodle system Moser M.,Pálmai Gy.: The Basics of Environmental Protection National Textbook Publisher, Budapest, 1992 U. Förstner: Environmental Technology, Springer-Verlag Budapest, 1993 U. U. Peststner, U.S. University of Applied Sciences, Budapest, 2000
Recommended reading and resources	Teaching materials and catalogues on Moodle system, materials in foreign languages
Assignments	As stated in the first lesson. During the semester 2 essays and 2 PowerPoint presentations to be submitted on a topic of your choice.
Description and schedule of exams	As stated in the first lesson. By the end of the study period, 2 mid-year assignments/projects/evening studies must be prepared and submitted in pre-specified elective topics. If the arithmetic average of the scores of the two mid-term assignments/case studies does not reach 51%, the grade can be obtained in a written exam during the exam period according to the score limits specified in the Study and Examination Regulations. The conditions for signing and registering for the exam is:

	Writing and submitting 2 mid-year independent assignments/theses/case studies in electronic form. During the semester period a total of 2 independent project papers/case studies and 2 PowerPoint presentations of your choice on topics related to Energetics and Environmental Policy.
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted for mid-year assignments, project work, papers, and presentations, primarily as a supplement to and verification of independent work, with appropriate citation and source identification. . Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student's own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student.

Up-to-date Material and Production Technologies

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="3">Korszerű anyag- és gyártástechnológiák</td><td>Level</td><td>MSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="3">Up-to-date Material and Production Technologies</td><td>Code</td><td>DUEN(L)-MUA-152</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="5">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="5"></td></tr>
</table>

<table>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</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 rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>0</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Gábor Vizi, PhD</td><td>schedule</td><td>college teacher</td></tr>
</table>

<table>
<tr><td>Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="2">Goals, development objectives
By mastering the material of the subject, students learn about today's modern material separation technologies, as well as the special technologies with which modern structural materials can also be processed,</td></tr>
<tr><td rowspan="4">Typical delivery methods</td><td>Presentation</td><td>For all students, using a large speaker, a board presentation, a projector or an overhead projector</td></tr>
<tr><td>Practice</td><td>Small-room board exercises for up to 20 people</td></tr>
<tr><td>Laboratory</td><td></td></tr>
<tr><td>Other</td><td></td></tr>
<tr><td rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="2">Knowledge
He knows the fundamental theories and relationships of the technical field and the terminology that builds them up. Knows and understands the basic facts, limits and expected directions of development and development of the knowledge and activity system of the technical field.</td></tr>
<tr><td colspan="2">Ability
Capable of designing, organising and performing self-study.
It is capable of identifying routine professional problems, identifying, formulating and resolving the practical and practical background necessary to resolve them (using standard operations in practice).
Capable of creating basic models of technical systems and processes.</td></tr>
<tr><td colspan="2">Attitude
It shall endeavour to contribute to the development of new methods and tools related to the technical field. His sense of vocation deepened.
o - Strives to develop both your own knowledge and your staff's knowledge through continuous self-training and training.
o - Strives to comply with and enforce the ethical principles of the culture of work and organisation.
o - Strives to comply with and enforce quality requirements.
o - Strives to acquire a wide range of comprehensive literacy.</td></tr>
<tr><td colspan="2">Autonomy and responsibility
Even in unexpected decision-making situations, it independently takes a look at the broad, underlying professional issues and development on the basis of specific sources.
In carrying out his professional duties, he also cooperates with qualified professionals in other fields (primarily technical, economic and legal).
Share your experiences with colleagues to help them grow.
It takes responsibility for the consequences of its technical analyses, its proposals and the decisions that are taken.</td></tr>
<tr><td>Short description of the subject content</td><td colspan="2">Overview of modern cutting operations. High-speed cutting, high-speed milling, characteristics and areas of application. Ultra-precision and micro machining. Characteristics and application of hard machining. Nanotechnologies. Grouping and characteristics of high energy density machining utilizing different physical principles. Modern processing methods with high energy density. Mechanical, chemical and thermal energy utilization processes. Characteristics of radial machining. Characteristics and applications of ultrasonic machining, abrasive water jet cutting. Electroerosion machining. Processing with plasma and laser. Processing with electron and ion beams</td></tr>
</table>

Types of student activities	Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%.
Required reading and resources	• 1. Takács János: Korszerű technológiák a felülettulajdonságok alakításában, Műegyetemi Kiadó, 2004, p346 • 2. Niebel-Draper-Wysk: Modern manufacturing process Engineering, Mc Graw-Hill Publishing Company 1989, p986.
Recommended reading and resources	• 1. Dudás I.: Gépgyártástechnológia III. A megmunkáló eljárások és szerszámaik. Fogazott alkatrészek gyártása és szerszámaik. Miskolci Egyetemi Kiadó, 2003., p539 • 2. Dudás Illés: Gépgyártástechnológia I., Gépgyártástechnológia alapjai, Miskolci Egyetemi Kiadó, Miskolc, 2000. • 3. T. Jagadeesha: Non-Traditional Machining Processes, I K International Publishing House, 2016, p268
Assignments	
Description and schedule of exams	
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is not permitted

Measuring Techniques and Signal Processing

Subject name	In Hungarian	Méréstechnika és jelfeldolgozás					Level		MSc
	In English	Measuring Techniques and Signal Processing					Code		DUEN(L)-MUG-116
2025/2026 I.									
Responsible educational unit		Institute of Technology, Department of Mechanical and Energy Engineering							
Compulsory prerequisite subject:		…							

Type	Number of lessons						Requirement	Credit	Language of education
	Lecture		Seminar		Lab				
Full time	Per week	3	Per week	0	Per week	1	V	5	English
Part time	Per semester	15	Per semester	0	Per semester	5			

Person responsible for the subject:	name	dr. Gabor PÓR	position	professor emeritus

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective Based on the understanding of the relationships between measurement and modelling, the student should be able to plan independent measurements, including the application of modern signal processing and interpretation knowledge.	
	Objectives and development goals We train students to develop the previous basic traditional measurement technology into modern, computational methods and models-based industrial measurement technology. During this, they will learn in detail the FFT techniques that are now widespread in industrial practice. But they will also learn the basics of methods and procedures that are currently only used at the mathematical and research level but will soon become industrial practice. The student will be able to manage measurement technology laboratories and introduce new measurement technology procedures.	
Typical delivery methods	Lecture	- A lecture hall for all students, with a whiteboard. Use of a projector
	Seminar	-N/A
	Lab	-
	Other	-In groups of 2, LABVIEW programming and measurement, with home processing
Requirements (in learning outcomes)	**Knowledge** He/She is familiar with signal processing and evaluation methods based on modern computer technology, especially spectral methods based on the Fourier technique, but also autoregressive, fuzzy and neural network models. He/She is confident in the methodology and technique of Fourier transformations. He/She can design measurement procedures and prescribe measurement sheets for subordinate engineers. He/She can confidently design the measurement uncertainty procedures and steps necessary for quality assurance in the evaluation of measurements.	
	Ability Able to plan and implement new measurement techniques. Able to professionally evaluate measurements, check and approve them. Able to plan, execute and review measurement protocols. Gained the ability to learn about future new methods and to creatively implement them in future work areas.	
	Attitude In addition to performing measurements based on previous specifications, he/she takes a critical approach to the procedures prescribing the measurements, takes into account the procedures prescribed and recommended by standards and scientific developments. In evaluations, he/she compares the results with the models and points out the differences. He/she independently initiates their changes.	
	Autonomy and responsibility Consciously and self-critically (with self-reflection) analyzes the results obtained. Makes suggestions for	

	changes. Takes responsibility for his/her work.
Short description of subject content	...The subject starts with understanding the importance of modeling. The MSC student understands that measurement is nothing more than determining the parameters of the model we choose. We reject the dogma of rule-based parameter measurement. We learn that every measurement relies on a model. Derivation of functions based on the FFT technique, and mastering its technique, measurement and equation system solution methods. Implementation of this on a digital computer. Shannon's theorem. Window functions. Autoregressive modeling: AR, ARMA, ARIMA, MAR. Sequential Likelihood Ratio Test, and its application, for cleaning signals covered by noise and event recognition. Mathematical foundations of fuzzy modeling, and its usability in industrial practice , Wavelets and application examples in nuclear power and fusion . Neural network (MI) method and its application in industrial practice
Types of student activity	... Processing the lectrues text with note-taking, moodle materials or AI assistance in homework 50% Writing and using an independent LABVIEW program in the lab experiment. Independent processing of lab measurements, preparation of a full measurement report, professional determination and analysis of measurement uncertainty 50%
Required reading and resources	• Pór Gábor: Measurement and Singal processing lectrue notes; via Moodle • Evaluation of measurement data — Guide to the expression of uncertainty in measurement, https://www.bipm.org/documents/20126/2071204/JCGM_100_2008_E.pdf • A mérési bizonytalanság meghatározása kalibrálásnál EA-4/02 M:2022_HUN (2023_v1) https://nah.gov.hu/admin/staticmedia/Oldalakhoz_csatolt_dokumentumok/NAR_NAD/KL/EA-4-02M-2022%20HU%20(v01).pdf
Recommended reading and resources	Mallat, S. (1999). Fourier kingdom. A Wavelet Tour of Signal Processing,
Assignments	... As stated in the first lesson: Measurement protocol on laboratory programming and the performed Propagation Perturbation Velocity measurement, with full processing and analysis
Description and schedule of exams	... According to what was said in the first lesson: closed-door from the Fourier part upon completion of its chapters. with a success rate of more than 50%
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted, but only in accordance with the usual scientific references: - for each submitted material, it must be stated exactly what AI, what it was used for and where it was used. - If the text was literally created with AI, it must be placed in quotation marks, if only knowledge/idea was used, but it is your own formulation, then it must be referenced according to the valid citation and referencing rules (including the date of access to the given AI!) - all figures and derivations must be cited, even if they were created with AI, it must be indicated / only figures not created with AI can be marked as your own - AI is not allowed in closed-class papers, written and oral exams, unless the teacher specifically permits it

Engineering Heat and Fluid Dynamics

Subject name	In Hungarian	Műszaki hő- és Áramlástan	Level	MSc
	In English	Engineering Heat and Fluid Dynamics	Code	DUEN(L)-MUT-152
2023/2024 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:				

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	E	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			
Person responsible for the subject:		name		Dr. Nagy András				position	associate professor	

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective After completing the course, students will be able to play in mechanical measurement, modelling and planning of thermal and flow processes	
	Objectives and development goal Students possess basic knowledge in mathematics, physics, and fundamental mechanical engineering sciences. The aim of the course is to deepen previously acquired knowledge in heat and fluid dynamics and to apply it to the analysis of more complex, non-stationary, and dynamic engineering processes. The course develops students' abilities to measure, model, and interpret heat transfer and fluid flow phenomena, with particular emphasis on applications in mechanical structures. Furthermore, it supports the development of analytical thinking, problem-solving skills, and the use of modern measurement and numerical simulation methods.	
Typical delivery methods	Lecture	In a classroom with the use of projector, Power Point and computer in each lecture
	Seminar	-
	Lab	Laboratory measurements in small groups
	Other	
Requirements (in learning outcomes)	**Knowledge** He is fully familiar with the basic facts, directions and boundaries of the field of technical expertise. You are familiar with the general and specific mathematical, natural and social science principles, rules, contexts and procedures necessary for the field of technical field. You are familiar with the concept system related to your field, the most important contexts and theories	
	Ability He performs a work that matches his qualifications. Ability to plan, organize and perform 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).	
	Attitude Strives to learning about and accepting automation design developments related to his qualification and field of expertise. Interested in new methods and tools related to the field	
	Autonomy and responsibility Responsibility for one's own work and the work of others	

Short description of subject content	Deepen the heat and flow processes known in the BSc and learn more about the theoretical context. An overview of the basic flow equations and how they are applied, and an extension mainly of non-stationer and dynamic processes. Characteristics of turbulent flows, turbulence modelling. Boundary layers, free rays, multiphase flows. Learn about heat transport and the basics of non-equilibrium thermodynamics. Exchangers. Laboratory exercises: state-of-the-art flow and thermal measurement methods, numerical simulation methods and their applications, in the framework of the solution of tasks, in particular in mechanical structures..
Types of student activity	Processing of theoretical material with control 20% Independent processing of theoretical material 20% Problem solution with control 20% Independent processing of tasks 40%
Required reading and resources	Materials on MOODLE Dr. Ferenc Szlivka: Heat-and Flow Technology Dunaújváros. 2019
Recommended reading and resources	Meinhard T. Schobeiri, Advanced Fluid Mechanics and Heat Transfer for Engineers and Scientists, Springer Cham, ISBN978-3-030-72924-0, eBook ISBN978-3-030-72925
Assignments	
Description and schedule of exams	
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to material-damage phenomena, fracture mechanisms, fatigue processes, crack-propagation models, and the theoretical background of testing methods), as well as for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the interpretation of damage-testing results, the analysis of failure mechanisms, the exploration of microstructural relationships, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

The Damage of Engineering Materials

<table>
<tr><td rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="5">Mérnöki anyagok károsodása</td><td>Level</td><td>MSc</td></tr>
<tr><td>In English</td><td colspan="5">The Damage of Engineering Materials</td><td>Code</td><td>DUEN(L)-MUA-254</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Technical Institute</td></tr>
<tr><td colspan="2">Compulsory prerequisite subject:</td><td colspan="7"></td></tr>
</table>

<table>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="6">Number of lessons</td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Language of education</td></tr>
<tr><td>Lecture</td><td colspan="2">Seminar</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/60</td><td>Per week 2</td><td>Per week</td><td>0</td><td>Per week</td><td>1</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/20</td><td>Per semester 10</td><td>Per semester</td><td>0</td><td>Per semester</td><td>5</td></tr>
<tr><td colspan="3">Person responsible for the subject:</td><td colspan="2">name</td><td colspan="3">Dr. Judit Pázmán</td><td>position</td><td>docent</td></tr>
</table>

<table>
<tr><td rowspan="2">Course objectives and justification (content, learning outcomes, place in curriculum)</td><td colspan="2">Short-term objective
The aim of the course is to enable students to understand the main forms of damage occurring in engineering materials, their underlying causes, and the methods used for their investigation, as well as to identify, evaluate, and determine possible prevention strategies for such damage phenomena. The knowledge acquired during the course enables students to independently draw professional conclusions in the reliability and lifetime analysis of complex engineering systems.</td></tr>
<tr><td colspan="2">Objectives and development goals
The course builds on foundational knowledge in materials science, mechanics, metallography, structural analysis, and mechanical engineering, which collectively provide the basis for understanding damage phenomena and the associated investigation methods. Its developmental aim is to provide students with in-depth understanding of various damage mechanisms (fatigue, corrosion, creep, brittle fracture, wear, etc.), to enable them to evaluate complex experimental results, identify root causes, and formulate well-founded prevention or intervention strategies within engineering practice.</td></tr>
<tr><td rowspan="4">Typical delivery methods</td><td>Lecture</td><td>using PPT slides and a projector</td></tr>
<tr><td>Seminar</td><td>-</td></tr>
<tr><td>Lab</td><td>Laboratory work, individual and collaborative</td></tr>
<tr><td>Other</td><td>-</td></tr>
<tr><td rowspan="3">Requirements
(in learning outcomes)</td><td colspan="2">Knowledge</td></tr>
<tr><td colspan="2">The student is familiar with the main damage mechanisms of engineering materials, the conditions under which they develop, and their effects under various operating environments. The student has detailed knowledge of the theoretical background and investigation methods of fatigue failure, corrosion processes, creep, brittle fracture, wear, and other relevant damage phenomena. The student understands the material-structural, mechanical, and environmental relationships involved in damage evolution, the principles of interpreting examination results, and the technical foundations of prevention strategies and lifetime-extension methods.</td></tr>
<tr><td colspan="2">Ability
The student is able to identify the various damage mechanisms and analyse their root causes from an engineering perspective. The student can evaluate examination results, recognise correlations between material structure, loading conditions, and environmental effects, and formulate professional recommendations for the prevention or mitigation of damage. The student is capable of selecting appropriate investigation methods, interpreting their results, and using these findings to support informed engineering decisions.</td></tr>
</table>

	Attitude The student strives for accurate, responsible, and objective engineering analysis and is open to acquiring knowledge of modern examination methods and diagnostic techniques. The student is committed to reliability-oriented thinking and engineering safety, as well as to the professional and evidence-based evaluation of defects and damage processes. In their work, the student adheres to the principles of engineering ethics and data accuracy.
	Autonomy and responsibility The student is able to independently carry out partial tasks related to damage investigations, draw independent conclusions, and assume professional responsibility for these conclusions. The student takes responsibility for the correctness of the methods applied during the investigations, the reliability of the results obtained, and the soundness of the recommendations derived from them. When necessary, the student is capable of preparing engineering decisions based on literature data and measurement results, as well as documenting the processes and presenting the findings in a professional manner.
Short description of subject content	The course provides a comprehensive overview of the mechanisms of damage in engineering materials, the conditions under which they develop, and the processes that lead to failure. It examines in detail the progression of fatigue damage, the theory of crack initiation and propagation, and the influence of loading spectra and operating environments. Special emphasis is placed on corrosion phenomena—including the underlying electrochemical processes, types of localized corrosion, stress-corrosion cracking, and the interaction between corrosion and fatigue—as well as on creep and high-temperature failure mechanisms. The course also addresses the conditions leading to brittle fracture, the influence of microstructural factors, and the lifetime-assessment methodologies based on these principles. Wear mechanisms, failure under complex loading conditions, and manufacturing-induced defects (such as welding imperfections, casting defects, and deformation-related damage) are also discussed. The practical component of the course is built around laboratory investigations, during which students work with microscopic (optical and electron microscopy) and macroscopic failure-identification techniques. They examine crack traces, fracture surfaces, corrosion products, and microstructural inhomogeneities. Laboratory tasks involve the documentation and evaluation of results, as well as the construction of possible cause-and-effect chains. By the end of the course, students learn to develop prevention strategies—such as material selection, technological modifications, load optimization, protective coatings, and environmental control—and to assess the engineering significance of failure analysis from a systems perspective.
Types of student activity	Participation in lectures and taking handwritten notes; independent study using PPT slides for preparing for mid-term tests (50%). Acquisition of practical skills through participation in laboratory sessions and plant visits (30%). Independent completion and processing of assigned tasks (20%).
Required reading and resources	Failure Analysis and Pevention, ASM Handbook Volume 11, 2002 Fatigue and Fracture, ASM Handbook Volume 19, 1997 Fractography, ASM Handbook Volume 12, 1992
Recommended reading and resources	Evert D. D. During: Corrosion atlas, A Collection of Illustrated Case Histories, Elsevier,1997 Corrosion: Materials, ASM Handbook Volume 13B, 2005
Assignments	According to the information provided during the first class, students are required to complete one assignment during the semester.
Description and schedule of exams	As communicated in the first lecture class
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: AI tools may be used for specific task types (in-class work, support in preparing written assignments and laboratory reports). Their use is strictly prohibited during mid-term examinations.

Physics

Subject name		In Hungarian		**Fizika**					Level		MSc
		In English		**Physics**					Code		**DUEN(L)-MUT-150**
2023/2024 I.											
Responsible educational unit				**Institute of Technology**							
Compulsory prerequisite subject:				**DUEN(L) 151**							
Type		Number of lessons						Requirement	Credit		Language of education
		Lecture		Seminar		Lab					
Full time		Per week	1	Per week	1	Per week	**1**	**V**	**5**		**English**
Part time		Per semester	5	Per semester	**5**	Per semester	**5**				
Person responsible for the subject:				name		**Endre Kiss, PhD**			position		College Professor

Course objectives and justification (content, learning outcomes, place in curriculum)	**Short-term objective** To study the basics of modern Physics with special emphases of the Physics of material testing, fracture mechanics, and surface phenomena	
	Objectives and development goals The course is based on BSc level, on the Engineering Physics, containing a stronger quantum mechanics and material structures. It has special emphases on the application of optics and X-ray technologies in material testing together with THz technologies. The electrostatic charging and discharging are having a considerable role. The discipline is giving foundation of mechanics of fatigue and introducing the basics of energy production.	
Typical delivery methods	Lecture	For all students in a large lecture hall with a presentation using projector.
	Seminar	-
	Lab	Measurement in laboratory in pairs
	Other	-
Requirements (in learning outcomes)	Knowledge The students are fully aware of the basic facts, directions and boundaries of the field of technical expertise, and familiar with the general and specific rules, contexts and procedures necessary for the cultivation of the technical field. Knows the concept of his field, the most important contexts and theories. The students are fully familiar with the main theories of this field of knowledge and problem-solving methods. At the employing level, they will be familiar with the measurement procedures used in mechanical engineering, their tools, instruments and measuring equipment. It can interpret, characterize and model the structure, operation, design and relationship of the structural units and components	

	of mechanical systems.
	Ability It is capable of basic analysis of the disciplines that make up the technical field of knowledge, the synthetic formulation of correlations and the activity of evaluating the quality. It is able to apply the most important terminology, theories and procedures of the technical field in which they are performed. It is capable of planning, organizing and performing independent learning. It is able to identify routine professional problems, to solve them in principle and to explore, formulate and provide practical background (standard operations (e.g., the application of this problem). It is able to understand and use the typical expertise, computer science and library resources of its field. The knowledge acquired is capable of carrying out tasks in its field solution of the application. It is capable of creating basic models of technical systems and processes It is able to communicate in your mother tongue in a professional manner, orally and in writing.
	Attitude The students accept and authentically represent the social role of their profession, and fundamental relationships with the world. It is open to the knowledge and acceptance and authentic transmission of professional, technological development and innovation in the field of technology. It strives to resolve problems as much as possible in cooperation with others. With sufficient endurance and monotony tolerance to carry out practical activities have. Using their acquired technical knowledge, they strive to learn more about observable phenomena, to describe and explain they legalities. In the course of its work, it complies with and enforces the relevant safety, health, environmental and quality assurance and control requirements.
	Autonomy and responsibility Even in unexpected decision-making situations, it independently takes a look at the broad, underlying professional issues and develops them on the basis of specific sources. In carrying out their professional duties, they also cooperate with qualified professionals in other fields (primarily technical, economic and legal). Share their experiences with colleagues to help them grow. It takes responsibility for the consequences of its technical analyses, its proposals and the decisions that are taken.
Short description of subject content	Overview and revival of BSC physics education. Properties of light, microscope, spectroscope, Schlieren equipment. Foundations of atomic physics and quantum mechanics. Properties of solid state. Electron microscopes (SEM TEM, and their application in the material testing. The crystal structure of solid state. Amorphous structures. Structure of the surface of solid state. Surface phenomena and their application in the material testing. Surface plasmons, quantum dots and other structures. Absorption, Auger spectroscopy. The basics of fracture mechanics.
Types of student activity	Lecture: Written text processing with notetaking 40%, theoretical material self-processing 20%, task solution 40%. Labor: Heard text processing with notetaking 10%, home preparation for measurement 20%, measurement 40%, minutes preparation 30%.

Required reading and resources	• Gruber: Physics for Engineers • Endre Kiss Engineering Physics/Engineering Physics, Electronic Note/Electronic book, Moodle.duf.hu • Lab Exercises Guides/Syllabuses for laboratory practices, Moodle/d • Serway: Physics for Engineers 15th edition
Recommended reading and resources	• Ágoston Budó: Experimental Physics I, II, III. (National Textbook Publisher, Budapest, 1997) • R. Feynmann: Modern Physics 1, 2, 3, 5, 7, 9 (Technical Publishing House, Budapest, 1986)-
Assignments	3 Laboratory reports according to schedule in part time 5 Laboratory reports according to schedule in full time 2 tests written according to schedule
Description and schedule of exams	According to the general rules of University of Dunaújváros
Framework and rules for the use of artificial intelligence	b)Partially the usage of artificial engineering is encouraged in producing student presentations exclusively from Chinese literature translation using the translation activity of AI.

Management Skills

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="3">Vezetési ismeretek</td><td>Level</td><td>MSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="3">Management Skills</td><td>Code</td><td>DUEN(L)-TVV-252</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="5">Institute of Social Sciences, Department of Management and Entrepreneurship</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="5"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</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 0</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term 0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td>Mónika Rajcsányi-Molnár, PhD</td><td>schedule</td><td colspan="2">College professor</td></tr>
</table>

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The subject matter is aimed at making the students acquainted with the fundamentals of strategic thinking and planning, the project thinking management and the system thinking production management, while relying on the management-organization fundamental knowledge obtained during their BSc studies. Through the attainment of knowledge transferred, the students are capable of understanding the planning processes that take place in work organizations, allocating the resources in a successful way and solving the problems in an efficient way. The practical examples promote the students in utilizing their theoretical knowledge and recognizing the relevant relationships.	
Typical delivery methods	Presentation	Lectures with blackboard and projector.
	Practice	Using projector and additional materials (max. 30 students).
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knows the fundamental aspects of his profession, the most important concepts, requirements, relationships and procedures. Has knowledge of the principles and methods for shaping and changing the organisational behaviour of organisations and institutions. Learns the fundamentals, theoretical and methodological foundations of strategic thinking and strategic management. Knows the methodological basics and techniques of managerial learning, information gathering, data processing and their ethical constraints and problem-solving methods. Recognises the importance of managerial efficacy and they know which factors, in which degree foster this. Knows the relationship between projects and corporate strategy, understands their and production management's systematic interpretations.	
	Ability Able to master the global design of complex systems based on a systems-based, process-oriented mindset. Ability to complexly plan and manage the use of technical, economic, environmental and human resources. Able to manage the work of their own and for others effectively, able to manage workgroups. Able to lead, plan, manage, check and develop the material and information processes of enterprises and work organizations. Able to identify problems and to integrate their knowledge in order to solve the problems and able to use the techniques and methods of problem solving in regard to their application possibilities. Has high sense of responsibility, (self)respect, analysing and synthetizing ability.	
	Attitude Strives to develop the knowledge of both himself and his employees through continuous self- and further training. Open to accommodate new innovative approaches. Open and willing to work in groups and to share knowledge with others. Strives to make decisions in coherence with the relevant legal and ethical norms.	

	Strives to adhere to the ethical principles of work and organizational culture. Strives to perform work with a complex approach applying systematic and process-oriented thinking. Examines research, development and innovation possibilities and aims to effectuate them during work.
	Autonomy and responsibility Acts independently and proactively when solving professional problems and initiating new practices. Able to manage, organise and supervise an organisational unit by taking responsibility for the organisation and their colleagues. Take responsibility for keeping professional, legal and ethical norms and rules in connection with their work and behaviour. Able to undertake the responsibilities in the management of an organization's technical and financial processes. They are responsible for sustainability.
Short description of the subject content	Characteristics of strategic thinking and planning, historical overview. Strategic planning processes and phases. Company environment, methodology of its analysis and evaluation. Development of company objectives, their levels and planning of implementation. Definition and regulation of competences, responsibilities and tasks. Characterization of organizational capabilities. Development of value chain. Relationships between the projects and company strategy. System of project management, methodological means of leading and organizing projects. Concept of production, management and production management and their interpretation in system theory respect. Production process and its structural types.
Types of student activities	Processing of theoretical material with control and independently 40% Task solution with management and independently 40% Analysing case studies, group work. Processing complex exercises in teams 20%. Gathering professional information corresponding the subject matters, processing and presentation 20%
Required literature and contact details	• Balaton Károly - Hortoványi Lilla - Incze Emma - Laczkó Márk -Szabó Zsolt Roland - Tari Ernő: Stratégiai menedzsment, Budapest: Akadémiai Kiadó Zrt., 2017. 338 p. ISBN 9789630594745 • Csath Magdolna: Stratégiai tervezés és vezetés a 21. században,Budapest: Nemzeti Tankönyvkiadó, 2004. 356 p. ISBN 9789631952513 • Eric Verzuh: Projektmenedzsment, Budapest: HVG Könyvek, 2006. 424 p. ISBN 9789637525773 • Koltai Tamás: Termelésmenedzsment, Budapest: Typotex, BME, GT, 2006. 280 p. ISBN 9789632790350
Recommended literature and contact details	• Pataki Béla: A technológia menedzselése, Budapest: Typotex, 2006. 180 p. ISBN 9789639548701
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted for mid-year assignments, project work, papers, and presentations, primarily as a supplement to and verification of independent work, with appropriate citation and source identification. . Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student's own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student

Project Tasks

Subject name	In Hungarian	Projektfeladat	Level	MSc
	In English	Project Tasks	Code	DUEN(L)-MGT-095
2026/2027 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/65	Per week	0	Per week	5	Per week	0	S	5	English
Part time	150/25	Per semester	0	Per semester	25	Per semester	0			

Person responsible for the subject:	name	Petrovickijné, Ildikó Angerer, PhD	position	associate professor

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course's to educate students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods.
	Objectives and development goals The aim of the course's is education of students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods. After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.

Typical delivery methods	Lecture	
	Practice	Consultation with the industrial and university consultants.
	Lab	-
	Other	-

Requirements (in learning outcomes)	**Knowledge** Students are familiar with the rules for the preparation of technical documentation. Student are familiar with the organisational tools and methods associated with management; the technical legislation necessary for the exercise of the profession. Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Have comprehensive knowledge of machine, system and process design methods in the engineering field.
	Ability Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes. It is able to enrich the knowledge base of the mechanical field with original ideas. It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology. It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mind-set.
	Attitude Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his

	legalities. Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.
	Autonomy and responsibility Taking responsibility for his own work and the work of his peers.
Short description of subject content	Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently. The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. The task can be prepared for the diploma plan task.
Types of student activity	Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous development and documentation of the thesis at an appropriate level.
Required reading and resources	Guide to the preparation of thethesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER Recommended by a consultant, the topic is processed by literature.
Recommended reading and resources	Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997.
Assignments	-
Description and schedule of exams	Signature
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted for mid-year assignments, project work, papers, and presentations, primarily as a supplement to and verification of independent work, with appropriate citation and source identification. . Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student's own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student.

Degree Planning 1.

Subject name	In Hungarian	Diplomatervezés 1.	Level	MSc
	In English	Degree Planning 1.	Code	DUEN(L)-MUG-096
2025/2026 II.				
Responsible educational unit		Institute of Technology, Department of Mechanical and Energetic		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requiremen	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/52	Per week	0	Per week	4	Per week	0	M	10	english
Part time	150/20	Per semester	0	Per semester	20	Per semester	0			
Person responsible for the subject:				name		László Koroknai		position	assistant lecturer	

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course's education is to educate students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods. After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.
	Objectives and development goals -

Typical delivery methods	Lecture	-
	Seminar	The student prepares his/her thesis independently in individual consultations in 100% of the practice.
	Lab	-
	Other	-

Requirements (in learning outcomes)	Knowledge You are familiar with the rules for the preparation of technical documentation. - You are familiar with the organisational tools and methods associated with management, the technical legislation necessary for the exercise of the profession. Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Have comprehensive knowledge of machine, system and process design methods in the engineering field.
	Ability Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes. It is able to enrich the knowledge base of the mechanical field with original ideas. It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology. It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mindset.
	Attitude Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities. Committed to high-quality, quality work, he sets an example for his colleagues to

	apply this approach.
	Autonomy and responsibility Taking responsibility for his own work and the work of his peers.
Short description of subject content	Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently. The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. Prepare the task for the diploma plan task. It's about 30% of the total.
Types of student activity	Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous development and documentation of the thesis at an appropriate level.
Required reading and resources	• Guide to the preparation of the thesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER • Recommended by a consultant, the topic is processed by literature.
Recommended reading and resources	• Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997
Assignments	-
Description and schedule of exams	-
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted only with proper citation.

Automated industrial systems

Subject name	In Hungarian	Automatizált Ipari Rendszerek	Level	MSc
	In English	Automated industrial systems	Code	DUEN(L)-MGT-159
2023/2024 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:				

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	E	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			

Person responsible for the subject:	name	Dr. Nagy András	position	associate professor

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to provide an advanced, system-oriented understanding of automated industrial systems, with particular emphasis on control and process automation. The course develops the ability to design, analyze, and implement complex PLC-based industrial control systems and to integrate modern automation technologies in industrial environments.
	Objectives and development goal Students are expected to have prior knowledge in control engineering, electrical engineering fundamentals, and technical informatics. Building on this background, the course aims to deepen students' competencies in the analysis, modeling, and integration of industrial automation systems. Special emphasis is placed on developing independent problem-solving skills, system-level thinking, and engineering decision-making required for advanced industrial applications.

Typical delivery methods	Lecture	In a classroom with the use of projector, Power Point and computer in each lecture
	Seminar	-
	Lab	Laboratory measurements in small groups
	Other	

Requirements (in learning outcomes)	**Knowledge** He is fully familiar with the basic facts, directions and boundaries of the field of technical expertise. You are familiar with the general and specific mathematical, natural and social science principles, rules, contexts and procedures necessary for the field of technical field. You are familiar with the concept system related to your field, the most important contexts and theories
	Ability He performs a work that matches his qualifications. Ability to plan, organize and perform 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).
	Attitude Strives to learning about and accepting automation design developments related to his qualification and field of expertise. Interested in new methods and tools related to the field
	Autonomy and responsibility Responsibility for one's own work and the work of others

Short description of subject content	The course covers advanced topics in industrial automation and process control, including control and regulation principles, industrial sensors and actuators, motor control and frequency converters, and industrial communication networks. It focuses on the structured design and programming of PLC-based control systems, as well as on safety concepts, control cabinet design, and system integration aspects. The acquired knowledge enables students to address complex industrial automation tasks in a systematic and professional manner.
Types of student activity	Processing of theoretical material with control 20% Independent processing of theoretical material 20% Problem solution with control 20% Independent processing of tasks 40%
Required reading and resources	Materials on MOODLE
Recommended reading and resources	Conner Gareth: Scenic Automation Handbook, ISBN9781138850279, 2018 Fabrizio Frigeni: Industrial Robotics Control, EAN9781484289884, 2022
Assignments	As described in the first lecture
Description and schedule of exams	As described in the first lecture
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted when preparing take-home assignments, but prohibited during in-class tests. The use of artificial intelligence is not allowed in assessments that measure individual performance (such as quizzes, exams, and practical tasks), where the goal is to evaluate independent engineering thinking and computational skills.

Industrial Energy Systems

Subject name	In Hungarian	Ipari Energetika	Level	MSc
	In English	Industrial Energy Systems	Code	DUEN(L)-MGT-223
2023/2024 I.				
Responsible educational unit		**Institute of Technology**		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time		Per week	0	Per week	**3**	Per week	**0**	F	**5**	**english**
Part time		Per semester	0	Per semester	**15**	Per semester	**0**			
Person responsible for the subject:				name		**Dr. Sánta Róbert**		position	Professor	

Course objectives and justification (content, learning outcomes, place in curriculum)	**Short-term objective** The aim of the course is to provide an understanding of industrial energy systems and their development potential through real industrial examples. Students learn energy efficiency, system integration, and optimization methods by analysing concrete systems.
	Objectives and development goals The course builds on the basic energy-related knowledge acquired in the Mechanical Engineering BSc programme (thermodynamics, fluid mechanics, energy systems) and extends it with a systems-level approach. Its aim is to provide a foundation for analysing and developing industrial energy systems, with a strong focus on energy efficiency and sustainable operation. Students will be able to evaluate industrial energy use and develop improvement proposals.
Typical delivery methods	Lecture: -
	Seminar: with a projector
	Lab: -
	Other: -
Requirements (in learning outcomes)	Knowledge Has both theoretical and practical knowledge relevant to the subject area.
	Ability Capable of carrying out tasks related to the subject area.
	Attitude Demonstrates a developing attitude towards solving engineering problems.
	Autonomy and responsibility Assumes responsibility for their work.
Short description of subject content	The Industrial Energy course presents the analysis of industrial energy use through real case studies. Students examine thermal and electrical energy systems, energy efficiency improvements, waste heat recovery, and renewable energy integration using practical industrial examples. The course aims to develop systems thinking and strengthen competencies in energy-related decision-making.
Types of student activity	Processing of spoken material with note-taking – 50% Guided structuring of information through tasks – 30% Independent completion of tasks – 20%
Required reading and resources	International Energy Agency (IEA) database and reports European Commission energy statistics (Eurostat) U.S. Department of Energy – Industrial Assessment Center resources
Recommended reading and resources	Thumann, A., Younger, W. J.: Handbook of Energy Engineering. Fairmont Press. Capehart, B. L., Turner, W. C., Kennedy, W. J.: Guide to Energy Management.

	CRC Press. Worrell, E., Price, L., Martin, N.: *Energy Efficiency in Industry*. Springer
Assignments	As explained during the first session.
Description and schedule of exams	As explained during the first session.
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted. Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student's own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student.

Industrial Internship

<table>
<tr><td rowspan="2">Subject name</td><td>In Hungarian</td><td colspan="4">Ipari gyakorlat</td><td>Level</td><td colspan="2">MSc</td></tr>
<tr><td>In English</td><td colspan="4">Industrial Internship</td><td>Code</td><td colspan="2">DUEN(L)-MGT-000</td></tr>
<tr><td colspan="9">2025/2026 II.</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical and Energetic</td></tr>
<tr><td colspan="2">Compulsory prerequisite subject:</td><td colspan="7">-</td></tr>
</table>

<table>
<tr><td colspan="2" rowspan="2">Type</td><td colspan="6">Number of lessons</td><td rowspan="2">Requiremen</td><td rowspan="2">Credit</td><td rowspan="2">Language of education</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Seminar</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>150/0</td><td>Per week</td><td>0</td><td>Per week</td><td>0</td><td>Per week</td><td>0</td><td rowspan="2">A</td><td rowspan="2">0</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/0</td><td>Per semester</td><td>0</td><td>Per semester</td><td>0</td><td>Per semester</td><td>0</td></tr>
<tr><td colspan="4">Person responsible for the subject:</td><td>name</td><td colspan="3">László Koroknai</td><td>position</td><td colspan="2">assistant lecturer</td></tr>
</table>

<table>
<tr><td rowspan="2">Course objectives and justification (content, learning outcomes, place in curriculum)</td><td colspan="2">Short-term objective
Based on the previously completed courses, the student has acquired comprehensive knowledge that enables them to solve an engineering task (heat treatment, plastic forming, failure analysis, materials testing). To demonstrate this competence, the student prepares a thesis, during which they integrate the knowledge gained in individual subjects into a coherent and complex body of knowledge. The student is able to understand the engineering task as a whole, solve it, and prepare a structured summary of the results.</td></tr>
<tr><td colspan="2">Objectives and development goals

-</td></tr>
<tr><td rowspan="4">Typical delivery methods</td><td>Lecture</td><td>-</td></tr>
<tr><td>Seminar</td><td>Completion and support of the theoretical and practical tasks of the thesis within the framework of consultation.</td></tr>
<tr><td>Lab</td><td>-</td></tr>
<tr><td>Other</td><td>Duration of the internship: 4 weeks</td></tr>
<tr><td rowspan="4">Requirements (in learning outcomes)</td><td colspan="2">Knowledge

Has comprehensive knowledge of the fundamental facts, directions, and boundaries of the technical field.
Is familiar with the conceptual framework of the specialization, as well as its most important relationships and theories.
Has comprehensive knowledge of the knowledge acquisition and problem-solving methods of the main theories of the field.
Has thorough knowledge of the learning, knowledge acquisition, and data collection methods of mechanical engineering, their ethical limitations, and the related problem-solving techniques.</td></tr>
<tr><td colspan="2">Ability
Is able to perform tasks corresponding to their professional qualification.
Is able to apply the key terminology, theories, and procedures of the given technical field in the execution of related tasks.
Is capable of planning, organizing, and carrying out independent learning.
Is able to apply and enforce occupational safety, fire protection, and hygiene regulations and requirements during their work.
Is able to communicate professionally and appropriately in their field of expertise, both orally and in writing, in their native language and in at least one foreign language.
Is able to apply the technical regulations related to the operation of mechanical systems, as well as the principles of setting up and operating machines and mechanical equipment, including their economic aspects.</td></tr>
<tr><td colspan="2">Attitude
Their attitude required for solving technical problems is improved..</td></tr>
<tr><td colspan="2">Autonomy and responsibility
Takes responsibility for their work..</td></tr>
</table>

Short description of subject content	The student plans and carries out the practical tasks related to the thesis, performs the necessary tests, evaluates the obtained results, and summarizes them in a thesis of at least 20 pages.
Types of student activity	Consultation, laboratory practice, and tasks to be carried out in an industrial environment.
Required reading and resources	-
Recommended reading and resources	-
Assignments	-
Description and schedule of exams	-
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted in all situations in this course.

Degree Planning 2.

Subject name	In Hungarian	Diplomatervezés 2.	Level	MSc
	In English	Degree Planning 2.	Code	DUEN(L)-MUG-097
2025/2026 II.				
Responsible educational unit		Institute of Technology, Department of Mechanical and Energetic		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requiremen	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/156	Per week	0	Per week	12	Per week	0	M	20	english
Part time	150/60	Per semester	0	Per semester	60	Per semester	0			

Person responsible for the subject:	name	László Koroknai	position	assistant lecturer

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course's education is to educate students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods. After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.
	Objectives and development goals
	-

Typical delivery methods	Lecture	-
	Seminar	Consultation with an industrial and university consultant
	Lab	-
	Other	-

Requirements (in learning outcomes)	Knowledge
	You are familiar with the rules for the preparation of technical documentation. - You are familiar with the organisational tools and methods associated with management, the technical legislation necessary for the exercise of the profession. Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Have comprehensive knowledge of machine, system and process design methods in the engineering field.
	Ability Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes. It is able to enrich the knowledge base of the mechanical field with original ideas. It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology. It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mindset.
	Attitude Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities. Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.

	Autonomy and responsibility Taking responsibility for his own work and the work of his peers.
Short description of subject content	Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently. The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. The task is to prepare a diploma plan 100% of the total.
Types of student activity	Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous development and documentation of the thesis at an appropriate level. Finish your thesis by.
Required reading and resources	• Guide to the preparation of the thesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER • Recommended by a consultant, the topic is processed by literature.
Recommended reading and resources	• Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997
Assignments	-
Description and schedule of exams	-
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted only with proper citation.

Lifetime management

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Élettartam gazdálkodás</td><td>Level</td><td>MSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Lifetime management</td><td>Code</td><td>DUEN(L)-MUG-150</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week 2</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term 10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Péter Trampus, PhD</td><td>schedule</td><td>Professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Having been learned the elements of life management of industrial facilities, on the basis of the reliability of operation and maintenance, the economy of the production process and taking further (quality, safety and environmental) aspects into consideration the student should be able to design the necessary actions, to make the decisions and arrangements in order to optimize the service life of an equipment or an industrial facility
In the past decades, life management became an independent, multidisciplinary area of engineering. Its key task is to have actual information on condition of operating systems and components, to maintain their function in accordance with the designer's intent which is a serious economic and quality / safety question as well.
To be able to answer these questions one has to know the design principles of the systems and components; the technological processes, from which operation loading and other environmental conditions can be derived; the performance of the structural and functional materials used under operation loads and environment, i.e. the materials degradation processes, and the impact of the flaws and other inhomogeneities if any.
The student has to be able to apply in skill level the methods of determination of loading in the component materials, as well as the methodologies to monitor and mitigate materials degradations. He/she has to be able to optimize operation and maintenance activities in order to achieve life management goals.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">Lectures using projector, flip chart</td></tr>
<tr><td>Practice</td><td colspan="6">Maximum 20 students, calculations, demonstrations</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6">Preparation of home works, individual learning, studying literature</td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knows the design principles of components; the technological processes from which the normal and off-normal loading and other operating conditions can be derived; the behaviour of structural and functional materials and the degradation processes and effects; the impact of flaws and other geometrical inhomogeneities in the materials.</td></tr>
<tr><td colspan="7">Ability
Can apply the methodologies for determination of component loading (stress/strain states) and detection and mitigation of degradations. Can optimize operation and maintenance taking the goals of life management into account. Understands and applies the online and printed technical literature pertaining to life management.</td></tr>
<tr><td colspan="7">Attitude
Seeks to contribute to the development of new methods and tools related to the technical field. Tries to utilize environmentally friendly technologies and to save built and natural environment. Tries to use energy-saving procedures and technologies.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Determines the methodology of analyses and/or inspection and testing; performs the analyses and the inspection or test, oversees the processes, the correctness of the calculated or measured / registered data, the quality of documentation responsible for the reliability of results.</td></tr>
</table>

Short description of the subject content	The definition of lifetime and operational/service life. Life management as the complex of technical and economic arrangements (with the purpose of the optimization of the service life of industrial facilities and their equipment while maximizing the profit). The degradations and other losses of functions in the structural materials induced by the operation. Aging processes. Running out of the life of components and systems. The safety aspects of component aging (decrease of the safety margin). Ageing of the design philosophies and the applied technologies. Mitigating actions: aging management, reconstruction, replacement (restoration of the safety margin). Connection between maintenance and life management. Spare part strategies (inventory management, disappearance and replacement of producers and suppliers). The human aspects of life management.
Types of student activities	Participation in the lectures (20%), practicum (20%), home work (10%), preparation of presentation (10%), individual learning (40%).
Required literature and contact details	• Shah, V. N., Macdonald, P. E. (1993): Aging and Life Extension of Major Light Water Reactor Components. Eslevier, Amsterdam. • Integrity for Life: Structural Integrity Assessment for Life Cycle Management (ed. Flewitt et al), EMAS Publishing, UK, 2004. • Presentation slides (in Moodle)
Recommended literature and contact details	• Materials Ageing and Life Management (ed. B. Raj et al), Vol. 1-3. Allied Publishers, New Delhi, 2000. • Understanding and mitigating ageing in nuclear power plants (ed. P. Tipping), Woodhead Publishing, Oxford, 2010
Description of tasks to be submitted/measurement reports	Home works (in Moodle)
Description and timetable of the workshops	1 written test, 1 home work
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted in the preparation of the homework assignment; however, its exclusive use is not allowed. A review of relevant literature is essential and will be verified as part of the assessment. The use of AI in other cases (e.g., exams or mid-term tests) is strictly prohibited.

Assembly and Repairment Technologies

Subject name		In Hungarian		Szerelési és javítási technológiák				Level		MSc
		In English		Assembly and Repairment Technologies				Code		DUEN(L)-MUA-256
2023/2024 I.										
Responsible educational unit				Institute of Technology						
Compulsory prerequisite subject:										
Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	1	Per week	0	E	5	english
Part time	150/15	Per semester	10	Per semester	5	Per semester	0			
Person responsible for the subject:				name		Szabó Attila, PhD		position		College associate professor

Course objectives and justification (content, learning outcomes, place in curriculum)	The short-term objective of the course is to provide students with a comprehensive understanding of mounting and restoration technologies, including their procedures, instruments, and planning methods. Students will gain the ability to analyze mounting tasks, apply appropriate technological solutions, and understand the role of assembly within the overall technological planning process.	
	Objectives and development goals	
	The course aims to develop students' competence in planning and managing mounting and repair technologies based on functional and technological analysis of products. They will be able to design mounting strategies, select suitable tools and procedures, and model assembly processes using deterministic and stochastic approaches. Furthermore, students will acquire knowledge of mechanical and welding-based restoration methods, surface modification technologies, and heat treatment planning. Emphasis is placed on selecting economically and technically appropriate solutions and determining the cost implications of applied technologies.	
Typical delivery methods	Lecture	projector, ppt presentations
	Seminar	projector, ppt presentations
	Lab	-
	Other	-
Requirements (in learning outcomes)	**Knowledge**	
	Knows in detail the rules for preparing technical documentation. Knows the organizational tools and methods related to management, the legislation of the field required for the practice of the profession. Has knowledge of measurement technology and measurement theory related to the field of engineering. Knows information and communication technologies related to mechanical engineering.	
	Ability Able to master the global design of complex systems based on a systems-based, process-oriented mindset. Ability to complexly plan and manage the use of technical, economic, environmental and human resources. Able to apply and further develop procedures, models, information technologies used in the design, organization and operation of mechanical systems and processes.	
	Attitude Seeks to contribute to the development of new methods and tools related to the technical field. Strives to develop the knowledge of both himself and his employees through continuous self- and further training.	

	Strives to adhere to and adhere to the ethical principles of work and organizational culture. Strives to adhere to and adhere to quality requirements. Strives to organize and perform its tasks in accordance with the expectations of environmental awareness, health awareness and sustainability.
	Autonomy and responsibility Able to solve engineering tasks independently. Takes the initiative in solving technical problems. Take responsibility for the sub-processes under your control. Makes professional decisions independently in its field of operation. Encourages its employees and subordinates to practice responsibly and ethically. Acts independently and proactively when solving professional problems. They are responsible for sustainability, occupational health and safety culture and environmental awareness.
Short description of subject content	Place and part the mounting plays in planning of technology. Component parts of mounting units. Analysis of mounting: functional and technological analysis of the product to be mounted. Methods of assuring the mounting tolerance. Deterministic and stochastic models of mounting. Mounting procedures and their means. Mounting of workpieces, assembly (joining), control, special mounting procedures. Specification of tools, devices, machines, requisites, mounting demands and the necessary activities: mounting tree, graph of activities. General model of mounting process, event-oriented tree. Restoration by using mechanical methods; welding, soldering and brazing, thermal spray, sticking and plastic technology. Determining welding materials for hardfacing, planning the necessary pre-heating and heat treatment technology. Technologies of high energy density to modify surface integrity and surface solidifying procedures.
Types of student activity	Processing theoretical course material with guidance: 60 % Independent processing of theoretical course material: 40 % Task solution with guidance 15 % Processing tasks independently 85%
Required reading and resources	• Richard Crowson, Assembly Processes: Finishing, Packaging, and Automation (Handbook of Manufacturing Engineering, Second Edition) 1st Edition, Kindle Edition, ISBN-13 978-0849355653, 2006.. • Materials on MOODLE
Recommended reading and resources	• Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, Product Design for Manufacture and Assembly (Manufacturing Engineering and Materials Processing, 74) 3rd Edition, ISBN-13 978-1420089271, 2010.
Assignments	Completion of 2 homework assignments during the semester
Description and schedule of exams	2 tests during the semester
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is permitted in the preparation of the homework assignment; however, its exclusive use is not allowed. A review of relevant literature is essential and will be verified as part of the assessment. The use of AI in other cases (e.g., exams or mid-term tests) is strictly prohibited.

Building Energetics

<table>
<tr><td rowspan="2">Subject name</td><td colspan="2">In Hungarian</td><td colspan="4">Épületenergetika</td><td>Level</td><td>MSc</td></tr>
<tr><td colspan="2">In English</td><td colspan="4">Building Energetics</td><td>Code</td><td>DUEN(L)-MGT-125</td></tr>
<tr><td colspan="9">2023/2024 I.</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Technology</td></tr>
<tr><td colspan="3">Compulsory prerequisite subject:</td><td colspan="6">-</td></tr>
<tr><td rowspan="2">Type</td><td colspan="5">Number of lessons</td><td rowspan="2">Requirement</td><td rowspan="2">Credit</td><td rowspan="2">Language of education</td></tr>
<tr><td>Lecture</td><td colspan="2">Seminar</td><td colspan="2">Lab</td></tr>
<tr><td>Full time</td><td>Per week 2</td><td colspan="2">Per week 1</td><td colspan="2">Per week 0</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>Per semester 10</td><td colspan="2">Per semester 5</td><td colspan="2">Per semester 0</td></tr>
<tr><td colspan="3">Person responsible for the subject:</td><td>name</td><td colspan="3">Dr. Sánta Róbert</td><td>position</td><td>Professor</td></tr>
<tr><td colspan="3" rowspan="3">Course objectives and justification (content, learning outcomes, place in curriculum)</td><td colspan="6">Shrrt-term objective
The aim of the course is to provide students with the necessary knowledge in all aspects of building services engineering: heating, cooling, ventilation and air conditioning (HVAC), water supply and sewerage, renewable energy sources.</td></tr>
<tr><td colspan="6">Objectives and development goals</td></tr>
<tr><td colspan="6">The course builds on the basic energy-related knowledge acquired in the Mechanical Engineering BSc programme (thermodynamics, fluid mechanics, energy systems) and extends it with a systems-level approach.
Its aim is to provide a foundation for analysing and developing building energy systems, with a strong focus on energy efficiency and sustainable operation. Students will be able to evaluate builidg energy use and develop improvement proposals.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Lecture</td><td colspan="5">-</td></tr>
<tr><td>Seminar</td><td colspan="5">with a projector</td></tr>
<tr><td>Lab</td><td colspan="5">-</td></tr>
<tr><td>Other</td><td colspan="5">-</td></tr>
<tr><td colspan="3" rowspan="5">Requirements
(in learning outcomes)</td><td colspan="6">Knowledge</td></tr>
<tr><td colspan="6">Has both theoretical and practical knowledge relevant to the subject area.</td></tr>
<tr><td colspan="6">Ability
Capable of carrying out tasks related to the subject area.</td></tr>
<tr><td colspan="6">Attitude
Demonstrates a developing attitude towards solving engineering problems.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Assumes responsibility for their work.</td></tr>
<tr><td colspan="3">Short description of subject content</td><td colspan="6">The basic elements of building energy, basic concepts and relationships of weather, building energy, basic concepts of thermal conditions, concepts and calculations of heat loss, heat gain and heat demand. Building water supply and drainage systems, system design, system components. Principles of sizing. Heating systems for buildings, design of systems. Elements of heating systems. Basic calculations related to the design of heating systems. Relevant standards specifications. Introduction to air duct networks. Thermal design of air ducts.</td></tr>
<tr><td colspan="3">Types of student activity</td><td colspan="6">Processing of spoken material with note-taking – 50%
Guided structuring of information through tasks – 30%
Independent completion of tasks – 20%</td></tr>
<tr><td colspan="3">Required reading and resources</td><td colspan="6">Csoknyai, T., Zöld, A .: Building energy. TERC Publishing House, Budapest, 2013. (online, available on the website)
Audel HVAC Fundamentals, Volume 1: Heating Systems, Furnaces and Boilers All New 4th Edition by James E. Brumbaugh (Author), ISBN 13 978-0764542060</td></tr>
<tr><td colspan="3">Recommended reading and resources</td><td colspan="6">Thumann, A., Younger, W. J.: Handbook of Energy Engineering. Fairmont Press.
Capehart, B. L., Turner, W. C., Kennedy, W. J.: Guide to Energy Management.</td></tr>
</table>

	CRC Press. Fundamentals of HVACR 3rd Edition by Carter Stanfield (Author), David Skaves (Author), ISBN10 0134016165
Assignments	As explained during the first session.
Description and schedule of exams	As explained during the first session.
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted. Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student's own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student.

Machine and Structural Health Monitoring

Subject name	In Hungarian	Gépek és szerkezetek állapotellenőrzése	Level	MSc
	In English	Machine and Structural Health Monitoring	Code	DUEN(L)-MGT-261
2025/2026 I.				
Responsible educational unit	Institute of Technology, Department of Mechanical and Energy Engineering			
Compulsory prerequisite subject:	Measuring techniques and Signal Processing DUEN-116			

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time		Per week	3	Per week	0	Per week	1	V	5	English
Part time		Per semester	15	Per semester	0	Per semester	5			

Person responsible for the subject:	name	dr. Gabor POR	position	prof. emeritus

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective Based on practical examples, students will be able to choose a machine condition determination method based on modern non-destructive material testing and non-invasive diagnostics and to plan the inspection itself. They will learn the basics of Structural Health Monitoring	
	Objectives and development goals The measurement and processing methods learned in the mandatory preliminary study form the possibilities for the industrial application of the methods used in industrial practice during the subject. Modern condition checks involve the use of computerized inspection programs, machines, and procedures. We are moving from the previous point-based measurements to a systematic approach. Non-destructive material tests, previously known as manual methods, are now also evaluated by computer. We train students in the system design and inspection approach, during which they have to design and build the inspection system for a given industrial task themselves.	
Typical delivery methods	Lecture	- A whiteboard presentation for all students in a lecture hall. Using a projector
	Seminar	-
	Lab	- Blackboard arithmetic practice (SHM) and laboratory measurement (non-destructive techniques) in groups of maximum 20 people.
	Other	-
Requirements (in learning outcomes)	**Knowledge** …He/She knows and understands in detail the methods of acquiring knowledge and data collection in the technical field, their ethical limitations and problem-solving techniques. - He/She has a comprehensive knowledge of the most important properties and application areas of structural materials used in the field of mechanical engineering. He/She has knowledge of measurement technology and measurement theory related to the field of mechanical engineering. He/She is familiar with information and communication technologies related to the field of mechanical engineering. He/She knows and understands the tools and methods of computer modeling and simulation related to the field of mechanical engineering. - He/She has extensive theoretical and practical preparation, methodological and practical knowledge for the design, production, modeling, operation and control of complex mechanical systems and processes	
	Ability … Able to apply the theories of the given technical field and the related terminology in an innovative way when solving problems. Able to approach and solve special problems arising within his/her field in a versatile interdisciplinary manner.	

	Able to organize cooperation with experts from related fields when solving a problem. Able to solve special technical problems arising in his/her field in an innovative way by using modern knowledge acquisition and data collection methods.
	Attitude ...By applying his acquired technical knowledge, he strives to gain a more thorough understanding of observable phenomena, to describe and explain their laws. He is committed to high-quality work and sets an example for his colleagues in applying this approach
	Autonomy and responsibility ... In his/her decisions, He/she takes into account the principles and application of environmental protection, quality, consumer protection, product liability, equal access, occupational health and safety, technical, economic and legal regulations, and the fundamental requirements of engineering ethics.
Short description of subject content	... Technology monitoring; planning of the necessary data processing; noise and vibration analyses; non-destructive material testing (visual, ultrasonic, eddy current, acoustic emission, high-speed camera, thermal imaging); non-invasive diagnostics (measurement of noise and fluctuations, use of inherent noise sources in diagnostics, application of coherence, wavelet, fuzzy and correlation methods in practice, application of autoregression, SPRT). Stress points of machines and materials; condition monitoring and types of vibrations of rotating machines, mathematical modeling of vibrations and flows, rotating machine testing in practice. Failure statistics and their use in failure analysis, probabilistic risk assessment, mean time between two failures and expected time to failure; cause-and-effect analyses, data set and knowledge base development. Fluctuation models and their solution of time-dependent differential equations in frequency space, through examples. Availability, monitoring and analysis of technological processes from the point of view of machine condition. Theoretical foundations and practice of the Structural Health Monitoring process and computer-based procedures for condition monitoring.
Types of student activity	... Processing heard text by taking notes and recording the material using your own and electronically available notes 40% Completing measurement exercises independently 20% Guided and independent processing of tasks 20% Solving test tasks with AI 20%
Required reading and resources	... https://www.nde-ed.org/NDETechniques/index.xhtml ISO (2011). ISO 17359:2011, Condition monitoring and diagnostics of machines - General guidelines. The International Organization for Standardization (ISO)
Recommended reading and resources	...ndt.net
Assignments	... According to what was said in the first class: - assignment to be submitted: write a four-choice test from SHM with the help of AI, including answers (test+answers+AI chatting) - either develop a final exam item, or present a ppt presentation of a workplace status monitoring method
Description and schedule of exams	... According to what was said in the first lesson, after the repetition, Zh is written, which must be completed better than 50% to be signed
Framework and rules for the use of artificial intelligence	...The use of artificial intelligence is partially permitted, but only in accordance with the usual scientific references: - for each submitted material, it must be stated exactly what AI, what it is for and where the student used it. - If the text was literally created with AI, it must be placed in quotation marks, if only knowledge/idea was used, but it is your own formulation, then it must be referenced according to the valid citation and referencing rules (including the date of access to the given AI!) - all figures and derivations must be cited, even if they were created with AI, it must be indicated / only figures not created with AI can be marked as your own - AI is not permitted in closed-class papers, written and oral exams, unless the teacher specifically permits it

Information technology in materials science

Subject name	In Hungarian	Anyaginformatika	Level	MSc
	In English	Information technology in materials science	Code	DUEN(L)-MGT-110
2026/2027 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	1	Per week	0	F	5	English
Part time	150/15	Per semester	10	Per semester	5	Per semester	0			

Person responsible for the subject:	name	Dr. Péter Bereczki, PhD	position	Research Fellow

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective An introduction to the principal technical and information systems employed in materials science and materials engineering. The course provides an overview of the general characteristics of material selection processes, computer-aided material selection systems, as well as information systems designed to support material-technology processes.
	Objectives and development goals The course builds upon the material covered in the mechanical engineering undergraduate curriculum, with particular emphasis on the aspects of machine design that relate to material selection. Within the context of the core subjects of the Mechanical Engineering Master's program, the knowledge bases of the courses Advanced Materials and Manufacturing Technologies, Mechanics, and Damage of Engineering Materials are considered relevant prerequisites. From the perspective of developmental objectives, a key priority is the acquisition of proficiency in materials informatics tools to enable material selection that is appropriately aligned with the expected loading conditions.

Typical delivery methods	Lecture	PowerPoint presentations and explanation on Flipchart
	Seminar	Fit-to-use material selection projects using Ansys Granta EDUPACK software
	Lab	-
	Other	-

Requirements (in learning outcomes)	Knowledge The student possesses a comprehensive understanding of the fundamental facts, directions, and boundaries of the technical field. The student is familiar with the general and domain-specific mathematical, natural science, and social science principles, rules, correlations, and procedures required for professional practice in engineering. The student understands the conceptual framework of the discipline, as well as its key relationships and theoretical foundations. The student has in-depth knowledge of the structural materials used in mechanical engineering, the methods of their production, and the conditions governing their application. The student possesses applied-level knowledge of the measurement procedures used in mechanical engineering, together with their associated tools, instruments, and measurement systems. The student has applied-level understanding of the occupational safety, fire protection, safety engineering, and occupational health requirements relevant to the field, as well as the applicable environmental protection regulations. The student has comprehensive knowledge of the fundamentals, boundaries, and requirements of the logistical, management, environmental, quality assurance, information technology, legal, and economic domains that are intrinsically connected to the mechanical engineering profession.
	Ability The student can conduct basic analyses of the disciplines that constitute the knowledge base of the technical field, formulating synthetic interpretations of their interrelations, and performing appropriate evaluative activities. The student

	is able to apply the principal terminologies, theories, and procedural frameworks of the given engineering domain in the execution of related tasks. The student can identify routine professional problems, uncovering and articulating the theoretical and practical background required for their solution, and resolving them through the practical application of standard operational procedures. The student is able to comprehend and utilize the characteristic scientific literature of the field, as well as its computational and library resources. The student can apply acquired information-technology knowledge in solving tasks arising within the profession. In the course of work, the student can apply and enforcing safety engineering, fire protection, and hygiene rules and regulations.
	Attitude The student is open to recognizing, understanding, and accepting professional and technological advancements and innovations within the engineering domain, and can convey such developments in an authentic and reliable manner. The student strives to ensure that self-directed learning within the field of mechanical engineering is continuous and aligned with his/her professional objectives. By applying acquired engineering knowledge, the student seeks to gain the most thorough possible understanding of observable phenomena, and to describe and explain their underlying regularities and governing principles.
	Autonomy and responsibility The student assumes responsibility for upholding and representing the ethical and professional values of the engineering discipline and responds openly to well-founded professional criticism. The student monitors legal, technical, technological, and administrative developments relevant to the field. The student takes responsibility for the consequences of his/her technical analyses, the recommendations formulated on their basis, and the decisions derived from them.
Short description of subject content	Content of Information technology in materials science course: • Classification of materials used in engineering practice. • Evolution of materials; the world of materials. • Material information; contemporary development directions of advanced steels. • Motivations for material selection. • Stages of the design process. • The relationship between design and material selection. • Fundamental tasks and conceptual frameworks of material selection. • Technical considerations in material selection: functional, load-related, safety- and manufacturability-related, sizing, environmental, and recyclability criteria. • The relationship between material selection and manufacturing processes. • The Ashby material-selection methodology. • Material selection during the conceptual phase of design. • Interpretation and derivation of material indices. • Material property maps and material property diagrams, and their application in the material-selection process. • Material properties and fundamental mechanical characteristics; parameters determining basic material properties and their interrelations. • Introduction to the Cambridge Materials Selector and its application in computer-aided material selection. • Introduction to the CES software environment: use of various functions; interpretation and construction of bar charts and bubble charts; principal types and fields of application. • Material selection based on complex criteria – development of individual tasks related to material selection (CES) within classroom practice. • Characteristic forms and mechanisms of damage in metals. • Material selection according to loading conditions I – selection based on mechanical properties: criteria for static-strength-based material selection.

	• Material selection according to loading conditions II – selection based on mechanical properties: material selection using stiffness-based criteria; development of individual CES tasks within classroom practice. • Material selection according to loading conditions III – selection under dynamic loading: the concept and characteristics of toughness; design principles for dynamic loading. • Material selection according to loading conditions IV – selection under cyclic loading: design principles for repeated loading. • Technical information systems; sources of material-related information; logical steps and methods for obtaining information. • Browsing online scientific literature databases; exploration of online material-information systems and material databases. • Material selection based on surface durability I – material selection for corrosion and wear resistance.
Types of student activity	• Classroom-based theoretical and practical sessions – 30% • Individual studying based on the provided course notes, supported by thematic questions – 60% • Course-related consultation and discussion on specific topics – 10%
Required reading and resources	• Presentations of Material selection and design (moodle system) • Dr. Budai István, Dr. Fazekas Lajos: Gépészeti anyagtan, TERC Kft. Budapest 2013 (moodle system)
Recommended reading and resources	• https://www.ensingerplastics.com/hu-hu/felkesz-muanyag/anyagkivalasztas
Assignments	Material-selection assignments using the Ansys Granta CES EduPack software; the summary should be submitted in task documentation
Description and schedule of exams	One mid-term test during the semester, covering materials-informatics systems and material-selection topics
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to materials-informatics systems, data-processing methods, modelling techniques, and the operation of engineering information systems), as well as for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the interpretation of data-processing procedures, the justification of using materials-informatics tools, the analysis of results obtained from information systems, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Computer Image Analysis and Measurement Techniques

Subject name		In Hungarian	Számítógépes képelemzés és méréstechnika			Level	MSc	
		In English	Computer Image Analysis and Measurement Techniques			Code	DUEN-MST-214 DUEL-MST-214	
2025/2026 II.								
Responsible educational unit			Institute of Technology, Department of Structure Integrity					
Compulsory prerequisite subject:			…					

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	M	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			
Person responsible for the subject:				name		Andrea Szabo PhD		position		assistant professor

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to enable students to acquire computer-based image analysis methods and to develop or apply their own programs for the quantitative evaluation of metallic or non-metallic samples. Starting from the acquisition of metallographic images (optical and SEM), students progress through the calibration–segmentation–measurement–uncertainty chain to obtain standardized quantitative descriptors (e.g., grain size according to ASTM/ISO, phase fractions, porosity, inclusion content). The structure of the course is inspired by the “Computer-Aided Image Analysis” subject taught in Miskolc, extended with modern instrumentation and software tools.
	Objectives and development goals Building on the materials science fundamentals acquired during the BSc studies, the course aims to develop students’ practical data-processing and image-analysis skills. The course enables students to independently design measurement tasks, interpret digital images, and evaluate results with engineering-level accuracy.

Typical delivery methods	Lecture	-ppt slides, lecture near to the board
	Seminar	--
	Lab	laboratorical practices, visiting to the research institute
	Other	-

Requirements (in learning outcomes)	Knowledge The student: • Understands the fundamentals of digital images (sampling, histogram, contrast, convolution filtering, morphology, thresholding, segmentation). • Has an overview of the concepts of quantitative metallography/stereology (point, line and area measurements; volume fractions; sampling) and their image-based measurement counterparts. • Is familiar with the main procedures and standards for grain size determination, including the possibilities and limitations of automated image analysis. • Has insight into the practical aspects of laboratory sample preparation and microscopic image acquisition (cutting, mounting, grinding, polishing, etching; bright-field/dark-field imaging; basics of SEM).
	Ability The student is able to: • Calibrate and preprocess image data (noise filtering, contrast enhancement), then perform segmentation (thresholding, watershed, morphology) and measurement (size, shape, distribution). • Determine grain size according to ASTM E112 / ISO 643 using the intercept or planimetric methods, and report the limitations of the procedure and its

	reproducibility. The student is able to estimate phase fractions, porosity and inclusion content using quantitative image analysis, and to document the results using the terminology of the ASM Handbook. • Develop an automated macro program to ensure the reproducible execution of the entire workflow.
	Attitude Data-driven and reproducible workflow; transparent documentation of image-processing steps (parameters, versions, environment). Awareness of standards and safety requirements, and responsible communication regarding uncertainties. Openness to using the laboratory's industrial software tools (e.g., AxioVision). .
	Autonomy and responsibility The student independently carries out the full sampling–preparation–imaging–evaluation workflow while adhering to laboratory safety and instrument-use regulations. The student takes responsibility for standard compliance and for ensuring that the code and documentation are transparent and verifiable.
Short description of subject content	The course provides a practice-oriented introduction to metallographic imaging and computer-based image analysis, with emphasis on measurement accuracy and reproducibility. The introductory module covers the fundamentals of optical microscopy (bright/dark field, polarization, interference contrast), micro-Vickers hardness testing, and practical aspects of SEM imaging. The image-analysis module includes intensity and histogram interpretation, contrast transformations, convolution filters, morphological operations, and segmentation methods, followed by object-based measurements. Quantitative metallography focuses on standardized procedures such as grain size (ASTM E112 / ISO 643), phase fractions, porosity, and inclusion analysis, together with an overview of uncertainty sources and recommended reporting practices. In a mini-project, students apply the full workflow to a real sample, developing a reproducible macro and submitting raw data, processing records and executable scripts to ensure auditability.
Types of student activity	Processing heard text with note-taking and recording the material using your own notes and electronically available notes 40% Independent completion of laboratory exercises 20% Completion of a mid-term assignment 20% Solving test tasks 20%
Required reading and resources	George F. Vander Voort, ASM Handbook, Vol. 9: Metallography and Microstructures. ISBN: 978-0-87170-706-2 ASTM E112 / ISO 643 – szemcseméret meghatározás (kézi és automatikus megvalósítások)..
Recommended reading and resources	Underwood, E. E.: Quantitative Stereology / Quantitative Metallography Addison-Wesley series in metallurgy and materials, ISSN 0515-3972
Assignments	During the semester, students are required to submit two types of documented assignments: An experimental design task (a DoE-based mini project). Laboratory measurement reports corresponding to the selected metallographic tests.

Description and schedule of exams	Midterm Test 1: 30% (Fundamentals of Image Processing and Calibration) Midterm Test 2: 30% (Quantitative Metallography and Application of Standards) Assignment (Literature Review): 25% Laboratory measurement reports: 15% To pass the course, both midterm tests must be completed at least at a satisfactory level (≥51%).
Framework and rules for the use of artificial intelligence	he use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to digital image-processing fundamentals, segmentation methods, quantitative image-analysis techniques, and measurement/evaluation procedures), as well as for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the interpretation of image-based measurement results, the justification of processing steps, the explanation of method selection, the evaluation according to ASTM and other standards, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Material and Structure Analysis

Subject name	In Hungarian	Anyag- és szerkezetvizsgálat	Level	MSc
	In English	Material and Structure Analysis	Code	DUEN-MUA-111 DUEL-MUA-111
2025/2026 II.				
Responsible educational unit		Institute of Technology, Department of Structure Integrity		
Compulsory prerequisite subject:		...		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	V	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			

Person responsible for the subject:	name	Judit Pazman PhD	position	docent

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective Mastering the basic testing methods necessary for examining the atomic, micro and macro structure of solid materials, as well as the operating principles and application areas of the most important testing instruments.
	Objectives and development goals The aim of the course is to fully explore the structural defects and damages of a given material by utilizing the knowledge of material structure (e.g. metals, polymers, ceramics) acquired at the BSc level, and by routinely using the related microstructure examination machines (optical, microscope, 3D microscope, scanning electron microscope, etc.). Accordingly, the practical part of the course develops the use of microscopes, the evaluation of their examination results and their recording. In the theoretical part, students can learn the operation of microscopes and their examination methods. In this way, they acquire complex knowledge and practical competence at the end of the course.

Typical delivery methods	Lecture	-ppt slides, lecture near to the board
	Seminar	--
	Lab	laboratorical practices, microstructure examinations
	Other	-

Requirements (in learning outcomes)	Knowledge Possesses theoretical and practical knowledge related to the subject area. Requirements for engineering structures and general properties of the structural materials used. Test procedures that verify the suitability of the chosen structural material for the given application. Transferability and interpretation of laboratory test results to the structure.
	Ability Able to perform tasks related to the subject area. Able to select and plan a laboratory procedure for examining a given property. Able to direct examinations and interpret results. Understand and use typical online and printed literature in his/her field in Hungarian and foreign languages.
	Attitude The attitude required to solve technical problems is developing. Striving for the continuous development of the applied testing procedures with a creative approach. Striving to apply environmentally conscious procedures and to protect the built and natural environment. Striving to apply energy and material-saving processes and technologies.

	Autonomy and responsibility Takes responsibility for his/her work. Determines the test procedure, independently performs the test or checks the process, the correctness of the registered data, the quality of the documentation. Responsible for the reliability of the test results.
Short description of subject content	The content of the subject is linked to the following logical chain: In order to determine the necessary material and structural properties, the requirements for the given structure / material must be known. These include, for example, the design requirements of the structure (mechanical loads, environmental effects), special aspects of manufacturability, and property changes (material damage) occurring as a result of use (operation). Testing procedures must be chosen that model the stress and damage processes on a laboratory scale, and the measurements obtained as a result of the test are suitable for assessing the safe and reliable use of the structure / material.
Types of student activity	Processing of a lecture by taking notes (50%), accomplishing material tests (30%), evaluating measurements and making a report (20%)
Required reading and resources	Tisza M. (szerk.): Anyagvizsgálat. Miskolc: Miskolci Egyetemi Kiadó, 2008 Prohászka J.: A fémek és ötvözetek mechanikai tulajdonságai. Budapest: Műegyetemi Kiadó, 2001
Recommended reading and resources	Nondestructive Testing Handbook. Colombus, Oh.: American Society for Nondestructive Testing, 1997-2007, Vol. 1-7, Third edition Fémek hegesztett kötéseivel szemben támasztott követelmények, a hegesztett kötések vizsgálata. In: Szunyogh László (szerk.): Hegesztés és rokon technológiák. Budapest: GTE, 2007
Assignments	Measurement protocols and making a report as explained in the lab exercises, submission deadline: last day of the academic period
Description and schedule of exams	1 closed-door paper during the semester, on the topic of structural analysis
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to material testing methods, micro- and macrostructural characteristics, evaluation principles, and application fields), as well as for developing the structure or improving the linguistic quality of submitted laboratory reports and written assignments. Students must ensure that all submitted professional content—particularly the interpretation of test results, the analysis of structural characteristics, the comparison of measurement methods, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Innovative application of polymers and composites

Subject name		In Hungarian		Poimerek és kompozitok innovatív alkalmazásai				Level	MSc	
		In English		Innovative application of polymers and composites				Code	DUEN(L)-MGT-011	
2025/2026. II.										
Responsible educational unit				Institute of Technology, Department of Mechanical and Energy Engineering						
Compulsory prerequisite subject:										
Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	F	5	english
Part time	150-15	Per semester	10	Per semester	0	Per semester	5			
Person responsible for the subject:				name		Judit Pazman PhD		position	docent	

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to familiarize students with new methods of producing polymers and composites, the possibilities of binding technologies, and the industrial applications of these materials.	
	Objectives and development goals With the knowledge of the fundamental properties and manufacturing technologies of polymers, ceramics and metals acquired at the BSc level, students further develop their knowledge in the field of complex material systems. By the end of the course, they will be able to apply the knowledge of manufacturing technology, bonding technology and surface treatment required for specific applications, and will be able to participate in the development of complex, high-performance material systems.	
Typical delivery methods	Lecture	power point slides, whiteboard presentation
	Seminar	
	Lab	3D printing (polymers, ceramic, composites), material testing on the 3D printed samples
	Other	-
Requirements (in learning outcomes)	Knowledge To know the application possibilities of modern polymers and composites, To be able to take a position on application technology issues. To be able to select bonding technologies and design technologies. To know modern manufacturing technology processes, such as 3D printing.	
	Ability Able to systematically perform certain organizational and management tasks related to the field. Able to process and systematize information collected during the operation of modern production systems and processes. Participates in quality assurance, measurement technology and process control tasks in the case of material production systems and technologies. Able to perform certain tests, process, evaluate and document measurement results.	
	Attitude Striving to enforce the requirements of sustainability and energy efficiency. Strives to plan and carry out his/her tasks independently or in a work group at a high professional level. Strives to carry out his/her work in a complex approach based on a systems and process-oriented way of thinking. In the course of his/her work, he/she examines the possibility of setting research, development and innovation goals and strives to achieve them	
	Autonomy and responsibility Acting independently and proactively in solving professional problems. Taking responsibility for sustainability and environmental awareness. Sharing experiences	

	with colleagues, thus helping them develop. Taking responsibility for the consequences of technical analyses, the proposals formulated based on them, and the decisions made.
Short description of subject content	Classification of polymers, methods of their production and binding processes. Production technologies, surface treatment processes and binding technologies of polymer matrix composites. Classification of metal matrix composites, their production and binding processes. Application of these materials in vehicles, aircraft, rapid prototyping, Additive manufacturing technologies (FDM, SLS, 3D printing in the case of ceramics), their novel developments.
Types of student activity	Processing of heard text by taking notes and recording the material using your own and electronically available notes 40% Independent completion of laboratory exercises, preparation of minutes 40% Preparation of semester assignment 20%
Required reading and resources	Lecture aids available for download from the www.uniduna.hu website, moodle system Free3Dee; 3D printing basics - notes Welding pocket book I. (Welding procedures), Cokom Engineering Office Ltd, Budapest 2023, Welding pocket book II. (Welding production technology), Cokom Engineering Office Ltd. Budapest, 2023
Recommended reading and resources	https://www.e3dplusvet.eu/wp-content/docs/O1A1-EN.pdf https://mill.pt/share/basics-of-3D-printing.pdf
Assignments	Preparation of protocols based on what was said in the laboratory practical class
Description and schedule of exams	2 closed papers during the semester, on the topic of 3D printing and welding, surface treatment processes
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (e.g. class work, submitted papers), in other cases (e.g. closed papers) it is prohibited. Within the framework of the subject, artificial intelligence can be used to write the theoretical part of the protocols and to collect information. To develop individual topics when preparing for a closed paper.

Weldability

Subject name	In Hungarian	Hegeszthetőség	Level	MSc
	In English	Weldability	Code	DUEN(L)-MUA-112
2023/2024 I.				
Responsible educational unit		Institute of Technology, Department of Structural Integrity		
Compulsory prerequisite subject:				

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time		Per week	2	Per week	x	Per week	1	M	5	English
Part time		Per semester	10	Per semester	x	Per semester	5			

Person responsible for the subject:	name	Dr. habil Palotás Béla	position	Professor Emeritus

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to provide an understanding of the causes of weld cracks/defects and how to avoid them, as well as the rules for welding different materials.
	Objectives and development goals The student knows the materials technology processes, they know the welding processes and technology, their application and documentation. They know the production rules of deffect free welds and welded strutures, on the case of a given material they can determinate the preheating temperature and technology of post weld heat treatment. They can select welding consumable and welding sequences with minimal stress or deformation.

Typical delivery methods	Lecture	For all students in a large lecture hall or on-line with MS PowerPoint presentation. Use of projector or MS Teams programme
	Seminar	-
	Lab	(Workshop) lab exercise, use of projector.
	Other	-

Requirements (in learning outcomes)	**Knowledge** The student will know the rules for making flawless joints, be able to prescribe the necessary preheating and post-heating for a given material, and will also learn the correct choice of welding material and the correct welding sequences.
	Ability Ability to perform certain organisational and management tasks related to the field in a systematic way. Ability to process and organise information gathered during the operation of modern manufacturing systems and processes. Contribute to quality assurance, metrology and process control tasks for material manufacturing systems and technologies. Ability to perform specific tests, process, evaluate and document measurement results.
	Attitude Strive to implement sustainability and energy efficiency requirements. Strive to plan and carry out tasks to a high professional standard, either independently or in a team. Strive to carry out their work in a complex approach based on a systems and process-oriented thinking. In the course of his/her work, he/she will explore the possibility of setting research, development and innovation objectives and strive to achieve them.
	Autonomy and responsibility Act independently and proactively when solving professional problems. Demonstrates responsibility in the area of sustainability and environmental awareness. Shares his/her experience with colleagues to help them develop. Assumes responsibility for the consequences of his/her technical analyses, proposals and decisions.

Short description of subject content	Welding heat processes, modelling of heat processes in different cases, calculation of different heat cycles and cooling rates. Causes of welding cracks (crystallization, cold, terracing and reheating cracks), crack avoidance. Calculation of preheating temperatures. Investigation of crack susceptibilities. Welding heat induced material structural anomalies and their avoidance. Weld stresses, deformations, correct welding sequences. Modelling of weld stresses and strains. Correct selection of welding materials for different applications. Welding rules for non-alloyed, mild and high alloy steels (hot strength, cold suction, heat and corrosion resistant and tool steels). Overlay welding of tools. Welding rules for cast irons. Welding rules for non-ferrous and light metals. Making mixed joints. Rules for welding ceramics and composites. Welding of polymers. Soldering and bonding techniques.
Types of student activity	Active participation in lectures and laboratory exercises.
Required reading and resources	[1] Downloadable lecture notes from www.duf.hu [2] Welding pocket book I. (Welding procedures), Cokom Mérnökiroda Kft., Budapest 2023, [3] Welding pocket book II. (Welding production technology), Cokom Mérnökiroda Kft., Budapest 2023
Recommended reading and resources	[4] Welding Handbook, Tom 4-5. AWS, Miami, Fl, The USA, 2010. [5] Dr. Károly Bödök: Corrosion resistance of non-alloyed, low-alloyed and high-alloyed structural steels, with special reference to their weldability, Corweld Ltd., Bp.1997.
Assignments	As stated in the first lesson.
Description and schedule of exams	As stated in the first lesson.
Framework and rules for the use of artificial intelligence	b) Partial permission In this course, the use of artificial intelligence tools is partially permitted for mid-year assignments, project work, papers, and presentations, primarily as a supplement to and verification of independent work, with appropriate citation and source identification. Students may employ AI-based tools (e.g. literature synthesis, concept generation, data interpretation) in the context of in-class activities, assignments, and project work, provided that the use is explicitly documented and complemented by the student’s own professional analysis and critical reflection. The use of AI is not permitted in assessments intended to evaluate individual performance (e.g. quizzes, examinations, calculation-based tasks), where the objective is to assess independent engineering reasoning and analytical competence. In project-based tasks, AI may be applied as a design-support tool (e.g. comparison of energy alternatives, exploration of conceptual solutions). However, all final technical calculations, evaluations, and conclusions must be produced and defended independently by the student.

Special Materials and Technologies

Subject name	In Hungarian	Különleges anyagok és technológiák	Level	MSc
	In English	Special Materials and Technologies	Code	DUEN(L)-MUA-115
2025/2026 II.				
Responsible educational unit		Institute of Technology, Department of Structure Integrity		
Compulsory prerequisite subject:		...		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	F	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			

Person responsible for the subject:	name	Judit Pazman PhD	position	docent

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective After completing the course, students should be able to approach and solve material science and technological problems arising during life-cycle management in a modern way, as well as to consciously apply the latest findings in material science..	
	Objectives and development goals Further exploration of the physical, chemical, and mechanical properties of traditional materials (metals, polymers, ceramics) studied during BSc studies and their development possibilities. By the end of the course, the student will be able to identify the applicable manufacturing technology(ies) to achieve the best combination of properties for a given material for a specific application. Additionally, the student will be familiar with the testing methods required for material qualification and their evaluation techniques.	
Typical delivery methods	Lecture	-ppt slides, lecture near to the board
	Seminar	--
	Lab	laboratorical practices, destructive material testing, second phase volume fraction determination
	Other	-
Requirements (in learning outcomes)	Knowledge He/she has knowledge of measurement technology and measurement theory related to the mechanical engineering field. He/she possesses extensive theoretical and practical preparation, methodological and practical knowledge for the design, production, modelling, operation, and control of complex mechanical systems and processes..	
	Ability Capable of laboratory testing and analysis of materials used in the field of mechanical engineering, as well as evaluating and documenting the test results. Prepared to process, organize, and analyze information collected during the operation of mechanical systems and processes, and to draw conclusions. Capable of enriching the knowledge base of the mechanical engineering field with original ideas. Able to apply integrated knowledge from the areas of machines, mechanical equipment, systems and processes, industrial materials and technologies, as well as related electronics and informatics. Capable of mastering global design of complex systems based on a systems-thinking, process-oriented approach. Able to plan and manage the complex use of technical, economic, environmental, and human resources..	

	Attitude He strives to carry out his work with a systematic and process-oriented approach in a comprehensive manner. In his work, he examines the possibility of setting research, development, and innovation goals and endeavors to achieve them.. .
	Autonomy and responsibility He makes his decisions carefully, consulting with representatives from other fields, and takes responsibility for them independently.
Short description of subject content	Technologies for repairing damaged (e.g., worn) surfaces. Application conditions for the so-called cold metals. The so-called cold metals as PMCs. The technique and technology of laser beam micro-deposition welding (cladding). Production of metal powders by gas and/or liquid atomization. Rapid prototyping technology. Requirements for parts manufactured by rapid prototyping. Possible materials for rapid prototypes. Laser hardening of the worn surface of large components. Surface enhancement of parts exposed to intensive wear by the combination of laser alloying and nitriding. Directed crystallization of alloys. Manufacturing technology of single-crystal turbine blades made from Ni-based superalloys. Metallurgical and thermal aspects of 'fiber-reinforced' composites produced from eutectic alloys through directed crystallization. Production technologies of ultrafine-grained (UFG) or nanocrystalline (NG) metals and alloys. The ECAP, HPT, and MF technologies. Characteristics of particle-reinforced metal matrix composites with enhanced creep resistance, the production of ODS materials using powder metallurgy (HIP) technology. Production of amorphous alloys using rapid solidification (RS) techniques. Prerequisites for the formation of the amorphous state. Mechanical, corrosion, and magnetic properties of amorphous ribbons. Compositional variations of high-entropy HEA alloys. Deformation mechanisms of amorphous HEA alloys. Silicon nitride as a wear-resistant structural material, the engine valve made of silicon nitride.
Types of student activity	Processing of a lecture by taking notes (50%), accomplishing material tests (30%), evaluating measurements and making a report (40%)
Required reading and resources	Dr. Tóth Tamás: Kompozit anyagok, Főiskolai kiadó, 2000. Gácsi Zoltán, Simon Andrea, Pázmán Judit: Fémkompozitok, Miskolci Egyetem, 2011.
Recommended reading and resources	ASM Handbook: Composites
Assignments	Measurement protocols and making a report as explained in the lab exercises, submission deadline: last day of the academic period
Description and schedule of exams	2 closed-door papers during the semester, on the topics of composites and special production tehcnologies
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to the structure, properties and processing of special materials, as well as the theoretical background of their industrial applications), and for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the analysis of engineering applicability, the interpretation of special technologies, the evaluation of industrial examples, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Physical simulation in materials science

Subject name	In Hungarian	Anyagtudományi fizikai szimulációk	Level	MSc
	In English	Physical simulation in materials science	Code	DUEN(L)-MGT-224
2026/2027 I.				
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Compulsory prerequisite subject:		-		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	F	5	English
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			

Person responsible for the subject:	name	Dr. Péter Bereczki, PhD	position	Research Fellow

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to provide students with an understanding of the principal methods used in the numerically assisted physical modelling of materials-science, materials-testing, and materials-processing phenomena. The course integrates modern multiscale modelling approaches (DFT, MD, phase-field methods, FEM, CFD) with physical simulations that reproduce the thermomechanical loading path of real industrial metal processing technologies on small-scale specimens, with particular emphasis on the application of Gleeble thermomechanical simulators.
	Objectives and development goals The course builds upon the courses completed in the Mechanical Engineering BSc program, with particular emphasis on the knowledge acquired in Mechanics, Thermodynamics and Fluid Mechanics, and Technology of Structural Materials. Within the framework of the basic courses of Mechanical Engineering MSc program, the courses of Advanced Materials and Manufacturing Technologies, Mechanics, and Damage of Engineering Materials are considered relevant academic prerequisites. Students acquire the knowledge and skills required to integrate computer-aided modelling with the experimental investigation of real material processing technologies, and to apply this combined expertise in the development and optimisation of industrial processes.

Typical delivery methods	Lecture	PowerPoint presentations and explanation on Flipchart
	Seminar	-
	Lab	Introducing the Gleeble 3800 thermomechanical simulator; joint physical simulation task with evaluation
	Other	-

Requirements (in learning outcomes)	Knowledge The student is familiar with the physical and mathematical foundations of the multiscale modelling methods applied in materials science (DFT, MD, phase-field modelling, FEM, CFD). Furthermore, the student understands how these models and their output data are used for parameterising physical simulations. The student comprehends the numerical representation of microstructure–property relationships, as well as the application domains and inherent limitations of the various modelling approaches. The student has a clear overview of the role of thermal, fluid-mechanical, and plastic deformation models with the associated physical simulations in the modelling and optimisation of industrial processes. The student possesses detailed knowledge of the operating principles, hardware architecture and software structure of thermomechanical simulators. The student understands the physical background of simulating thermomechanical cycles, including thermal systems, servo-hydraulic mechanical systems, and in-situ measurement techniques. The student knows how physical simulations serve as tools for the validation of numerical models.

	The student is familiar with modelling approaches applied to the thermomechanical loading paths of metallurgical manufacturing processes (casting, rolling, forging, additive manufacturing, heat treatment, etc.), and understands their relationship to microstructure evolution.
	Ability The student will be able to: • Construct numerical models suitable for representing the thermomechanical loading path of metal-processing technologies, adapt and execute the corresponding computational methods, and interpret the resulting outputs. • Interpret the results of phase-field and molecular dynamics (MD) models and draw engineering-relevant conclusions from them. • Develop appropriate material models (flow-stress models, diffusion and phase-transformation models) for use in numerical simulations. • Independently design a thermomechanical testing plan for the physical modelling of an industrial process. • Utilise the results of in-situ and ex-situ materials science investigations performed on test specimens (dilatometry, hardness testing, microstructural analysis) for the refinement and validation of models. • Apply physical-simulation data (flow curves, transformation kinetics, thermal parameters) for the calibration of numerical models. • Compare and critically interpret the results obtained from numerical and physical simulations.
	Attitude The student demonstrates openness toward the combined application of numerical and physical simulations as a fundamental methodology in modern materials-processing development. The student is committed to the critical and scientifically rigorous evaluation of measurement and simulation data. The student shows interest in new modelling approaches, material models, and measurement techniques. The student applies problem-oriented and systems-level thinking and can recognise which simulation or experimental approach is most appropriate for addressing a given materials technology problem. The student approaches laboratory-based thermomechanical testing responsibly and with strong safety awareness. The student is dedicated to engineering innovation and to enhancing the efficiency of materials-processing operations.
	Autonomy and responsibility The student assumes responsibility for upholding and representing the ethical and professional values of the engineering discipline and responds openly to well-founded professional criticism. The student monitors legal, technical, technological, and administrative developments relevant to the field. The student takes responsibility for the consequences of his/her technical analyses, the recommendations formulated on their basis, and the decisions derived from them.
Short description of subject content	Content of Physical simulation in materials science course: • The role of physical modelling in materials science. • Multiscale simulation systems: quantum-mechanical models (DFT); atomistic simulation (molecular dynamics – MD); mesoscale models (phase-field); macroscale modelling (FEM, CFD, physical simulation). • The relationship between material properties and microstructure. • Equations of state, diffusion models, and thermal models. • Numerical stability, convergence, and error analysis. • The theoretical foundations of physical simulation. • The role of physical and numerical simulations in the development of materials and materials-processing technologies. • Architecture and operating principles of Gleeble and other thermomechanical simulators, including the thermal and mechanical loading paths which can be simulated on them.

	• Measurement systems of Gleeble and other thermomechanical simulators; the programming and process-control capabilities enabled by the measured quantities. • Thermomechanical modelling of high-temperature plastic-deformation processes: required data-processing and computational methods; programming and execution of physical experiments; evaluation procedures and technological recommendations. • Simulations required for establishing material laws and their evaluation: temperature- and strain-rate-dependent flow curves; determination of recrystallization kinetics. • Modelling of loading paths in engineering structures; execution of complex materials-testing procedures using physical simulators to predict crack propagation and fatigue properties in metallic structural materials; evaluation of results and formulation of fatigue kinetics laws.
Types of student activity	• Classroom-based theoretical sessions – 30% • Individual studying based on the provided course notes, supported by thematic questions – 50% • Laboratory experiments – 20%
Required reading and resources	• Presentations of lectures (moodle system) • Gleeble Application Notes és Technical Guides (moodle system) • D. Raabe: Computational Materials Science: The Simulation of Materials Microstructures and Properties. Wiley-VCH (online) • S. Yip (ed.): Handbook of Materials Modeling. Springer (online) • F. Montheillet et al.: Hot Deformation and Processing of Aluminum Alloys (online)
Recommended reading and resources	• Z.X. Guo, J. Dong: Physical Simulation of Thermal-Mechanical Processing of Steels. (online) • Sellars, C. M., Tegart, W. J. McG.: Hot Workability of Metals. (online) • H. Fujiwara, T. Fujii: Thermomechanical Processing of High-Strength Steels. (online) • Porter, D., Easterling, K., Sherif, M.: Phase Transformations in Metals and Alloys. CRC Press. (online) • Doherty, R. D. et al.: Current Issues in Recrystallization: A Review. Progress in Materials Science. (online) • Hosford, W. F., Caddell, R.: Metal Forming – Mechanics and Metallurgy. (online)
Assignments	Execution and documentation of selected modelling and evaluation tasks associated with physical simulation performed during the group laboratory experiments.
Description and schedule of exams	One mid-term test during the semester, covering the modelling and physical simulation of materials-science and materials-processing phenomena.
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to numerical simulation methods, multiscale modelling approaches, and the physical principles governing materials-science processes), as well as for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the interpretation of simulation results, the comparison of modelling methods, the analysis of the relationship between experimental and simulated data, and the formulation of conclusions—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Nanotechnology

Subject name	In Hungarian	Nanotechnológia	Level	MSc
	In English	Nanotechnology	Code	DUEN(L)-MST-110
2025/2026 II.				
Responsible educational unit		Institute of Technology, Department of Structure Integrity		
Compulsory prerequisite subject:		...		

Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	F	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			
Person responsible for the subject:				name		Judit Pazman PhD		position	docent	

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective Materials engineers need to be familiar with the properties of various composite materials, their production technologies, and their application areas. The student should be able to select a composite material suitable for a given technical process. Based on the properties of micro and nano composites, they should be able to make optimal material choices.	
	Objectives and development goals Building on the properties and manufacturing technologies of traditional material families (metals, polymers, ceramics) learned at the BSc level, it develops knowledge through understanding complex material systems below the micrometer scale and their testing methods. By the end of the course, students will be familiar with the manufacturing technologies of nanostructured materials, be able to select suitable nanomaterials for a given purpose, understand the basics of transmission electron microscopy, the atomic force microscope, and their test results, and be able to perform the evaluations as well.	
Typical delivery methods	Lecture	-ppt slides, lecture near to the board
	Seminar	--
	Lab	laboratorical practices, visiting to the research institute
	Other	-
Requirements (in learning outcomes)	Knowledge To be familiar with the basic types of materials (metals, polymers, and ceramics) and their production technologies, as well as the technologies for manufacturing composite materials. To be familiar with the micro- and nanostructures used in electronics, their characteristic properties, and manufacturing technology.	
	Ability Able to apply the related computational and modelling principles and methods in product and technology design. Capable of selecting the optimal raw materials and specifying the appropriate manufacturing technology for producing the composite product for a given application. Understands and utilizes the characteristic online and printed professional literature of their field in both Hungarian and foreign languages.	
	Attitude It strives for the continuous development of applied technologies and processes through a creative approach. It aims to use environmentally conscious technologies and to protect the built and natural environment. It seeks to apply energy- and material-saving processes and technologies.	

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	Autonomy and responsibility To take responsibility for the own work. To define the properties of various products, checks the quality of the work phases characteristic of the technology, and performs quality management of the sub-tasks. To assess and rationalize energy consumption related to material production...
Short description of subject content	Types of engineering materials (metals and alloys, ceramics, polymers, semiconductors). Nano-structured particle-strengthened, fiber-reinforced, laminated composites, their manufacturing technologies, properties, applications, and development possibilities. Analysis of the properties of metals and other engineering materials and trends in their changes. Materials for nanoelectronics. Layer formation technologies, thin films for electronics (lithography, etching, chemical mechanical polishing). Scanning Probe Technologies. Production of nanocomposites, fullerene, graphite and carbon nanotubes, ceramic nanotubes and particles. Logic devices (MOSFETs, ferroelectric field-effect transistors). Problems of material selection. Transmission electron microscopy, structure and applications of atomic force microscopy. Manufacturing technology of bulk nanomaterials – SPD techniques.
Types of student activity	Processing heard text with note-taking and recording the material using your own notes and electronically available notes 40% Independent completion of laboratory exercises 20% Completion of a mid-term assignment 20% Solving test tasks 20%
Required reading and resources	**1.** Dr. Tóth Tamás: Kompozit anyagok, Főiskolai kiadó, 2000. **2.** Gácsi Zoltán, Simon Andrea, Pázmán Judit: Fémkompozitok, Miskolci Egyetem, 2011. **3.** Mojzes Imre, Molnár László Milán: Nanotechnológia, Műegyetemi Kiadó, 2007 Rainer Waser: Nanoelectronics and Information technology, Wiley-VCH, 2005. II-III. fejezet – 187-498. pp.
Recommended reading and resources	1. Bársony István: Mikrogépészeti eljárásokkal a nanotechnológia felé, 1083-1089 pp. 2. Yanhui Liu és társai: Metallic glass nanostructures of tunable shape and composition, NATURE COMMUNICATIONS | 6:7043 | DOI: 10.1038/ncomms8043 | www.nature.com/naturecommunications 3. Zhuofei Gan és társai: High-fidelity and clean nanotransfer lithography using structure-embedded and electrostatic adhesive carriers; Microsystems & Nanoengineering (2023) 9:8, www.nature.com/micronan;
Assignments	Semester project: Choose one of the nanomaterials studied during the semester and carry out a comprehensive analysis of it. This means presenting its physical, chemical, and mechanical properties, possible manufacturing techniques, and testing methods. Length: max. 10 pages, Times New Roman 12 pt, 1.25 line spacing.
Description and schedule of exams	1 closed-door papers during the semester, on the topic of nano materials and their production technologies
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (e.g. class work, submitted papers), but prohibited in other cases (e.g. closed-door papers). Within the framework of the subject, artificial intelligence can be used to write the semester project and collect information. To develop individual topics when preparing for a closed-door papers

Experimental Design in Mechanical Testing

Subject name		In Hungarian		Kísérlettervezés a mechanikai vizsgálatokban				Level		MSc
		In English		Experimental Design in Mechanical Testing				Code		DUEN(L)-MST-213
2025/2026 II.										
Responsible educational unit				Institute of Technology, Department of Structure Integrity						
Compulsory prerequisite subject:				…						
Type		Number of lessons						Requirement	Credit	Language of education
		Lecture		Seminar		Lab				
Full time	150/39	Per week	2	Per week	0	Per week	1	M	5	english
Part time	150/15	Per semester	10	Per semester	0	Per semester	5			
Person responsible for the subject:				name		Andrea Szabo PhD		position		assistant professor

Course objectives and justification (content, learning outcomes, place in curriculum)	Short-term objective The aim of the course is to enable students to master modern experimental design methods related to mechanical testing, and to develop the ability to design tests, establish measurement protocols, and interpret experimental results. The course provides an overview of data acquisition, evaluation and statistical principles applied in mechanical material testing practice, with particular emphasis on reproducibility and measurement uncertainty.	
	Objectives and development goals Building on the material testing and measurement fundamentals acquired during the BSc studies, the course develops students' competencies in experimental design and data interpretation. Its aim is to enable students to independently design and evaluate reliable, reproducible mechanical tests.	
Typical delivery methods	Lecture	-ppt slides, lecture near to the board
	Seminar	--
	Lab	laboratorical practices, visiting to the research institute
	Other	-
Requirements (in learning outcomes)	Knowledge The student becomes familiar with the fundamental concepts of experimental design, the structure of experimental plans, the basics of analysis of variance and regression evaluation, as well as the characteristic measurement parameters and potential error sources of mechanical tests (tensile, hardness, impact, bending and instrumented measurements). The student understands the role of measurement system capability and measurement uncertainty, and is aware of the documentation and quality assurance requirements associated with the tests.	
	Ability The student is able to design multivariable experiments, control measurement environments and specimen conditions, carry out the tests, and perform statistical analysis of the resulting data. The student can determine effects and interactions, identify data errors and distortions, and is capable of summarizing results as well as formulating engineering conclusions and optimization recommendations.	
	Attitude The student strives for accuracy, reproducibility and professional rigor in performing measurements, and demonstrates independence in carrying out experimental work. The student is open to applying modern measurement and data-processing methods, and is committed to conducting experimental activities in a reliable, transparent and ethically responsible manner. .	

	Autonomy and responsibility The student acts responsibly when planning and carrying out experiments, taking into account laboratory safety, environmental and quality-related regulations. The student is capable of independently documenting and substantiating the measurement process and the resulting data.
Short description of subject content	The course introduces the principles of experimental design, multifactor test planning, and the concepts of measurement system capability and uncertainty. It also covers the handling of key test parameters and measurement errors in mechanical material testing. Through small project tasks, students design, perform and evaluate experiments while applying fundamental data-processing and inference methods. Laboratory assignments are based on tensile, impact, bending, hardness and surface-roughness tests, focusing on the effects of selected parameters and the statistical evaluation of responses. Across these exercises, students learn to relate measurement variability and surface or material conditions to the mechanical behaviour observed.
Types of student activity	Processing heard text with note-taking and recording the material using your own notes and electronically available notes 40% Independent completion of laboratory exercises 20% Completion of a mid-term assignment 20% Solving test tasks 20%
Required reading and resources	ASTM E8/E8M 22: Standard Test Methods for Tension Testing of Metallic Materials William D. Callister, Jr. Materials Science and Engineering An Introduction, 7th edition, 2006 Chapter 6 Mechanical Properties of Metals 131-173 pp.
Recommended reading and resources	Norman E. Dowling – Stephen L. Kampe – Milo V. Kral: Mechanical Behavior of Materials (5th ed., Pearson, 2018/2019)
Assignments	During the semester, students are required to submit two types of documented assignments: An experimental design task (a DoE-based mini project). Laboratory measurement reports corresponding to the selected mechanical tests.
Description and schedule of exams	Test 1: 30% (Fundamentals of Experimental Design) Test 2: 30% (Experimental Design in Mechanical Testing) Assignment / DoE mini-project: 25% Laboratory measurement reports: 15% To pass the course, both written tests must be completed at least at a satisfactory level (≥51%).
Framework and rules for the use of artificial intelligence	The use of artificial intelligence is partially permitted: it may be applied for the preparation of in-class assignments (organizing information related to experimental design principles, measurement strategies, and statistical evaluation methods), as well as for developing the structure or improving the linguistic quality of submitted reports and written assignments. Students must ensure that all submitted professional content—particularly the justification of experimental design decisions, the interpretation of measurement results, the analysis of reproducibility, and the evaluation of measurement uncertainty—reflects their own, verifiable work. During midterm tests, examinations, and all forms of individual assessment, the use of artificial intelligence in any form is strictly prohibited.

Computer and modelling simulation

Name of the subject	in Hungarian	Számítógépes modellezés és szimuláció	Level	MSc
	in English	Computer and modelling simulation	Code	DUEN(L)-MUG-220
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Name of compulsory prior learning DUEN(L)-		IMA-250		

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	M	5	english
Part time	150/15	per term	5	per term	0	per term	10			

Teacher responsible for the subject	Name	Gábor Pór, PhD	schedule	professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** To acquaint students with the most important numerical modelling procedures and a brief introduction to the mathematical and numerical modelling of complex technical-physical processes occurring in engineering practice. With this knowledge, students will be able to study processes occurring in the wider vertical of mechanical science, as well as finite element strength calculations (VEM) of mechanical equipment, computer modelling of thermal and flow processes using ANSYS CFX.

Typical delivery methods	Presentation	Large lecture for all students, board lecture. Using a projector (66.66% of total hours) (26 hours)
	Practice	
	Laboratory	Board counting practice in groups of up to 30 people. (33.33% of total hours) (13 hours)
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** Knows and understands the tools and methods of computer modelling and simulation related to the field of mechanical engineering. - Has a wide range of theoretical and practical training, methodological and practical knowledge for the design, manufacture, modelling, operation and control of complex mechanical systems and processes. Has a comprehensive knowledge of machine, system and process design methods in the field of engineering ...
	Ability Prepared for the processing and systematization of information collected during the operation of mechanical systems and processes, for analysis and for drawing conclusions. Able to enrich the knowledge base of the mechanical engineering field with original ideas. Ability to apply integrated knowledge in the fields of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and informatics. Able to master the global design of complex systems based on a systems-based, process-oriented mind-set.
	Attitude Strives to conduct its work in a complex approach based on a systems-based and process-oriented mind-set. In the course of its work, it examines the possibility of setting research, development and innovation goals and strives to achieve them. By applying the acquired technical knowledge, he strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws.
	Autonomy and responsibility He (She) shares his (her) acquired knowledge and experience with formal, non-formal and informal forms of information transfer with practitioners in kis (her) field. Evaluate the work of your subordinates by sharing critical comments promotes their professional development. Able to solve engineering tasks independently. Takes the initiative in solving technical problems.

Short description of the subject content	Numerical solution possibilities of mathematical models describing strength and heat and flow processes. The most commonly used numerical methods, discretization methods, the basics of the finite volumetric method. Basic iterative solution methods for systems of linear equations with a special coefficient matrix obtained during discretization (Gauss-Seidel, Conj. Grad, Multi Grid). Advantages, disadvantages and applicability of the methods. Structure of the ANSYS and ANSYS-CFX program system, INPUT / OUTPUT data, definition and interpretation of boundary conditions, mathematical form of each boundary condition. Strength applications using finite element program, shape optimization. Solving major heat and flow problems with a finite volume program.
Types of student activities	Processing of heard text with notes and recording of the material using own and electronically available notes 40% Performing measurement exercises independently 20% Controlled and independent processing of tasks 20% Solving test tasks 20%
Required literature and contact details	• György Popper, Ferenc Csizmás: Numerical Methods for Engineers, Budapest, Akad. K. • Typotex, 1993. 166 p. ISBN 963-05-6454-8 • Gábor Ladányi: Finite element calculation methods, E-learning curriculum, Dunaújváros College, TAMOP 4.1.2 / A, 2011, moodle.duf.hu • ANSYS user manual
Recommended literature and contact details	• Stoyan Gisbert: Numerical Mathematics for Engineers and Programmers, Typotex ISBN 978-963-9664-41-8 • Stoyan Gisbert, Takó Galina: Numerical Methods 1., Typotex (2005) • Stoyan Gisbert: MATLAB, Typotex, ISBN 9639548499, 9789639548497
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	
Framework and rules for the use of artificial intelligence	Partial permission: artificial intelligence is allowed for certain types of tasks (e.g. class work, submitted papers), but prohibited in other cases (e.g. closed-door papers). Within the framework of the subject, artificial intelligence can be used to write the theoretical part of the reports and collect information. To develop individual topics when preparing for exam